CREATING A LEARNING RESOURCE FOR DEVELOPMENTAL CARE IN THE NICU: EMBRACING A HOLISTIC APPROACH

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A report submitted to the School of Graduate Studies in partial fulfillment of the requirements

for the degree of

Master of Nursing

Faculty of Nursing

Memorial University of Newfoundland

December 2020

St. John's Newfoundland and Labrador

Abstract

Background: The Neonatal Intensive Care Unit (NICU) is a specialty unit that requires expert and skillful nurses to care for a vulnerable group of patients. While the biomedical model has long been the emphasis of the NICU, the aim of nursing care has shifted to include holistic nursing values and practices, such as developmental care and family-centered care to improve patient outcomes. Though many facilities provide post-entry level NICU training, there is a gap in education specifically related to developmental and family-centered care. **Purpose:** The purpose of this practicum project was to develop a learning resource focused on developmental care and family-centered approaches for Registered Nurses (RNs) providing neonatal nursing care at the Cape Breton Regional Hospital (CBRH). **Methods:** An integrative literature review related to developmental and family-centered care was conducted, highlighting the importance of the two in improving patient outcomes. Specific evidence-based developmental care interventions were identified and methods of involving families in the NICU setting were uncovered. Consultations were held with RNs currently employed at the CBRH to assess their learning needs and identify gaps in their knowledge of developmental care and family-centered care. Clinical Educators from Atlantic Canada NICUs were contacted, and an environmental scan was conducted to determine developmental care interventions, family-centered care practices, and educational methods used. **Results:** An education resource detailing developmental care and family-centered care approaches was developed for RNs working in the NICU at the CBRH. The resource consists of a 33-page booklet and includes topics of sound, light, scent, touch, pain, and sleep; contains self-reflection questions and ends with a case study. **Conclusion:** This learning resource will offer an opportunity for RNs to expand their knowledge of developmental and family-centered care, and associated interventions. It will also help them implement these approaches to care in their daily nursing practice, which should improve patient outcomes. In doing so, this resource will assist RNs in providing optimal care to their patients and families.

Acknowledgements

I would like to express my heartfelt appreciation for my wonderful supervisor, Paula Kelly. Her passion for women and children's health is truly inspirational. Her kindness, boundless patience, and invaluable feedback has made this project possible. Thank you for always pushing me to be my best.

I would like to wholeheartedly thank my mother, Rosanne, for her unwavering support throughout my entire academic career, especially these last few months. She is always available to help me, whether it be with a hot meal, babysitting service, or a shoulder to cry on. Thank you, Mom, I love you.

I would like to express my sincere gratitude to my husband, Andrew. It isn't easy being the husband of a graduate student, but he fulfilled the role with grace, patience, and humour. Thank you for picking up the slack, and never complaining when I spent countless evenings couped up in the basement doing schoolwork. You are the best partner I could have ever hoped for.

To my beautiful baby boy, James, you are my light, my heart, and my biggest motivator. You kept Mama smiling throughout this journey, and you always served as the most delightful reminder that family is most important. Thank you, my sweet boy.

To my Dad, the late Kenny Paruch, thank you from the bottom of my heart for encouraging me to become a Registered Nurse. I could write an entire book listing the ways you have helped me to succeed and I still wouldn't be able to cover them all. Thank you for the countless hours you spent as my resident therapist, talking me though the trials and tribulations of life, love, and post-secondary learning. You always believed in me, even when I didn't believe in myself. I promised you I would finish this… and here I am. This is for you, Daddy.

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Introduction

The neonatal intensive care unit (NICU) is a specialty unit that requires expert and skilled nurses to care for a vulnerable group of patients. According to the Canadian Nurses Association (2020), neonatal intensive care nursing is considered a nursing specialty and certification may be earned by passing a two-part exam. While there is no nationwide course required for initial employment in the NICU setting, many facilities offer their own version of specialty training. The Cape Breton Regional Hospital (CBRH) offers the Neonatal Orientation and Education Program (NOEP) developed by the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN). The NOEP course is offered to new staff on an irregular basis and for existing staff, participation in the course is not mandatory.

The NICU at the CBRH is a 12-bed unit and functions as a level 111A facility, provided there is neonatologist coverage. A level 111A NICU can provide continuous ventilator support for infants whose gestational age is greater than or equal to 28 weeks or for infants weighing greater than or equal to 1000g, however it does not have access to high-frequency oscillation or advanced neonatal surgery (American Academy of Pediatrics [AAP], 2004). Despite the high level of care provided in this unit, a practice gap exists in the area of developmental care. While the NOEP course includes a module on developmental care, the irregularity of the course offering makes it unsatisfactory as the unit's only form of developmental care education. This lack of developmental care education, coupled with the absence of developmental care practice standards, creates inconsistencies in this area of nursing care.

This practicum project presents an excellent opportunity to close this practice gap through the creation of an educational resource describing a set of developmental care practice guidelines, along with vital information on family-centred care.

Background

Developmental care is both a specific set of interventions, and a way of providing medical interventions that protect a premature infant's brain development. In a normal, healthy pregnancy, optimal infant brain development occurs the womb. Unfortunately, when the pregnancy presents a high risk of adverse outcomes, the womb may no longer be the best environment for development. When infants are born prematurely—before the period of critical brain growth (approximately 36 weeks)—neurodevelopment continues in the unfavourable extrauterine environment which is bright, loud, cold, and stressful (Soleimani et al., 2020). Developmental care may be utilized to try and mimic the intrauterine environment to "reduce stress, support sleep, maintain physiological stability, and promote neural growth and development" (Soleimani et al., 2020, p.2). Essentially, developmental care is a form of holistic nursing care comprised of interventions targeting the infants' senses and protecting their neurodevelopment.

Without developmental care, premature infants have increased risk of cognitive and motor developmental delays (Soleimani et al., 2020). When a premature infant's brain is exposed to noxious environmental stimuli, neurons form different connections than they would have if development continued in-utero, and this stressful or painful stimuli cause some neurons to die (Soleimani et al., 2020). When this neuronal death occurs, the neurological development of the infant is negatively impacted and may lead to delays in cognitive or motor development (Soleimani et al., 2020). These developmental delays may include difficulty with attention,

academic achievement, and behaviour (Gaspardo et al., 2008). Therefore, one of the goals of developmental care is to protect the infant's neurodevelopment by altering the NICU environment to mirror the uterine environment (Macho, 2017).

Developmental care is deeply rooted in a family-centred care approach. Family-centred care is defined as "an approach to medical care with the belief that optimal health outcomes are achieved when patient's family members have an active role in providing social, emotional, and developmental support to the patient" (Gooding et al., 2011 as cited in Macho, 2017). In the past, the focus of NICU nursing has aligned with the biomedical model, prioritizing the highly "technical" (p.273) aspects of care, with little regard for the infant as an individual (Kaye, 2016). As of late, there has been a shift in focus and NICU nursing has become more aligned with a holistic, family-centred care model that places the infant's individuality and relationship with the extrauterine environment at the forefront (Kaye, 2016).

Objectives

The overall goal of this practicum project is to develop an educational resource to guide developmental care practice in the NICU at the CBRH in Sydney, Nova Scotia. The key objectives for this practicum project are:

1. Through consultations with practicing nurses, describe the various ways developmental care practices are implemented in NICUs across Atlantic Canada.
2. Identify developmental care practices, if any, currently implemented at the CBRH NICU and determine how they can be improved.
3. Determine which developmental care practices need to be initiated at the CBRH NICU.
4. Develop a self-directed developmental care education resource to guide nursing practice in

the CBRH NICU.

5. Demonstrate advanced nursing practice competencies.

Overview of Methods

This practicum project began with an integrative review of the literature, to discover more information on developmental care history, philosophy, interventions, and ties to family-centred care. Following the completion of the literature review, consultations were held with RNs currently employed in the NICU at the CBRH to assess their knowledge of developmental care and determine how developmental care and family-centred care are currently being practiced in this unit. Simultaneously, an environmental scan was conducted by contacting six clinical nurse educators (CNEs) from NICUs across Atlantic Canada. The purpose of the environmental scan was to gather information on developmental care and family-centred care practices in other facilities in a similar geographical area. The above methods were executed from May 2020 to August 2020.

Summary of the Literature Review

The purpose of the literature review was to discover recently published, evidence-based developmental care interventions to function as the foundation for the educational resource. Additionally, the literature review aided in establishing the potential benefits of implementing developmental care and family-centred care in the NICU. The following is a summary of the literature review. The complete literature review can be found in Appendix A.

Databases CINAHL and PubMed were searched using the terms “developmental care” and “neonatal intensive care” or “NICU” or “special care” or “baby unit” or “newborn intensive care”. Limiters included scholarly journals only, published between the years 2015-2020, and

written in the English language. This search yielded 171 results. A total of 24 articles were deemed relevant to this practicum project. The studies were critically appraised and deemed appropriate for inclusion.

Family-Centred Care

Doane and Varcoe's (2015) relational inquiry was chosen as the model of care as developmental care is rooted in family-centred care. Illness does not affect a person in isolation, rather, illness affects the entire family and only a small portion of what each family copes with is observable (Doane & Varcoe, 2015). When utilizing relational inquiry, RNs must disregard their preconceived notions of what *family* is, recognize the family as equal members of the healthcare team, and learn about each family's unique needs (Doane & Varcoe, 2015).

Developmental Care Interventions

Main themes from the literature review include how interventions related to sound, light, scent, touch, pain and sleep can create an environment conducive to neurodevelopment and maintaining family-centred care. In addition, findings from the literature demonstrated that RNs play a significant role in the achievement of developmental care within the NICU setting. NICU culture, that is – nurses attitudes combined with their usual practices, is also an important indicator of whether developmental care will be successful.

Knowles' Theory of Adult Learning

A self-directed module was chosen as the format for the educational resource because adult learning is "increasingly self-directed" (p. 216) and adults have "preferred differences in personal learning style" (p. 216) (Candela, 2016). Knowles' found that past life experience provides context for adults' learning preferences (Candela, 2016). Thus, it is important to

determine, through consultations, what the learners already know about developmental care and family-centered care before developing this resource. Likewise, it is key to have the learners reflect on their past experiences with developmental care and family-centred care, if any (Candela, 2016). Adult learners are task-orientated and wish to problem solve; therefore, the resource includes practical case-studies for the learners to apply their new knowledge to a real-world scenario (Candela, 2016).

Benner's Novice to Expert Theory

Benner's novice to expert theory suggests that RNs pass through five various stages of expertise, from novices requiring supervision to experts who are leaders and creative thinkers (Candela, 2016). Due to the non-mandatory training regimen, it can be assumed that in the CBRH NICU, the RNs likely have varying knowledge levels about developmental care. Some staff members are newly graduated RNs with little to no exposure to developmental care. At the same time, there are other, more experienced RNs who have worked in larger NICUs where developmental care is a routine part of practice. Benner's theory was fundamental in guiding this resource because the learner must be met at whatever stage they are in (Candela, 2016).

Summary of Consultations and Environmental Scan

Consultations

Consultations with four RNs from the CBRH NICU were completed to gain insight into RNs' current knowledge and practices related to developmental care. Two of the participants have less than five years of NICU work experience, and two have more than 20 years of experience working in a NICU. All four of the participants who were contacted returned

completed questionnaires via email. The goals of the consultations and environmental scan were as follows:

1. To explore the RN's understanding of developmental care.
2. To obtain feedback from RNs related to the importance of developmental care in daily care.
3. To discover whether developmental care interventions are currently in practice at the CBRH NICU.
4. To understand any perceived or real barriers to developmental care delivery.
5. To explore RNs vision for developmental care at the CBRH NICU.

Through consultation with four RNs from the CBRH NICU it was found that all participants value developmental and family-centred care and appear to have a foundational knowledge level of this specified approach to nursing care. However, the participants stated that developmental care is not a frequent topic of education provided in the NICU. Numerous practical interventions were listed by participants, such as proper positioning, clustering of care, minimizing infant handling, reducing light and noise, minimizing painful procedures, and choosing non-invasive alternatives to procedures whenever possible. However, this specialized approach to nursing care is inconsistent as there is a lack of standardized developmental care practices in the CBRH NICU.

Because there is no standardized approach, families are left confused when each RN practices developmental and family-centred care differently. One participant wrote of the difficulty RNs face when attempting to involve parents in the care of their infants. They explained how RNs are usually able to provide care more efficiently than the infant's family, and

it is common for the RNs to feel they "know best", causing a barrier to the delivery of family-centred care. The RNs also identified a lack of equipment and opportunities for continuing education on developmental care and family-centred care as barriers to providing high quality developmental care.

Environmental Scan

The environmental scan was completed through consultation with Clinical Nurse Educators (CNEs) from various NICUs across Atlantic Canada. The aim of the environmental scan was to explore how developmental care practices are implemented and educational material are offered in other NICUs. Additionally, institutions' websites were examined for specific information related to developmental care. Seven NICUs were approached and contact information for the CNE was requested. One of the seven NICUs declined to participate because they do not have a dedicated CNE. The CNEs were contacted via telephone or email, and the project's purpose and rationale for the environmental scan were explained. A questionnaire was attached to the email and consent to participate would be assumed upon the receipt of a completed questionnaire or by participation in a phone interview. All six of the CNEs completed the questionnaire via email.

The results of the environmental scan found only one of the six NICUs had a formal developmental care protocol in place. Four of the CNEs interviewed felt that their NICU requires improvement in the way in which they practice developmental care. One of the CNEs said that developmental care and family-centred care are well established in their NICU despite the absence of a formal protocol. One NICU has formal protocols in place, and these have potential to be adapted to fit the needs of the CBRH NICU.

Further, developmental care education is not offered to NICU nursing staff on a routine basis at any of the participating facilities. Education specific to developmental care is offered either during orientation sessions, repeated yearly, on an as-needed basis, or during ad-hoc, one-time only sessions.

Not all members of the healthcare team receive developmental care education. At some facilities, only RNs receive the education, and at others, physicians and multidisciplinary staff—such as physiotherapists, occupational therapists, or volunteers—receive the education as well. A search of the institutions' websites revealed that one facility had an informative webpage for the families of NICU patients describing developmental care and what to expect. Many of the facilities did not mention developmental care on their websites, and some facilities did not have a website at all.

Summary of the Resource Developed

The final result of this practicum project was the creation of a self-directed educational resource on developmental care and family-centered care guidelines for Registered Nurses in the NICU. This resource takes the form of a 33-page booklet and covers topics such as the sensory environment, positioning and handling, sleep, and pain minimization. The completed resource is found in Appendix C of this report.

The resource begins with a short introduction describing background information about developmental care and family-centred care in the NICU. The introduction also includes the purpose of this education and explains the self-directed nature of the resource. The next section informs the learner what they can expect to learn from this resource. The four topics this resource addresses (sensory environment, positioning and handling, sleep and pain minimization)

are listed. This section makes note of the fact that although feeding is an important developmental care topic, it is beyond the scope of this resource and will not be addressed.

The learners are then provided with a definition of developmental care and a list of reasons why it is important to NICU nursing, followed by a definition of family-centred care and the benefits that family-centred care provides to infants in the NICU. On the next page, family-centred care values are listed along with an opportunity for nurses to reflect on assumptions that have previously been made about a patient's family. The next section offers the learner a chance to reflect on their practice before moving forward with the main body of the educational resource.

In the main body of the educational resource the learner will discover best-practice developmental care interventions, a rationale for each, and accompanying family-centred care considerations. It is divided into subsections for each of the main categories: sensory environment, positioning and handling, sleep, and pain minimization. Each subsection begins with a short paragraph providing a more detailed description of each category. The interventions, rationale, and family-centred care considerations are colour-coded and organized in a tabular format. The resource contains images to enhance the descriptions of the interventions. This section totals 16 pages in length.

Following the intervention section, the learner has an opportunity to reflect once again, this time about what they have just learned from the resource. This section also provides a short list of websites the learner can explore should they require more information on developmental care and family-centred care.

Finally, the learner gets the chance to try out their new knowledge with a fictional scenario. The scenario follows "Nurse Betty" as she cares for patients in the NICU. The learner is then

asked a series of questions about “Nurse Betty’s” care. On the following page, the scenario is re-written to reflect the values of developmental care and family-centred care. The learners are then able to compare their answers to the re-written scenario.

The resource concludes with a short paragraph summarizing the aim of the resource and the importance of developmental care and family-centred care in the NICU. Included after the reference list is a poster highlighting some key developmental care interventions that may be posted in the unit to serve as a reminder to staff and families that developmental care is valued in this NICU.

Advanced Nursing Practice Competencies (ANP)

The subsequent paragraphs summarize the Canadian Nurses Association advanced practice nursing competencies addressed through this practicum project in each of the following categories: optimizing health systems, education, and leadership.

Optimizing Health System Competencies

The competency chosen for optimizing health systems is: “Generate and incorporate new nursing knowledge to develop standards of care, practice guidelines, care protocols, programs and policies” (Canadian Nurses Association, 2019, p. 30). This competency is complete. Through the comprehensive review of the literature, consultations, and environmental scan, evidence-based nursing knowledge was incorporated to develop new developmental care practice guidelines for the CBRH NICU. If the CBRH NICU decides to adopt this practice guideline, it will optimize the health system by providing a standard of care for RNs to follow. If not, this project has provided experience in protocol development that can be applied in future situations.

Educational Competencies

The competency chosen in the category of education is: “Identify the learning needs of nurses and other members of the healthcare team and find or develop programs and resources to meet those needs” (Canadian Nurses Association, 2019, p.31). This competency is complete. By performing consultations with NICU RNs, their learning needs relating to developmental care interventions were assessed. RNs in this unit have varying levels of experience and knowledge as it relates to developmental care. It was discovered, through consultation with staff, that there are inconsistencies in developmental care delivery. These needs were addressed and the commitment to increasing nurses’ professional growth and learning is achieved by creating a self-directed education resource on developmental care and family-centred care practice guidelines. This resource will aid nurses in broadening their knowledge, helping them to deliver competent and consistent developmental care.

Leadership Competencies

The competency chosen in the category of leadership is: “Identify problems and initiate change to address challenges at the clinical, organizational or system level” (Canadian Nurses Association, 2019, p. 33). This competency is in progress. A problem or practice gap was identified at the CBRH NICU – the lack of a formal developmental care protocol in the NICU. Through this practicum project, change was initiated by developing a resource to improve staff understanding and delivery of developmental care. Leadership skills will further be displayed by leading this practice change at the clinical level.

Next Steps

The work on this practicum project will continue after this course is over. Ultimately, having the resource adopted by the CBRH NICU is the principle goal. However, prior to this happening, there are a number of measures that must occur. I will request a meeting with the clinical nurse educator and the chief neonatologist for the CBRH NICU to first introduce the resource as they are key individuals involved in changing how current care is being provided in the NICU. The CBRH NICU has recently hired a new neonatologist who is interested in implementing a standardized developmental care protocol. I am hopeful we can collaborate on this initiative. Following this, it is necessary to present the resource to the quality committee of which I am a member. My goal is to have the resource accepted by the quality committee and to then develop a plan for its implementation within the NICU. Prior to implementation, it will be necessary to familiarize NICU nursing staff with the resource. This can be achieved through in-services, staff meetings, or virtual meetings. I also intend to share this project via our health authority newsletter by writing a descriptive article outlining this new practice initiative. Finally, I anticipate presenting the resource at an internal conference called "Patient Safety Sharing Day" in which new practice initiatives are shared with other members of the health authority.

Conclusion

Developmental care is a vital NICU practice that aims to reduce stress, support sleep, maintain physiological stability, and promote neural growth and development in premature infants (Soleimani et al., 2020).This is accomplished through interventions designed to mimic the intrauterine environment while maintaining focus on the family (Soleimani et al., 2020). The shift in the focus of NICU care from a biomedical model to a family-centred care model is

critical for the healthy development of premature infants and to foster strong attachment between infants and their families. Following a comprehensive literature review and consultations with front-line RNs and clinical nurse educators, an education resource detailing best-practice developmental care and family-centred care guidelines was developed. Advanced practice nursing competencies in the categories of optimizing health systems, education, and leadership were met. If adopted by the CBRH NICU, this resource will help to close a critical practice gap and direct the focus of care toward relationships between infants, their families, and the wider NICU environment.

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Appendix A: Literature Review

Developmental Care in the Neonatal Intensive Care Unit

An Integrative Literature Review

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For this final practicum project, a toolkit will be developed to educate and encourage Registered Nurses (RNs) who work in a 12-bed neonatal intensive care unit (NICU) in Sydney, Nova Scotia, to provide evidence-based developmental care as part of their nursing practice. The toolkit will be comprised of a protocol detailing best practice developmental care interventions, and an accompanying self-directed learning resource to educate RNs on the new protocol. The protocol for this project will focus on easily executed interventions to optimize the infant's environment. Interventions related to infant feeding, although important to developmental care, are beyond the scope of this project and will not be included. Knowles' (1980) theory of adult learning and Benner's (1984) novice to expert learning theory will serve as the theoretical underpinnings for the learning module. Doane and Varcoe's (2015) relational inquiry approach will act as the foundation to guide a family-centred model of nursing care.

Background

Between the years 2000 and 2013, the preterm birth rate in Canada was between 7.3% and 8.0% of all live births (Statistics Canada, 2016). Modern advances in medicine and technology have led to decreased mortality rates in infants born prematurely; unfortunately, this is accompanied by increased rates of morbidity (Soleimani et al., 2020). At the age of 2 years old, roughly 25% of infants born between 28-32 weeks gestation will have a developmental disorder, and by age 10, this number will climb to 40% (Soleimani et al., 2020). Most preterm infants receive care by RNs in the NICU. Most NICUs are an open bay design, with incubators, radiant warmers, cots, or larger cribs separated by curtains. The lights are usually bright, and there is no protection from the noise of equipment or voices. Newer NICUs are being designed as single rooms with one incubator or crib per room, with space for parents to spend the night. With a single-room design, the light and noise levels are easily controlled to suit each infant's

needs. Some NICUs are a combination of open bay and single room care. The type of bed in which an infant is assigned depends on their acuity and care needs. The design of the NICU at the CBRH is an open bay.

In the past, the focus of NICU nursing has aligned with the biomedical model, prioritizing the highly "technical" (p.273) aspects of care, with little regard for the infant as an individual (Kaye, 2016). An example of this could be a nurse removing an infant from the mother's chest to do a non-urgent blood draw. Today, NICU nursing is moving toward aligning with a family-centred care model that places the infant's individuality and relationship with the extrauterine environment at the forefront (Kaye, 2016). Family-centred care is defined as "an approach to medical care with the belief that optimal health outcomes are achieved when patient's family members have an active role in providing social, emotional, and developmental support to the patient" (Gooding et al., 2011 as cited in Macho, 2017). The earliest evidence of a family-centred approach to neonatal care was in the 1940s when Jackson began to facilitate rooming-in practices and skin-to-skin contact between mother and infant (Maree & Downes, 2016). In the 1950s, however, these efforts were derailed as the first NICUs began to open, and all parents were banned from visiting after getting blamed for causing the death of their premature infants via germs they supposedly carried (Maree & Downes, 2016). In the 1960's a neonatologist by the name of Marshall Klaus revived family-centred care by allowing parents to re-enter the NICU (Kaye, 2016). Today, families of infants in the NICU are invited to spend as much time as possible at the bedside, and to fully participate in their infants' care and medical decision making (Lavallée et al., 2018b).

In the 2015 book "How to Nurse," Doane and Varcoe remind us that the illness of an individual, especially a child, does not affect that person in isolation (Doane & Varcoe, 2015).

Rather, the illness affects the entire family and RNs must remember that only a small portion of what a family is coping with is visible (Doane & Varcoe, 2015). Doane and Varcoe propose a relational inquiry approach to nursing the family (2015). When utilizing this approach, RNs must shed their preconceived definitions or theories of what they think family is or should be (Doane & Varcoe, 2015). The family as a healthcare partner is a common concept in family-centred care, but RNs must truly consider what it takes to foster a true partnership with an equal division of power (Doane & Varcoe, 2015). Often, healthcare providers offer the guise of a partnership by presenting the family with choices that are agreeable to healthcare staff, but not to them (Doane & Varcoe, 2015).

To fully participate in the decision making for their child, the NICU staff must provide the parents with consistent, complete, and clear communication about the infant's condition (Altimier, 2015; Lavallée et al., 2018b). Nelson and Bedford (2016) studied the impact of the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) on the mothers of premature infants. They discovered that mothers had feelings of guilt and felt judged by the RNs when they could not be at the infant's bedside as much as was expected. Many women had other children at home and felt "torn" (p. e277) between their responsibilities to their other children/spouse and their premature infant (Nelson & Bedford, 2016). Conversely, some mothers feel that their participation in their infant's care is a burden to some RNs who want to complete the care themselves more efficiently (Nelson & Bedford, 2016). Feelings such as these can be harmful to a mother's self-confidence and can threaten the relationship she will have with her infant post-discharge. These feelings can be prevented when utilizing a relational inquiry approach to nursing, as RNs will take the time to assess what is important to this particular patient and their family, at the "point-of-care" (Doane & Varcoe, 2015, p. 213). Rigid family-

centred policies will not work for everyone, so the nurse must adjust care based on each family's needs at the moment (Doane & Varcoe, 2015).

Family-centred care has been linked to many benefits such as improved neurobehaviours in the infant, improved cognition later in life, less stress on the infant, increased breastfeeding, better weight gain, increased parent-infant bond, decreased length of hospital stay, decreased morbidity, and increased parental confidence (Griffiths et al., 2019, Lavallée et al., 2019a). Sannio et al. (2016) found that mothers whose infants received NIDCAP care perceived more support from NICU staff, felt more confident to approach NICU staff with concerns, and felt more confident to take care of their children post-discharge.

To accomplish family-centred care goals, the NICU team must allow the parents unrestricted access to the bedside, including during shift-change report and medical rounds (Craig et al., 2015). Extended family members such as the infant's siblings and grandparents must also be welcome on the unit (Craig et al., 2015). The family must be provided with tailored support from a multidisciplinary team, such as lactation consultants, social workers, psychologists, occupational therapists, chaplains, palliative care staff, and peer support if available (Craig et al., 2015). By forgetting what we think we know about families, we can learn what is relevant to the family being cared for in the moment, and provide complete, tailored family-centred care.

Within the framework of family-centered care, developmental care exists. The concept of developmental care can be attributed to the 1982 work of Dr. Heidelise Als on the synactive theory of development. This theory proposes that the extrauterine environment will influence the neurodevelopment of the premature infant (Nelson & Bedford, 2016). According to Als, developmental care is "an approach, which views infants as active collaborators in their own

care, determinedly striving to continue their developmental trajectory in continuous relationship with their environment and those around them" (Macho, 2017, p. 164).

During pregnancy, a fetus undergoes growth and development from a single cell to a fully formed human being. The brain and central nervous system of a fetus develop in the optimal conditions of the uterine environment – darkness, muffled sounds, warmth, cushioning of amniotic fluid and lack of painful stimuli (Alemdar, 2018). The typical NICU setting is opposite to the intrauterine environment – bright, loud, uncomfortable, and with plenty of painful stimuli in the form of medical interventions (Alemdar, 2018). Neuron production in an infant's brain is generally complete by 32-36 weeks' gestation, although some development occurs in the final weeks of pregnancy and continues after birth (Cheong et al., 2019). When a baby is born before 36 weeks, during the period of critical brain growth, neurodevelopment occurs in the unfavourable extrauterine environment (Soleimani et al., 2020). Neurons form different connections than they would have in-utero, and stressful or painful stimuli cause some neurons to die (Soleimani et al., 2020). When neuronal death occurs, the neurological development of the infant is negatively impacted and may lead to delays in cognitive or motor development (Soleimani et al., 2020). These developmental delays may include difficulty with attention, academic achievement, and behaviour (Gaspardo et al., 2008). Therefore, one of the goals of developmental care is to protect the infant's neurodevelopment by altering the NICU environment to mirror the uterine environment (Macho, 2017).

Poor quality developmental care or lack thereof, can be detrimental to the long-term outcomes of premature babies. Among NICUs with "low quality" (p. 1014) developmental care, in which infant pain management was poor, mothers reported high internalizing behavioural problems (anxiety, moodiness, withdrawal, and somatic complaints) in their infants once they

reached 18 months of age (Montirosso et al., 2016a). Moreover, high levels of pain experienced by infants in the NICU, together with certain temperament traits such as poor self-regulation of emotion, is associated with attention problems at toddler age (Gaspardo et al., 2017). Very preterm children from NICUs providing low-quality developmental care scored worse in receptive language, and sentence comprehension skills than very preterm children from NICUs providing high-quality developmental care (Montirosso et al., 2016b). Additionally, infants from NICUs providing high-quality infant centred care had higher scores in the liveliness component of health-related quality of life than infants from NICUs providing low-quality infant centred care (Montirosso et al., 2016c).

Neonatal intensive care is considered to be a specialty area (Canadian Nurses Association, 2020), in which RNs care for infants born preterm (less than 37 weeks gestation) or any infant born with a condition requiring specialized care, regardless of gestation. Despite the specialized nature of the NICU, RNs receive very little education about neonatal intensive care nursing in undergraduate school and do not have enough clinical exposure to the NICU environment to learn about developmental care. Likewise, seasoned RNs may have expertise in one speciality but lack the knowledge and skills necessary to begin work in another, such as the NICU. In some facilities, formalized positions such as developmental care nurse specialists are employed, and RNs in these roles would receive specialized training to be a leader in developmental care (Kaye, 2016). However, Altimier et al. (2015) caution against relying on a few developmental care "experts" (p.12) to carry the effort and suggest including the entire multidisciplinary staff in developmental care training. Ensuring everyone receives developmental care education is required to shift unit culture toward a developmental care model and increase staff "buy-in" (Altimier et al., 2015, p.12).

The Canadian Nurses Association offers an exam to earn a specialty certification in neonatal intensive care nursing, however this certification is not required to work in the NICU (2020). This highlights the importance of providing developmental care education to RNs upon orientation to the NICU, and at regular intervals throughout RNs' NICU career (Griffiths, 2019; Macho, 2017).

At the CBRH, a NICU education program is offered to new staff on an inconsistent basis. Existing staff are not mandated to receive this education. There is a small section of the education program dedicated to developmental care, but the information does not directly reflect the practices of the unit. This creates inconsistency and can cause confusion for new staff. This resource will help RNs bridge theory to practice, because it will pair a practice protocol with a tailored education resource. The RNs will learn the theory and rationale that support the specific developmental care interventions they will apply to their practice.

Education, while important, is not the sole influence on developmental care delivery in the NICU. Park and Kim (2019) found that RNs' perceived self-efficacy was the most significant influence on developmental care practice. When the unit is short-staffed, or acuity is high, it is common for NICU RNs to give an unbalanced level of attention to medical interventions and neglect developmental care practice (Brandon & McGrath, 2017). When staffing is adequate and the work environment is positive, RNs are more likely to deliver quality developmental care (Park & Kim, 2019). RNs' attitude and perceived importance of developmental care as well as the culture of the NICU influence delivery of developmental care (Park & Kim, 2019). Unfortunately, many RNs view the medical care of premature infants as more important than developmental care (Kim & Shin, 2014 as cited in Park & Kim, 2019). However, practicing developmental care can help RNs and physicians to "regain their professional identity" (p. e81)

as caregivers, deepen their understanding of premature infant development and foster the "art" (p. e81) of caring once again (Mirlashari et al., 2018). Creating a resource to increase RNs' knowledge, self-efficacy, and confidence is imperative to the successful implementation of developmental care interventions.

The purpose of this integrative literature review is to discover evidence-based developmental care interventions which will function as the foundation for the unit protocol and to establish the benefits of providing developmental nursing care within a neonatal intensive care unit.

Search Method

The search method for this integrative literature review began with a search of the term "developmental care" in Google Scholar to obtain an initial understanding of the scope of the literature on the topic and to help inform search terms. Next, databases CINAHL and PubMed were searched with the terms "developmental care" and "neonatal intensive care or NICU or special care, or baby unit or newborn intensive care". The search was limited to scholarly journals, published between the years 2015-2020, and written in the English language. This search yielded 171 results. Any research study focused on developmental care in the neonatal surgical patient was excluded. Abstracts were read for relevance, and articles were screened for access to full text. A total of 24 articles were deemed relevant to this practicum project, including 14 original research studies, and ten other forms of scholarly literature such as narrative reviews, concept analyses, and best practice guidelines. The quantitative studies and systematic reviews were critically appraised using the Infection Prevention and Control Guidelines Critical Appraisal Tool Kit. Of the 12 quantitative studies, two were given a strong rating, while the

other 10 were rated as moderate. The two qualitative studies were evaluated using the Critical Appraisal Skills Programme (CASP) checklist and were deemed appropriate for inclusion.

Developmental Care Interventions

There are a number of interventions outlined in the literature describing how developmental care is provided. They are categorized by the manner in which they influence the infant's sensory environment. Specifically, interventions concerning sound, light, scent, and touch were found. Interventions that influence infant positioning, pain and sleep were also discovered.

Sound

The NICU is notorious for being noisy with the hum of equipment, ringing of alarms, and loud speaking voices. Loud noises or high-frequency sounds may damage an infant's hearing. Some infants have an added risk when they require medications that are harmful to their hearing, such as "ototoxic agents" (e.g. gentamicin) (Cheong et al., 2019, p. 3). Normal conversation is considered to be 60 decibels (Healthwise Staff, 2018). Safe noise levels in the NICU should be on average, no more than 45 decibels per hour, 50 decibels no more than 10% of total time, and never exceeding 65 decibels (Lavallee et al., 2018b). To ensure the sound levels are in a safe range, Griffiths et al. (2019) recommend NICUs have sound meters placed around the unit to notify staff when noise levels are increasing or staying too high (Griffiths et al., 2019).

RNs are encouraged to decrease noise levels created by "equipment and general NICU activity" (Lavallée et al., 2018b, p.3). This can be achieved through responding quickly to all alarms, moving equipment away from the incubator, draping a blanket over the incubator to muffle sound, and using silicone earplugs or earmuffs for infants (Lavallée et al., 2018b, Altimier et al., 2015). Infants who had earplugs or earmuffs in place experienced positive

benefits ranging from improved weight gain, stable vital signs, improved tone and possibly improved cognitive development at 18-22 months (Lavallée et al., 2018a).

Not all sound is noxious to the preterm infant. In fact, the sound of their mother's voice can be pleasant and supportive (Provenzi et al., 2018). According to a systematic review of the effect of maternal voice on preterm infant development, hearing maternal voice aids cognitive development, improves weight gain, enhances oral feeding skills, and may even positively affect brain structure (Provenzi et al., 2018). Hearing the human voice can foster attachment between the premature infant and their parents and lead to improved neurological and social development (Griffiths et al., 2019). Similarly, reading to a premature infant can have a positive effect on their cognitive development (Griffiths et al., 2019). Provenzi et al. (2018) discovered when infants are exposed to their mothers' voices immediately following birth, they experienced more positive effects than infants who were delayed in hearing their mother's voice by a month. However, when maternal voice is higher than 60 decibels, the infant may have a hard time differentiating the voice from other noises, and the volume may cause stress (Provenzi et al., 2018).

Light

NICUs tend to be bright, constantly illuminated by florescent lighting. This is in contrast to the developmentally appropriate, dark intrauterine environment. Cycled lightening is an alternative to a continuous state of bright light. Cycled lighting involves alternating light and darkness in the NICU environment (Griffiths et al., 2019; Lavallée et al., 2018a). Benefits of cycled lighting include increased weight gain, decreased crying time, improved oxygen saturation, and reduced length of hospital stay (Lavallée et al., 2018a). Lavallée et al. (2018b) suggest for infants older than 28 weeks gestation, brighter more intense light from 7:00 am to 7:00 pm, and near darkness and less powerful light from 7:00 pm to 7:00 am. For infants less

than 28 weeks gestation, they recommend continuous near darkness. To diminish bright light, NICU staff can cover the incubator with a blanket, close curtains, ensure all procedural lamps are shut off, and ensure the infants' eyes are covered each time they must be exposed to bright light during procedures or physical examinations (Lavallée et al., 2018b). However, as Cheong (2019) cautions, further research is required to determine the long-term effects of NICU lighting.

Scent

By 24 weeks gestation, infants have a functioning sense of smell and can use it to distinguish their mother's breastmilk and amniotic fluid from another woman's breastmilk and amniotic fluid (Young & Yeo, 2020). The scent of the mother's breastmilk may elicit positive effects in the premature infant, such as a stable heart rate and improved oxygen saturation (Young & Yeo, 2020). Young and Yeo (2020) studied the behavioural state and physiological response of premature infants to continuous olfactory stimulation using their mother's breastmilk. The results demonstrated a "tendency" (p. 4) for continuous olfactory stimulation of breastmilk to have a positive effect on infant behavioural state, but the effect was not significant (Young & Yeo, 2020). However, the results demonstrated a significant effect on the physiological state of the infants in the experimental group, as displayed by considerably small changes in heart rate and oxygen saturation (Young & Yeo, 2020). The researchers also discovered noxious scents, such as adhesive remover or alcohol swabs can decrease oxygen saturation (Young & Yeo, 2020). It is therefore important to maintain a fragrance-free environment in the NICU (Altimier et al., 2015). Altimier et al. (2015) and Nelson and Bedford (2016) suggest that leaving the mother's scent behind when she is unable to hold or care for her infant has positive maternal effects. The researchers discovered that mothers felt that were truly

"caring" (p.e278) for their premature infants when they could place a soft piece of fabric with their scent on it in the infant's incubator (Nelson & Bedford, 2016)

Touch

Developmental care also includes interventions to assist with providing touch in a way that mimics the intrauterine environment. A gentle touch, free of sudden movements, is suggested by Altimier et al. (2015) as a method to be used when interacting with the infants. Facilitation of frequent kangaroo care, also known as skin-to-skin contact (SSC) between the infant and their mother, is an important touch-related developmental care intervention (Griffiths et al., 2019; Lavallée et al., 2018a, Lavallée et al., 2018b). SSC offers several benefits for the parent and infant such as the alleviation of pain, encourages sleep, promotes breastfeeding, temperature regulation, decreased mortality, decreased infection rate and strengthened bond with the parent (Altimier et al., 2015; Cheong et al., 2019; Kaye, 2016).

Toxic stress is the "stress experienced in the absence of the buffering presence of adult support" (Altimier & Philips, 2018, p. 565) and can develop in an infant who is admitted to NICU. They suggest ways to avoid this type of stress by maintaining mom and baby togetherness after birth and facilitating touch through skin-to-skin contact as early and as often as possible.

Positioning

As many infants in the NICU are receiving care in an incubator, positioning of the infant is important as it is connected to motor and neuro development. Nursing staff are encouraged to position babies less than 37 weeks gestation in the fetal position: "slight flexion of the neck, head and neck well aligned with the rest of the body, shoulders brought forward, upper and lower limbs contained near the body, symmetrical posture and spine slightly in flexion" (Lavallée et al., 2018a, p. 4). This positioning has been associated with increased sleep, decreased stress, and

positive effects on neurodevelopment and motor development (Lavallée et al., 2018a). The infant's head position should be frequently alternated to prevent head asymmetry, a condition that is associated with developmental delays (Griffiths et al., 2019; Lavallée et al., 2018b).

There may be a link between prone positioning and reduced oxygen requirements for the premature infant, especially when receiving mechanical ventilation (Lavallée et al., 2018b). However, the evidence on this topic varies, as one study indicates that prone positioning may increase infant stress levels, while other research suggests there is no link between positioning and physiological stability (Lavallée et al., 2018a). Lavallée et al. also stress the importance of oxygen saturation monitoring for any baby placed pone or lateral, due to the increased risk of sudden infant death syndrome in these positions (2018b).

When transferring an infant to a different incubator or out with mom for skin-to-skin contact, Griffiths et al. recommend slow movements, maintaining flexion of the limbs and keeping the infants head and body in alignment (2019). Two people should be used for repositioning and transferring, called "4-handed support" (Altimier et al., 2015, p. 14). Keeping the premature infants' head in midline position is best for cerebral perfusion (Griffiths et al., 2019). Instructing and involving the parents in repositioning the infant has been associated with better motor development than when healthcare providers were solely responsible for positioning (Lavallée et al., 2018b).

Pain

The management of pain is considered an important developmental care intervention because uncontrolled pain in a premature infant can lead to altered brain plasticity and hyperactivity of the central nervous system (Lavallée et al., 2018a). In turn, this can lead to issues such as decreased motor and intellectual outcomes at 18 months of age and

hypersensitivity to pain later in childhood (Lavallée et al., 2018a). The management of pain can be divided into two categories: pharmacological management and non-pharmacological management (Lavallée et al., 2018a).

Alemdar (2018) conducted a non-blinded randomized controlled trial that studied the effect of light, odour and recorded maternal voice on infant pain levels. Infants whose incubators were covered during and after peripheral IV insertion showed a statistically significant ($p < 0.05$) reduction in pain levels compared to a control group, and odour and recorded voice groups (Alemdar, 2018).

A widely utilized non-pharmacological pain relief measure is the administration of oral sucrose accompanied by non-nutritive sucking (pacifier), three minutes before the painful procedure (Altimier et al., 2015, Lavallée et al., 2018a, Lavallée et al., 2018b). Other effective non-pharmacological pain relief measures prevalent in the literature include skin-to-skin contact with the mother, swaddling, and tucking (Altimier et al., 2015, Griffiths et al., 2019, Lavallée et al., 2018a, Lavallée et al., 2018b). Reduced environmental light, olfactory stimulation, recorded maternal voice, massage, music, rocking, co-bedding twins and other non-pharmacological methods for pain control are not well studied or have conflicting evidence in the premature infant (Lavallée et al., 2018b).

Two concepts that seem to be well accepted in the literature are the need for a validated pain assessment tool, and to involve the parents in the management of pain for their child (Altimier et al., 2015, Lavallée et al., 2018b). The NICU team can involve the parents by keeping them informed about their child's pain levels, helping them to recognize pain cues, teaching them to administer sucrose and swaddle, and encouraging skin-to-skin contact (Altimier et al., 2015).

Sleep

Sleep is the "predominant state for neonates" (Griffiths et al., 2019, p.5). Interrupted sleep or not enough sleep in the neonatal period is associated with reduced cerebral cortical size, decreased brain plasticity, and subsequent behavioural difficulties (Griffiths et al., 2019). Completed sleep cycles are important in the development of learning abilities and memory (Lavallée et al., 2018a). Interrupting sleep can also lead to increased stress, which leads to increased physiological events such as apnea, bradycardia, and increased intracranial pressure (Lavallée et al., 2018a). On average, premature infants in the NICU are handled 14-71 times per day, an amount not conducive to proper sleep (Lavallée et al., 2018a).

Due to the detrimental effects of poor quality and quantity of sleep, RNs should avoid interrupting premature infants' sleep, especially for non-essential care that can be completed at a later time (Griffiths et al., 2019). RNs are encouraged to cluster care around the infant's wakeful times and continually monitor the infant for stress cues, such as oxygen desaturation, during clustered care (Altimier et al., 2015). If the infant must be woken, care providers should use a gentle approach, with a soft voice and touch (Altimier et al., 2018). Once care is completed it is proposed to wait at least 90 minutes before touching the infant again, unless necessary, to allow for the neuroprotective effect of completed sleep cycles (Lavallée et al., 2018b).

Frequent skin-to-skin contact with the infant's mother may promote better sleep in the premature neonate (Altimier et al., 2015). NICU staff are encouraged to model "back to sleep" (p. 14) positioning for all infants approaching discharge, and ensure the infants are used to sleeping in this position before going home (Altimier et al., 2015). Prone and lateral sleeping positions are associated with an increased risk of sudden infant death syndrome (Government of Canada, 2018).

Guiding Framework

The toolkit for this practicum project will be comprised of a protocol to guide developmental care in the NICU, as well as a self-directed learning module to educate NICU staff on the importance of developmental care. Knowles' adult learning theory (1980) and Benner's novice to expert theory (1984) will serve as the theoretical underpinnings for the learning resource. As described above, Doane and Varcoe's (2015) relational inquiry approach will serve as the model for family-centred care delivery.

Knowles recognized that adult learners have qualities that make them unique from child learners (Candela, 2016). Adult learnings are "increasingly self-directed" (p. 216), and their past life experiences provide context for their learning (Candela, 2016). Therefore, a self-directed module was chosen as the format for the learning resource. Since adults have preferred differences in personal learning style" (p. 216), a self-directed module will be appropriate as the learner can set their own pace (Candela, 2016). They can either work through the module silently, by reading it aloud, together in groups, or write notes as they progress through it. According to Knowles, adults "are more likely to prefer being actively involved in the learning process" (Candela, 2016, p. 216). Therefore, the future recipients of this resource will be consulted on their preferences for content and format (Candela, 2016). It is important to know what they would like to learn and how they would like to learn it.

Adults have past experiences that shape their learning, so it will be key to have the learners reflect on their past experiences with developmental care if any (Candela, 2016). Adult learners are task-orientated and wish to problem solve (Candela, 2016). The resource will address this by educating the nursing staff on the importance of developmental care and will assist them in making it a routine part of their practice. Self-directed learning is not always

appropriate and is not always preferred by every student (Levett-Jones, 2005). This includes such times when the learner has no prior concept of the material, or the learner is unprepared to learn independently (Levett-Jones, 2005). The future recipients of this resource may not have considerable experience with developmental care, but the concept will not be new to them as they incorporate a few informal developmental care interventions into their practice.

Benner's novice to expert theory suggests that RNs pass through five various stages of expertise, from novices requiring supervision to experts who are leaders and creative thinkers, and multiple steps in between (Candela, 2016). In this NICU, the RNs likely have varying knowledge levels about developmental care. Some staff members are newly graduated RNs with little to no exposure to developmental care. At the same time, other experienced, senior RNs have worked in larger NICUs where developmental care is a routine part of practice. For example, the IWK Health Centre in Halifax, Nova Scotia, has an entire committee dedicated to developmental care, and it is incorporated into each aspect of nursing practice. Benner's theory will be fundamental in guiding this resource because the learner must be met at whatever stage they are in (Candela, 2016).

Conclusion

Developmental care is an important facet of NICU nursing care, which consists of interventions related to creating a favourable sensory environment for infants while at the same time keeping the family at the focal point of care. The implementation of interventions related to sound, light, scent, touch, pain and sleep can create an environment conducive to neurodevelopment and maintaining FCC. RNs play a significant role in the achievement of developmental care within the NICU setting. Therefore, awareness through education begins immediately once hired to work in the unit and remains ongoing throughout the RNs' career. The

culture of the NICU is an important indicator of whether or not developmental care will be successful. RNs are key to effective developmental care delivery, and their attitudes toward it affects successful implementation. Developmental care can also have both positive and negative impacts on infants' mothers, but the negative impacts may be mitigated by applying a relational inquiry approach to family-centred care. A toolkit guiding care and providing education will help to impact unit culture positively and inform RNs of evidenced-based ways to improve their developmental care practice.

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Literature Summary Table

Study Design	Methods	Key Results	Strength of Design
Authors: Soleimani et al. (2020) Design: systematic review and meta-analysis Purpose: review the effects of developmental care in the NICU setting on mental and motor development of preterm infants	N: • 21 studies suitable for systematic review • 13 of which suitable for meta-analysis Country/setting: various countries/NICU setting Data Collection: databases searched include PubMed, EMBASE, CINAHL, Scopus, Web of Science, Chochrane library up to Oct 8/17 with keywords premature, preterm, low birth weight, Bayley and relevant medical subject headings Outcomes: effects of developmental care in NICU on mental and motor development of preterm infants at 12 and 24 months of age, using the Bayley scale of infant development (BSID)	Developmental care in NICU improved: Mental developmental index of BDSI at 12 months of age • $p < 0.05$ • 95% CI 0.23-0.87 Psychomotor developmental index of BSDI at 12 months of age • $p < 0.05$ • 95% CI 0.08-0.57 Psychomotor developmental index of BDSI at 24 months of age • $p < 0.1$ • 95% CI -0.02-0.32	Strength of Design: **Strong** Quality: **Medium** Issues: • Egger's test showed publication bias in MDI at 12 months of age (? due to small number of studies) • meta-analysis limited due to large variation in interventions and limited number of RCT • impossible to blind the recipient and individual giving intervention unless cluster RCT in which there were none included in this review

			• possible publication bias for meta-analysis
Authors: Provenzi & Montirosso (2018) Design: systematic review Purpose: to determine the effects of maternal voice exposure on preterm infant's development	N: 18 research studies Country/setting: various countries/NICU setting Data Collection: data bases searched were PubMed, Scopus, CINAHL, Web of Science with search terms maternal OR mother, voice OR sound AND preterm infant Outcomes: the effect of maternal voice on physiological outcomes, feeding behaviours, cognitive and neurological development	• maternal voice is a non-noxious intervention • two studies suggest maternal voice exposure may activate auditory brain plasticity before term gestation • maternal voice promotes weight gain and improves oral feeding skills in preterm infants • maternal voice leads to better visual/auditory performance at 3 months but not at 6 months • maternal voice does not affect pain related stress reactions in preterm infants	Strength of Design: **Strong** Quality: **Medium** Issues: • non-English records were excluded • did not look at grey literature
Authors: Alemdar (2017)	N: 123 preterm infants undergoing peripheral IV insertion	• the effect of incubator cover on pain was found to be	Strength of Design: **Strong** Quality: **High**

Design: non-blinded RCT Purpose: study the effect of recorded maternal voice, breastmilk odor and incubator cover on pain before, during and after peripheral IV insertion in premature infants	Country/setting: Turkey/NICU setting Maternal voice intervention group: N=30 preterm infants Breastmilk odor intervention group: N=30 preterm infants Incubator cover intervention group: N=31 preterm infants Control group receiving standard care: N=32 preterm infants Data collection/outcomes: • infants were video recorded starting 1 minute before peripheral IV insertion, and ending 15 min after peripheral IV insertion • pain level was assessed using the premature infant pain profile • comfort level was assessed using comfort scale	statistically significant during, and after peripheral IV insertion (but not before) ○ $p < 0.05$ • The effects of breastmilk odor and recorded maternal voice on pain were not statistically significant before, during, or after peripheral IV insertion ○ $p > 0.05$ • The effects of incubator cover, breastmilk odor and recorded maternal voice on comfort were not statistically significant before, during, or after peripheral IV insertion ○ $p > 0.05$	Issues: • assessors were non-blinded
Authors: Sannio et al. (2016) Design: NRCT	N: 43 infants of 32 weeks gestation Country/setting: Italy/NICU setting	• % of infants fed any human milk significantly higher in intervention group than control group	Strength of Design: **Strong** Quality: **Medium** Issues:

<u>Purpose:</u> to evaluate the effectiveness of NIDCAP program on mother's support and infant development	<u>Intervention group:</u> N=21 infants receiving NIDCAP assessment from birth to discharge every 10 days
	
	<u>Control group:</u> N=22 infants receiving standard NICU care
	
	<u>Data collection/outcomes:</u>
	• neonatal Functional Assessment Tool used to evaluate items in the infant's neurodevelopmental profile
	  ○ each item scored from 0 (normal function) to 4 (function not possible)
	• neonatal Intensive Care Unit Neurobehavioral Scale used to evaluate visual and auditory function
	  ○ each item scored either 0, 1, 2 (0 being better function
	• Nurse Parent Support Tool is a 21 item Likert scale questionnaire assessing the mother's opinion on the care her infant received
	• length of admission, number of days required to establish full oral feeds and type of
		○ $p < 0.0001$
		• Significantly higher normal neurofunctional assessment at term equivalent age among intervention group
		  ○ $p = 0.30$
		• higher % of normal visual orientation among infants in intervention group
		  ○ $p = 0.122$
		• mothers in intervention group awarded higher scores on questionnaire than mothers in control group
		• length of NICU stay (days) were similar between the intervention and control groups
			• non-randomized groups
			• relatively small sample size
			• selection bias because all participants from the same geographical area

	milk at discharge was recorded		

Authors: Young & Yeo (2020)
 	
Design: CBA
 	
Purpose: evaluate the effectiveness of continuous olfactory stimulation with breastmilk (COSB) on behavioural and physiologic states of Korean premature infants
	N: 30 premature infants born before 37 weeks gestation receiving incubator care, not on a ventilator or receiving CPAP
	
	Country/setting: South Korea/NICU setting
	
	Experimental group: N=14 infants exposed to continuous scent of mother's breastmilk via soaked gauze
	Control group: N=16 infants exposed to gauze soaked in sterile saline
	
	Data collection/outcomes:
	• behavioural state of infants measured using Anderson Behavioural State Scoring, done at baseline and q8h for 24h
	  ○ categorizes infant behaviour state into 12 stages ranging from very quiet to severe crying
	• physiological response measured using heart rate and oxygen saturation, observed at baseline then at the 24h, 48h and 72h marks
		• experimental group presented significantly reduced heart rate variations
		  ○ $p = 0.039$
		• significant differences in heart rate at all points in the control group
		  ○ $p < 0.001$
		• more stable heart rates at all points in time in experimental group
		  ○ $p = 0.089$
		• positive effects of COSB on the behavioural state of premature infants at some points
			Strength of Design: **Strong**
			
			Quality: **Medium**
			
			Issues:
			• small sample size and convenience sampling from a single centre
			• the presence of other olfactory stimulation may have affected results
			• because averages of outcome variables were taken, may not reflect change over time

	• observation log recorded general characteristics/medical information of the infants		
Authors: Sathish et al. (2019) Design: CBA Purpose: to enhance neonatal nurses' abilities to acquire knowledge and skills regarding Developmental Supportive Care	N: 50 level 111B NICU nurses Country/setting: India/level 111B NICU located in a tertiary care hospital Intervention group: N=25 nurses receiving Developmental Supportive Care Program (DSCP) training Control group: N=25 nurses not receiving the DSCP training Data collection/outcomes: • Knowledge of NICU nurses providing developmental supportive care was assessed using a structured knowledge questionnaire before and after the DCSP intervention • Skill of NICU nurses providing developmental supportive care was assessed using an observational checklist (post-intervention only for intervention group)	• a significant increase in the mean knowledge score was seen among participants in the intervention group ($p = 0.01$) but not in the control group ($p = 0.98$) • improvement in providing developmental supportive care skills was higher in the intervention group, relative to the control group ○ $p < 0.01$ at 0.05 level of significance	Strength of Design: **Strong** Quality: **Medium** *Issues:* • relatively small sample size • convenience sampling used • control of light and noise in each baby environment were not possible • skill of nurses only able to be observed at one point in time

Authors: Gaspardo et al. (2018) Design: Case Control Purpose: • to examine the effects of individual characteristics of neonates and neonatal pain-related stress on attention problems and externalizing behavioural problems of toddlers born preterm • to analyze the moderating effects of the dispositional traits of temperament	N: 62 toddlers aged 18-36 months and their mothers Country/setting: Brazil Data collection/outcomes: • Child Behaviour Checklist ○ Assessing toddlers' attention and externalizing behaviour problems • Early Childhood Behaviour Questionnaire ○ Assessing toddlers' temperament • Adult Temperament Questionnaire ○ Assessing mothers' temperament • Neonatal Infant Stressor Scale ○ Analyzed the number of pain-related stress events during NICU admission recorded in hospital charts	• high neonatal pain-related stress total index, associated with toddlers' temperament with less effortful control, and mothers' temperament with high surgency explained 23% variability of attention problems ○ $p < 0.005$ • the externalizing behavioural problems were explained by temperament, not by neonatal pain-related stress	Strength of Design: **Moderate** Quality: **Medium** Issues: ○ relatively small sample size ○ convenience sampling used ○ high attrition rate ○ pain not measured using direct observations of the biobehavioural responses during painful procedures back when participants were NICU patients
Authors: Montirosso et al. (2016a) Design: Case Control	N: 257 18-month-old corrected age children Country/setting: Italy	• preterm children from low-care NICUs in the IPM group reported higher scores in	Strength of Design: **Moderate** Quality: **Medium**

Purpose: examine the relation between quality of developmental care (DC) in the NICU and behaviour problems at 18 months corrected age in preterm children	Exposed: 134 18-month-old corrected age children born preterm from 22 NICUs • further split into groups based on whether they received care from high-quality developmental care NICUs or low-quality developmental care NICUs ○ quality level based on Infant Centered Care Index (ICC) and Infant Pain Management Index (IPM) Non-exposed: 123 18-month-old children who were born at term gestation Data collection/Outcomes: • quality level of DC examined using the NEO-ACQUA Quality of Care Questionnaire (QCQ) ○ administered to a neonatologist who did not directly care for the participants	internalizing problems, compared to children from high-care units ○ $p = 0.028$ • no differences found between high-care IPM and full-term children • no significant IPM effect was found for externalizing problems • no significant ICC effect emerged for both internalizing and externalizing problems	Issues: • although QCQ has acceptable to good internal reliability, it did not undergo tests of construct validity or test-retest reliability ○ interpret results with caution • the 22 NICUs self-selected into the study and not representative of the DC quality of 130 Italian NICUs • quality of developmental care examined using self-report questionnaire • impossible to determine which pain management interventions may have influenced the outcome • examination of DC quality was incomplete (e.g.

	○ ICC graded from 0-8 (higher score = better care) ○ IPM graded from 0-10 (higher score = better care) • child behaviour was examined using the Child Behaviour Checklist (1.5-5) questionnaire ○ administered to the mothers ○ 99 items, parent indicated whether the problem not, sometimes, or often true for their child (0,1,2) • mothers' stress examined using the Parenting Stress Index Short Form ○ 36 item Likert-scale ○ score from 12-60 (high score = high stress) • infants' perinatal data obtained from medical records • mothers' sociodemographic data obtained through a questionnaire		disruption of sleep not examined)

Authors: Montirosso et al. (2016b) Design: Case control Purpose: examine the relationship between the quality levels of NICU developmental care and language skills at 36 months in children born very preterm (VPT)	N: 168 children at 36 months of age Country/setting: Italy Exposed: 78 36-month-old children born VPT from 19 NICUs Non-exposed: 90 36-month-old children born at full-term gestation Data collection/outcomes: • quality level of DC examined using the NEO-ACQUA Quality of Care Questionnaire (QCQ) o administered to a neonatologist who did not directly care for the participants o ICC graded from 0-8 (higher score = better care) o IPM graded from 0-10 (higher score = better care) • child behaviour was examined using the Child Behaviour Checklist (1.5-5) questionnaire	• VPT from low-care units with respect to ICC obtained lower scores in sentence comprehension, compared to children from high-care units o p=0.12 • no differences were found between preterm children from high-quality ICC NICUs and full-term children • compared to the control group, children from both low and high quality IPM NICUs showed lower performance in word comprehension and sentence comprehension o effect related to preterm status rather than level of DC	Strength of Design: **Moderate** Quality: **Medium** Issues: • although QCQ has acceptable to good internal reliability, it did not undergo tests of construct validity or test-retest reliability o interpret results with caution • high attrition rate • the 19 NICUs self-selected into the study and not representative of the DC quality of 130 Italian NICUs • quality of developmental care examined using self-report questionnaire • examination of DC quality was

	○ administered to the mothers ○ 99 items, parent indicated whether the problem not, sometimes, or often true for their child (0,1,2) • language skills investigated through a standardized Italian test for preschool children called Test di Valutazione de Linguaggio (TVL) ○ score from 0-10 (lower scores = low language skills) • maternal depressive symptoms examined using the Beck Depression Inventory (BDI) ○ 21 item questionnaire commonly used in non-clinically depressed samples • infants' perinatal data obtained from medical records • mothers' sociodemographic data obtained through a questionnaire		incomplete (e.g. disruption of sleep not examined)

Authors: Montirosso et al. (2016c)
 	
Design: Case control
 	
Purpose: examining the effect that developmental care quality (in the NICU) has on health-related quality of life (HRQoL) in 5-year-old children born preterm
	N: 212 5-year-old children
	
	Country/setting: Italy
	
	Exposed: 102 5-year-old children born very preterm (VPT) from 20 NICUs
	
	Non-exposed: 110 5-year-old children born at full-term gestation
	
	Data collection/outcomes:
	• quality level of DC examined using the NEO-ACQUA Quality of Care Questionnaire (QCQ)
	  ○ administered to a neonatologist who did not directly care for the participants
	  ○ ICC graded from 0-8 (higher score = better care)
	  ○ IPM graded from 0-10 (higher score = better care)
	• HRQoL was assessed using the TNO-AZL Preschool Children's Quality of Life Questionnaire (TAPQOL)
		• VPT children from low-quality ICC NICUs scored lower in HRQoL compared to VPT from high-quality ICC NICUs
		  ○ $p = 0.01$
		• no differences found between VPT children from high-quality ICC NICUs and full-term children
		• no differences were found in any groups related to IPM quality
			Strength of Design: **Moderate**
			
			Quality: **Medium**
			
			• although QCQ has acceptable to good internal reliability, it did not undergo tests of construct validity or test-retest reliability
			  ○ interpret results with caution
			• issues: The 20 NICUs self-selected into the study and not representative of the DC quality of 130 Italian NICUs
			• quality of developmental care examined using self-report questionnaire
			• examination of DC quality was incomplete (e.g. disruption of sleep not examined)

	○ 43 item questionnaire consisting of 12 multi-item scales ○ each scale scored from 0-100 (higher score = better quality of life) • developmental outcomes were assessed usingiu8u the Child Development Inventory ○ 270 item parent-report assessment • parent stress examined using the Parenting Stress Index Short Form ○ 36 item Likert-scale ○ score from 12-60 (high score = high stress)		
Authors: Altimier et al. (2015) Design: UCBA Purpose: to determine the effect of the comprehensive Wee Care Neuroprotective NICU program on 7 neuroprotective core	N: 81 level 11 or level 111 hospital NICU sites from 27 US states as well as Belgium and the Netherlands which had implemented the Wee Care Program and had completed pre and post-site surveys Country/Setting: USA, Belgium, Netherlands/NICU setting Data collection/outcomes: • Wee Care Assessment Survey	• each individual core measure represented in the Neonatal Integrative Developmental Care Model resulted in statistically significant improvements after implementation of the Wee Care Training Program as well as the	Strength of Design: **Weak** Quality: **Medium** Issues: • because the timeframe of each Wee Care Neuroprotective NICU Program spanned 1-3 years, external events

measures for family-centered developmental care of premature neonates	○ questions/observations related to 7 neuroprotective core measures ○ Likert scale from 0-5 rating (higher score = better practices) ○ overall composite score = 180 ○ pre-site survey completed 4-8 weeks prior to Wee Care Training Program ○ post-site survey 12-14 months after Wee Care Training Program • the 7 neuroprotective core measures are healing environment, partnering with families, positioning and handling, safeguarding sleep, minimizing stress and pain, protecting skin, optimizing nutrition	overall composite core measures score ○ $p < 0.001$	could have influenced improvement in scores • education model included multiple interventions that could either complement or compete with each other
Authors: Park & Kim (2019) Design: Cross-sectional	N: 141 NICU nurses from 6 hospitals in South Korea Country/setting: South Korea/NICU setting	• professional efficacy had the largest influence on DC practice ○ $p < 0.001$ • followed by:	Strength of Design: **Weak** Quality: **Medium** Issues: • convenience sample

<u>Purpose:</u> examine factors that influence developmental care (DC) practice among neonatal intensive care unit nurses	<u>Data collection/outcomes:</u>
	• developmental care practice measured using the Developmental Supportive Competency Scale for nurses caring for preterm infants
	  ○ 13 items on a 4-point Likert Scale (1 = not at all, 4 = almost always)
	  ○ total score range 13-52
	• nursing work environment measured using the "staffing and resource adequacy subscale of the Practice Environment Scale of Nursing Work Index
	  ○ 5 items on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree)
	  ○ total score range 4-16
	• organizational culture was measured using the Nursing Organization Culture Measurement Scale
	  ○ 20 items and 4 subscales on a 5-point Likert scale (1 = not at all, 5 = absolutely yes)
		○ perception of DC ($p < 0.005$)
		○ task-orientated organizational culture ($p = 0.046$)
		• clinical and educational experience regarding DC and working environment was not associated with DC practice among NICU nurses
			• study variables explained only 22% of the variance
			○ Study could not involve all confounding variables
			• data only collected from 6 hospitals in metropolitan cities
			• Korean NICUs not divided based on acuity level
			• only dayshift nurses participated

	○ Total score range 20-100 • perception of developmental care measured using the subscale of the Attitude in Agreement with Theory of Planned Behaviour statement ○ 8 items on a 5-point Likert scale (1 = completely disagree, 5 = completely agree) ○ total score range 8-40 • professional efficacy was measured using a subscale of professional efficacy in the Maslach Burnout Inventory-General Survey ○ 6 items on a 7-point Likert scale (0 = never, 6 = every day) ○ total score ranges from 0-36 (higher score = higher satisfaction)		
Authors: Nelson & Bedford (2016) Design: Existential-Phenomenologic	N: 7 mothers of a preterm infant 30 weeks gestation or less at birth Country/setting: USA/level 111 NICU setting	• mothers praised NIDCAP for education and support • great sensitivity is required by healthcare professionals	Quality: **High** Issues: • study conducted in a NICU where only 10% staff are NIDCAP certified

Purpose: to describe the unique meaning and significance of the essential elements of mothering a preterm infant receiving NIDCAP care in a level 111 NICU	Data collection: a single interview between the researcher and each participant was tape recorded, transcribed verbatim, an exhaustive description written, and a fundamental structure of each phenomenon was written	• private rooms should be maintained for entire admission • ongoing NIDCAP education and team meeting required amongst staff • 1 overarching theme: Parenting with permission • 3 essential themes: choosing to participate, dealing with people, coming to feel like a mother ○ 9 subthemes: managing, settling in, making friends, meeting needs, facing judgement, recognizing not everyone is "onboard", coming to feel like a mother.	• the number of infants born before 30 weeks gestation is limited • NIDCAP implemented only 6 months prior to study
Author: Mirlashari et al. (2018)	N: 15 participants • 11 nurses • 4 physicians	• NIDCAP provides a comprehensive and effective care model	Quality: **Medium** Issues:

Design: Phenomenologic Purpose: investigate nurses and physicians' experiences of implementing the NIDCAP model to optimize its implementation for both caregivers, infants and families in the NICU	Country/setting: Iran/4 NICUs in Iran Data collection: • semi-structured, face-to-face, in-depth interviews, comprised of 13 guided questions • each interview lasted 30-60 minutes • tape recordings were transcribed verbatim, followed by coding, then formation of themes and subthemes followed • interviews continued until no new codes emerged and data saturation was reached	for premature infants, with the goal to promote neonatal growth and development, while also facilitating the self-efficacy of caregivers • implementation requires attention to be paid to social context, infrastructure, needs of caregivers, and adjustment based on the resources of each facility and country • 6 themes and 20 subthemes were constructed o NIDCAP: a milestone o helping to rebuild the core of the family o caregiver excellence o realism towards the	• difficulty accessing participants to maximize sample variability for data collection • NIDCAP hospitals dispersed throughout various geographical locations therefore interviews were conducted using various methods such as telephone, virtual communications channels

		feasibility of NIDCAP ○ proper managerial position of NIDCAP specialists in the health system ○ caring for the caregivers	

Appendix B: Consultation Report

Consultation Report

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The purpose of this practicum project is to address a practice gap in the 12-bed neonatal intensive care unit (NICU) at the Cape Breton Regional Hospital (CBRH) in Sydney, Nova Scotia. This unit is the only NICU servicing Cape Breton Island. Despite being equipped to care for preterm infants, there is no formal protocol in place to guide developmental care practice at the CBRH NICU. Additionally, there is a lack of ongoing education related to the provision of developmental care for Registered Nurses (RNs). This project involves the development of a toolkit to guide developmental care practice and will emphasize the importance of developmental care in the NICU setting. The first component of the toolkit will be a self-directed learning resource to increase the RNs' knowledge and understanding of developmental care. The second component of the toolkit will include a best-practice protocol to assist RNs with incorporating evidence-based developmental care interventions into their everyday practice.

Consultations with four RNs from the CBRH NICU were completed to gain insight into RNs' current knowledge and practices related to developmental care. This information gleaned from the RNs will help with the content of the protocol and self-directed learning module. The environmental scans were completed through consultation with Clinical Nurse Educators (CNEs) from various NICUs across Atlantic Canada. The aim of the environmental scans was to explore how developmental care practices are implemented and educational material are offered in other NICUs. Additionally, institutions' websites were examined for specific information related to developmental care.

Methods

Consultations and environmental scans were completed. All participants were aware that their names would remain confidential and completed questionnaires would be saved on a password-protected computer. No identifying information is present on any documents.

Four RN participants from the CBRH NICU were contacted and participated in the consultations. Two of the participants have less than five years of NICU work experience, and two have more than 20 years of experience working in a NICU. The participants were contacted via email and given a summary of the project's purpose and the rationale for the consultation. The option to participate in a telephone conversation or email questionnaire (Appendix A) was provided. It was specified that consent to participate is assumed upon the receipt of the completed questionnaire or by participation in a phone interview. All four of the participants who were contacted returned completed questionnaires via email.

The environmental scans were completed in the Atlantic Canada region. Participants included six Clinical Nurse Educators (CNE) from NICUs throughout Nova Scotia (including the CNE for the CBRH NICU), New Brunswick, Prince Edward Island, and Newfoundland and Labrador. The CNEs had a wide range of NICU experience, spanning from none to 45 years. Seven NICUs were approached and contact information for the CNE was requested. One of the seven NICUs did not have a dedicated CNE and therefore declined to participate. The CNEs were contacted through telephone or via email, and the project's purpose and rationale for the environmental scan were explained. The option to participate in a telephone conversation or email questionnaire (Appendix B) was provided. The questionnaire was attached to the email and specified consent to participate would be assumed upon the receipt of a completed questionnaire or by participation in a phone interview. All six of the CNEs completed email questionnaires.

Results

CBRH NICU Consultations

Definitions of developmental care and family-centred care. Participants were asked to describe their interpretation of developmental care and family-centred care. All four of the

participants demonstrated knowledge of developmental care in their descriptions. Two of the participants described developmental care as a practice that aims to mimic the development an infant would experience if they had continued to mature in the womb and were born at term gestation. The two other participants described developmental care as a practice that aims to protect the neurological and cognitive development of the infant. Another participant explained developmental care as it relates to term-gestation babies who are admitted to NICU. They described the separation of the infant and mother to be abnormal and therefore inconsistent with the normal development of an infant after birth. This led to a discussion about the importance of family-centred care in which this participant stated that developmental care could not exist without family-centred care. The participants described family-centred care as placing the infant's family at the forefront, involving them in the care and decision-making for their infants. One participant stated that supporting the relationship between an infant and their parents is the most important aspect of NICU care.

Current developmental care and family-centred care practices at the CBRH NICU. One participant noted a lack of standardized developmental care practice in this NICU. Two of the participants discussed facilitating early and often, skin-to-skin contact between the infants and their parents whenever possible. Three of the participants stated that they keep parents informed about their infant's plan of care and involve the parents in the direct care of their infants whenever feasible, e.g. feeding and diaper changing. The importance of preparing the parents to care for the infants after discharge was a common response. This often includes having the infant "room-in" with the parents in a private room close to the NICU. Other practical interventions were listed, such as proper positioning, clustering of care, minimizing infant

handling, reducing light and noise, minimizing painful procedures, and choosing non-invasive alternatives to procedures whenever possible.

Difficulties in implementing developmental care or family-centred care. A lack of a standardized developmental care protocol was highlighted. RNs and other multidisciplinary staff not "being on the same page" regarding the developmental care plan provides a source of difficulty and frustration. For example, one participant illustrated an instance where she had planned to be "hands off" and allow her patient to sleep from 0800 to 1100. However, during that time, the neonatologist arrived and examined the baby at 0900 and ordered the baby to be extubated and placed on CPAP. By the time the respiratory therapist arrived, completed their assessment and set up the CPAP, it was almost 1100. By this time, the baby had been handled for the majority of the previous three hours. Another participant noted that more education and promotion of developmental care is needed in this unit. Interestingly, one participant wrote of the difficulty RNs face when attempting to "step back" and allowing the parents to take over the care of their infant. They explained how it is common for the RNs to feel they "know best" and are usually able to provide care more efficiently than the infant's family. However, this causes a barrier to the delivery of family-centred care. Other common responses include a lack of equipment designed to assist with providing developmental care. For example, the lack of incubator covers causes difficulty when attempting to shield the infant from light and noise. The lack of positioning aids and gel wedges creates a barrier to positioning the infant in a developmentally appropriate manner. The nurses must work with what they have (folded blankets, etc.), and it is often challenging to achieve the desired result. Related to this is the difficulty an open bay NICU design presents for the control of light and noise.

The involvement of parents in infant care at the CBRH NICU. All participants mentioned examples of having the parents involved with hands-on care such as bathing, feeding, and diaper changing. All participants stated they provide education, offer frequent updates regarding infant status, and communicate the plan of care to the parents. Other actions, such as the promotion of unlimited visiting and seeking parent input when planning care, were also discussed.

Developmental care education at the CBRH NICU. The final question of the consultation asked participants to describe any developmental care education they have received. One participant stated they took the Neonatal Orientation and Education Program, which contains a module dedicated to developmental care. Only RNs recently hired have received this course. All participants discussed an increase in Baby Friendly Initiative (BFI) related education sessions provided by the hospital's BFI Lead, which focuses on the importance of skin-to-skin contact between mother and infant. However, the participants stated that developmental care is not a frequent topic of education provided in the NICU.

CNE Consultations/Environmental Scans

Definition of developmental care and family-centred care. All CNEs described developmental care as the need to provide sensory care appropriate for the infant's gestational age, providing a womb-like environment for the premature infant, and providing an individualized approach to care specific to each patient. All CNEs described family-centred care as involving the parents with the physical care of their infant, care-planning, and decision-making as much as possible. Participants also included other elements of family-centred care, such as being culturally sensitive to each family's needs and increasing the parent's confidence

to care for their infant post-discharge. One CNE stated that the NICU in which they work subscribes to a philosophy of family-integrated care, as opposed to family-centred care. The CNE explained that family-centred care and family-integrated care are often used interchangeably but have differences. Specifically, the parents are "immersed" in the healthcare team. They are provided with individualized support to care for their child and participate in decision-making when family-integrated care is used. This differs from family-centred care in which the parents are involved but are not viewed as healthcare partners.

Developmental Care Policy. Of the six facilities consulted, only one has a formal protocol to guide developmental care and family-centred care practices. During a brief phone call, the CNE explained that their developmental care policy is based on the results from a Sunnybrook Health Sciences Centre study on the Family-Integrated Care Model (FICare). Under the FICare model, "families should be supported, educated, and empowered to provide as much of their infant's care as they are able" (O'Brien et al., 2015 p. 2). Through parent and nurse education, peer support, and policy and infrastructure changes, FICare aims to integrate families into the neonatal care team (O'Brien et al., 2015). The FICare model has been shown to improve neonatal outcomes such as weight gain and exclusive breastfeeding while decreasing parental stress and anxiety levels (O'Brien et al., 2018). A search of this facility's online policy library yielded a practice guideline aimed at developmental care guidelines. The guideline outlines detailed practices for the areas of developmental care in the NICU. It addresses issues such as the healing environment, partnering with families, positioning and handling, safeguarding sleep, minimizing stress and pain, protecting skin, and optimizing nutrition.

Of the five CNE's whose facilities do not have a formal developmental care protocol, three of them stated they believe there is value in having a dedicated developmental care policy. Many of the participants expressed interest in obtaining the finished toolkit to adapt to the NICUs in which they work. This belief demonstrates that a practice gap exists in this area of NICU nursing and that this resource will help address that gap. Many CNEs stated the facilities have formal protocols addressing developmental care. However, some explained developmental care is embedded in their unit's culture as something they "have always done" but did not elaborate further on the developmental care culture of the unit. Others claim developmental care and family-centred care interventions are dispersed among other unit policies. Finally, without a formal protocol in place, it creates a lack of a standardized approach, which leads to a fragmented and inconsistent approach to developmental care within the unit.

Developmental care interventions. The CNEs were asked how developmental care and family-centred care are incorporated into the practices of their unit. All participants stated that developmental care is included in the care provided at the facility in which they work; however, some mentioned that they believe this area needs improvement. Although improvements to developmental care and family-centred care have been made at one facility, the CNE said that families are often not adequately included in patient care. Parents are often viewed as "outsiders" as opposed to the infant's primary caregivers and decision-makers. Numerous developmental and family-centred care interventions were listed by the participants, including:

- Single-room care/rooming-in practices
- Unrestricted visiting hours for family
- Skin-to-skin contact between parent and infant

- Parent participation in care activities such as feeding, diaper changing, bathing, clothing temperature taking, comforting touch.
- Inviting parents to actively participate in multidisciplinary rounds/present their baby for rounds if comfortable
- Cluster premature babies to one area of an open-bay NICU to more easily control light and noise levels
- Dimming lights, utilizing quiet voices
- Utilization of incubator covers, positioning aids, noise meters
- Non-nutritive sucking/sucrose for painful procedures
- Clustering of care activities
- The use of "swaddle sacks"

Developmental care education. The CNEs were asked whether developmental care education/training was delivered at their facility and if so, who is offered it, in what form, and at what frequency? Five of the six CNE participants stated that their facilities provide developmental care education to staff. All five of these facilities include some training on developmental care in the orientation of new staff members. For some NICUs, developmental care training is informal and makes up a small portion of the orientation, and for others, it makes up a large portion of the education provided. One CNE stated that their facility offers developmental care education yearly and is only repeated on an as-needed basis. Other CNEs stated that developmental care training is rarely repeated after orientation. Another CNE said the NICU in which they work offers developmental care education throughout the year as part of something they call, "Did You Know?" campaigns. In some NICUs, developmental care education is offered to RNs only; others offer it to RNs and physicians; while others include all

multidisciplinary staff (RNs, physicians, Occupational Therapists, volunteers, etc.) to participate in developmental care training. The methods of delivery vary and include in-person training, webinars, and self-directed learning packages. Many of the CNEs stated that education around developmental care and family-centred care is an area they wish to see improvement.

Website search. As part of the environmental scan, each facility's website was searched to find additional information on their developmental care and family-centred care practices. Two of the six facilities had information related to their developmental care practices online. One of the institution's website contained more detailed information than the other. Interestingly, one NICU with no formal developmental care policy had detailed information of how the unit subscribes to the FICare model on their website. The website provided a general overview of the NICU environment, an explanation of developmental care, a description of the family-integrated philosophy of care, and what families can expect when their infant is a patient at the facility. Descriptions of common developmental care practices, as well as a link to the main FICare webpage is also provided.

Implications

The information gathered from these consultations, and environmental scans will help create an effective developmental care practice protocol and self-directed learning resource for the CBRH NICU. Completing consultations provided an understanding of RNs' current knowledge level related to developmental and family-centred care. Understanding RNs' knowledge level of developmental care and family-centred care will help guide the level of detail required in the self-directed learning resource. The consultations also provided an indication of the unit culture as it relates to developmental care, and which developmental care practices are

already being implemented on the unit. This information will help shape the protocol. Knowing that the RNs see the need for this resource provides a sense of how this toolkit will be received by staff.

The information from the consultations with the CNEs from across Atlantic Canada is important to the development of the toolkit. The consultations provided information such as how other NICUs incorporate developmental care and family-centred care into their practice, and how and when they educate their staff about developmental care. This information will help to shape the protocol and self-directed learning resource. Understanding that other facilities educate their multidisciplinary team on developmental care provides direction to expand the resource in the future so it may be adapted to fit the learning needs of different disciplines.

The environmental scans uncovered one facility with a developmental care practice guideline in place. Because this protocol has been successfully implemented in another facility, it provides a solid foundation for the development of a protocol for the CBRH. The layout, wording, and content of this existing practice guideline can be adapted to fit the needs of the facility for which it is being written.

The CBRH NICU RNs that have participated in this consultation have all expressed their support for the development of this toolkit and have confirmed the value and the need for this in their facility. Many of the CNEs who participated in this consultation also expressed interest in this project, and some asked for the completed toolkit to be shared with them so it may be adapted to suit their unit in the future.

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Appendix A

Questionnaire for CBRH NICU Staff

Completing this form and returning by email assumes you agree to participate in this consultation. The information you share will be used for a master's degree practicum project. Any personal information will remain confidential, and no identifying information will be used.

1. How long have you been a Registered Nurse?

2. How long have you been a NICU nurse?

3. Have you worked in other NICUs? If yes, where?

4. In a few words, what does developmental care mean to you? Family-centred care?

5. How do you incorporate developmental care or family-centred care in your current nursing practice at the CBRH NICU?

6. If you include developmental care in your nursing care, do you experience any difficulties, including this approach into your practice? If yes, please explain.

7. How do you involve the infant's parents in your daily practice?

8. Can you describe any recent training/education you have received on the topic of developmental care, or family-centred care?

Appendix B

Questionnaire for Clinical Nurse Educators

Completing this form and returning by email assumes you agree to participate in this consultation. The information you share will be used for a master's degree practicum project. Any personal information will remain confidential, and no identifying information will be used.

1. How long have you been a Registered Nurse?

2. How long have you been a NICU nurse?

3. At which facility are you employed?

4. How long have you been the Clinical Nurse Educator for this facility?

5. In a few words, what does developmental care mean to you? Family-centred care?

6. Is developmental care/family-centred care incorporated at your facility? If yes, how so?

7. Who is/was responsible for initiating this approach to care? Is it aimed at all who work in the NICU or only those responsible for direct care of newborns?

8. Does your facility have a protocol/policy to guide developmental care practice?

9. Can you describe how developmental care interventions are incorporated into the daily practice of your staff?

10. Can you describe how parents are involved in patient care at your facility?

11. How often does your staff participate in education related to developmental care or family-centred care? Is education on these topics required for staff orientation? Required for hire? Any CNA certifications acknowledged?

12. What staff receives developmental care training? (e.g. RNs? Physicians? Ward aids? Everyone?)

13. How is this education provided to staff? (e.g. self-directed learning, in-person presentation, webinar etc.)

Appendix C: Educational Resource

Developmental Care Practice Guidelines for Registered Nurses

Developed for the Cape Breton Regional Hospital NICU

Maria Young, BScN, RN, IBCLC

Memorial University of Newfoundland

(Wannapik Studio, 2020b)

Developmental Care Practice Guidelines for Registered Nurses

Introduction

The past number of decades have brought many innovations to neonatal intensive care. If you were to walk into a NICU 40 years ago, it would look much different than it does today. Advances in technology have changed the face of the NICU environment. For example, pulse oximetry was a thing of the future and ventilators were often used in place of Continuous Positive Airway Pressure (CPAP). You would also notice little regard for developmental care and limited family involvement. Unfortunately, outcomes for premature infants born 40 years ago were not as positive as they are today. While advances in technology are largely responsible for these positive outcomes, the impact and progress in the evolution of developmental care cannot be ignored. Developmental care is part of our holistic nursing practice but is often ignored, undervalued, or deemed as non-essential. Registered nurses play a critical role in the care of NICU patients and your delivery of quality developmental care is necessary to bridge the gap between a premature infant who survives versus one who thrives. Holistic care that incorporates evidenced based practice with developmental care is vital to the premature infant's overall growth and development.

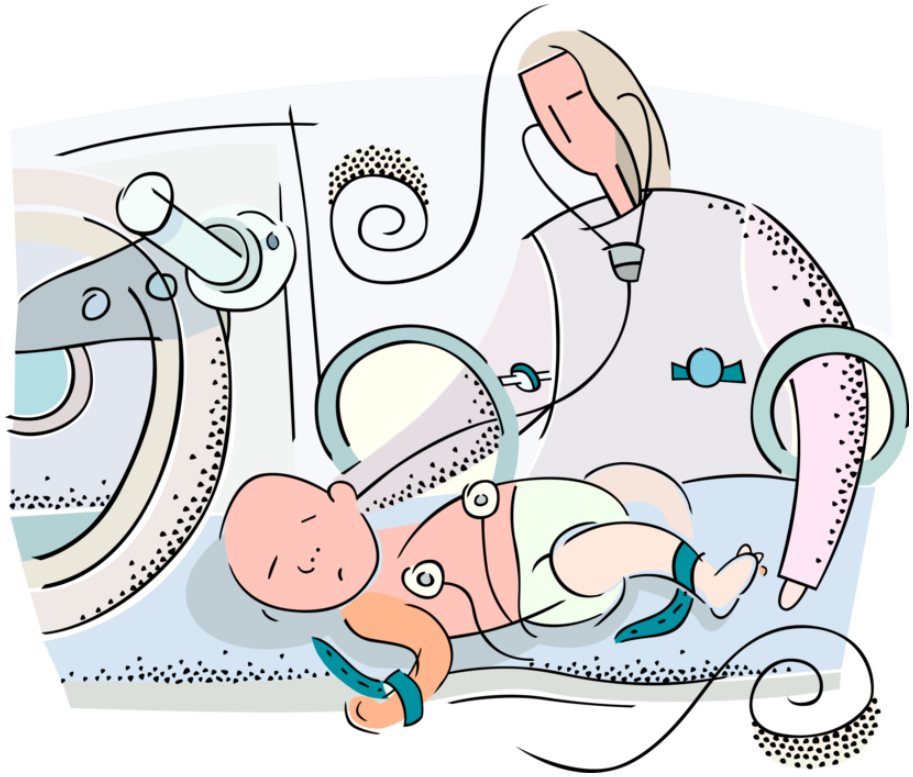
The purpose of this resource is to help you become familiar with holistic care including effective evidenced based practice through the use of developmental care and family-centred care. This booklet is designed in a way that allows you to learn at your own pace, at a time and place convenient for you. The intention of this resource is not to increase in workload. Instead, it is hoped that you will begin integrating these practices into your already expert nursing care to further benefit newborns and their families.

What To Expect from this Resource

In this resource, you will learn about best-practice recommendations for providing developmental care in the NICU setting. Along the way, you will discover how to utilize a family-centred approach while implementing each developmental care intervention. The interventions discussed will fall under 4 categories:

1. The sensory environment
2. Positioning and handling
3. Sleep
4. Minimizing pain

**Please note while there are many developmental care considerations for feeding and nutrition, these topics will not be covered in this booklet.*



(Wannapik Studio, 2020c).

Developmental Care

Developmental Care

- Developmental care is a term used to describe a certain method of care delivery in the NICU. Specifically, it aims to reduce stress, support sleep, maintain physiological stability, and promote neural growth and development through interventions designed to mimic the intrauterine environment while maintaining focus on the family (Soleimani et al., 2020).

Why is Developmental Care Important in the NICU?

- The womb is the optimal environment for brain development (Alemdar, 2018).
- The usual NICU environment (bright, noisy, uncomfortable) can be harmful to a premature infant's brain development, and actually cause neurons to die (Soleimani et al., 2020).
- When neurons in the brain die, the neurological development of the infant is negatively impacted and may lead to delays in cognitive or motor development (Soleimani et al., 2020).
- Developmental care interventions are associated with the protection of the neurological development of the premature infant from the noxious stimuli of the NICU environment (Soleimani et al., 2020).

Did You Know?

At the age of 2 years old, roughly 25% of infants born between 28-32 weeks gestation will have a developmental disorder, and by age 10, this number will climb to 40% (Soleimani et al., 2020).

Family-Centred Care

Family-Centred Care

- Family-centred care is at the core of providing effective developmental care to infants in the NICU. It is a philosophy of care which subscribes to the belief that the patient will achieve better outcomes when their family is deeply involved in all aspects of their care such as hands-on care, emotional support and care planning (Macho, 2017).

Why is Family-Centred Care Important in the NICU?

- Family-centred care has been linked to many benefits such as:
  (Griffiths et al., 2019, Lavallée et al., 2019a)
  - Improved cognition later in life
  - Less stress on the infant
  - Increased breastfeeding
  - Better weight gain
  - Increased parent-infant bond
  - Decreased length of hospital stays
  - Decreased morbidity
  - Increased parental conf

(Wannapik Studio, 2020a)

Family-Centred Care (Continued)

Family-Centred Care Values

- Clear and consistent communication exists between the healthcare team and the family regarding the infant's condition and plan of care (Altimier et al., 2015; Lavallee et al., 2019b).
- Parents are allowed unrestricted access to the bedside (Craig et al., 2015).
- Parents are invited to participate in the care of their infant (bathing, diaper changing etc.) (Lavallee et al., 2019a).
- Families are invited to participate in multidisciplinary rounds (Craig et al., 2015).
- Extended family such as siblings and grandparents are welcome on the unit (Craig et al., 2015).
- The care plan is individualized based on each family's unique needs at the point-of-care (Doane & Varcoe, 2015).

Important!

An essential element of family-centred care is to never make assumptions! We must get into the habit of asking families what is important to them and tailoring our approach to their unique needs (Doane & Varcoe, 2015). An example of this is assuming that a mother wants to skip night feeds in favour of getting extra sleep.

Take a moment to think of a time that you have made an assumption about the desires of a patient's family.

Initial Questions for Reflection

1. What do developmental care and family centered care mean to you?
2. How you currently incorporate developmental care and family-centred care into your daily practice?
    a. How might you change or incorporate more of these practices that embody holistic nursing care?
3. Can you think of any barriers you experience (personal or systems-based) when practicing family-centred care and/or developmental care?

Developmental Care Interventions

In the following pages of this booklet you will be introduced to best-practice developmental care interventions and the rationales to support them. These interventions are meant to be used as guidelines in order to optimize your developmental care and family-centered care practice. These guidelines may not apply to every baby in every situation. You are encouraged to adapt these interventions to best fit your patient's needs and the needs and desires of the family.

The Sensory Environment

The sensory environment refers to stimulus that impacts the natural senses in the form of sound, light, scent, and touch. Most NICUs (such as ours) are an open bay design, with incubators or open cots separated by curtains. The lights are usually bright, and there is no protection from the noise of equipment, alarms, or voices. The infant's sensory environment is an essential component of developmental care. Optimal brain development happens in the womb environment – dark, quiet, comfortable – so our aim is to mimic this environment as much as possible by eliminating harmful stimuli (Macho, 2017).

Intervention	Rationale	Family-Centred Care Considerations
<u>Noise Reduction:</u> Keep voices low when speaking near the infant care area (Griffiths et al., 2019). Be mindful of your effect on the noise meters located on the wall (Griffiths et al., 2019).	Loud noises can damage an infant's hearing and cause unwanted stress (Cheong et al., 2019). **Safe noise levels in the NICU should be no more than 45 decibels on average/hr** (Lavallee et al., 2019b). For reference, normal conversation is considered to be a volume of 60 decibels (Healthwise staff, 2018). Normal conversation volume near the incubator is too loud (Lavallee et al., 2019b).	Explain to the family the reason for speaking in hushed tones. Model low speaking voices when interacting with the family but be sure to ask if they can hear you well enough. If they are hard of hearing, move away from the infant care area when explaining important information to the family.

(SoundEar A/S, 2020)

Please refer to the sound meters (as pictured) located throughout the unit. They are calibrated to reflect the recommended noise levels.

Green light = Monitoring.
Yellow light = Warning… getting too loud.
Red light = Too loud! Must quiet down.

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Noise Reduction:</u> Respond promptly to alarms whenever possible (Lavallee et al., 2019b). Move noisy equipment as far from the incubator/cot as possible (Lavallee et al., 2019b). Drape a blanket over the incubator to muffle loud noises (ensure O_2 saturation monitor is in place when infant is not visible) (Lavallee et al., 2019b).	Loud noises or high frequency sounds can damage an infant's hearing – especially when paired with common ototoxic agents such as gentamicin (Cheong et al., 2020).	Explain the purpose of the blanket covering over the incubator and the importance of minimizing noise levels around the infant.

(Koriakin, 2012)

The incubator on the left in the above photo is covered with a blanket to muffle outside sounds. Note that the incubator on the right is not covered. In our facility, we have specially fitted covers to accommodate phototherapy lights and you are encouraged to utilize them.

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Noise Reduction:</u> Consider the use of silicone earplugs or earmuffs for the infant (Altimier et al., 2015; Lavallee at al., 2019b).	Possible benefits of earplugs or earmuffs include improved weight gain, stable vital signs, improved tone, potential improved cognitive development at 18-22 months (Altimier et al., 2015; Lavallee at al., 2019b).	Explain the rationale for the earplugs or earmuffs to the family and teach parents how to apply and remove them. Have them demo this skill back to you.

(MRIequip, 2019)

While it is impossible to achieve complete quiet in the NICU (especially an open bay design), earmuffs like the ones pictured above are a simple, non-invasive way to reduce noise levels experienced by infants.

**While our NICU currently does not have such earmuffs, this is something we can inquire about purchasing.*

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Promoting Positive Sound:</u> Encourage parents to speak or read softly to their infants (Provenzi et al., 2018).	Hearing human voices, especially the maternal voice, can foster attachment and improve neurological, and social development (Griffiths et al., 2019). Reading to an infant can improve cognitive development (Griffiths et al., 2019).	Explain to families the benefits of speaking or reading softly to their infant and encourage them to do this if they desire. Encourage parents to utilize the bag of books given to them on the postpartum unit upon the birth of their baby. Provide books on the unit for their use. Ensure they are plastic coated and can be wiped down.

(PickPik, n.d.)

(Sadiq, 2007)

This intervention can be easy to implement! We can remind parents of the Read to Me! bag of books that all families receive shortly after their baby is born.

We can assist and support parents, so they are comfortable reading to their infants while skin-to-skin.

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Light Regulation:</u> **For infants 28 weeks gestation and older:** cycled lighting should be implemented if possible: **Cycled Lighting:** brighter light from 0700-1900 and near darkness from 1900-0700 (with the exception of soft lighting when providing care) (Lavallee at al., 2019b). **An example of soft lighting would be a procedure lamp on the lowest setting while still having adequate light for the task at hand.* If the lights are unable to be dimmed, utilize blankets to cover the incubator. Shut off procedure lamps when not in use (Lavallee at al., 2019b).	Benefits of cycled lighting include increased weight gain, decreased crying time, improved oxygen saturation, and reduced length of hospital stay (Lavallee et al., 2019a).	Explain to families the benefits of cycled lighting. Suggest that they follow a similar lighting schedule at home. Natural light in the daytime and use darker conditions for sleep. For example, utilize blackout curtains, don't use night-lights etc.

Example of an incubator covered appropriately in times when overhead lighting can't be turned off.

(Vapotherm|Solus Medical, 2019)

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Light Reduction:</u> **For infants less than 28 weeks:** keep a blanket covering the incubator, close curtains near infant care area, and cover the infant's eyes with an eye mask if exposure to bright light is unavoidable (Lavallee et al., 2019b). Consider clustering infants less than 28 weeks in sites close together so the lights may be dimmed in that area of the unit.	For infants less than 28 weeks, continuous near darkness is recommended as it is the closest lighting conditions to the womb, and therefore will present the optimal environment for development (Lavallee et al., 2019b).	Explain to families that continuous near darkness is developmentally appropriate for this gestational age. Parents can be shown how to apply eye shields.

Pictured below is an infant wearing eye shields for protection from phototherapy light. These eye shields can also be used to protect a premature infants' eyes during a procedure requiring bright light, or when lights are unable to be dimmed to provide continuous near darkness (for infants less than 28 weeks gestation).

(Burian, 2013b)

The Sensory Environment (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Promoting Comfort Through Positive Scent:</u> Infants should have a soft piece of fabric placed in the incubator with the scent of their mother or their mother's breastmilk (Young & Yeo, 2020).	Infants are able to distinguish between their mother's scent and other scents (Young & Yeo, 2020). Infants may experience positive effects from being exposed to the scent of their mother's breastmilk such as a stable heartrate and improved oxygen saturation (Young & Yeo, 2020). Mother's experience positive effects when they feel they are doing something beneficial for their infant (Altimier et al., 2015; Nelson & Bedford, 2016).	Explain the activity to the infant's mother and suggest she participate in this activity due to the many benefits it will provide her and her infant. Give her a small piece of fabric and encourage her to place it in her bra for a few hours. Explain to her that her baby will be comforted by her scent as well as experience a more stable heart rate and improved oxygenation when the fabric is placed in the incubator.

(Saccheri, 2006)

Pictured are examples of fabric squares we can provide to mothers to participate in this bonding activity. These are often called "bonding squares". They may be smaller than the squares pictured here.

Positioning and Handling

An infant's positioning is important for neuro development, motor development, skin integrity and comfort (Lavallee et al., 2018a). In the womb, infants experience the gentle cushioning of amniotic fluid and maintains flexion of the limbs while remaining snug in a tight space. In the NICU, it is critical we mimic this environment by maintaining flexion of the limbs and providing a cozy and comforting space for the infant (Lavallee et al., 2018a). In the following pages proper positioning for infants is outlined and the importance of skin-to-skin contact with mom is reviewed. Please utilize rolled blankets or positioning aids (if available) to achieve desired positioning as needed.

Intervention	Rationale	Family-Centred Care Considerations
<u>Transferring/Repositioning:</u> When handling, transferring or repositioning infants: utilize a gentle touch free of sudden movements, while maintaining flexion of the limbs and alignment of the head and body (Altimier et al., 2015; Lavallee et al., 2019a). Utilize two people for transferring premature infants. Also known as "4-handed support". (Altimier et al., 2015).	Providing touch that mimics the uterine environment – slow, gentle, fluid movements – is beneficial to infant development (Altimier et al., 2015). Keeping the head in midline alignment with the body is best for cerebral perfusion (Griffiths et al., 2019). 4 hands on the infant better ensures proper positioning during a transfer (Altimier et al., 2015).	Encourage families to provide gentle touch to their infants if desired.

4 Handed Support

Two nurses may be required for the transfer or repositioning of very preterm infants to maintain proper flexion and containment of the limbs and alignment of the head and neck. Both nurses will work together using "4 hands" to support the infant in a flexed, aligned and comfortable position to minimize stress during a transfer, to a new incubator or to a parent's chest for skin-to-skin contact.

Positioning and Handling (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Skin-to-Skin Contact:</u> Facilitate early and often skin-to-skin contact with the mother or second parent whenever possible (Griffiths et al., 2019; Lavallee et al., 2019a; Lavallee et al., 2019b). E.g. whenever the parent requests it, during painful procedures and gavage feeding. Please refer to any existing policies or guidelines referencing skin-to-skin contact.	Skin-to-skin contact between mother and infant has many benefits such as decreased pain, sleep promotion, increased breastfeeding, decreased infection rate, temperature regulation, decreased mortality and strengthened infant/parent bond (Altimier et al., 2015; Cheong et al., 2020; Kaye, 2016).	Explain to families the benefits of skin-to-skin contact and offer this to families early and often. We should be encouraging mothers to participate in skin-to-skin contact with their infants often. Also, we must make every effort to accommodate a parent's request for skin-to-skin contact with their infant.

(UK Department for International Development, 2012)

(Kratochvil, n.d.).

Skin-to-skin aids, such as a wrap or band may be used to help facilitate proper positioning and keep the infant feeling snug and warm.

Other family members, such as the infant's father or second parent, can also perform skin-to-skin contact.

Please Note

Skin-to-skin contact can be performed even with breathing support in place, such as high-flow nasal prongs pictured to the left. Skin-to-skin contact can also be facilitated while the infant is intubated.

Positioning and Handling (Continued)

Intervention	Rationale	Family-Centred Care Considerations
<u>Positioning:</u> Position all infants less than 37 weeks gestation in the fetal position: slight flexion of the neck and spine, head and neck in alignment with body, shoulders forward, limbs contained close to the body, symmetrical posture (Lavallee et al., 2019a).	This positioning has been associated with positive effects on neuro and motor development as well as increased sleep and decreased stress (Lavallee et al., 2019a).	Explain to families the benefits of fetal positioning. Teach families how to position their infants in this way and encourage them to participate in repositioning their infants. Instructing and involving parents in the positioning of their infants is associated with better motor development than when healthcare providers are solely responsible for positioning.
Frequently alternate the infant's head position (Griffiths et al., 2019; Lavallee et al., 2019b).	To prevent head asymmetry (flat head) (Griffiths et al., 2019; Lavallee et al., 2019b).	Encourage families to participate in the frequent repositioning of the infant's head.

(Tammydz, n.d.)

Note in the pictures that the infant's limbs are flexed and close to the body, and the position is symmetrical. The infant is "nested" with blankets and positioning aids to help him feel secure.

Positioning and Handling (Continued)

Intervention	Rationale	Family-Centred Care Considerations
Positioning: Place the infant prone while maintaining the elements of the fetal position, if this position is associated with increased physiological stability for that particular infant (Lavallee et al., 2019b). Ensure every infant in the prone position is receiving continuous oxygen saturation monitoring (Lavallee et al., 2019b).	Some studies show a link between prone positioning of the infant and improved oxygen saturation – especially when receiving mechanical ventilation (Lavallee et al., 2019b). However, because the evidence on this varies, be sure to evaluate each infant for their unique response to this positioning (Lavallee et al., 2019a). Prone positioning during sleep is associated with an increased rate of SIDS, therefore, continuous oxygen saturation monitoring is mandatory (Lavallee et al., 2019b).	Explain to families the rationale behind prone positioning and ensure they understand that this position is only appropriate because of the availability of hospital-grade oxygen saturation monitoring. Explain the increased risk of SIDS associated with prone positioning for sleep at home. Encourage "back to sleep" for the home environment. Model supine positioning for sleep when discharge approaches.

(Burian, 2013a)

(National Institute of Child Health and Human Development, 2019)

Above: Prone positioning may be associated with increased physiological stability for some infants. If the infant is to be positioned prone, ensure the elements of the fetal position are maintained and continuous oxygen saturation monitoring is in place.

Right: Stress to parents the importance of "back to sleep" positioning for home sleep.

Sleep

As you are already aware, sleep is the "predominant state for neonates" and the protection of uninterrupted sleep is an essential element of developmental care (Griffiths et al, 2019). Think of a typical day caring for a neonatal patient. How many times is the infant's sleep interrupted unnecessarily? Sleep is interrupted when the lab comes to draw blood, when the physician wants to examine the infant, when an x-ray is needed – the list is endless. While necessary, these tasks are not urgent and can wait until the infant is awake so sleep cycles can be completed.

Intervention	Rationale	Family-Centred Care Considerations
Protecting Sleep: Avoid interrupting infant sleep whenever possible – especially for non-essential care such as routine examinations and non-urgent procedures (Griffiths et al., 2019). Frequently communicate this to all members of the care team.	Interrupted sleep or not enough sleep in the neonatal period is associated with reduced cerebral cortical size, decreased brain plasticity and subsequent behavioural difficulties (Griffiths et al., 2019). Interrupted sleep can also lead to increased stress, apnea, bradycardia and increased intracranial pressure (Lavallee et al., 2019a).	Educate families on the importance of non-interrupted sleep and encourage them to wait for wakeful moments to participate in care activities.
Cluster care around the infant's wakeful times. Monitor the infant for stress cues – such as oxygen desaturation – during clustered care (Altimier et al., 2015).	Clustering care around the infant's wakeful times decreases sleep interruptions (Altimier et al., 2015). Observing for stress cues will help you to monitor the infant's tolerance to the increase in activity while awake (Altimier et al., 2015).	Teach families how to recognize infant's stress cues while they provide care to avoid overstimulation and added stress. Stress cues include a change in breathing, heart rate, O_2 desaturation, flailing limbs, grimacing, shrill crying, colour change, arching.

Did You Know?

Premature infants in the NICU are handled 14-71 times per day on average! (Lavallee et al., 2019a).

Sleep (Continued)

Intervention	Rationale	Family-Centred Care Considerations
Protecting Sleep: Try and wait a minimum of 90 minutes between care activities (Lavallee et al., 2019b). Write the next care time on a sign and tape it to the incubator as a reminder to other members of the care team.	Waiting a minimum of 90 minutes between care activities will help the infant to achieve completed sleep cycles (Lavallee et al., 2019b). A visual reminder of the next care time will remind all members of the care team to avoid sleep interruption.	Encourage families to wait at least 90 minutes between waking the infant for care whenever possible. Explain the benefit of completed sleep cycles.
Facilitating Sleep: Facilitate early and often skin-to-skin contact with the mother or second parent whenever possible. Please refer to any existing policies or guidelines referencing skin-to-skin contact (Altimier et al., 2015).	Skin-to-skin contact promotes infant sleep (Altimier et al., 2015).	Explain to families the benefits of skin-to-skin contact and offer this to families early and often. Make every effort to accommodate a parent's request for and provide assistance with skin-to-skin contact with their infant.

My Next Care Time Is:

1130

A visual reminder, such as a sign on the incubator, can help to remind all members of the care team when the infant is able to be roused again.

Unless it is urgent, it is preferable not to disturb the infant until the time stated on the sign.

Minimizing Pain

The management of pain is considered an important developmental care intervention because uncontrolled pain in a premature infant can lead to altered brain plasticity and hyperactivity of the central nervous system (Lavallee et al., 2019a). In other words, uncontrolled pain can affect how the brain responds and wires itself when exposed to new experiences. In turn, this can lead to issues such as decreased motor and intellectual outcomes at 18 months of age and hypersensitivity to pain later in childhood (Lavallee et al., 2019a).

Intervention	Rationale	Family-Centred Care Considerations
<u>Pain Reduction:</u> Administration of oral sucrose combined with non-nutritive sucking with a pacifier 3 minutes before a painful procedure (Altimier et al., 2015; Lavallee et al., 2019b).	Provides pain relief and comfort (Altimier et al., 2015; Lavallee et al., 2019b).	Explain to families the benefits of oral sucrose and non-nutritive sucking and involve the family in the administration of this technique if they desire.

(Tillery, 2009)

Please see the standing physician's orders for specific information such as gestational age, amount, timing, and frequency of oral sucrose administration.

Dropping oral sucrose into infant's mouth and facilitating sucking on a pacifier can minimize pain during a painful procedure.

Minimizing Pain (Continued)

Intervention	Rationale	Family-Centred Care Considerations
Evaluating Pain: Utilize a validated pain assessment tool to rate pain levels frequently (Altimier et al., 2015; Lavallee et al., 2019b). An example of a validated pain scale would be the FLACC Pain Scale.	The use of a validated pain assessment tool is widely accepted in the literature as a way to help control pain levels in infants (Altimier et al., 2015; Lavallee et al., 2019b).	Teach families how to use the pain assessment tool and how to recognize the outward signs of a pain response in their infant (Examples pictured below) (Altimier et al., 2015). Families should be encouraged to use the tool frequently and alert nursing staff to any worsening pain response.

FLACC Scale	**0**	**1**	**2**
Face	No particular expression, or smile.	Occasional grimace or frown, withdrawal, disinterested.	Frequent to constant frown, clenched jaw, quivering chin.
Legs	Normal position, or relaxed.	Uneasy, restless, tense.	Kicking, or legs drawn up.
Activity	Lying quietly, normal position, moves easily.	Squirming, shifting back and forth, tense.	Arched, rigid or jerking.
Cry	No crying (awake or asleep)	Moans or whimpers, occasional complaints.	Crying steadily, screams or sobs, frequent complaints.
Consolability	Content, relaxed.	Reassured by occasional touching, hugging, or being talked to, distractible.	Difficult to console or comfort.

(Health Jade Team, 2019)

When utilizing the FLACC Pain Scale, observe the infant for at least 2-5 minutes, and score each category from 0-2, following the chart above and total for a final score between 1-10 (Health Jade Team, 2019).

0 = Relaxed and comfortable
1-3 = Mild discomfort
4-6 = Moderate pain
7-10 = Severe discomfort/pain

Minimizing Pain (Continued)

Intervention	Rationale	Family-centered care considerations
Pain Reduction: Skin-to-skin contact and/or breastfeeding before and during a painful procedure (Altimier et al., 2015; Griffiths et al., 2019; Lavallee et al., 2019b).	Provides pain relief and comfort (Altimier et al., 2015; Griffiths et al., 2019; Lavallee et al., 2019b).	Explain to families the pain-relieving effect of skin-to-skin contact. Teach them how to utilize skin-to-skin and breastfeeding to minimize pain before and during a painful procedure.
Swaddling and tucking the infant before and during a painful procedure (Altimier et al., 2015; Griffiths et al., 2019; Lavallee et al., 2019b).	Provides pain relief and comfort (Altimier et al., 2015; Griffiths et al., 2019; Lavallee et al., 2019b).	Explain to families the benefits of swaddling, teach them how to swaddle their infant and encourage them to do this to participate in pain minimization. Have them demo this skill back to you.
Reduce environmental light by placing a blanket or covering over the incubator during and after a painful procedure (Alemdar, 2018).	Reduced environmental light during and after a painful procedure showed statistically significant reduction in pain levels during studies (Alemdar, 2018).	Explain to families the benefit of reducing environmental light during and after a painful procedure.

(Dempster, 2010) © PAHO Jane Dempster

Skin-to-skin contact before and during a painful procedure, such as a lab draw, is an excellent way to minimize pain while keeping the mother or other parent involved in the infant's care.

Questions for Reflection

1. How will you apply what you have learned to enhance your developmental care practice?

2. If you had previously identified any barriers to practicing family-centred care, do you continue to believe these barriers still exist? If so, how can they be overcome?

3. Was there anything in this resource that surprised you?

4. Is there anything you have learned in this resource that you would like to learn more about?

    - **Resources for further learning:**

        - http://familyintegratedcare.com/

        - https://www.mountsinai.on.ca/care/nicu/model-of-care/family-integrated-care

Try it Out!

Read the following scenario and consider the reflections questions below:

Nurse Betty is caring for a 2-week-old infant who was born at 31 weeks' gestation. She arrives to the bedside and turns the procedural lamp on and opens the curtains to make it "brighter and cheerier" in the room. Her colleague is 3 incubators over, and Betty wants to tell her something. She yells across the unit to converse with her friend. The lab arrives to draw bloodwork, and the infant's mom is asking if there is anything you can do to minimize the baby's pain. Betty states "no, and don't worry about that, he won't remember this anyway". After the lab draw, the infant needs a diaper change and a bath. The mother asks to be shown how to bathe her baby but Betty has 2 other babies to bathe and feed so she says no "it will be faster if I just do it". The infant's mom sits back, and watches Betty perform these tasks. After the infant is fed, he needs to be resettled in the incubator. Betty lays him on his back with his arms and legs splayed out. Once he is settled, the RT arrives and wants to do a routine assessment to auscultate the baby's lungs. Even though the infant just fell asleep, Betty tells the RT to go ahead. The physician soon arrives and wants to begin rounds. The mother asks to stay and listen, but Betty encourages her to go back to her room for a nap instead. It is now 10:00 and the infant isn't due to feed again until 11:00. During rounds, the physician orders the cardiac monitoring to be stopped. Betty immediately removes the leads from the baby's chest, waking him.

1. Has nurse Betty's practice been consistent with the values of holistic developmental care and family-centred care?

2. What could nurse Betty have done differently to improve her developmental care and family-centred care practice?

3. What could nurse Betty have done differently to involve the infant's mother?

4. Based on what you have learned in this resource, re-write the above scenario so it reflects developmental care and family-centred care. Compare your re-developed case to the one on the following page. How does it compare? Is there anything you would do the same or differently from nurse Betty?

Try it Out! (Continued)

The following is the same scenario, only nurse Betty follows best-practice developmental care practices and adheres to the principles of family-centred care:

Nurse Betty is caring for a 2-week-old infant who was born at 31 weeks' gestation. She arrives to the bedside and turns the procedural lamp on the lowest setting that she needs to see. She opens the curtains to allow natural light into the room, while being sure the light isn't shining in the infant's eyes. Her colleague is 3 incubators over, but Betty will wait until they are away from the patient care area to converse with her. The lab arrives to draw bloodwork, and the infant's mom is asking if there is anything you can do to minimize the baby's pain. Betty states "absolutely, why don't I get someone to help me transfer your son out to you to do skin-to-skin during the blood draw". After the lab draw, the infant needs a diaper change and a bath. Betty offers to show the mother how to bathe her baby and encourages her to participate hands-on. After the infant is fed, he needs to be resettled in the incubator. Betty shows the mother how to position him in the incubator in the fetal position, with his limbs flexed and close to his body, with rolled blankets providing a snug "nest". Once he is settled, the RT arrives and wants to do a routine assessment to auscultate the baby's lungs. Because the infant is stable and just fell asleep, Betty asks the RT to return to assess the baby at his next care time, which is 1100. The physician soon arrives and wants to begin rounds. The mother asks to stay and listen, and Betty encourages her to stay and participate and ask questions. It is now 10:00 and the infant isn't due to feed again until 11:00. During rounds, the physician orders the cardiac monitoring to be stopped. Betty chooses to wait until 1100 to remove the chest leads, to allow the infant to remain sleeping.

Conclusion

Thank you for taking the time to participate in this learning activity! The aim of this resource is to introduce you to approaches that make it possible for nurses to carry out holistic care that is evidence-based and includes fundamental developmental care interventions. Providing care in this manner should ultimately improve health outcomes for babies and their families. Providing high-quality developmental care and family-centred care are essential components to providing holistic care while in the NICU. Involving the infant's family as much as possible may be different than how we usually practice, however the endless benefits for infants and parents make it a worthwhile practice change.

Thank You!

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We are proud to practice Developmental Care

Please remember…

Shhhh… Keep voices low

Cover my eyes when you need bright light

Bring me out to snuggle my mama

Don't forget my sucrose before a painful procedure

Don't wake me unless it's very important!

Read to me!
Talk to me softly

Don't forget my scent square!
I want to smell my mama