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## Neuroprotective Care and Painful Procedures

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# Walden University

College of Nursing

This is to certify that the doctoral study by

Jelda Frank

has been found to be complete and satisfactory in all respects,  
and that any and all revisions required by  
the review committee have been made.

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Executive Summary: Staff Education Project

Neuroprotective Care and Painful Procedures

by

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MSN, Walden University, 2020

ASN, Keiser University, 2015

Executive Summary Submitted in Partial Fulfillment

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## Summary

An inconsistent application of neuroprotective care provided by clinical staff, based on my observations, to minimize the negative effects of painful procedures that can negatively impact the neurodevelopment of neonates in the neonatal intensive care unit (NICU), was the identified practice problem for my Doctor of Nursing Practice (DNP) staff education project. Implementation of evidence-based neuroprotective and neuropromotive strategies aim to optimize outcomes for premature infants and minimize risk of potential negative effects to the neonate's short and long term neurodevelopment.

The DNP project practice-focused question addressed whether a presentation of an evidence-based educational program for NICU clinical staff would improve their knowledge and confidence of strategies to provide neuroprotective care to neonates during painful procedures as measured by a pre-/post-survey. The purpose of this project was to develop, implement, and evaluate a short 20-minute virtual education session on evidence-based neuroprotective care related to painful procedures to minimize the potential risk of negative effects on neonates' neurodevelopment. Pre-education, between 1 (20%) and 4 (80%) disagreed on four out of five of the items assessing their knowledge perception and increased to (5) 100% strongly agreed post education. In addition, between 1 (20%) and 3 (60%) were not at all or somewhat confident pre-education, and 1 (20%) was confident and 4 (80%) were strongly confident post education. Nursing practice, social change, diversity, equity, and inclusion could be enhanced by increasing NICU staff knowledge on procedural neuroprotective care strategies to promote healthy brain development for all infants, while integrating parental involvement to maintain focus on positive neurodevelopmental, behavioral, and cognitive outcomes.

## **Background**

In one 300+ bed hospital, I observed an inconsistency in providing evidence-based neuroprotective care to the neonates by neonatal intensive care unit (NICU) clinical staff during painful procedures. Per Tortora et al. (2019), “preterm neonates necessitate invasive treatments as part of their essential intensive care and can be subjected to multiple painful procedures requiring skin breaks (i.e., heel lances, intravenous or central line insertion, intramuscular injection, and surgical interventions” (para 1). Further, Boggini et al. (2021) found that “Repetitive pain exposure in newborn infants has been proposed to play a role in their brain development, auxological growth, pain sensitivity, and stress response systems as well as in adverse neurodevelopmental, behavioral, and cognitive outcomes, which can persist later in life” (para 3).

Regarding the practice focused-question for this DNP staff education project, I asked “Will the presentation of an evidence-based educational program for NICU clinical staff improve their knowledge and confidence of evidence-based strategies to provide neuroprotective care to neonates during painful procedures as measured by a pre-/post-survey?” The purpose of the project was to develop, implement, and evaluate a staff education session aimed to increase the knowledge and confidence among NICU staff nurses on performing evidence-based neuroprotective care related to painful procedures.

Search strategies that I used to obtain evidence for this project were searching keywords together, ensuring articles of interest were directly related to the evidence-based practice question, and having a one-on-one virtual session with a Walden librarian. The Walden online library, Google Scholar, Google, PubMed and ProQuest were the primary databases I used to search for evidence-based peer-reviewed journal articles.

Some of the keywords searched included *neonates AND neuroprotective care, staff education AND neuroprotective care in the NICU, staff education AND neuropromotion, heel sticks AND neurodevelopment, neonatal procedural pain AND neuroprotective care, NICU nurses AND neonatal pain, noxious stimuli AND neuroprotective care, AND NICU nurses AND neonatal procedural pain*. To better assess and organize the evidence-based peer-reviewed articles of interest, I used the following Johns Hopkins tools provided by Walden University: question development, individual evidence summary table, synthesis & recommendations, and translation & action planning. Of the relevant evidence-based sources for this DNP staff education project, I identified one *high* quality Level I, one *good* quality Level II, and three *good* quality Level V sources of evidence. The three Level V pieces of evidence were drawn from organizational experience and were beneficial to my evidence-based project due to being based on a multisite review of quality improvement projects.

Sources of evidence supported that administration of a pretest, followed by staff education, and concluded by a posttest, could lead to a significant improvement in NICU clinical staff knowledge regarding neuroprotective and neuropromotive care as it relates to painful procedures (Elarousy et al., 2020). Increasing the sensitivity of healthcare personnel to neonatal procedural pain led to better use of analgesic measures during procedures and avoidance of repetitive procedures (Anne et al., 2021).

### **Staff Education Project Development**

For my DNP staff education project, I developed a staff education PowerPoint to cover key content, a pre-/postsurvey to evaluate knowledge perception and confidence, and an overall presentation evaluation to assess participant satisfaction. Content covered

in the staff education PowerPoint consisted of defining neuroprotective care, explaining the correlation between neonatal neurodevelopment and procedural pain, describing procedural evidence-based neuroprotective care strategies, and a discussion scenario to apply those strategies to nursing practice. Following DNP project committee approval of proposed project materials and approval of an Ethics Pledge by Walden University, each document developed for the education session was reviewed by two invited content experts at project site. Both experts have pivotal roles in education and quality improvement projects in the NICU. They completed and returned a content expert evaluation form I developed. Per recommendation from one of the project site content experts, I developed a short demographic survey to assist with describing the job experience of project participants. Based on each content expert's evaluation, I ensured the importance of the use of Bloom's taxonomy verbs to reword learning objectives, the use of larger fonts on PowerPoint slides for easier viewing, and the inclusion of "safeguarding sleep" as an important topic in neuroprotective care to be included in my education program. Per a recommendation from a content expert during my Action Plan Review, I incorporated a discussion scenario based on a fictional patient that specifically related to the project site. With this feedback, I made necessary revisions to my project materials prior to implementation. See the Appendix for educational materials.

### **Results**

With the NICU being primarily staffed by newer registered nurses (RNs), they were the target population for my DNP staff education project. I sought out volunteers to participate in the implementation of my project, of which five NICU staff nurses agreed to. Per the short demographic survey that I previously mentioned, this was each of the

five invited participant's first time working in a NICU, and they were all within the 6 months to 1 year range of being a NICU RN at the site. To better accommodate staff schedules, I performed two virtual teaching sessions using the Teams and Zoom applications. The pre/post and presentation evaluation surveys were administered electronically via links from the SurveyMonkey website that I sent to their mobile devices at the beginning and end of the project implementation. I was able to ensure anonymity using the SurveyMonkey website in that no participant identifiers were displayed.

Using descriptive statistics to analyze results, there was a noted increase in knowledge perception and confidence in relation to providing neuroprotective care to infants during painful procedures in the NICU. Prior to the education session, between 1 (20%) and 4 (80%) disagreed on four out of five of the items assessing their knowledge perception. See Table 1 for the 5-item survey used to evaluate pre and post project implementation results on knowledge. At the end of the education session, 100% strongly agreed that they were knowledgeable on all five items.



**Table 1**

*Effect of Pre & Post Project Implementation on Nurses' Perception of Self-Competency on Performing Neuroprotective Care to Infants in the NICU During Painful Procedures*

Questions	Pre-survey				Post-survey			
	Strongly agree	Agree	Disagree	Strongly disagree	Strongly agree	Agree	Disagree	Strongly disagree
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
I can define neuroprotective care.	0	4 80%	0	1 20%	5 100%	0	0	0
I can explain the importance of neuroprotective care with painful procedures in the NICU.	0	3 60%	2 40%	0	5 100%	0	0	0
I can identify at least 2 neuroprotective care strategies related to painful procedures in the NICU.	0	4 80%	1 20%	0	5 100%	0	0	0
I can recognize which neuroprotective strategies are tailored to individualized infant care in the NICU.	0	1 20%	4 80%	0	5 100%	0	0	0
I can answer parents' questions about neuroprotective strategies tailored to their infant in the NICU.	0	1 20%	4 80%	0	5 100%	0	0	0

Prior to the education session, between 1 (20%) and 3 (60%) were not at all or somewhat confident; 1 (20%) was confident. See Table 2 for the 1-item survey used to evaluate pre and post project implementation results on overall confidence. At the end of the education session, 1 (20%) was confident and 4 (80%) were strongly confident in their ability to provide neuroprotective care to NICU infants during painful procedures.

**Table 2**

*Effect of Pre & Post Project Implementation of Nurses' Overall Confidence on Performing Neuroprotective Care to Infants in the NICU During Painful Procedures*

QUESTION	Pre-survey				Post-survey			
	Strongly confident	Confident	Somewhat confident	Not confident at all	Strongly confident	Confident	Somewhat confident	Not confident at all
Overall, I am confident in my ability to provide neuroprotective care to infants in the NICU with painful procedures.	0	1 20%	3 60%	1 20%	4 80%	1 20%	0	0

Following post-survey completion, the overall presentation evaluation resulted in 100% very satisfied from all five participants. The survey tool can be found in Section V of the Appendix.

### **Impact**

The results support the benefit of having a short, focused education session on providing neuroprotective care to infants during painful procedures showing an increase in NICU staff nurses' knowledge perception and confidence postimplementation. The project participants engaged in a didactic portion followed by the discussion scenario created to apply the information learned and relate it to their current practice. The session has potential to impact neonatal units beyond the site by continuously educating NICU clinical staff on the importance of reducing neonatal neurodevelopment challenges related to painful procedures, in turn improving short- and long-term patient outcomes.

### **Limitations**

The main limitation of the project is the small sample size. Although the evidence-based program was effective, testing with a larger staff sample would provide more robust findings to support its effectiveness. A wider spectrum of results may be

achieved with a potentially wider range of years of NICU nursing experience. To address another limitation, the project should be repeated in intervals over time to better validate the effectiveness of the staff education program.

### **Recommendations**

Post implementation, this DNP staff education project opens up a window of opportunity for impacting patient outcomes by improving knowledge and confidence of NICU staff about neuroprotective evidence-based practice to minimize risks to neurodevelopment among neonates. Per the SWOT analysis completed with a project mentor in the earlier phases of the project, minimal to no experience RNs make up the primary staff nurse population at the site. Because of that along with the post implementation results of my DNP staff education project, recommending the inclusion of the 20-minute staff education module and implementing more evidence-/scenario-based learning for newer NICU staff nurses earlier on could build upon the already existent curriculum and NICU infant care bundle at the project site, thereby continuing positive impacts on patient outcomes. An additional recommendation would be increasing the awareness of NICU nursing staff about evidence-based practice approaches to providing neonatal neuroprotective care during painful procedures. Based on my observation, this could be achieved by developing painful procedure neuroprotective care strategy info cards and/or signage visible throughout the NICU at the project site.

### **Conclusions**

For NICU clinical staff, promoting healthy brain development for all infants is a necessity. Neuroprotective care strategies to minimize the potential negative impact on neonatal neurodevelopment during painful procedures are extremely important to any

NICU. To uphold that level of importance, continuous staff education is key to ensure adequate knowledge and confidence in providing evidence-based neuroprotective care strategies related to procedural pain. In addition, these strategies, along with parental involvement, aid in the process and promote positive social change not only in the NICU but within external communities as well.

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## **Appendix: Educational Materials**

### **Neuroprotective Care & Painful Procedures in the NICU**

#### **I. DNP Project Demographic Survey**

1. Is this your first time working in a NICU?
  - Yes
  - No
  
2. Select the number of months worked as an RN at this NICU:
  - Less than 6 months
  - 6 months to one year
  - 1 to 2 years
  - More than 2 years

#### **II. Introduction/Thank You Letter**

To whom it may concern,

I sincerely appreciate your participation in my Doctorate of Nursing Practice (DNP) Staff Education Project. Your participation will consist of taking a short pre-survey, listening to a brief 20-minute education PowerPoint virtual presentation, followed by taking a short post-survey, and ending with completing an evaluation of the presentation. On presentation day, I will send you a link to complete each form electronically upon my instructions. Please answer each question as honestly as possible as there is no judgement or bias of any kind; the results will be completely anonymous. Thank you for your consideration and time devoted to assisting me with my DNP project.

Regards,

Jelda

### III. Pre/Post-Survey

#### PRE-SURVEY

Prior to completion of the evidence-based education presentation on *Neuroprotective Care & Painful Procedures in the NICU*, please rate your level of agreement with the following statements:

1. I can define neuroprotective care.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
2. I can explain the importance of neuroprotective care with painful procedures in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
3. I can identify at least 2 neuroprotective care strategies related to painful procedures in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree

4. I can recognize which neuroprotective strategies are tailored to individualized infant care in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
  
5. I can answer parents' questions about neuroprotective strategies tailored to their infant in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
  
6. Overall, I am confident in my ability to provide neuroprotective care to infants in the NICU with painful procedures.
  - Strongly confident
  - Confident
  - Somewhat confident
  - Not confident at all



## POST-SURVEY


Upon completion of the evidence-based education presentation on *Neuroprotective Care & Painful Procedures in the NICU*, please rate your level of agreement with the following statements:

1. I can define neuroprotective care.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
2. I can explain the importance of neuroprotective care with painful procedures in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
3. I can identify at least 2 neuroprotective care strategies related to painful procedures in the NICU.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree

4. I can recognize which neuroprotective strategies are tailored to individualized infant care in the NICU.
- Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
5. I can answer parents' questions about neuroprotective strategies tailored to their infant in the NICU.
- Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
6. Overall, I am confident in my ability to provide neuroprotective care to infants in the NICU with painful procedures.
- Strongly confident
  - Confident
  - Somewhat confident
  - Not confident at all

## IV. Staff Education PowerPoint

Neuroprotective Care & Painful Procedures in the Neonatal Intensive Care Unit (NICU)



Presented by:  
Jidda Frank  
Walden University DNP Student

1

By the end of this presentation, the NICU staff nurses will be able to:

**LEARNING OBJECTIVES**

- Define neuroprotective care
- Describe evidence-based strategies that promote effective & efficient neuroprotective care to neonates when painful procedures are performed
- Apply neuroprotective strategies that are tailored for individualized infant care

2

**WHAT IS NEUROPROTECTIVE CARE?**

• A model of care that focuses on the reduction of sensory and environmental stimuli of the NICU... supporting the neuroplasticity of the developing neonatal brain (Scahill et al., 2016, p. 4)



3

**BACKGROUND**

• **Brain Development**

- Critical period from 3<sup>rd</sup> trimester to five 3 months of life
- Infants depend on environment to stabilize physiologic functions
- Cumulative immature brain experiences can affect long-term development
- The smaller the gestation = increased neuroprotective needs (Scahill et al., 2016, p. 4)

• **Pain**

- Disrupts infant's environment
- Causes physiologic instability
- Can cause decreased brain size, cortical thickness, & white matter
- Repeated exposure can possibly lead to future issues (ex. ADHD, anxiety, emotional disorders) (Scahill et al., 2016, p. 4)

4

### NEUROPROTECTIVE CARE STRATEGIES RELATED TO PAINFUL PROCEDURES

Check for each item link to see additional info.

<p><b>Healing Environment</b></p> <p><b>Strategy:</b> Minimize noise &amp; lights</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Avoid setting rooms on top of radiology</li> <li>Defer or voice both</li> <li>Minimize alarms</li> <li>Minimize bright lights as much as possible</li> <li>Cover infant's eyes if possible</li> </ul>	<p><b>Positioning &amp; Handling</b></p> <p><b>Strategy:</b> Use appropriate positioning &amp; handling</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Swaddling (nesting if possible)</li> <li>Avoid quick turning movement</li> <li>Avoid lifting lower extremities too high especially with premature &amp; high-risk neonates</li> </ul>	<p><b>Minimizing Stress &amp; Pain</b></p> <p><b>Strategy:</b> Provide non-pharmacological &amp; pharmacological interventions</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Cluster care</li> <li>Non-removal suckling</li> <li>Administer pain meds prior to procedure if necessary, use more slowly</li> <li>Utilize oral sucrose (if allowed)</li> <li>Advocate for minimal changes of care</li> </ul>
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5


### NEUROPROTECTIVE CARE STRATEGIES RELATED TO PAINFUL PROCEDURES

Check for each item link to see additional info.

<p><b>Partnering with Families</b></p> <p><b>Strategy:</b> Encourage family involvement</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Allow parents to assist in care if possible</li> <li>Whether they can help or not, always explain your tasks to their infant to the infant's needs during procedures</li> <li>Encourage skin-to-skin (if possible)</li> <li>Encourage skin-to-skin (if possible)</li> </ul>	<p><b>Promoting Skin</b></p> <p><b>Strategy:</b> Minimize/prevent injury</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Be mindful of medical equipment touching skin</li> <li>Avoid friction</li> <li>Gently remove adherents</li> <li>Avoid pulling on skin from rash &amp; lines</li> <li>Monitor # of pulses (if possible)</li> </ul>	<p><b>Safeguarding Sleep</b></p> <p><b>Strategy:</b> Decrease sleep interruptions</p> <p><b>Examples:</b></p> <ul style="list-style-type: none"> <li>Avoid unnecessary activities</li> <li>Cluster care</li> <li>Avoid too many changed items at once</li> <li>Utilize IV cover &amp; gromet both</li> </ul>
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6

### Keys To Success



- Healthcare personnel sensitivity to neonatal procedural pain is essential (Lauze et al., 2015)
- Providing consistent neuroprotective care in the NICU requires a team effort (Cohen et al., 2015)
- Provide predictable, cue-based care (Cohen et al., 2015)
- Parent presence matters (Candace et al., 2015)


7

### DISCUSSION SCENARIO

\*based on a fictional patient\*

On a Sunday night, you're the nurse caring for a baby born at 30 weeks gestation, adjusted to 31 weeks. The baby is on HFNC 4L @ 25%, in an isolette on servo mode, has a PIV in the right hand infusing PN and lipids, and an OG tube inserted for feedings. You notified the provider via phone that the baby has been having frequent apnea/bradycardia episodes during your shift. Mom of the baby is sitting at bedside & visibly emotional. The provider orders NPO status, a STAT CBC, CRP, & blood culture. You quickly collect & send your labs with assistance from the resource nurse and move on to your next patient so that you don't get behind.

➡ Discuss some neuroprotective care strategies that can be tailored for this scenario.



8



9

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10

**V. Presentation Evaluation**

## DNP Project Presentation Evaluation

- 1) The educational content was relevant and helpful to you.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
  
- 2) The presentation was engaging.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
  
- 3) The presentation was done at a comfortable pace.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree
  
- 4) The presenter appeared to be knowledgeable on the topic.
  - Strongly Agree
  - Agree
  - Disagree
  - Strongly Disagree

Rate your overall satisfaction with the quality of the presentation.

- Very Satisfied
- Satisfied
- Dissatisfied
- Very Dissatisfied