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Evidence-Based Change to Address Newborn Pain during Painful Procedures

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Evidence-Based Change to Address Newborn Pain During Painful Procedures

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The University of Texas at Tyler

by

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Contents

Executive Summary

The once-believed theory that newborns do not experience pain has often been proven wrong. The current research topic is how practitioners integrate the knowledge that newborns feel pain into their practice. A nonverbal newborn cannot express pain like a coherent adult can. Therefore, the burden falls on the physicians and nurses to assess and treat newborn pain. There are many options for treating pain in the newborn during painful procedures. The goal to provide the most effective, most accessible, and most cost-effective means of addressing pain in the newborn brings the current evidence-based change project with the following question: In newborns undergoing painful procedures (P), how does adding a group of nonpharmacological measures (I) compared with not adding nonpharmacological measures (C) affect the level of pain demonstrated (O) in a three-month timeframe (T)?

Rationale for the Project

A healthy newborn born in an American hospital will experience at least three to four painful procedures in the first days of life. These procedures include blood draw via heel lance, injections, and circumcision (for the male newborn). The nurse caring for the newborn is ethically obligated to address the newborn's pain during these procedures (Robins, 2018). Although several nonpharmacological methods are available at this facility, they are not consistently used. A chart review revealed that up to 30% of painful procedures conducted on newborns have no interventions in use for pain relief. Failure to address pain in term and preterm newborns affects the structural development of the brain, pain modulation, and reactivity (Perrone et al., 2017; Duerden et al., 2018). In 2016, the American Academy of Pediatrics updated its policy to include recommendations for consistently using nonpharmacological interventions to decrease pain during painful procedures.

Literature Synthesis

A literature review was conducted using three databases: PubMed, Cochrane Library, and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Search terms included *newborn, infant, pain, distress, discomfort, pain management, pain intervention, swaddling, pacifier, nonnutritive sucking, facilitated tucking, positioning, held, breastfe*, "skin to skin",* and *"kangaroo care"* across all databases. The search yielded nine randomized control trials, one systemic review, one cross-sectional study, and one meta-analysis.

Assessing newborn pain before, during, and after painful procedures can be done with various models. The Premature Infant Pain Profile (PIPPS), Newborn Infant Pain Scale (NIPS), Neonatal Pain and Sedation Scale (NPASS), and the French Douleur Aigue Nveaune DAN scale were used in the twelve studies of this project. When measured with the PIPPS, pain scores are lower when interventions are grouped (Peng et al., 2018; Benoit et al., 2021) or used single (Zhao et al., 2021). Swaddling or tucking in a blanket while giving sucrose or breastmilk and being allowed to suck on a pacifier or gloved finger lowers the pain displayed via PIPPS (Peng et al., 2018; Benoit et al., 2021). In a systematic review of twelve randomized control trials, Zhao et al. (2021) found kangaroo care alone to be successful at lower PIPPS scores. Lan et al. (2021) demonstrated that a group of nonpharmacological interventions would lower NIPS scores. Gentle touch and comforting voice used with breastmilk taste and/or odor lowers NIPS scores. Massage (Yavas et al., 2021), vibration (Antepli et al., 2021), and breastfeeding or kangaroo care or facilitated tucking (Avcin & Kucukoglu, 2021), used individually resulted in lower NIPS scores after heel-lancing procedures. Comparisons have been made using interventions singly or as a group using NPASS (Chang et al., 2020) and NIPPS (Yilmaz & Inal, 2020) scales. Using interventions individually, Chang et al. (2020) found that administering sucrose or glucose

individually is the most reliable intervention to lower NPASS scores during heel lance procedures. Yilmaz & Inam (2020) compared single interventions to a group of interventions and found swaddling and holding while breastfeeding to be more effective than just swaddling or swaddling and holding. In a meta-analysis of studies using salivary cortisol levels, Canadas et al. (2021) link nesting in blankets, skin-to-skin, or breastmilk odor to lower pain levels evidenced by lower cortisol levels.

Using combinations of nonpharmacological interventions for pain management has successfully lowered pain demonstrated by newborns. Nonnutritive sucking (with a pacifier or gloved finger) and swaddling lower pain scores when combined with breastmilk (Peng et al., 2018) or sucrose (Benoit et al., 2021) administration. Nonnutritive sucking and breastmilk (Peng et al., 2018) or breastfeeding while skin-to-skin (Benoit et al., 2021) also lowers pain scores significantly. Nonpharmacological interventions used individually can also positively affect pain demonstrated by newborns (Yavas et al., 2021; Antepli et al., 2021; Chang et al., 2020; Canadas et al., 2021). A surprising finding was that the use of massage from the mother (Yavas et l., 2021) or a vibration device to act as a massage (Antepli et al., 2021) lowered the NIPS score by over 2 points. In fact, a study by Gomes et al. (2019) compared using *any* nonpharmacological intervention to using *no* interventions and found that using any type of nonpharmacological intervention has a better impact on pain scores than using nothing at all. (See Appendix A)

Project Stakeholders

Research shows the advantages of using interventions during painful procedures on newborns, and the stakeholders, such as parents, nurses, and hospital leaders, will want the interventions in place. Parents of newborns do not like to see their babies in pain. Nurses of newborns suffer from distress from repeatedly subjecting infants to painful procedures. Hospital

leaders want good outcomes and a high level of patient satisfaction. Therefore, the key stakeholders – patients, parents of patients, nurses, and hospital administration- will favor this policy change.

Implementation Plan

Create Awareness and Interest

A meeting will be held with the manager of the mother-baby unit to gain approval for the project and seek support for policy change. Then the first step will begin, requiring two weeks to complete. A survey of nurses about their attitudes toward newborn pain, what tools are available to address it, what tools are used, and what barriers exist to using those tools will be conducted to create a baseline of knowledge. (See Appendix B)

Build Knowledge and Commitment

For the next step, I will work with the unit educator to approve individually-completed continuing nursing education (CNE) credits about neonatal pain. These CNE opportunities will include scholarly articles on neonatal pain with comprehension questions. The CNEs will be available on all the units included in the EBP project in a notebook accessible by all staff to complete when time allows. The folder will be presented to the staff during daily huddles, weekly staff meetings, email, or whatever method the unit uses for regular communication amongst staff.

A poster presentation will be prepared and displayed in each unit with the PICOT and research from this EBP project. Staff will be encouraged to read the poster and sign a verification log that they have read it. The poster presentations and the CNE opportunities will run simultaneously for a total of 4 weeks.

Promote Action and Adoption

The third step involves addressing the issues identified in the surveys from step one. Review the barriers listed by nurses and work to eliminate them. If a barrier is identified as “supplies not easily accessible,” change the layout or location of supplies for easier access. If a barrier is identified as “not educated on use,” provide more education through a poster presentation. Using a poster presentation will allow the information to remain in place for an extended period so the nurses can refer back to it as often as needed.

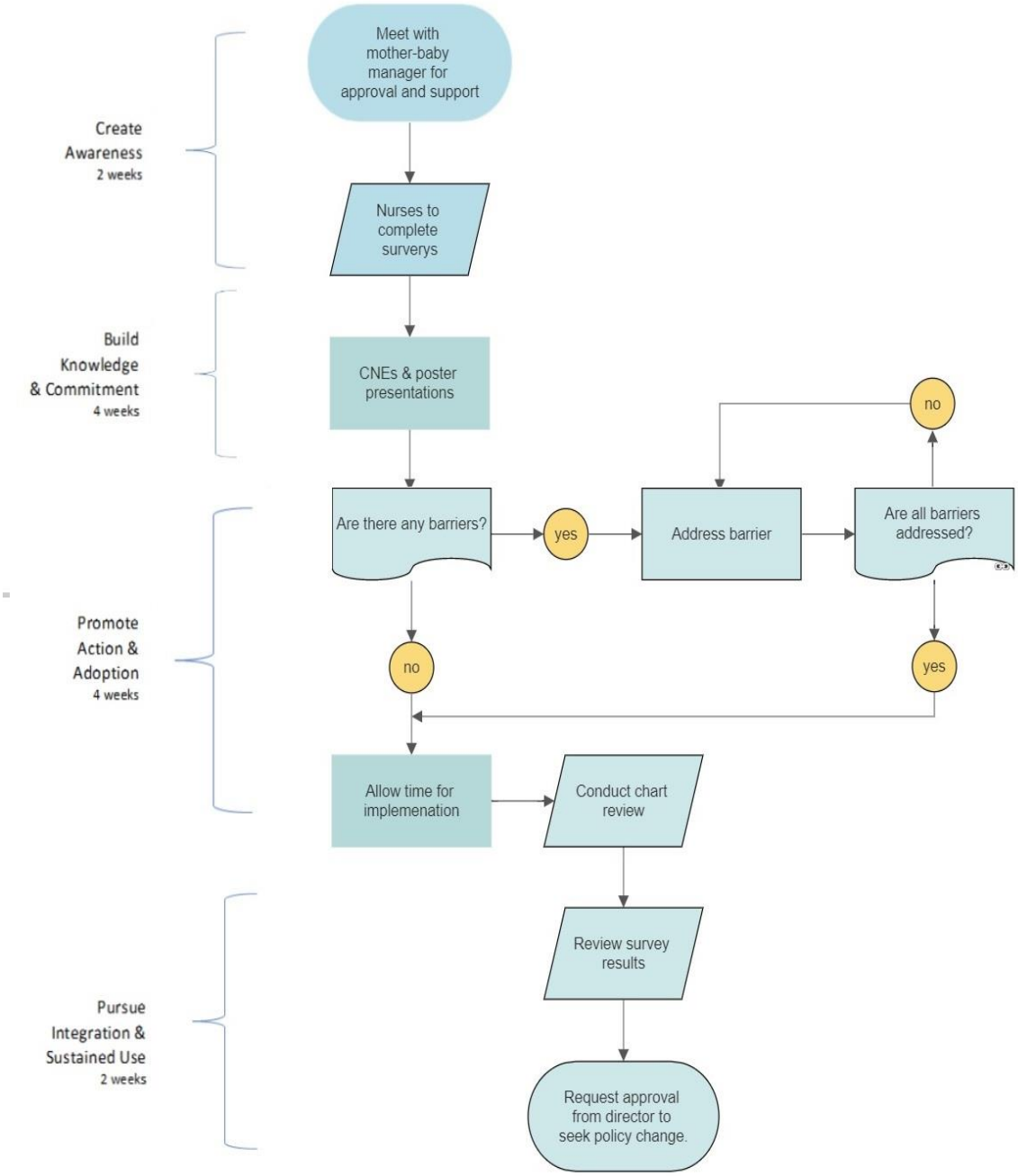
After waiting another four weeks, a chart review will be conducted. If all barriers have been addressed, there should be an increase in the use of nonpharmacological interventions during painful procedures on neonates. There should also be a decrease in the pain scores of newborns.

Pursue Integration and Sustained Use

With the completion of the 10-week pilot, new data can be gathered and shared. The survey submitted in step one will be circulated again. After allowing two weeks for completion, results will be analyzed. Expectations are that the knowledge and use of nonpharmacological interventions have improved.

As part of the final step to pursue sustained use, this EBP project, with all the research and 12-week pilot, will be taken to the director of women’s services to seek approval for a new policy. The flowchart below (figure1) shows the flow of the project process and the time needed to complete it.

Figure 1


Create Awareness
2 weeks
Build Knowledge & Commitment
4 weeks
Promote Action & Adoption
4 weeks
Pursue Integration & Sustained Use
2 weeks
Meet with mother-baby manager for approval and support
Nurses to complete surverys
CNEs & poster presentations
Are there any barriers?
yes
Address barrier
Are all barriers addressed?
no
no
yes
Allow time for implemenation
Conduct chart review
Review survey results
Request approval from director to seek policy change.

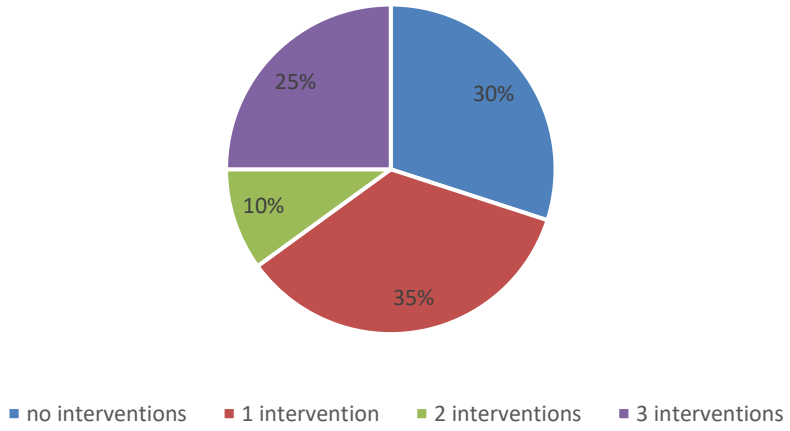
Data Collection Methods

Baseline data

Baseline data should be collected before the project commences. The evidence collected for hospital-based EPB projects is internal and may come from several sources: quality management, finance, human resources, clinical systems, administration, and electronic health records (Alexandrov et al., 2019). For the project mentioned above, data was extracted from the electronic health records of neonates admitted to the newborn nursery during a one-week period. The chart below (figure 2) shows the interventions that were used. Nonpharmacological interventions were used seventy percent of the time. Thirty percent of procedures were performed without nonpharmacological interventions.

Figure 2

Interventions used during painful procedures



Outcome measures

Outcome measures will be taken from electronic health records upon the completion of the project. The exact dates will be determined after the ten weeks of creating awareness, building

knowledge and commitment, and promoting action and adoption. The following steps will be taken to acquire and compare the outcome data to the baseline data.

1. A chart review will be conducted to locate every injection, heel lance, and blood draw performed on a neonate within a one-week period. This enormous task will require assistance from electronic health records professionals from the facility. The researcher should work with that department to gain access to the data in a manner acceptable to the facility. Some facilities may decline to give full access but supply the researcher with the data needed. Other facilities may not have the workforce to produce the data but may grant the researcher access to obtain the data directly.
2. A further chart review will determine what nonpharmacological interventions were used during each procedure. The date and time of the procedure should be matched with other documentation to determine what interventions were used at that precise time.
3. Procedures and interventions will be tallied on a chart. This step requires a simple tally in the column appropriate for the procedure and interventions used.
4. A simple comparison analysis will be conducted and displayed using a clustered bar chart. The percentage of times no intervention was used can be calculated with the following formula:

$$\frac{\text{number of times for no intervention}}{\text{Total number of procedures}} = \text{percentage of times no intervention was used}$$

This formula should be repeated for one, two, three, and more than three interventions. A simple comparison can be made using this raw data to the baseline data to determine if nonpharmacological interventions are used more frequently after providing education.

Cost/Benefit Discussion

Combining information from the literature and knowledge of supplies on the unit, several options are available for nonpharmacological pain relief.

- Blankets and swaddle sacks are available and already in use. There would be no additional cost to swaddle a baby before a painful procedure.
- Pacifiers are available on the unit and often used to soothe an upset newborn. At the cost of $0.89 for each pacifier, the unit would incur a cost increase of about $90/month to provide every newborn with a pacifier for painful procedures.
- Sucrose gel is available on the unit. For $1.12 each, providing every newborn with sucrose gel during painful procedures would cost approximately an additional $112/month.
- Syringes approved for oral dosing of a newborn are available on the unit for $0.38. These syringes capture expressed breastmilk from mothers and dispense it to newborns during painful procedures. An additional cost of up to $25/month could be expected for the widespread use of expressed breast milk during painful procedures.
- Music can be provided via the stereo already present in the nursery. Alternatively, a device that plays various musical tones, a heartbeat, or white noise can be purchased. This device would cost approximately $40.

Discussion of Results

At this time, this evidence-based project has not been brought to fruition. Efforts are underway to move the project forward.

Conclusions/Recommendations

The reality of newborn pain during procedures has been proven (Duerden et al., 2018; Perrone et al., 2017)). The nonpharmacological interventions to address newborns' pain are evident in the research (Peng et al., 2018; Benoit et al., 2021; Zhao et al., 2022; Yavas et al., 2021; Antepli et al., 2021; Avcin & Kucukoglu, 2021; Lan et al., 2021; Yilmaz & Inal, 2020; Gomes et al., 2019; Chang et al., 2020; Canadas et al., 2021;). Nurses are ethically responsible for addressing the pain of all patients (Robbins, 2018). This evidence-based change proposal seeks approval to improve the care of patients by implementing a policy for the use of nonpharmacological interventions during painful procedures on newborns.

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Appendix A

Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** LOE Strengths/Weaknesses Feasibility Conclusion RECOMMENDATION
Peng, (2018). Non-nutritive sucking, oral breast milk, and facilitated tucking relieve preterm infant pain during heel-stick procedures: A prospective, randomized controlled trial.	To compare combinations of NP interventions NNS+BM+FT and NS+BM on preterm infant pain during heel sticks	Preterm pain can be relieved with nonpharmacological methods	RCT Clinstat block randomization Convenience sampling Random assignment to CG, NNS+BM+FT, NNS+BM Heel stick performed and recorded; PIPP assessed by trained personnel	N=109 preterm infants Setting: level III NICU in Taiwan Exclusion criteria: surgery; congenital anomalies; medications using sedatives, muscle relaxants, anti-epileptics, or analgesics	IV1 NNS+BM IV2 NNS+BM+FT All groups placed in supine position with rolled supports 1 hour prior to procedure NNS = pacifier	PIPPS scale 8 phases: baseline, 1st and 2nd minute during procedure; 1, 2, 3, 4, and 10 minutes post procedure	GEE method multiple linear regression model	**NNS+BM lower pain score .7 to 4.3 units** **NNS+BM+FT lower pain score 1.1 to 3.6 units**	**Strengths**: high LOE; procedure performed by same RN; PIPPS score administered via recording by same personnel **Limitations**: complete blind not possible; small size **LOE**: II **Strength of evidence:** moderate, B **Feasibility**: Inclusion of these variables is feasible in the current unit as all supplies are already available and acceptable interventions are available.

3Ts=taste, touch, talk; BM=breastmilk; BF=breastfeeding; BT=bottle; CG=control group; CV=comforting voice; DAN=Douleur Aigue Nveaune; EBP=evidence based practice; FT=facilitated tucking; GT=gentle touch; HOL=hours of life; HR=heart rate; IV=independent variable; LOE=level of evidence; NBS=newborn screen: NCBS Newborn Comfort Behavior Scale: NICU=neonatal intensive care unit; NIPS=newborn infant pain scale NNS=non-nutritive sucking; NP=non-pharmacological; NPASS=neonatal pain and sedation scale; NPP=nested prone position; O2=oxygen saturation; OR=odds ratio; PIPPS=premature infant pain profile scale; RCT=randomized control trial; RM=repeated measures; RR=respiratory rate; SG=sucrose or glucose; STS=skin to skin;

Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Chang (2020). Comparing the Analgesic Effects of 4 Nonpharmacologic Interventions on Term Newborns Undergoing Heel Lance.	investigate analgesic benefits of 4 NP interventions on infants undergoing heel lance procedure	Newborn pain can be relieved with nonpharmacological methods	RCT O2 sensor applied, phlebotomist performed heel lance, 2 RNs scored pain with NPASS before and after; BF throughout or 5 drops SG or pacifier or STS throughout or CG in crib with blankets	226 term neonates Inclusion criteria: 38w-40w, 2.5-4.0 kg, 24-48 HOL, Apgar >7@ 1 minute, NPASS score < 3 before procedure.	IV1 BF IV2 SG **IV3 NNS** **IV4 STS** **DV lower pain score**	NPASS	Kruskal-Wallis test Wilcoxon-Mann-Whitney Spearman's rank correlation coefficient	NPASS scores: IV1 1.88 IV2 1.01 IV3 1.84 IV4 3.21 CG 5.14 OR: IV1 0.09 IV2 0.03 IV3 0.10 IV4 0.25	**Strengths:** high LOE, scored by 2 RNs **Limitations**: small sample size; did not account for confounding variables **Risk**: concerns of tolerance, safety of long-term use, & efficacy of repeat use of SG have been reported & under investigation **LOE**: 2 **Strength of evidence:** moderate, B **Feasibility**: easily used for policy change & implementation on unit as all equipment readily available

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Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Cañadas (2021) The impact of Nonpharmacological Interventions on Cortisol During Heel Lance Procedures on Preterm Infants: A Meta-Analysis Of RCTs.	Analyze effects of NP interventions on cortisol production of neonates during heel lance None	None	Meta-analysis	6 studies 552 neonates	**IVs= NPP=nested prone position** **BM odor** **STS(kangaroo care)** **Cobedding for twins** **DV=lower levels of cortisol**	Level of cortisol in saliva	Cochrane's Collaboration Tool	NP interventions are associated with a reduction in salivary cortisol levels with fixed effect mean differences of –0.11 and with a 95% C.I. of –0.28 to –0.05.	**Strengths:** high LOE, large size, objective data **Limitations**: **Risk**: none stated; none apparent **LOE**: 1 **Strength of evidence:** moderate, B **Feasibility**: easily used for policy change & implementation on unit as all equipment readily available

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Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** LOE Strengths/Weaknesses Feasibility Conclusion RECOMMENDATION
Yavas (2021) The Effect on Pain Level and Comfort of Foot Massages Given by Mothers to Newborns Before Hell Lancing: Double-Blind Randomized Controlled Study.	To determine effect of foot massages given by mothers on the pain and discomfort of newborns during heel lancing.	Painful experiences may alter neural and sensory development of newborn. NP measures may reduce pain of procedures.	Double-blind RCT CG: infant taken to room and held by mother while procedure is performed. Experimental group: at least 2 hours before procedure mother massaged infant's foot for 10 minutes then followed same steps as the CG.	128 full-term newborns at 24 HOL (64 in experimental group and 64 in CG)	Pain, discomfort, and distress of infants during and after a heel lance procedure.	NIPS scale for pain NCBS scale for pain, discomfort, and distress	2-way analysis of variance	Infants in study group had lower NIPS scores than the CG during the procedure: 4.875 versus 6.578 with a $p<.05$. The NCBS scores of the study group were lower than the CG: 20.14 versus 23.28 with a $p<.001$. Both groups had a significant decrease in scores after the procedure.	**Strengths**: double-blind study; single nurse performed all heel lances, single evaluator applied NIPS and NCBS scale by watching video recording. **Limitations**: small sample size, massage carried out by mother could have been performed differently, affecting the reliability of the study **Risk**: none **LOE**: 2 **Strength of evidence:** Moderate, B

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									Feasibility: easily used to implement policy change and to use on a hospital unit
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Antepli, (2021). The Effect of Vibration on Pain During Heel Lance Procedures in Newborns.	The effect of using vibration to relieve on newborns during heel lance procedure.	Pain-transmitting nerves can be repressed with vibration – gate control theory by Melzack and Wall (1965).	RCT CG: no interventions used during heel lance procedure. Experimental group: vibrating device applied below the knee to the same side as heel lance procedure approx. 30 seconds before procedure. Procedure was recorded, including the 20-second pre-	56 full-term newborns less than 28 days old (28 in CG and 28 in experimental group)	Pain as shown by behavioral responses.	NIPS scoring done at 3 intervals of heel lance procedure: before beginning, 15-20 seconds and 5 minutes post-procedure. Scoring done by nurse conducting procedure	Mann Whitney *U* test was used to compare the NIPS scores.	Scores were nearly the same for all 3 scorers throughout the study. Pre-procedure scores less than 1 for both groups. Post-procedure scores almost doubled in CG (4.42-5.71) vs. experimental group (2.53-2.96) with $p<.7$	**Strengths**: high LOE, same group of scorers on each subject, same nurse carried out each procedure. **Limitations**: While this is LOE 2, some details are not discussed in this paper: training provided to scorers and environment used for procedure. **Risks**: skin may become irritated at vibration site. **LOE: 2**

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			procedure and 5-minute post-procedure assessment times.			and by 2 trained Ph.D. students watching the recorded video.			**Strength of evidence:** Moderate, B **Feasibility**: good evidence for EBP project; implementation requires additional equipment from what is currently available.
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Benoit (2021)The influence of breastfeeding on cortical and bio-behavioural indicators of procedural pain in newborns: findings of a randomized controlled trial.	To compare BF to 24% SG on infant pain	BF and SG reduce pain	RCT ALL: video recorded, EEG monitored throughout **BF group**: test nonnoxious stimulation, go skin to skin for 2 minutes, breastfeed for 5 minutes, test nonnoxious stimulation, perform heel	39 full-term infants	IV1=BF IV2=SG DV=PIPP score DV=EEG DV=seconds to recovery	PIPP scores taken at 4 intervals post heel lance Recovery time back to base heart rate in seconds EEG results at precise	Means were compared using unpaired Student t tests	PIPP scores/changes were nearly identical in both groups EEG results were nearly identical in both groups Recovery time in BF group was 1 minute faster than in the SG group	**Strengths:** single-blind; training provided, video capturing event was scored **Limitations**: study states it is measuring BF and SG, but other differences are present: BF group is skin-to-skin with mother, and SG group is wrapped and using pacifier or gloved finger for sucking

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			lance, assess PIPP at 30, 60, 90, & 120 seconds after heel lance **SG group**: test nonnoxious stimulation, swaddle in blanket for 2 minutes, test nonnoxious stimulation, perform heel lance, assess PIPP at 30, 60, 90, & 120 seconds after heel lance			time of heel lance			**LOE:** 2 **Strength of evidence:** Moderate, B **Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Avcin, E., & Kucukoglu, S. (2021). The effect of breastfeeding, kangaroo care, and facilitated tucking positioning in reducing the pain during	Compare BF, KC, & FT during heel stick	We can control neonate pain with NP interventions	RCT	140 term neonates 3 family health centers in Turkey	IV1=BF IV2=KC IV3=FT DV1=pain DV2=cry time DV3=HR DV4=RR DV5=O2	NIPS score Seconds of crying HR, RR, O2 by sensors	Shapiro-Wilk ANOVA Kruskal-Wallis Student t test	DV1 FT ↓NIPS DV2 FT ↓cry time DV3, DV4, DV5 no sig diff	**Strengths:** single-blind; training personnel scored by video **Limitations**: small size **LOE:** 2 **Feasibility:** supplies are easily accessible at

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heel stick in neonates.									facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Yilmaz, D., & Inal, S. (2020). Effects of three different methods used during heel lance procedures on pain level in term neonates.	To determine the effects of swaddling, swaddling=holding, & swaddling+holding+BF during heel lance	Saturating senses of neonate reduces pain	RCT	160 term neonates from hospital setting 2-4 days old Healthy Hospital in Bandirma	IV1=swaddling IV2=swaddling+holding IV3=swaddling+holding+BF DV1=pain DV2=cry time	DV1 NIPS DV2 seconds of crying	Dunnett's T3 test	IV3 ↓NIPS, less cry time	**Strengths:** single-blind; **Limitations**: small size, NIPS performed researcher, not nurse **LOE:** 2 **Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Zhao, Y., Dong, Y., & Cao, J. (2022). Kangaroo Care for Relieving Neonatal Pain	Evaluate and combine research on KC for pain on neonates	KC is best form of NP intervention for pain for neonates	Systematic reveiw	12 studies all use PIPP scale, RCTs	IV=KC DV1=pain DV2=HR DV3=O2	DV1=PIPP scale DV2/3=monitors	Pooled MD Egger's test	IV ↓PIPP, but not better than SG; IV1+SG may be better	**Strengths:** "some" or "low" risk of bias according to Cochrane **Limitations**: **LOE:** 1

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Caused by Invasive Procedures: A Systematic Review and Meta-Analysis									**Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Lan, H.-Y., Yang, L., Lin, C.-H., Hsieh, K.-H., Chang, Y.-C., & Yin, T. (2021). Breastmilk as a Multisensory Intervention for Relieving Pain during Newborn Screening Procedures: A Randomized Control Trial.	Develop more wholistic approach to NP pain interventions	NP interventions and breastfeeding friendly initiative can coexist	RCT	120 term neonates convenience sampling from newborn nursery in Taiwan	IV= GT+CV IV2=GT + CV +BM odor IV3=GT+CV+BM odor + BM taste DV=pain	NIPS	Means and standard deviation for continuous data; frequencies; GEE	IV ↓NIPS	**Strengths:** single tester, 2 trained personnel scoring via video recording with >.85 reliability **Limitations**: complete blinding not possible; small size; only one medical center involved **LOE:** 2 **Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Kumar, P., Sharma, R., Rathour, S.,	Compare effects of 5 NP interventions	NP interventions are	RCT	300 term neonates receiving	IV1=BF IV2=SG IV3=NNS	DAN score	Pearson chi square;	DV1 & DV2 lowest with IV2	**Strengths:** single tester, single scorer, same method each time

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Karol, S., & Karol, M. (2020). Effectiveness of various nonpharmacological analgesic methods in newborns.		easy, effective, economical, and ethical		routine Hep B vaccine in hospital in India	IV4=water IV5=rocking DV1=cry time DV2=pain	Seconds of cry time	t test Tukey honestly significant difference		**Limitations**: complete blinding not possible; small size; only one medical center involved **LOE:** 2 **Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project
Citation: authors, date, title	Purpose of Study	Conceptual Framework	Design/Method	Sample/Setting	Major Variables Studied and their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	**Worth to Practice:** Strengths/Limitations Risks LOE Strength of evidence Feasibility
Gomes, P. P. de S., Lopes, A. P. de A., Santos, M. S. N. dos, Façanha, S. M. de A., Silva, A. V. S. e, & Chaves, E. M. C. (2019). Non-pharmacological measures for pain relief in venipuncture in newborns: description of behavioral and physiological responses.	Observe and describe differences in behavior of NICU infants during venipucture with and without NP interventions for pain	NP interventions for pain and interfere with negative effects of pain	Cross sectional study	NICU of Brazil hospital 84 infants	IV1=no NP IV2=any NP DV1=pain DV2=HR DV3=O2	NIPS monitors	Not discussed	For all IV2 all DV lower significantly	**Strengths:** single scorer, **Limitations**: lower LOE **LOE:** 3 **Feasibility:** supplies are easily accessible at facility for use; good evidence for use in EBP Project

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Appendix B

Survey on Newborn Pain

Please answer the following questions and return this survey to your manager.

1. Do you believe newborns experience pain?

   _____

2. Do you believe you should use interventions to reduce newborn pain, if possible?

   _____

3. Do you ever conduct procedures that increase pain for the newborn? What are those procedures?

   _____

4. What methods have you used to reduce newborn pain here or at another facility?

   _____

5. What is available at this facility to reduce newborn pain?

   _____

6. Is there anything that prevents you from using the available supplies?

   _____

7. What can be done to increase the frequency you use interventions to reduce newborn pain?

   _____