

# Gravens By Design: Selected Abstracts from the 36<sup>th</sup> Annual Gravens Conference on the Environment of Care for High Risk Newborns: Resiliency and Change in the NICU

Robert White, MD, Joy Brown, PhD, Vincent Smith, MD, Mitchell Goldstein, MD, MBA, CML

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**Gravens 2023-2**

**Abstract title:** The Isolette Does Not Protect from the Noise Within

**Authors:** Mitchell Goldstein, Munaf Kadri, Mita Shah, Perpetua Lawas, Gilbert Martin, Elba Fayard, Ricardo Peverini

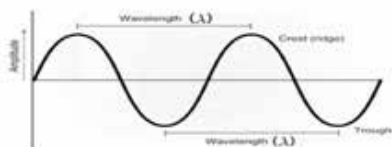
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**Introduction:** The isolette is an essential part of the care of the newborn. It provides appropriate humidification and warmth, protection from an outside bacterial and viral infection, and prevents room noise from penetrating and affecting the baby inside the chamber. However, the isolette is less able to protect the baby from noise emanating from inside the chamber. Despite improvements in noise abatement from outside the isolette, other than the infant mattress, there is relatively little barrier to noise propagation, especially if that noise comes from an organized waveform with a predictable repeat pattern, such as a high-frequency oscillator that uses a piston or "speaker" to generate ventilation. In these circumstances, standing waveforms can result in optimal propagation through the chamber and maximal disturbance to the baby inside.

**Hypothesis:** Can the potential effect of high-frequency oscillator waveforms be estimated using a model of optimal waveform propagation in an isolette?

**Materials and Methods:** A simulated environment was created using a typical isolette with a plastic chamber 1 meter long by 0.5 meters high by 0.5 meters wide. HFOV settings



of 5, 10, and 15 Hz at a mean airway pressure of 20 cm H2O, and amplitudes varied from 10 to 40 cm H2O. For this study, a standard endotracheal tube was assumed. Although the endotracheal tube is typically situated in the trachea, in this study, the ETT was presumed to be in the closed isolette environment (e.g., to find a maximal theoretical effect). Using the simplified displacement equation (e.g., string), the displacement of the string is defined as  $y(x,t) = A \sin(kx - \omega t) + A \sin(kx + \omega t) = 2A \sin(kx)\cos(\omega t)$ . At position multiples of 90 degrees, the resultant waveform oscillates with amplitude  $2A \sin(kx)$  in both a negative and positive direction. Wavelength ( $\lambda$ ) was calculated by dividing the speed of sound ( $v = 343$  meters/second) by the frequency (Hz) represented as  $\lambda = v/f$ . No actual human or animal subjects were involved in this stimulation. This procedure did not involve animal or human subjects, so it was exempt from IRB reporting requirements.

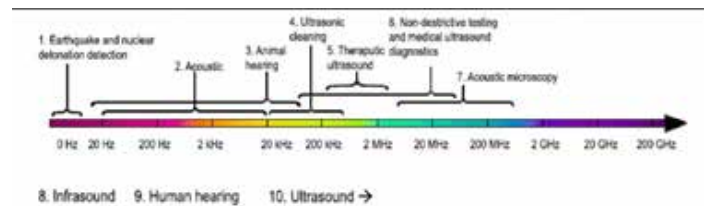
**Anatomy of a wave**

**Results:** Data are presented in Standing Wave \* Wavelength (cm-M). The calculations show lower frequencies and higher amplitudes produce more pronounced standing waves. See the table below and the enclosed figures.

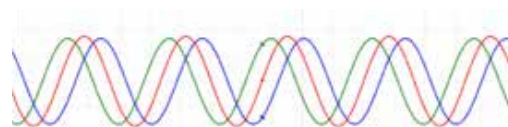
**Standing Wave \* Wavelength product in cm-m**

Standing Wave * Wavelength product in cm-m			
	5	10	15
10	1360	680	456
20	2720	1360	912
30	4080	2040	1368
40	5440	2720	1824

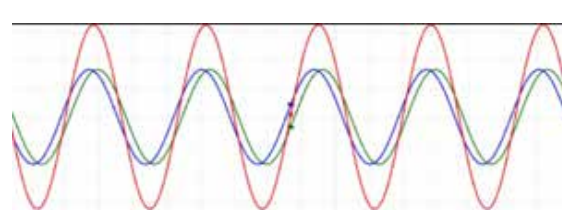
**Pressure and sound waves**



**Out-of-phase projections**



**In-phase projections**



**Discussion:** Although high-frequency ventilation resembles low-frequency sound in more than waveform construction, much like the sub-woofer of a highly optimized sound system, these lower frequencies produce dramatic effects that can permeate the room or, in this example, isolette. Standing wave formation is a given despite selectively employing higher frequencies and lower amplitudes. Padding within the isolette is a consideration, but it potentially increases the risk of infection and may not perform well in a humid environment. Other passive sound abatement technology may cause issues with the isolette's operation and may not completely resolve the issue.

**Conclusion:** High-frequency ventilation technologies preclude the benefit offered by the isolette environment. Further efforts to reduce sound/noise propagation in the isolette must be undertaken to maximize the quiet environmental space necessary for optimal growth and development.

**Problem statement:**

What is the significance of noise that enters the isolette environment from a respiratory intervention? This study identifies a barrier to the quiet environment.

**Learner objectives:**

1. Learners should be able to identify impediments to the quiet environment.
2. Learners should be able to identify ventilator settings that produce more disruption.

**Gravens 2023–4**

**Abstract title:** A quality improvement project to determine the suitability and efficacy of diaper wipes used in the NICU

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**Background and Purpose:** Diaper Dermatitis is a common condition seen in infants and was first identified in the 1940s. A literature review indicated that the prevalence of diaper dermatitis in large NICUs may be as high as 29%. A simple strategy that may aid in prevention is the use of diaper wipes. The use of disposable diaper wipes in the Neonatal Intensive Care Unit (NICU) has long been discussed. Evidence from the literature indicates that disposable diaper wipes provide soft gentle cleansing and minimize skin compromise. This project is noteworthy because it evaluated the use of two commercially available wipes as opposed to evaluating a disposable wipe versus sterile water and gauze for skin cleansing.

**Aim:** The aim of this quality improvement project was to de-

termine which of two commercially available diaper wipes was better at cleansing the skin in the diaper area, efficacious, and cost effective for use.

**Methodology:** This project was designed to compare the use of two different brands of diaper wipes to determine which wipe best cleansed and improved diaper area skin condition and barrier function. The unit was already using a popular commercially available wipe, but bedside staff were requesting a change to another commercially available wipe. Due to the large size of the NICU, 140 beds in a south-eastern women's hospital, a decision was made to limit the study to the 30-bed single room level 2. The unit was a pod configuration, and it was decided that each pod would use a different brand for the duration of the study. Pod A used the current product, and Pod B used the staff-requested product. A convenient sample of 24 neonates and their families participated. All infants in the sample were required to have a length of stay of 10 days or more in the unit. A survey assessed ease of use, family satisfaction, skin condition and appearance and was completed daily by bedside staff.

**Budget and Resources:** The goal for this quality improvement project was to remain budget neutral. Prior to the start of the project, all bedside staff were educated in the correct use of diaper wipes, which occurred on their scheduled shift by the unit CNS and staff educators. Additionally, the NICU was already using a commercially available wipe and sterile water and gauze, and those costs were included in the yearly supply budget. The comparison wipe was provided to the unit for the duration of the project, and no costs were incurred for the comparison wipes, which allowed the goal of budget neutrality to be met.

**Results:** No diaper dermatitis occurred during the 6-week trial when using either product, as determined by chart review. It is possible that a Hawthorne effect took place due to staff education and overall awareness that the project was taking place. What was interesting to note was the clear preference of the staff and parents for the staff-requested product, as 84% of those taking part in this project recommended that the unit switch to the staff-requested project.

**Conclusion:** After the completion of the project and a review, a recommendation was made to the NICU Leadership and Nursing Practice Council that a change to the staff-recommended product occur. All areas of this 142 bed NICU began using the staff-requested wipes. So successful was the switch that the

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use of the product spread, and staff are now using it to sponge bathe babies in the NICU when the infants require bathing but are not ready to have a swaddle bath performed. This project demonstrates how using a quality improvement project can lead to both staff and parental satisfaction in the NICU.

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**Problem statement:** The use of disposable diaper wipes in the Neonatal Intensive Care Unit (NICU) has long been discussed. Evidence from the literature indicates that disposable diaper wipes provide soft gentle cleansing and minimizes skin compromise.

Needed to determine which of two most popular commercially available diaper wipes was better at cleansing the skin in the diaper area, efficacious and cost effective for use.

### **Learner objectives:**

1. Discuss the benefits of using quality improvement methodology when considering a product change.
2. Identify the Hawthorne effect and how it can affect a project.
3. Recognize the importance of reviewing the literature and using an evidence-based approach is important when developing a quality improvement project.

## Gravens 2023–6

**Abstract title:** Feeding Support Needs of Infants in a Level III NICU

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A retrospective chart review was performed for infants admitted to a large (66 bed, >900 admissions per year) Level III NICU in 2018-2022. We utilized the FOIS-P to track PO progress in infants during their NICU stay and across the first year at home. Within- and between-rater reliability were established.

During their NICU stay, >95% of infants require PG feeds; approx. 35% of infants require modified feeding equipment/positioning/strategies; and approx. 5% of infants require thickened liquids. At the time of discharge home, approx. 25% of the NICU population continue to display immature/disordered feeding skills; 2% require home PG feeding (FOIS-P 1-3), and the remainder are fully PO fed but require modified feeding equipment/positioning/strategies +/- thickened liquids (FOIS-P 4-5). At home, within 1 month of discharge (0-2 months corrected age), approx. 90% of NICU infants are breastfeeding/ bottle feeding without need for feeding modifications (FOIS-P 6), but 10% continue to require some compensations (FOIS-P 2-5). Approx. 35% of infants attending NICU follow-up clinic display delayed transition to solid foods at 8 and 12 month corrected age (FOIS-P 4.5 -5)

Age at attainment of age-appropriate feeding skills (i.e., not requiring therapeutic compensations – FOIS 6) is negatively correlated with gestational age at birth and is highly positively associated with the presence of certain illnesses (BPD, CHD, GER, HIE) during the NICU stay.

Evidence-based reporting tools assist in monitoring of patient outcomes. Through systematic data collection, we are better able to guide staff and parent expectations regarding age at attainment of PO feeding milestones and plan appropriate support services for infants continuing to need therapeutic compensations to feed safely. We encourage others working in this area to track functional feeding outcomes in the newborn period and throughout infancy.

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**Problem statement:**

Preterm and other high-risk infants often display difficulty establishing oral (per os, PO) feeding in the Neonatal Intensive Care Unit (NICU). Most initially require enteral tube (per gavage, PG) feeds. Then, as they transition to PO feeds, many require the use of therapeutic compensations (e.g., special bottle nipples, positioning, strategies) to assist them to feed safely and efficiently. Some infants continue to require therapeutic compensations +/- PG feeds post-discharge from the NICU. These infants continue to require ongoing feeding support.

We aimed to track the corrected age when infants admitted to the NICU reach key feeding milestones, including age at start of PO feeds, full PO feeds, and PO feeds without the need for therapeutic compensations.

**Learner objectives:**

1. List 3 potential complications of feeding impairments in the NICU
2. List 3 evidence-based therapeutic feeding interventions for use in the NICU
3. List 3 indicators of pediatric feeding disorder

## Gravens 2023–7

**Abstract title:** Oh (Small) Baby!

**Authors:** Kathryn Colacchio, MD; Bethany Eldredge, MSN, RN; Blare Forbes, MSN, RNC-NIC; Taylor Hannah, BSN, RNC-NIC, C-ELBW; Jamil Khan, MD, FAAP; Moll, Elizabeth, MSN, RN, CPNP; Miranda O'Leary, BSN, RNC-NIC; Jan Thape, MSN, RNC-NIC; Laura Warner, BSN, RNC-NIC, C-ELBW; Leslie Worley, Data Coordinator

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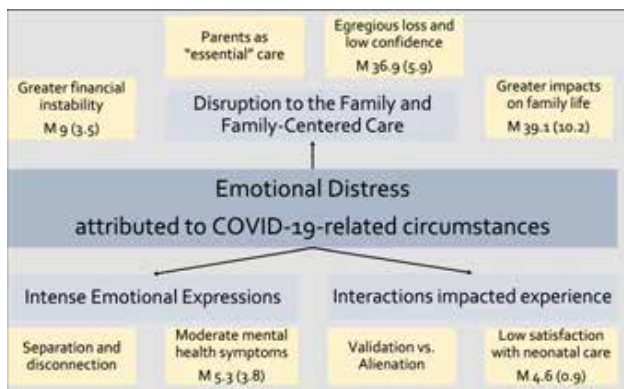
1-757-668-9463

Extremely low birth weight patients are considered by many

the new generation NICU population. Their survival requires specialized care and practice. Development of a Small Baby Unit is pertinent in improving both morbidity and mortality rates among our smallest NICU patients.

We utilized the Neuroprotective Family-Centered Developmental Care Model by Altimier & Philips (2013) to begin the framework of the development of our Small Baby Unit. We used evidence-based research on the seven core measures that Altimier & Philips' developed to drive our Small Baby practice in protecting and promoting optimal neurodevelopmental care. These seven measures include: Safeguarding sleep, positioning and handling, protecting skin, minimizing pain and stress, nutrition, partnering with families, and healing environment. In our unit we felt that adding an 8th core measurement of 'Golden Hour' was important for this patient population since much of the time it sets the tone for their stay in the NICU (2021).

Data was collected by chart audits on factors that are known to alter long-term developmental outcomes of our small-



est patients. Some of these factors included intraventricular hemorrhage, sepsis, retinopathy of prematurity, bronchopulmonary dysplasia, necrotizing enterocolitis, mortality, and length of stay. We compared our data points from the year prior to the implantation of our small baby unit, to our data at the end of our first year of our small baby unit. The previous year (year prior to implementation) we had 88 patients that met the criteria to be considered a small baby. The criteria included patients less than or equal to 26 6/7 weeks of gestation and admitted within 48 hours of birth. Our first year of the SBU implemented ended with a total of 83 patients that went through the small baby unit. When comparing our data, we have shown great strides in decreasing our necrotizing enterocolitis rates and overall length of stay. In efforts of aiding in decreasing our necrotizing enterocolitis rates we focused on a strict human milk-based diet, particularly mothers' own milk, and the time to initiation of the first feed. Our goal is to feed patients within the first 48 hours of life if they are stable enough to do so. After implementation of this feeding guideline, we had 56% of our small babies fed within 48 hours, compared to our pre-implementation cohort of 38%. We believe this supports our necrotizing enterocolitis rates going from 10% pre-implementation to 4% post-implementation.

Prior to the implantation of our small baby unit, neurodevelopmental care often got trumped by the medical management of these patients. Neurodevelopmental education and training were and continue to be a crucial topic that we educate our small baby bedside providers on. Small elements of insuring quiet closure of incubator portholes, opening alcohol pads outside the incubator, and limiting loud noises/voices in the patient's room to the bigger elements on proper positioning, family centered care, and skin to skin care were some focuses of our training. During our first year, the Supporting and Enhancing NICU Sensory Experiences (SENSE) program (2019) was rolled out to these small babies to help not only encourage family involvement but also give age-appropriate care to these patients. To facilitate family education and involvement, a small baby brochure was developed to give to all families upon admission to the NICU.

Some data did not show improvements in rates. Bronchopulmonary dysplasia was shown to be an area of needed improvement. Seeing this allowed our small baby team to collaborate with the NICU respiratory team on how we could improve our bronchopulmonary dysplasia rates. With this collaboration we implemented Bubble CPAP as an additional respiratory modality for our smallest patients.

With any new program there are also barriers. Some identified during our first year was location of admitting these patients that require specialized care. When we first rolled out our small baby unit, the patients were admitted anywhere in our 70-bed private/semiprivate unit. The unit consists of 3 neighborhoods with 2 pods within each neighborhood. It was difficult to have the patients assigned to the properly trained nursing staff when they were scattered throughout the unit. We implemented having our small babies admitted into one neighborhood of the unit. With this implementation it ensured that the patients would have the specialized nursing care but also have these patients in the same area where specialized equipment and environmental awareness would be consistent. Over the last year, we have learned many things and implemented change to ensure that our patients are receiving excellent, high-quality care. We continue to track and analyze data to identify areas of improvement and also highlight the areas of success.

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risk infants. *Early Hum Dev.* 2019 Jun;133:29-35. doi: 10.1016/j.earlhumdev.2019.04.012. Epub 2019 May 1. PMID: 31054467.

### Problem statement:

As the age of viability decreases the rate of mortality and morbidities increase. How can we, as providers, tailor our knowledge, understanding, and skill set for these patients to improve their outcomes?

### Learner objectives:

1. List three core measures from the Neuroprotective care guidelines.
2. Identify one factor that is linked to decreased morbidity and mortality in very low birth weight patients.
3. List three nursing interventions that focus on small baby care.

### Gravens 2023–8

**Abstract title:** Recognizing Parents as Essential Care in the NICU

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**Introduction:** While there is sufficient evidence demonstrating negative parental outcomes secondary to having an infant in the NICU, it was unknown how parents were impacted and experienced a NICU hospitalization in the context of COVID-19. Therefore, the aim of this study was to explore parent experiences and impact of a neonatal hospitalization during the COVID-19 pandemic.

**Methods:** An anonymous online survey was developed to gather data on family life, financial stability, mental health, confidence, satisfaction with neonatal care, and family demographics. Participants were recruited through social media platforms and study inclusion required a NICU admission between February 1–July 31, 2020. The survey included the following validated measures: Impact on Family Scale, Karitane Parent Confidence Scale, PHQ-4, and EMpowerment of PARents in THe Intensive Care (EMPATHIC-N) and five open-ended questions about their hospital experience. Results were summarized descriptively and thematically using STATA and NVivo 11 qualitative software.

**Results:** Our sample included 169 parents from 36 US states, of which 97% were mothers, 60% were non-Hispanic white, and 70% had an infant born preterm (< 37 weeks). Parents reported significantly higher impacts on family life and finances (M 39.1 SD 10.2; M 9 SD 3.5, respectively), low confidence (M 36.9 SD 5.9), moderate anxiety and depressive symptoms

(M 5.3 SD 3.8) and low satisfaction with neonatal care (M 4.6 SD 0.9). Three broad themes were identified: 1) intense emotional expressions, 2) interactions impacted experiences, and 3) disruption to the family and family centered care (Figure 1). These themes provide greater context to the quantitative results highlighting disruption to family life and emotional distress. To quote a parent, “hospital policies [were] not in touch with the reality of families, making the impossible pain of [having] a baby in the NICU even more impossible.” NICU parents experienced feelings of painful separation, disconnection, and isolation and expressed intense and frequent disappointment at having their visitation restricted. Lastly, there was a desire for more empathy, validation, and inclusion in decision making.

### Figure 1

**Discussion:** Results from this study indicate that families experienced significant impacts on family routines, mental health, and financial wellbeing while their infant was hospitalized in the NICU during the initial phase of the COVID-19 pandemic. The descriptions of parent experiences document the emotional struggle of being separated from support systems, feelings of isolation, lack of family-centered care, and exacerbation of emotional distress already known to be common to the NICU journey. The consensus statement entitled “Essential Care in the NICU during the COVID-19 Pandemic” was developed in response to these findings to advocate for parents during hospitalization and endorsed three professional organizations. The unintended consequences and lessons learned during the initial phase of the pandemic can help leaders implement more family-focused, evidenced based policies that do not undermine well established family-centered care practices. This presentation will conclude with how unlimited parental presence can be an effective strategy to advance health equity, improve family health, and empower clinicians to advocate for unlimited parental presence and supportive family practices.

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#### Problem statement:

Parenting and family life were exceptionally susceptible to unanticipated changes during the COVID-19 pandemic. Prior to COVID-19, parental presence was encouraged through unrestricted visitation and family-centered care practices in neonatal intensive care units (NICU) knowing that parental caregiving is essential for infant healthy development. Yet, during the COVID-19 pandemic, hospitals across the world responded to the public health crisis by modifying hospital visitation practices, which impacted parent and family presence during hospitalization. This presentation will review changes to visitation practices, describe unintended consequences of limiting parental presence, discuss study results from the NICU COVID Experiences study, and review the global zero separation guidelines.

#### Learner objectives:

1. Describe modifications to visitor guidelines throughout the US and globally and challenges reported by families.
2. Discuss the benefits of parental presence on infant, child, and family health in a review of results from the NICU COVID Experiences Study.
3. Discuss policies and strategies to overcome challenges and barriers to unlimited parent presence and implementation of zero separation guidelines.

#### Gravens 2023-9

**Abstract title:** The NICU blues: "Am I losing my mind?"

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**Introduction:** Approximately 10% of U.S. babies will spend time in a newborn intensive care unit (NICU).(1) There remains a significant percentage of infants born at the earliest gestational age who die in the NICU.(2) Family-centered NICUs often lack a single, clear definition for common, transitory parental levels of distress.(3) There does not exist a parental non-pathological term to capture this distressing

sequel. Further, we often have limited time to have a positive impact with families and babies in the NICU. This time in the NICU can have long lasting effects on the parents and their neonate's well-being during infancy. Hence, we propose the use of an adaptive intervention of a novel term to identify common parental experience specific to the NICU.

**Methods:** Over ten years, the principal author collected confidential qualitative comments from hundreds of mothers and fathers with newborns in a Level III family centered NICU. Generally, parents' concerns and expressions of suffering and pain were *not* pathological. Fathers' express feelings such as "I am going to lose my entire family," and mothers express guilt and shame such as "I caused my baby to be born too soon." Both parents collectively declared, "This is not how we imagined our newborn's birth." These comments are common narrative themes to an unexpected birth event. However, research clearly documents higher rates of Diagnostic Statistical Manual-5 (DSM-5) diagnoses for parents in the NICU.(4-7) A literature review revealed there exists a common level of acute disorientating parental distress lacking a non-pathological term. We organized these parental narratives into four factors, including NICU trauma, baby blues, postpartum mood and anxiety disorders, and NICU grief to formulate a novel paradigm, the NICU blues.

**Results:** With the accumulated parental narratives, multidisciplinary staff insights and the literature review, we developed a new paradigm for the non-pathological term experience and named it the "NICU blues." We found that giving name to "NICU blues" for parents provided optimal relief and meaning for parents and other caregivers moving through a unique and challenging NICU journey. NICU blues provides both parents and the multidisciplinary staff a voice for expected and understandable transitory states of parental functioning. The term NICU blues normalizes common parental experiences for transitional parental adaptation within a unique NICU setting.

**Conclusions:** We propose the inclusion of a predictable term, NICU blues, into protocols of robust universal clinical standards of family-centered care. Identification and early intervention of NICU blues by staff and parents may ultimately foster bonding, establish a sense of parenthood, and increase communication between NICU staff and parents promoting a more positive NICU experiences.

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#### Learner objectives:

1. Identify parental factors for a novel term “NICU blues” as a predictable, common, and non-pathological adaptation to a unique NICU experience.
2. Describe how awareness and early intervention for parents and NICU staff can mitigate the experience of NICU blues, foster increased bonding between parent and baby, increase interactions among multidisciplinary NICU staff and parents, promoting a positive NICU experience.

#### Gravens 2023–10

**Abstract title:** Time is More Precious than Gold: A Golden Hour Improvement Project

**Authors:** Kathryn Colacchio, Kirstina Crizaldo, Bethany Eldredge, Blare Forbes, Taylor Hannah<sup>3</sup> Nicholas Heitkamp, Jamil Khan, Elizabeth Moll, Miranda O’Leary, Jan Thape, Laura Warner, Leslie Worley

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In January 2021, we began tracking patients who met the criteria for golden hour (GH). These included patients  $\leq 32$  weeks

gestation or 1500 grams, and born at the neighboring facility, Sentara Norfolk General Hospital (SNGH). The NICU Data and Project Coordinators performed chart audits in the Electronic Medical Record (EMR) to track certain metrics. A GH Admission Form was also created and completed by bedside staff. Simultaneously, staff was educated on the GH components and the use of the form.

From January 2021 to October 2022, there were 238 patients that met inclusion criteria. We obtained quantitative data to assess areas of improvement and success, and qualitative data to understand staff perceptions of the GH process. Baseline data from 2019 included 78 patients. We chose to measure the following metrics: Time to Admission from Delivery Room (DR), 1<sup>st</sup> and 2<sup>nd</sup> admission temperatures and glucoses, time to 1<sup>st</sup> glucose, initiation and confirmation of central line placement, antibiotic and fluid administration, Amikacin delivery at the bedside, and incubator top down.

To help reduce hypothermia ( $<36.5^{\circ}\text{C}$ ), we implemented utilizing a thermal hat, Neowrap, and thermal mattress in the DR (of which is in a Preemie Pack on our transport isolette) and using a clear drape used for line placement to preserve heat. The percentage of patients arriving hypothermic decreased from 17% to 14%. Hypothermia is also impacted by the time it takes to get from the DR to the NICU. This time decreased from 35 to 29 minutes.

To reduce hypoglycemia ( $\leq 45$  mg/dL) and to intervene early, we reduced the time to obtaining an initial glucose by placing a heel warmer on the patient in the DR (in the Preemie Pack). The time to obtaining the initial blood glucose decreased from 21 to 17 minutes.

To reduce respiratory distress, surfactant is given in the DR within 10 minutes of birth. A standardized algorithm was created that patients born at  $<25$  weeks are placed on the High Frequency Jet Ventilator, and  $>25$  weeks are placed on the Conventional Ventilator.

Another factor addressed is central line placement, which impacts the time to treat hypoglycemia, and used to administer fluids/antibiotics. We started having one provider remain sterile until lines are confirmed. Additionally, we instituted an admission order set of 3 x-rays, so the provider didn’t need to place additional orders after getting sterile. The time to initiation of central line placement decreased from 18 minutes to 13 minutes. The time to central line confirmation on x-ray decreased by 1 hour and 21 minutes.

To reduce the risk of early-onset sepsis, we worked to ensure Amikacin arrived at the bedside earlier (decreased by 1 hour and 2 minutes during this project). The time to Amikacin administration decreased from 3 hours and 6 minutes to 1 hour and 29 minutes. The time to D10PNC Administration reduced from 2 hours and 40 minutes to 1 hour and 20 minutes.

The time to incubator top down was the last quantitative measure tracked. In 2019, it took 4 hours and 26 minutes and recently, 1 hour and 27 minutes. We did not implement anything specific to closing the top earlier but identified that

prompt central line placement confirmation results in earlier closure of the top.

For the qualitative data, we measured various communication metrics; one including calling from the DR to the NICU with the patient's Length, Weight, Head Circumference, and mode of ventilation. Confusion was reduced as orders could be placed and equipment prepared prior to admitting the patient (improved from 0% to 71%). We also had the team ring the NICU doorbell when coming through NICU doors. This acted as an audible cue for the Secretary and therefore announced "Golden Hour Admission" on the NICU overhead speaker (improved from 0% to 86%). Additionally, the Secretary tracked the time of birth and the time of being able to enter the patient into our EMR. This allowed us to identify delays in this process, although we have not recently identified any.

Two final interventions included a Pre-Admission Huddle (July 2022) and Admission Huddle (October 2022). The Pre-Admission Huddle is done prior to the admission and serves to share known information about the patient, to ensure all equipment is at bedside, and for delineation of roles and preparation for line placement. This is occurring ~60% of the time. The Admission Huddle is done once the patient arrives. The patient remains in the NICU transport isolette until a DR provider gives a GIMME 5 report (Gestational Age, Indication for delivery, Mode of delivery, Major delivery room interventions, ETT size/depth & vent settings). This ensures a Shared Mental Model amongst the team and has occurred in 100% of the October 2022 GH admissions. Overall, staff feels that the admission process has improved, and they are more aware and better prepared for the patient that they are taking care of.

One major barrier that we faced was relying on paper audit forms, as there are various audited elements that are left unknown. Additionally, it was challenging to ensure all team members are knowledgeable of the GH practices. Particularly when x-rays are needed on the night shift, as there are limited resources of which are spread all over the hospital. Overall, although there were identified barriers, we have made great strides in the time to complete all golden hour tasks.

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#### Problem statement:

How will improved communication and a streamlined admission process impact the time it takes to complete all golden hour tasks of very low birth weight patients? By improving communication and working as an interdisciplinary team, the golden hour admission process will be more efficient and patient outcomes will be improved.

#### Learner objectives:

1. Describe the importance of a shared mental model and effective communication during the admission process of very low birth weight patients
2. Identify nursing interventions to reduce the risk of hypothermia and cold stress in very low birth weight patients
3. Describe patient outcomes that can be impacted by having a more efficient and standardized admission process

#### Gravens 2023–11

**Abstract title:** Salivary Oxytocin and Cortisol Release Are Associated with Premature Infant Neurobehavioral Patterns

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**Objective:** Oxytocin is critical in experience-dependent plasticity underpinning neurobehavioral functioning during sensitive periods of development. The research study purpose to examine infant salivary oxytocin and cortisol levels related to SSC and infant neurobehavioral functioning.

**Design/Setting:** A randomized cross-over design study was conducted in the Neonatal Intensive Care Unit, NICU. The sample of 28 healthy premature infants contributed to 168 saliva samples for oxytocin and cortisol were collected pre-SSC, 60-min during-SSC, and 45-min post-SSC randomized to whether the infant was held first by mother or by father.

**Methods:** Infant neurobehavioral assessment using NICU Network Neurobehavioral Scale prior to hospital discharge generated 13 NNNS Summary scores. Data were analyzed using R version 4.0.3. Linear regression models included four predictor variables: salivary oxytocin and cortisol levels after SSC, two measurements for each for maternal and paternal SSC. The outcome measures: saliva was collected by infant swab (Salimetrics© State College, PA) methods typically using swabs for five minutes can obtain at least 120 µL of saliva, whereas the minimum saliva needed for testing salivary oxytocin is 70 µL. The swab is 5 x 90 mm, an appropriate size for mouths of young infants. The infants were found not to be disturbed by the sampling process. The saturated oral swabs are then placed in a small insert tube with snap cap. Saliva samples

were immediately stored in a -80°C freezer until thawed for analysis. Salivary oxytocin was collected and analyzed via an enzyme immunoassay (EIA) (Assay Designs, Ann Arbor, Michigan). This method is similar to that specifically developed and validated for salivary oxytocin. The sensitivity limit without correcting for the concentration is at 11.7 pg/mL, and the lower limit of sensitivity is at 2.0 pg/mL with correction for the extraction. The intra- and inter-assay coefficients of variation were 4.8% and 8%, respectively. Salivary cortisol was collected and analyzed via an EIA (Salimetrics, State College, PA) with a detection limit of < 0.007 µg/dL. The average intra- and inter-assay coefficients of variation were 4.13% and 8.89%, respectively. The NNNS has 115 items that are administered and computed into scores that create 13 summary scales. The summary scales include: habituation, attention, handling, quality of movement, regulation, nonoptimal reflexes, asymmetric reflexes, stress/abstinence, arousal, hypertonicity, hypotonicity, excitability, and lethargy scores. The Score for Neonatal Acute Physiology with Perinatal Extension, SNAPPE-II, score is a valid indicator of an infant's severity-of-illness and predictor of mortality risk with a composite range of 0–162.

**Results:** The majority of infants were White (61%) males (68%). The infants were relatively healthy, with a mean SNAPPE-II score of 3.93. Results indicate a significant inverse relationship for infants held SSC with their mothers demonstrating higher oxytocin levels and lower Stress Summary scores ( $t=-3.48, p=.003$ ) and also a significant relationship with higher Self-Regulatory Summary scores ( $t=2.104, p=.049$ ). Interestingly, infants held SSC by mothers that demonstrated higher cortisol levels also demonstrated higher Asymmetrical Reflexes Summary scores ( $t=2.413, p=.026$ ). Infants held by mothers with higher cortisol levels ( $t=2.249, p=.037$ ) also had similarly high levels with fathers ( $t=2.156, p=.044$ ) and were also associated with higher infant Stress Summary scores.

Table 1. Infant Sample Characteristics (N=28)

Characteristic	n (%)	Mean	SD
<b>Gender</b>			
Female	9 (32)		
Male	19 (68)		
<b>Race/Ethnicity</b>			
Asian	2 (7)		
Black	4 (14)		
Hispanic	5 (18)		
White	17 (61)		
<b>Gestational age at birth (weeks)</b>			
30-30 6/7	4 (14)		
31-31 6/7	5 (18)		
32-32 6/7	1 (3)		
33-33 6/7	3 (11)		
34-34 6/7	15 (54)		
<b>Weight (grams)</b>			
900-1300	3 (7)	1882	416.66
1301-1700	5 (18)		
1701-2100	12 (43)		
2101-2500	5 (18)		
2501-2900	3 (3)		
<b>Snappe II</b>			
0	21 (75)	3.93	7.78
7-10	3 (11)		
18-21	3 (11)		
22-27	1 (3)		
<b>Apgar Score (1 minute)</b>			
0-4	4 (14)	7.11	2.04
5-7	7 (25)		
8-10	17 (61)		
<b>Apgar Score (5 minutes)</b>			
0-4	1 (3)	8.29	1.27
5-7	4 (14)		
8-10	23 (87)		
<b>Mode of Delivery</b>			
Vaginal	11 (39)		
Cesarean	17 (61)		

Modified from (Vittner et al., 2018)



**Conclusion:** We found oxytocin is an important biomarker that improves infant neurodevelopmental competence. These findings are an important step in exploring oxytocin as an important biomarker that provides evidence that demonstrates potential improvement in infant neurodevelopmental functioning and competence. The organization of oxytocin availability is critical to the limbic and neocortical systems, and those nervous system structures related to emotion depends on early caregiving experiences. SSC is an intervention that increases oxytocin and decreases cortisol.

Additionally, these findings provide further evidence that neurobehavioral assessments can and should be incorporated into the care of preterm infants to identify individualized plan of care to support the unique strengths of the infant's current level of behavioral functioning. Nurses can use SSC as a strategy to activate oxytocin release as a means to enhance infant neurodevelopmental outcomes.

**Table 2.** NNNS Summary Scores of study sample

NNNS Summary Scale	Mean	(SD)
Habituation Summary Score	6.64	1.78
Attention Summary Score	5.19	1.09
Arousal Summary Score	3.48	0.43
Regulation Summary Score	5.01	0.61
Handling Summary Score	0.51	0.20
Quality of Movement Summary Score	3.97	0.61
Excitability Summary Score	3.71	1.74
Lethargy Summary Score	4.68	2.20
Non-Optimal Reflexes Summary Score	5.25	1.84
Asymmetry Summary Score	1.43	1.60
Hypertonicity Summary Score	0.00	0.00
Hypotonicity Summary Score	0.75	0.97
Stress/Abstinence Summary Score	0.21	0.10

is an important step in developing therapeutic modalities to increase parent engagement and improve health outcomes. Oxytocin is critical in experience-dependent plasticity underpinning neurobehavioral functioning during sensitive periods of development. The purpose of this research study was to examine infant salivary oxytocin and cortisol levels related to SSC and infant neurobehavioral functioning.

**Learner objectives:**

1. Participants will describe the role of oxytocin for premature infants
2. Participants will critically reflect on premature infant experiences in the NICU to improve neurobehavioral functioning.

**Gravens 2023–12**

**Abstract title:** Acceptability and Feasibility of a Digital Educational Intervention for Parents with a Preterm Infant at The Neonatal Intensive Care Unit: A Pilot Randomized Controlled Trial

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**Methodology:** A pilot randomized controlled trial (RCT) was conducted. Parents were invited to participate if they met the following inclusion criteria: 1) 18 years of age or older; 2) speak and read French; and 3) have a preterm infant born at 36 weeks gestation or less, who was hospitalized in a neonatal unit in the province of Quebec (Canada) at the time of recruitment. Following recruitment via an advertisement on a social networking site (Facebook®), participants were randomized to either the intervention or the control group. The intervention *Information pour les Familles ayant un Enfant né Prématurément* (Info FEP)/Information for Families of Prematurely Born Children is an educational website, and the content included was developed based on a qualitative study conducted with the population of interest. Parents in the control group received an electronic general information leaflet on prematurity following recruitment.

Data collection took place over a five-week period. First, parents completed the online socio-demographic data questionnaire after enrolment. Shortly after, a team member sent them their group assignment (intervention vs. control) via email according to a randomized sequence developed by a research assistant not involved in the study. For the following weeks, parents were invited to consult the website or leaflet as often as they desired. Then, two and four weeks after recruitment, participants from both groups were invited, via email (Lime Survey link), to complete the Parental Stress Scale: Neonatal Intensive Care Unit questionnaire (PSS: NICU) and the Edin-

**Table 3.**

Adjusted Regressions between NNNS Summary Scores and Infant Oxytocin and Cortisol Levels (N=28)

NNNS Summary Scores	Predictor	Estimate	Std. Error	t value	p value
Attention Summary Score	Oxytocin (F)	0.411	0.205	2.004	0.006
	PCGA	1.142	0.419	2.724	0.014
	Bachelor	-1.159	0.516	-2.245	0.038
	Oxytocin (M)	-0.071	0.021	-3.428	0.003
Self Regulation Summary Score	Oxytocin (M)	0.376	0.179	2.104	0.049
	PCGA	0.483	0.236	2.048	0.050
Handling Summary Score	Bachelor	0.235	0.088	2.669	0.015
Excitability Summary Score	Oxytocin (M)	-1.122	0.497	-2.256	0.036
	Cortisol (M)	1.055	0.498	2.121	0.047
	PCGA	-1.483	0.656	-2.259	0.036
	Graduate	2.151	0.847	2.541	0.020
Asymmetric Reflexes Summary Score	Cortisol (M)	1.211	0.502	2.413	0.026
Stress/Abstinence Summary Score	Cortisol (M)	0.045	0.021	2.156	0.044
	Cortisol (F)	-0.033	0.014	-2.249	0.037
	Bachelor	0.121	0.032	3.732	0.001

Note: Oxytocin (M): oxytocin level when held by mother, Oxytocin (F): oxytocin level when held by father, Cortisol (M): cortisol level when held by mother, Cortisol (F): cortisol level when held by father, PCGA = post conceptual gestational age

\*n = 26

**Problem statement:**

It has been optimistically, yet incorrectly proposed, that healthy preterm infants without major complications eventually catch-up developmentally to term infants. This research explores the bio-behavioral mechanisms that modulate high-risk infants' behavioral, autonomic and stress responses utilizing an individualized developmental family-centered care approach. Skin-to-skin contact is an evidenced-based holding strategy that increases parental proximity to their infant. This physical proximity allows for a continuously interactive environment that is known to enhance infant physiologic stability and affective closeness between parent and infant. Uncovering the neurobiological basis of early parent-infant interaction

burgh Postnatal Depression Scale (EPDS) questionnaires. The adapted online Treatment Acceptability and Preference (TAP) questionnaire regarding the acceptability and feasibility of the intervention was sent by email five weeks after recruitment.

Descriptive statistics (i.e., means, standard deviations) were conducted to describe the participants' characteristics, to present results of the adapted TAP Questionnaire and describe the use of the Info FEP educational website.

**Results:** A total of 20 parents participated. Almost all were mothers ( $n = 19$ ). For 25% of parents, the infant was their first child, and the mean gestational age at birth was 29 ( $\pm 1.31$ ) weeks. The majority of parents (65%) had a yearly household income between \$50,000 and \$100,000 (CAD), and 60% had a post-secondary education.

Regarding the acceptability of the educational website, 100% of participants who had access to the website considered it appropriate or very appropriate to meet their information needs. All participants (100%) thought the convenience of consulting the website was appropriate or very much appropriate, as the website was accessible at whatever time and location they wished to access it. In addition, 100% viewed the website as an effective or very much effective method to receive information. The majority of parents (85%) who had access to the website consulted it 1 to 3 times per day and 54% of them spent 5 to 10 minutes each time on the website, while 15.4% spent 10 to 20 minutes per visit.

In the comments section included in the adapted TAP questionnaire, many parents indicated that the website is beautiful, accessible, easy to understand, helps to normalize their experience, and that it meets their information needs. A few parents also provided suggestions for additions/modifications to the content, such as addressing the period before preterm delivery (e.g., preterm labor), and adding a chat with other parents or health professionals.

Scores about the stress and depressive symptoms questionnaires were not compared between the two groups, since pilot studies are not designed to evaluate efficacy (Feeley & Cossette, 2017). Two weeks after enrolment, PSS: NICU and EPDS scores were respectively 3.69 ( $\pm 0.63$ ) and 16.1 ( $\pm 4.95$ ) for parents in the website group, as well as 3.71 ( $\pm 0.16$ ) and 12.67 ( $\pm 10.07$ ) for parents in the control group. Four weeks after enrolment, those same scores were 3.32 ( $\pm 0.52$ ) and 15.33 ( $\pm 6.28$ ) for parents in the website group, as well as 3.42 ( $\pm 0.22$ ) and 14.71 ( $\pm 4.35$ ) for parents in the control group.

In conclusion, the educational website Info FEP developed by the research team, collaborators, and parents of preterm infants proved to be an acceptable and feasible way to provide parents with such information during their infant's NICU stay. Educational websites may be convenient for parents, easy to update with current evidence, and may reduce the costs and environmental impacts of paper educational tools. A large-scale study must be conducted to assess the effect of this educational website on parents' psychological well-being.

**Problem statement:** Families experience psychological distress when their preterm infant is in the Neonatal Intensive Care Unit. A tailored educational intervention may be beneficial for their psychological well-being. Unfortunately, there are very limited digital educational interventions designed to improve the psychological well-being of parents and existing websites have moderate to low information quality. The aim of the present study is to measure the acceptability and feasibility of a digital educational intervention (a website) designed to improve the psychological well-being of parents.

**Learner objectives:**

1. To understand the acceptability and feasibility of a website designed to improve the psychological well-being of parents.
2. To understand parent's point of view regarding a website designed to improve their psychological well-being.

**Gravens 2023–13**

**Abstract title:** Developmental Participation Skills Assessment

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**Methodology:** The research focus was to complete content development and validation for the Developmental Participation Skills Assessment (DPS). Following a literature review, the development of the DPS items was extrapolated from well-established tools to achieve the most evidence-based criteria. Following item inclusion generation, the DPS went through five phases of content validation: (1) Initial tool development and use by five NICU professionals as part of their developmental assessment and expansion of the use of the DPS to include three more hospital NICUs within the health system. (2) Item adjustment and use as part of a bedside training program at a Level IV NICU. (3) Focus group of professionals using the DPS provided feedback and scoring was added. (4) Pilot of DPS by a multidisciplinary focus group in a Level IV NICU. (5) Feedback form sent to 20 NICU experts and content of DPS finalized with reflective portion added. A total of 50 professionals across the Midwest (4 OT, 2 PT, 3 SLP, 41 nurses) utilized the DPS as a part of standard practice throughout the phases of development. Assessments were completed on both full-term and preterm hospitalized babies. Professionals within these phases utilized the DPS with babies within a wide range of adjusted gestational ages from 23 weeks to 60 weeks (20 weeks post term). Babies ranged in severity from breathing room air to being intubated on a ventilator.

**Main Outcome Variable:** The establishment of an observation-

Table 2. Infant Medical and Contextual Characteristics across each Time Point

	Time Series 1		Time Series 2		Time Series 3	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Gestational Age (days)	229 (2.4)	227-233	229 (0.51)	234-247	245 (0.1)	241-252
Weight (kg)	1.80 (20)	1.13-2.17	1.86 (33)	1.40-2.54	2.06 (29)	1.50-2.94
<b>Respiratory Status</b>						
HFNC	8		7		5	
CPAP	1		1		1	
Nasal Prong Vent	1		0		0	
Nasal Cannula	1		0		0	
Room Air	1		4		6	
<b>Feeding Type</b>						
Gavage in crib	5		2		3	
Gavage while holding	5		3		1	
Gavage while holding twin	2		3		0	
Gavage with Nuzzling	0		2		1	
Pacifier Dips	0		1		0	
Active	0		1		7	
<b>Nurturing Style</b>						
Infant held alone	7		8		10	
Infant held with twin	2		3		2	
Infant in bed	3		1		0	
<b>Bed Type</b>						
isolette	3		3		4	
Radiant Warmer	2		2		0	
Open Crib	1		2		8	

Note: n=12 infants; HFNC = high-flow nasal cannula; CPAP = continuous positive airway pressure

al instrument, the Developmental Participation Skills Assessment, that provides a means for identifying baby readiness, assessing the quality of baby participation and prompting clinician reflective processing.

**Impact and Results:** After all phases of development and expert panel feedback, the final result was the formation of an easy-to-use observational tool (see attached upload) for assessing baby readiness prior to caregiving, participation during caregiving, and stability following caregiving. In addition, there is the opportunity for the clinician to reflect following the caregiving interaction in a concise, consistent way.

**Conclusion:** The DPS is an observational instrument that provides a means for identifying baby readiness, assessing the quality of baby participation, and prompting clinician reflective processing. It has the potential to guide practice by inviting the clinician to initiate care based upon the baby's inherent capabilities for a positive caregiving interaction. This bedside assessment tool supports the caregiver's mindful presence and opportunity to attune to the baby thereby enhancing the quality-of-care experience for both the baby, family and clinician. Implementation of the DPS as a guide for mentorship and orientation for clinicians has also shown to be beneficial. The DPS shows potential to be a clinically useful tool for all hospitalized babies.

### DPS Assessment

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### Developmental Participation Skills Assessment (DPS)

Name: \_\_\_\_\_ Date: \_\_\_\_\_ DOL: \_\_\_\_\_ GA at Birth: \_\_\_\_\_ Adjusted Age: \_\_\_\_\_

**Readiness for Caregiving Interaction**

Baby does not wake or show signs of readiness for care. Minimal fluctuations in autonomic system (heart rate, breathing and oxygen saturations)

Baby is beginning to stir but remains drowsy or returns to sleep. Limited resting and/or minimal active hands to face and mouth. May show fluctuations in heart rate or best feed breathing.

Baby is awake prior to caregiving. Beginning to show signs of readiness for care. May show fluctuations in heart rate and have variable breathing. Baby may require more than 2L breathing support.

Baby is beginning to stir but initially drowsy. Begins to wake, showing signs of readiness for care and eating through rooting/mouthing/sucking. Steady breathing less than 60 breaths per minute. Baby on 2L or less oxygen.

Baby is awake prior to caregiving. Showing more eager signs of readiness for care and eating through rooting/mouthing/sucking. Steady breathing less than 60 breaths per minute. Baby on 2L or less oxygen. *If baby is on greater than 2L of oxygen, they receive a score of 2.*

**Readiness Indicators for Care: (Skin to skin holding is always encouraged regardless of readiness score)**

1- Prone sleep: Provide only medically necessary care for urgent needs or adjustments to promote stability and comfort.

2-3- Direct baby: Initiate supporting, caring interaction. Offer pleasurable, nurturing experience and/or opportunity to breast.

4-5- Direct baby: Initiate supporting, caring interaction. Offer pleasurable, nurturing, eye-feeding or eating experience (best of both).

**Participation During Caregiving**

AUTONOMIC	3	2	1
Stable heart rate	Maintains stability	Occasional rise or dips 10-20% from baseline	Frequent rise or dips 20% from baseline
Stable oxygen saturations	Maintains stability	Occasional dip below desired range	Frequent or prolonged dips below desired range
Regular, even breathing pattern	Steady breathing	Variable breathing	Prolonged pauses OR fast breathing
Maintains steady, even color	No color change	Occasional color change	Frequent or prolonged color change
Comments:	Autonomic Score (Range 4-12): _____		

MOTOR	3	2	1
Actively brings hands to face/mouth	Frequently	Occasionally	Rarely
Gripping and holding on	Frequently	Occasionally	Rarely
Bracing legs gently against support	Frequently	Occasionally	Rarely
Active movement of body/arms/legs	Frequently	Occasionally	Rarely
Comments:	Motor Score (Range 4-12): _____		

STATE	3	2	1
State	Awake	Drowsy OR Flus/icy	Asleep OR Shutdown
Energy level	Maintains	Decreases	Minimal/depleted
Comments:	State Score (Range 2-6): _____		

REGULATION	3	2	1
Hand on hand OR Foot on foot	Frequently	Occasionally	Rarely
Rooting and mouthing hands	Frequently	Occasionally	Rarely
Initiates non-nutritive sucking	Frequently	Occasionally	Rarely
Signs of stress (c)	Rarely	Occasionally	Frequently
Comments:	Regulation Score (Range 4-12): _____		

**Following Caregiving – Impact on the baby:** Which best describes the baby 10 minutes following care?

Baby is settled, content, well regulated (autonomic-motor-state)       Baby is unsettled or fatigued, more dysregulated (autonomic-motor-state)

Total DPS Score: Raw (Range 14-42): \_\_\_\_\_ Percentage: \_\_\_\_\_ / 42 x 100 = \_\_\_\_\_ %

### DPS Assessment Discussion

**Developmental Participation Skills Assessment Discussion**

Optional: Complete in order to describe the baby's experience, guide team discussion or provide opportunity for teaching

**CONTEXT OF CAREGIVING**

**Activity/Environment:**

- Calm/relaxed
- Increased or unexpected noise/activity
- Loud/active
- Other: \_\_\_\_\_

**Care Provided:**

- Routine care
- Swaddled bath
- TV placement
- NG/OG placement
- Skin to skin transfer
- Suctioning
- Intubation
- Other care: \_\_\_\_\_

**Care Providers:**

- Parent
- Nurse
- Medical provider
- RT
- Other provider: \_\_\_\_\_

**Care utilized a second person:**  Yes  No

Length of caregiving interaction (min): \_\_\_\_\_

Comments: \_\_\_\_\_

**REFLECTIVE PROCESSING**

How did the caregiving interaction feel for you?

How do you think the caregiving interaction felt for the baby?

How do you think the caregiving interaction felt for the parents?

What comes to mind for next time?

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with regulation and negatively impacts neurodevelopment and nbsp. By providing an organized way to assess readiness for care and capacity to participate in care, the baby will experience less stress and trauma.

**Learner objectives:**

1. The learner will list three benefits of the Developmental Participation Skills Assessment (DPS).
2. The learner will discuss the DPS as a tool to reduce toxic stress and create safe, supportive nurturing experiences.
3. The learner will demonstrate application of the DPS to score readiness and baby participation in care on at least one baby through video examples.

PRE IMPLEMENTATION SURVEY RESULTS NNP - 3 TOTAL RESPONSES (75%)					
	Always	Almost Always	Neutral	Almost Never	Never
I utilize input from nursing staff when developing my plan of care.	1 (33%)	1 (33%)	1 (33%)		
Nursing staff is able to express concerns about their patients to the NNP team.	3 (100%)				
I am able to review lab and imaging results with nursing staff daily.	1 (33%)	2 (66%)			
I am satisfied with the collaboration among members of the multi-disciplinary team.		3 (100%)			
There is good communication between providers and nurses.		3 (100%)			
The nursing staff has a good understanding of the rationale behind the provider's daily orders and plan of care for my patients.		1 (33%)	2 (66%)		

Key:  
 Communication Theme  
 RN-Provider Collaboration Theme  
 Nursing Knowledge of Plan of Care Theme



**Problem statement:** Non-contingent caregiving impairs a baby's autonomic, motor, and state stability, which interferes



**Gravens 2023–14**

**Abstract title:** Mother-Infant Interaction Patterns in the NICU: Variations Across Time and by Social Context

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This study used a within-subjects repeated time series design to observe changes in frequency and duration of interaction patterns in 12 mother-preterm infant dyads hospitalized in a level-IV NICU (see Table 1). Beginning when infants were between 32-weeks gestational age ( $M=32.7$ ), dyads were video recorded across three time points in three social situations (routine care, feeding, and nurturing), resulting in a total of 27 total minutes per dyad. Applying a predefined coding scheme grounded in the Biobehavioral Model of Synchrony (Feldman, 2012), codes included maternal communicative behaviors (task touch, nurturing touch, vocal, gaze, and vestibular stimulation) and infant communicative behaviors (touch, gaze/eyes open, vocalization, and movement). Using Observer XT software, maternal and infant behaviors were coded using frame-by-frame microanalysis.

Table 1. Participant Demographic and Medical Characteristics

Characteristics	M (SD)	Range
<b>Infants (N=12)</b>		
GA at birth (days)	210 (20.9)	180-261
Weight at birth (kg)	1.34 (.38)	.61 – 2.12
NICU length of stay (days)	63 (18.9)	38-99
	<i>f</i>	
Males	5	
Females	7	
Twins	6	
Singltons	6	
<b>Mothers (N=9)</b>		
Age (years)	27.8 (6.7)	20-38
	<i>f</i>	
Married	4	
Single	5	
First-time parent	6	
<b>Race/Ethnicity</b>		
Latino/Hispanic	4	
White/Non-Hispanic	4	
Black/African American	1	

Note: GA = gestational age

To estimate intercoder reliability for infant behaviors and maternal behaviors, 15% of the videos were randomly selected and coded by all members of the coding team which included the study investigator (i.e., gold standard coder) and three additional trained coders. Using a 1-s window with the frequency/sequence setting in the Observer XT software, the average Cohen's kappa for infant behaviors was 0.82 (range: 0.77-.0.89) and for maternal behaviors was 0.88 (range: 0.85-0.92). In addition, intra-coder reliability was calculated using

another set of 15% randomly selected videos and averaged a Cohen's kappa of 0.92 (range: 0.81-1.00) for maternal behaviors and 0.87 (range: 0.69-1.00) for infant behaviors.

Using Observer XT, the mean duration, total duration, rate per minute, and frequency of each communicative behavior for mothers and infants were calculated for each social interaction context and across each time point. Next, a one-way repeated measures ANOVA with pairwise comparisons was performed for each interaction behavior for mothers and infants, respectively, using SPSS (Version 28.0.0.0), to determine if there were any significant differences in infant and/or maternal behaviors across time points as well as according to social contexts.

**Results:** Descriptive statistics of infant medical factors and the contextual characteristics for each observation session are reported in Table 2. Infants demonstrated variability in medical characteristics with some infants requiring greater respiratory support than others across all time points of data collection. Contextual factors varied across social interaction situations and time, most notably in feeding contexts.

Table 3 displays the summary statistics for all behaviors across each time point. For mothers, results across time showed a significant increase in their duration of task touch behaviors,  $F(2,22) = 5.48, p = .012$ . We also detected a decreased trend in duration of nurturing touch behaviors over time. No changes in other maternal behaviors were found. For the preterm infants, results showed a significant increase in duration of non-distressed vocalizations,  $F(2,22) = 12.84, p < .001$ , and a significant decrease in touch behaviors,  $F(2,22) = 3.60, p < .05$ , over time. We also observed a trend upward for duration of time infants' eyes remained open.

Table 3. Mean duration, total duration, rate, and frequency of mother-infant behaviors across time series

	Time 1 (n=35)				Time 2 (n=16)				Time 3 (n=16)			
	M Dur (SD)	% Dur Observed	RPM	f	M Dur (SD)	% Dur Observed	RPM	f	M Dur (SD)	% Dur Observed	RPM	f
<b>Infant Behaviors</b>												
Eyes Open	8.8 (9.1)	10.1	0.7	74	13.8 (23.4)	17.3	.8	82	15.0 (32.8)	19.3	.8	84
Touch	14.1 (34.7)	28.8	1.0	101	13.3 (26.8)	15.2	.7	75	8.2 (24.6)	9.2	.7	73
Vocal	2.1 (7.4)	5.3	1.5	162	3.0 (5.0)	10.2	2.0	221	4.1 (5.2)	16.3	2.4	257
Calm-MP	10.9 (8.1)	1.7	.09	10	12.3 (15.1)	1.5	.07	8	11.1 (10.6)	2.4	.15	14
Distress	18.7 (20.4)	48.6	2.1	226	15.1 (19.8)	50.0	2.0	217	15.6 (27.5)	54.2	2.1	227
MP	13.1 (7.7)	1.9	.08	9	29.8 (37.7)	1.8	.04	4	13.2 (10.3)	2.4	.1	12
<b>Mother Behaviors</b>												
Gaze	53.7 (64.0)	85.3	1.0	101	40.2 (52.6)	85.9	1.3	140	44.2 (52.6)	89.9	1.2	133
Nurt Touch	15.1 (25.2)	34.1	1.4	144	13.8 (29.4)	29.2	1.3	139	18.7 (37.0)	24.9	1.4	152
Task Touch	17.5 (23.3)	28.9	1.0	105	20.4 (28.0)	34.0	1.0	109	24.2 (33.8)	44.6	1.1	120
Vestibular	21.9 (23.6)	10.7	0.3	31	13.0 (8.5)	4.0	.2	20	39.5 (29.9)	6.7	.1	11
Vocal	4.6 (4.1)	24.0	3.2	335	5.6 (5.9)	24.6	2.6	286	5.3 (6.5)	22.2	2.5	227

Note: N=12 dyads; MP = mildly busy; Mvt = movement; Nurt = Nurturing

Table 4 displays the summary statistics for all behaviors for each social context. In analyzing maternal behaviors, significant differences were identified for both nurturing,  $F(2,22) = 11.81, p < .001$ , and task touch,  $F(2,22) = 37.76, p < .001$ ,

behaviors. Overall findings for maternal touch behaviors indicated that mothers provided a significantly greater duration of nurturing touch in nurturing contexts followed by feeding and then routine cares. In contrast, mothers were observed using a significant duration of task touch behaviors during routine cares, followed by feeding and nurturing contexts, respectively. Analyses for infant behaviors between contexts showed significant results for touch,  $F(2,22) = 4.54, p < .05$ , gaze,  $F(2,22) = 6.64, p < .01$ , non-distressed vocalization,  $F(2,22) = 21.39, p < .001$ , and non-distressed movement,  $F(2,22) = 25.07, p < .001$ , behaviors. Pairwise comparisons showed infants demonstrated longer durations of touch during feeding and nurturing contexts, longer duration of eyes opened during feeding contexts, and longest duration of non-distressed vocalizations and non-distressed movement during routine cares.

**Conclusion:** This present investigation documented behavioral trends across time and social contexts as an important step to understanding early interaction patterns between mothers and their preterm infants in the NICU. Findings indicated that interaction behaviors for both mothers and infants varied according to social context. Infant vocal and touch behaviors changed over time whereas maternal behaviors, except for touch, remained consistent. Overall, each social context presented unique differences in the duration of maternal and infant interaction behaviors. This study builds on developmental science principles in furthering understanding of early relational communication patterns between mothers and preterm infants as they naturalistically unfold in the NICU (Provenzi et al., 2018). Subsequent studies may illuminate understanding if these dyadic interaction patterns are generalizable across other NICU settings. Ultimately, the results of this study are positioned to inform early interaction patterns and establish best practices that promote the emergence of synchronous exchanges that impact preterm infant's developmental trajectory.

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**Problem statement:**

The NICU is a high-risk context for mother-infant relationship development, yet few studies have examined mother-preterm infant interaction patterns during the NICU hospitalization (e.g., Reyna et al., 2012; Stefana et al., 2020). This study aimed to identify the variations in frequency and duration of mother-infant communication patterns in the NICU and measure variations across time and across social contexts.

**Learner objectives:**

1. Participants will identify how mother-infant interaction patterns vary across time and across social contexts during the NICU hospitalization period.
2. Participants will acquire information regarding systematic observational methods that can be used to measure familial interaction processes in the NICU.

**Gravens 2023-15**

**Abstract title:** Implementation of Nurse Led Multi-Disciplinary Rounds in a Level II NICU

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This quality improvement project took place at Bellin Hospital in Green Bay, WI in an 18-bed, private room, Level II unit, and the only Family-Integrated Care Unit (FICU) in the state of Wis-

Table 4. Mean duration, % duration observed, gtr, and frequency of mother-infant behaviors according to interaction context

	Routine Cares (n=35)				Feeding (n=36)				Nurturing (n=35)			
	M Dur (SD)	% Dur Observed	RPM	F	M Dur (SD)	% Dur Observed	RPM	F	M Dur (SD)	% Dur Observed	RPM	F
<b>Infant Behaviors</b>												
Eyes Open	9.4 (15.1)	11.3	.72	76	17.3 (32.6)	28.5	.9	108	8.1 (31.2)	6.9	.51	56
Touch	3.1 (4.9)	5.6	1.1	116	23.7 (31.4)	22.7	.58	63	22.6 (40.2)	24.1	.64	79
Vocal	3.6 (4.3)	20.7	3.5	366	2.7 (5.0)	6.2	1.4	153	2.9 (5.0)	5.4	1.1	121
Distress	3.6 (10.9)	5.7	.3	32	-	-	-	-	-	-	-	-
Mvt Calm-MF	25.9 (32.6)	76.3	1.8	187	11.6 (17.6)	46.7	2.4	263	9.1 (13.3)	30.7	2.0	220
Mvt Distressed	15.8 (16.9)	6.2	.24	25	-	-	-	-	-	-	-	-
<b>Mother Behaviors</b>												
Gaze	52.6 (50.1)	93.3	1.0	110	37.5 (55.2)	85.3	1.4	149	48.2 (62.4)	84.7	1.1	113
Nurt Touch	6.0 (8.2)	8.0	.8	84	12.1 (25.2)	31.3	1.6	170	17.4 (27.4)	48.1	1.7	181
Task Touch	22.1 (24.6)	67.7	1.8	194	28.3 (37.5)	34.8	1.0	107	12.2 (18.5)	6.2	.3	33
Vestibular	-	-	-	-	21.4 (18.24)	6.5	.2	20	22.5 (25.1)	14.4	.4	42
Vocal	4.6 (4.8)	26.4	3.4	361	5.1 (5.2)	21.8	2.6	281	5.8 (6.6)	22.7	2.3	256

Note: N=12 dyads; MF = mildly fussy; mvt = movement; Nurt = Nurturing

**References:**

consin (Bellin, 2022). The FICU model allows infants requiring intensive care to share hospital rooms with their mother while mom remains an inpatient, post-partum, hospitalized patient. The NICU staff consists of approximately 25 RNs, 4 full-time Neonatal Nurse Practitioners (NNP), 4 Neonatologists, Case Management, Speech Therapy, Occupational and Physical Therapy, Dieticians, a Clinical Nurse Educator, and a Team Leader.

An implementation roadmap was created using a Plan, Do, Study, Act (PDSA) format. During the planning phase, a literature search was conducted to determine the benefits of multidisciplinary rounding, as well as the benefits utilizing the bedside nurse to lead rounds. Results of the search were evaluated to determine both the benefits of both multidisciplinary rounds and nurse-led rounds individually. The review of the literature revealed several benefits of nurse-led multi-disciplinary rounds, including improved medical team collaboration, better communication among team members, and enhanced nurse understanding of the plan of care. These themes became the overall goal of the project.

NICU RNs and NNPs were asked to complete an anonymous, pre-implementation survey. A nine question Likert scale survey was distributed to nurses with the option to respond with “always,” “almost always,” “neutral,” “almost never,” and “never.” Nurses were asked if they felt their input was utilized in creating the daily plan of care, if they understood the rationale behind the plan of care, how they felt about communication between providers and nurses, and if they felt they were able to advocate for patients to the Providers. NNPs were also given a Likert scale survey utilizing the same ranking options.

They were asked if they utilize nursing input when creating a plan of care, how they felt about communication with nurses, and if they felt that nurses understood the rationale behind the treatment plan. Staff was given two weeks to complete the survey.

The survey completion rate was 60% for nurses and 75% for NNPs. All NNPs felt that there was “almost always” good communication between nurses and providers, whereas 87% of nurses stated that there is “almost always” good communication, and 13% felt that there is “always” good communication. All NNPs that completed the survey felt satisfied with collaboration between members of the multi-disciplinary team, selecting “almost always,” which is contrasted to only 60% of nursing staff responding the same way. There was a stark contrast in survey responses between NNPs and RNs surrounding understanding of the rationale behind the plan of care and review of lab and imaging results: 73% of nurses felt they “almost always” understood the rationale behind daily orders and plans of care, contrasted to only 33% of NNP feeling nurses “almost always” understood rationales. Overall, however, results were consistent between RNs and NNPs on the themes of communication and collaboration.

### NNP Pre-implementation survey results

Staff RNs and NNPs were given a follow-up survey one month after rounds were implemented. 64% of RNs and 75% of RNs completed the survey. 63% of RNs and 100% of NNPs felt that rounds improved communication and collaboration. Addition-

### Appendix--Tool 1: FSAC (Family Snapshot Antenatal Consult) Tool-3 pages

Antenatal Consultation

*Indicate those that apply with [x]*

**Reason for Consultation:**

---

**Maternal History**

Gestational age: \_\_\_\_\_

Genetics: [ ] Trisomy [ ] Down [ ] Abnormal [ ] Live

Estimated date of delivery (yyyy/mm/ki)

Maternal age

Labs and serologies:

HbA1c	Urine Culture
HIV	Blood group
Rubella	Flu
Syphilis	Antibody screen
Coarctata	Group B Strep
Chlamydia	Other:

Past medical history and family history:

Past obstetrical history and outcomes:

Current pregnancy:

Antenatal genetics screening:

NIFT: [ ] Amniocentesis

FIS: [ ] Other:

Ultrasonals:

Date (yyyy/mm/ki)	Gestational age	Estimated Fetal Weight	Biophysical Profile	Other findings

Maternal Medications (please indicate which of the following and add dates/specifications as necessary):

[ ] Antibiotics [ ] Betamethasone (please indicate dates)

[ ] Sedatives [ ] Other medications:

[ ] MgSO4 (please specify amount of hours)

Substance use during pregnancy:

Description provided about preterm birth and expected NICU course (please elaborate on what was discussed, specify any statistics if any given):

*Have you or anyone you know had any experience with babies born prematurely? Can you tell me what you know, heard, or read about prematurity? (From friends, reading, the internet, etc.)? If so, what do you know so that I can help fill in the blanks:*

*This is a brief overview of what the NICU stay for a baby born at \_\_\_\_\_ gestation. \_\_\_\_\_ BW will look like. When your baby is admitted to the NICU, it can be overwhelming as there are lots of machines but none of these are as important to your baby as you are. The machines are temporary, you will be with your child forever. Your baby will know your smell, touch, and voice. There are lots of ways that you can support your baby while they are in the NICU. Some examples include:*

Please check off which of the following were expanded on:

Feeding - early hand expression, breastfeeding

Hand holding

Kangaroo care

Scented cloths

Being present for your baby whenever you can

*I just shared a lot of information with you about what might happen next and about prematurity. Do you have any questions?*

Potential transfer addressed. Preferred hospital:

**Impression and Plan:**

**Staff Neonatologist Sign off Comments:**

ally, 75% of RNs and 100% of NNPs responded that they find rounds to be beneficial. 50% of RNs and 100% of NNPs responded that rounds have improved RN understanding of the plan of care. One RN stated that rounds help to “understand why we do the things that we do, why we are seeing certain things with our babies, and helps me understand the changes that are made for our babies to help them grow and thrive. Nurse-led rounds also help me feel like a part of the team and decision making.” While Neonatologists were not included in the surveys, one Neonatologist stated, “It really gets the nurses speaking the same language as the physicians and NNPs, and I think creates a deeper understanding of what we’re doing and why. It helps create engagement with the nurses as part of the team with important input to provide.”

### RN Pre-implementation survey results

PRE IMPLEMENTATION SURVEY RESULTS RN – 15 TOTAL RESPONSES (60%)					
	Always	Almost Always	Neutral	Almost Never	Never
My input is well-received by the providers.	3 (20%)	11 (73%)	1 (7%)		
It is difficult to have my voice heard by providers.				14 (93%)	1 (7%)
I am able to express concerns about my patients with the providers during rounds.	4 (27%)	11 (73%)			
I am able to review lab and imaging results with providers daily.	1 (7%)	4 (13%)	6 (40%)	4 (13%)	
I feel included in developing the daily plan of care for my patients.	1 (7%)	9 (60%)	5 (33%)		
I feel the providers create a plan of care for patients without utilizing my input.		2 (13%)	6 (40%)	4 (13%)	
I am satisfied with the collaboration among members of the multi-disciplinary team.	2 (13%)	9 (60%)	3 (20%)		
There is good communication between providers and nurses.	2 (13%)	13 (87%)			
I have a good understanding of the rationale behind the provider’s daily orders and plan of care for my patients.	2 (13%)	11 (73%)	2 (13%)		
I am able to advocate for my patients and families.	3 (20%)	11 (73%)	1 (7%)		

Key:  
Communication Theme  
RN-Provider Collaboration Theme  
Nursing Knowledge of Plan of Care Theme

### NNP Post-implementation survey results

POST IMPLEMENTATION SURVEY RESULTS NNP – 3 TOTAL RESPONSES (75%)					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Rounds have improved nurses’ understanding of the rationale for orders and the plan of care.	3 (100%)				
Rounds have improved my ability to review lab results with nurses.	2 (67%)	1 (33%)			
Nurses are able to express concerns about patients during rounds.	3 (100%)				
Nurses contribute to the patient’s plan of care.	1 (33%)	2 (67%)			
Rounds have improved the communication between members of the medical team.	3 (100%)				
I found the rounding tool to be helpful in guiding the nurses in the presentation of their patients	2 (67%)	1 (33%)			
Rounds have increased my satisfaction with collaboration among members of the multidisciplinary team.	3 (100%)				
I find rounds to be beneficial.	3 (100%)				

Key:  
Communication Theme  
RN-Provider Collaboration Theme  
Nursing Knowledge of Plan of Care Theme  
Rounding and Script

### RN Post-implementation survey results

POST IMPLEMENTATION SURVEY RESULTS RN – 16 TOTAL RESPONSES (64%)					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Rounds have improved my understanding of the rationale for orders and the plan of care.	3 (19%)	5 (31%)	7 (44%)	1 (6%)	
Rounds have improved my ability to review lab results with providers.	3 (19%)	6 (38%)	5 (31%)	2 (13%)	
I am able to express concerns about patients during rounds.	4 (25%)	9 (56%)	3 (19%)		
I contribute to the patient’s plan of care.	2 (13%)	10 (63%)	4 (25%)		
Rounds have improved communication between members of the medical team.	2 (13%)	8 (50%)	5 (31%)	1 (6%)	
I find the rounding tool to be helpful in guiding the presentation of patients.		6 (38%)	6 (38%)	4 (25%)	
Rounds have increased my satisfaction with collaboration among members of the multidisciplinary team.	3 (19%)	6 (38%)	5 (31%)	2 (13%)	
I find rounds to be beneficial.	3 (19%)	9 (56%)	4 (25%)		

Key:  
Communication Theme  
RN-Provider Collaboration Theme  
Nursing Knowledge of Plan of Care Theme  
Rounding and Script

While the implementation of nurse-led rounds has aided in improving communication and collaboration, as well as increasing nurse understanding of the plan of care, the project was limited by inconsistent daily attendance at rounds. Additionally, rounds are completed daily during the day, without involvement of night shift RNs, however all RNs were



surveyed, which may have impacted survey results. There was also dissatisfaction with a detailed rounding script that was created for RN use during rounds. The rounding script has since been changed, with subsequent positive feedback.

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## Problem statement:

Multidisciplinary rounding improves communication among members of the care team. Communication breakdowns can result in errors and patient harm, especially in the vulnerable NICU population. To improve communication and collaboration among members of the NICU team, nurse-led multidisciplinary rounding was implemented in a Level II NICU. Prior to implementation, a review of the literature was conducted, a rounding script was created, and staff education was completed. A survey of staff RNs and NNPs was conducted before

multi-disciplinary rounding was initiated and revealed an overall feeling that there was good communication and collaboration among members of the team. A post-implementation survey of RNs and NNPs was conducted 30 days after implementation. Survey results indicated improved collaboration and communication. Feedback from RNs, NNPs, and Neonatology was favorable and indicated improved engagement, critical thinking, and understanding of the patient's plan of care.

## Learner objectives:

1. Understand the implementation process for nurse-led multi-disciplinary rounding
2. Summarize benefits of nurse led multi-disciplinary rounds

## Gravens 2023–16

**Abstract title:** Improving communication in the NICU: the implementation of the Family Snapshot Tool

**Authors:** Maya Dahan, Leahora Rotteau, Karel O'Brien, Paige Terrien Church

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**Background and Purpose:** Individualized decision making has become the standard of care in pediatrics and in neonatology<sup>1</sup>. The process of individualized decision-making in the Neonatal Intensive Care Unit (NICU) is grounded in the clinician's ability to understand each family's context and tailoring their guidance to each family's unique needs<sup>2,3</sup>. The family context includes everything that makes a family unique—their names, preferred pronouns, family structure, cultural and religious backgrounds, family values etc. Despite guidelines advocating for the medical team to better understand the family context to allow clinicians to engage in individualized decision making, minimal literature exists to guide its practical application by a multi-disciplinary inter-professional team<sup>4,5</sup>.

Based on this evidence, our transformational goal was to embed an understanding of the family context into all interactions. In the Sunnybrook NICU in Toronto, Canada, it was felt that sharing information between families and clinicians, and between clinicians, was inconsistent, especially with the large interprofessional team. Through semi-structured interviews with clinicians and parents at our center, we previously explored in depth if and how family context was currently being shared, and what real and perceived barriers existed<sup>6</sup>. These interviews highlighted inconsistent handover and poor documentation practices of information about the family's context.

The purpose of this study is to describe the creation and im-

plementation of two tools aimed to improve both family and clinician experience, by improving documentation about a family's context.

**Innovation:** Previous qualitative work helped guide the innovation. Surveys were used to validate and triangulate the issues identified in previous semi-structured interviews done with clinicians. There was a 75% response rate of full-time clinicians (143/190). Given the sensitivity of the topic and families only having a singular NICU experience, surveys were not done with families. The surveys and interviews identified the basic need for improved documentation of information around family context to avoid fragmented and miscommunication. Equipped with these gaps, an interprofessional leadership team including parent representatives brainstormed practical ways to address them. A process map was created to outline how information gets collected and shared throughout the NICU stay of a patient. Two gaps in the communication around family context were identified and this guided the development of two associated tools, The Family Snapshot Antenatal Consult (FSAC) and the Family Snapshot Tool (FST), and the processes for their implementation.

The first identified gap was eliciting and documenting the family context in an antenatal consultation, the first opportunity for the neonatal team to meet with families. At the time, the antenatal consult in our institution were handwritten on carbon copy sheets with no dedicated space on the sheet to write any information about the family context. The consult was reimagined using an experience-based co-design approach. A specific section, nicknamed the Family Snapshot, was designed to facilitate the collection and documentation of the family and adapted to help support trainees in these potentially difficult conversations. The FSAC was tested and tried by trainees and neonatologists (Appendix - Tool 1).

The second gap identified was the ability to transition the information gleaned during the antenatal consult to the newborn's chart after the delivery. Again, using experience-based co-design, the FST was created. The FST (Appendix - Tool 2) is a continuation of the FSAC and exists as a consolidated platform on the electronic medical record (EMR) in the Sunnybrook NICU. It allows information about the family context to be elaborated on as the relationship progresses between the family and the NICU team. The goal is to help the clinician team build on relationships and conversations about family context, so that families do not need to restart conversations with each new clinician. It is created as a dynamic tool that could be edited as new information is learnt and as a family's context evolved with time.

**Implementation:** The same interprofessional leadership team that designed the Family Snapshot Antenatal Consult (FSAC) and the Family Snapshot Tool (FST) were also the leaders for their implementation. Implementation of both tools required 1) information technology development to make the data collection tools compatible with the EMR, 2) the delineation of a new workflow for staff and 3) education to clinicians. Both tools were implemented in April 2022. Process measures are

continuously being collected to quantify their uptake and help target interventions to refine the process. Measures include the frequency of these tools being completed, audits as to how they are being completed and who is using them and completing them.

**Conclusion:** This implementation serves as an intermediary step in a larger quality improvement initiative aimed to improve communication between clinicians and families. The tools and process described here are continuously being reassessed and improved upon based on feedback from the clinicians using the tools and our interprofessional leadership team. Future steps include 1) further semi-structured interviews to assess the experience of families with sharing their family context now that these tools are in place and 2) repeating the surveys with clinicians to see if there has been any change in their experience with sharing information about the family context. Ongoing targeted initiatives to improve communication around family context will allow our NICU to engage in more family centered and individualized decision making.

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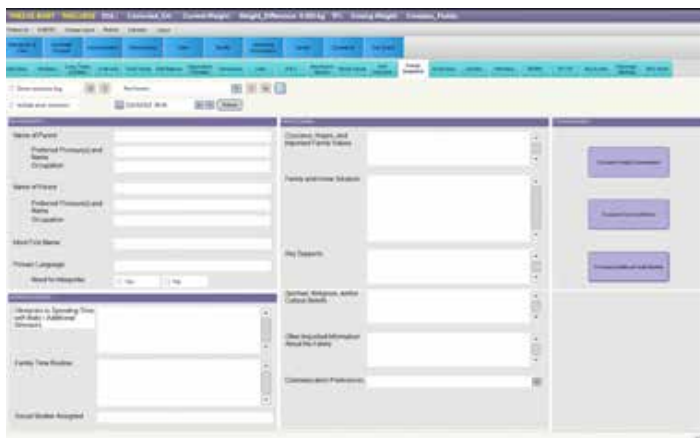
#### Problem statement:

We are describing the creation and implementation of the Family Snapshot Tools in the Sunnybrook Neonatal Intensive Care Unit (NICU) as a means of improving communication around family context.

#### Learner objectives:

1. Identify the strengths and gaps in understanding and communicating family context between families and clinicians, and between clinicians
2. Learn about a quality improvement (QI) initiative designed to address these gaps and improve communication around family context.

## Appendix --Tool 2: FST (Family Snapshot Tool)



**Building a relationship**

Significant person(s) present (please specify name, relationship to person who is pregnant, etc.):  
This is an important conversation to have. Is there anyone else you want to call/video conference in?

Interpreter used (please specify language):  
What language are you most comfortable with? Are you okay to have this conversation in English or would you like a translator?

Neonatal role introduced

NICU team and goal of the consult introduced  
Describe what the NICU is, where it is, etc.

The goal of our discussion is for us to get to know you and introduce you to the NICU. We know that getting to know a family can help us better help individualize our care for you. These are conversations and questions we have with all families who are about to have a baby that may be admitted to the NICU.

	Name	Preferred name and pronouns	Occupation
Parent			
Parent			

Baby's sex (if known):

Baby's name (if known):

**About the family**

About the family and key supports:  
Can you tell me a bit about you, and your family?

Spiritual, religious, or cultural beliefs:  
Are there any spiritual, religious, or cultural beliefs or practices that are important to your life?

Concerns, hopes and important family values:  
What are your thoughts and feelings about having a preterm child? Any or all thoughts are welcome. Anything that makes you nervous? Hopeful?  
What are your hopes for the birth, and care after birth for you and your baby?

Additional information about family:

**Sharing information**

How do parents prefer to receive information?  
Some parents want a general overview of what can happen, and some parents want to hear specific numbers and statistics. What works best for you?

## Gravens 2023–17

**Abstract title:** A Multi-Tiered Systemic Approach to Helping Families Thrive in the NICU and Beyond

**Authors:** Karolina Grotkowski, PhD, Augustina Bertone, PhD, Sierra Kuzava, PhD, Catherine Mogil, PsyD

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**Program:** The Family Development Program (FDP) is a relationship-based preventive intervention that supports caregivers to approach parenting so it can be joyful, intimate, and child-centered. Built on a randomized-controlled trial funded by the National Institute of Mental Health, the program now boasts over 30 years of results to support its effectiveness with parents from vulnerable backgrounds and continues to serve families with an infant born into the Neonatal Intensive Care Unit (NICU) via telehealth and in-person services. FDP also provides workforce education and training to NICU teams to improve outcomes for infants and their families. FDP uses a multi-tiered approach that aligns with the Institute of Medicine's (1994) prevention framework and includes: 1) system-wide education in trauma-informed, resilience-promoting care to equip NICU staff and leadership with tools to promote positive parenting practices right from the start while also helping to promote professional wellbeing of staff members, 2) family and staff consultations to address current challenges, and 3) targeted individualized therapeutic services to families who are struggling emotionally and are most at-risk for mental health challenges.

We will present program evaluation data, including both staff training outcomes and family outcomes and from 2017–2022. Staff training and support consisted of workshops, consultations, and presentations at staff meetings which included educational materials (handouts, videos, articles, presentations) on topics related to trauma, child development, and increasing equity in the NICU. Evaluation measures included knowledge checks, retrospective pre-post skill ratings, and satisfaction. Family consultations consisted of psychoeducation, brief coping and communication skills, and support. Outpatient interventions were selected based on family need but largely focused on treating mental health symptoms, increasing parent-child attunement, strengthening social support, and healing trauma. Parents completed the Patient Health Questionnaire (PHQ-9), General Anxiety Disorder (GAD-7), PTSD Checklist-Civilian (PCL-C) version, Perceived Stress Scale (PSS), Coping Self-Efficacy (CSE), Post-partum Bonding Questionnaire, and Revised Relationship Quality Satisfaction Survey (RDAS) before and after completing services.

**Impact and results:** Over 150 staff members have participated in trainings over the last 4 years. Training participants indicated that their “ability to find effective solutions for the

people I serve” were improved because of participating in the training. Additionally, their confidence in both “serving my clients” and “implementing skills” were enhanced. Ninety-eight percent (98%) thought that others should receive the training and 100% rated the course favorably (Good 9%, Very Good 27%, Excellent 64%). We have translated the training into a one-hour e-learning course and downloadable tip sheets that are publicly available and received similarly positive ratings.

On average our team serves 90 families each year, including 110 family consultations, and 330 therapy sessions. At intake, we obtain baseline measures of parent mental health (i.e., depression, anxiety, and posttraumatic stress) as well as family functioning and coping. Our families see an average decrease of 2.5 units in mental health symptom severity (average change by symptom type is as follows: Anxiety -2.4, Post-traumatic Stress -3.8, Depression -1.3, Perceived Stress -3.5). Most clients experience a decrease in symptom severity from the moderate to severe range into the mild or minimal range across these domains. Further, our clients report an average increase in positive coping utilization of 9.7 units.

**Conclusions:** NICU families and staff are eager for psychological services and will make full use of them. Families have unique needs and present with differing trauma histories and pre-existing symptoms, which necessitates that providers titrate support. The transition home is a time of incredible vulnerability and change, and many families benefit from family-wide support that extends beyond the NICU stay. Indeed, our empirical findings suggest that receiving outpatient family services after NICU discharge reduces psychological distress and increase coping and bonding. Finally, providing training and support to staff ensures that all families will receive some level of service and helps cultivate a family-oriented and trauma-informed NICU environment.

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### Problem statement:

Medical teams working with infants serve a unique role, as caring for an infant also entails caring for the family and equipping them to provide a nurturing environment for their child during a Neonatal Intensive Care Unit (NICU) stay and beyond. To complicate matters, more than 20% of parents with a medically ill child experience depression, anxiety, and/or post-traumatic stress disorder within the infant's first year life (2), which can have negative downstream effects on the child's so-



cioemotional development. To help infants and families thrive and set them up for long-term developmental success, NICUs must offer multi-tiered approaches to equip staff with education about parental mental health and support families using an accessible and flexible approach during this critical period.

#### Learner objectives:

1. Describe the Family Development Program (FDP) and three tiers of support provided to NICU families and staff.
2. List best practices and strategies to support caregivers in the NICU
3. Apply trauma-informed care strategies to promote future developmental success for families and professional wellbeing among staff

#### Gravens 2023–18

**Abstract title:** Interdisciplinary Guidelines and Recommendations for NICU Discharge Preparation and Transition Planning

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#### Problem statement:

This presentation will provide attendees with a high-level view of the guideline sections and a roadmap for integration into their own unit. Additionally, attendees will be oriented to the NICUtohome.org landing page, a source for the tools and information needed to put the Interdisciplinary Guidelines and Recommendations for NICU Discharge Preparation and Transition Planning into action.

#### Learner objectives:

1. Attendees will be able to identify at least three risk factors for readmission or health decline in infants recently discharged from the NICU.
1. Attendees will be able to list the five impact areas recommended for inclusion in NICU transition planning and discharge preparedness programs.
2. Attendees will be able to access at least 2 resources for transition planning and discharge preparedness to be integrated into their NICU.

#### Gravens 2023–19

**Abstract title:** Cardiac, Renal and Liver Function in Neonates with Hypoxic Ischemic Encephalopathy Treated with Therapeutic Hypothermia

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**Background:** Therapeutic Hypothermia (TH) reduces the impact of perinatal asphyxia in neonates. Cardiac dysfunction, kidney and liver injury have also been shown to present in these infants. TH is an established treatment, and its success in reducing HIE incidence is well documented in the literature,

but there is a lack of research data to explain how TH modulates neonatal cardiac, renal, and hepatic function. Moreover, it is unclear if the cardiac, renal, or hepatic function changes that occur during and post-TH can predict neonatal outcomes.

**Objective:** To evaluate cardiac, renal, and liver function in neonates with HIE treated with TH and to determine whether various biochemical/functional parameters of cardiac, renal, and hepatic function are significant predictors of mortality.

**Methods:** A retrospective electronic medical record review of 47 neonates, who qualified for TH because of HIE, over a seven-year period in a Level IV NICU. All study procedures were approved by the local Institutional Review Board. The subjects were divided into groups dependent upon: 1) their gestational age at birth—Late Preterm (PT) (36 0/7 to 36 6/7 weeks) and Term (37 0/7 to 42 0/7 weeks); 2) their Size-at-Birth—small for gestational age (SGA), and appropriate for gestational age (AGA); and 3) their Outcome—Alive (n=40) and Deceased (n=7). Data collected for analyses include cardiac, renal, and hepatic function parameters; diagnoses; and concomitant medications/treatments throughout the entire NICU course, and maternal and perinatal factors. One-way ANOVA and Pearson correlation analyses were used to compare continuous variables between the independent groups. Fisher exact test was used for categorical variables.

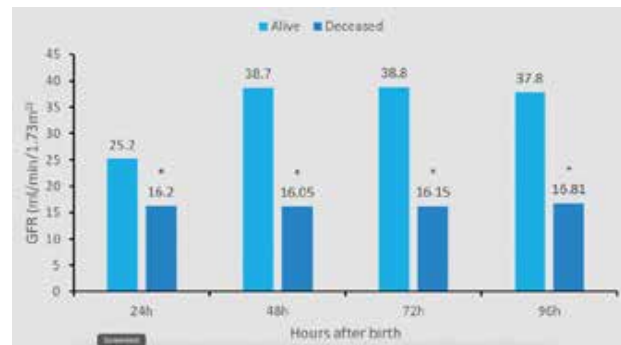
**Results:** There was no significant difference in echocardiogram's cardiac function parameters (EF, SFx, or LVIDd) between the alive and deceased groups ( $p > 0.05$ ) (Table 1). No significant correlation was found between EF, LVIDd, or SFx and any measured biomarker of cardiac (Troponin I and CK-MB), renal (BUN, Cr BUN/Cr, GFR), or hepatic (ALT, AST, Alk-Phos, LA) injury ( $p > 0.05$ ).

**Table 1**

(insert)

Mean GFR and urine output were significantly lower and serum Creatinine was significantly higher in the deceased group than the alive group at 24, 48, 72, and 96 ( $\pm 4$ ) hours after birth ( $p < 0.05$  and  $p < 0.005$ ) (Fig.1). Mean serum BUN was not significantly different at any time point between the alive and deceased groups ( $p < 0.05$ ).

**Figure 1**



Mean serum ALT, AST, and Lactic Acid were significantly higher in the deceased group than the alive group at 24 hours of life ( $p < 0.05$ ) (Table 2).

**Table 2**

Parameter	Alive	Deceased	Significance
24h ALT (U/L)	87.0 $\pm$ 98.6	359.4 $\pm$ 216.9	$p < 0.00001$
24h AST (U/L)	207.6 $\pm$ 296.9	1214.0 $\pm$ 847.7	$p < 0.00001$
24h Alk Phos (U/L)	142.8 $\pm$ 38.7	165.3 $\pm$ 105.5	$p = 0.33$
24h Lactic Acid (mmol/L)	2.9 $\pm$ 1.5	8.6 $\pm$ 4.9	$p = 0.000013$

No significant differences were found in the cardiac, renal, and liver function parameters between the Gestational age or Size-at-Birth groups ( $p > 0.05$ ).

**Conclusions:** Cardiac, renal, and liver function parameters did not significantly differ based on gestational age or by weight for gestational age. Markers of renal and hepatic function may be predictive of survival in neonates with HIE being treated with therapeutic hypothermia.

**Problem statement:**

Can the cardiac, renal, or hepatic function changes that occur during and post-Therapeutic Hypothermia predict neonatal outcomes of HIE?

**Learner objectives:**

1. The effect of Therapeutic Hypothermia on cardiac, renal, and liver function in term and late preterm neonates with HIE.
2. The biochemical/functional parameters of cardiac, renal, and hepatic function can be predictors of post-Therapeutic Hypothermia mortality in neonates with HIE.

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**Abstract title:** “Cool attached”

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**Background:** Therapeutic hypothermia (TH) in the neonate with hypoxic ischemic encephalopathy is a very stressful experience for both the neonate and its parents.

Research on the safety and effect of kangarooing during therapeutic hypothermia has been limited.

In the Dutch Neonatal Intensive Care Units (NICU’s) no protocols or guidelines are available for kangarooing during TH. Kangarooing is often not allowed due to fear of dislocation of a tracheal tube or central venous line. In addition, there’s no knowledge of the effect of kangarooing during TH on vital parameters. This may lead to a disturbed attachment between the neonate and parents.

**Aim:** Validation of the protocol “kangarooing with neonates in therapeutic hypothermia”

**Methods:** Observational study, conducted in 2020 at the level III NICU of Isala, Zwolle, the Netherlands.

Neonates who underwent TH were included. They kangarooed according to established agreements in the protocol “kangarooing with neonates in therapeutic hypothermia.” During kangarooing, vital signs (blood pressure, respiratory rate, and heart rate) were monitored. Vital signs were assessed before, 15 minutes after installing, just before ending, and 30 minutes after kangarooing.

Any dislocations of tracheal tubes or central lines were tracked.

Afterwards, parents and nurses completed surveys about safety and experiences during kangarooing.

**Results:** Ten neonates with hypoxic ischemic encephalopathy who underwent TH were included.

We observed no major fluctuations in vital signs (Table 1). Differences in respiratory rate and heart rate were minimal and were even calmer during kangarooing. Mean arterial blood pressure (MAP) showed a decrease during kangarooing but recovered fast spontaneously afterwards. There was no bradycardia (heart rate <80 beats per minute) (Fig 1) or apnea in any of the participants. The mean core temperature was 33.5°C prior to and 33.5°C after kangarooing (Fig 2).

**Table 1**

	Respiratory rate (min)	Heart rate (BPM)	Mean blood pressure (mmhg)	Core temperature (°C)
T0	40	105	49	33,5
T1	31	106	42	33,6
T2	36	102	43	33,6
T3	39	102	51	33,5

Table 1 Shows mean values of vital signs of all participants.T0= Before holding, T1= 15 minutes after installation, T2 just before ending procedure, T3=30 min after the procedure

**Figure 1**

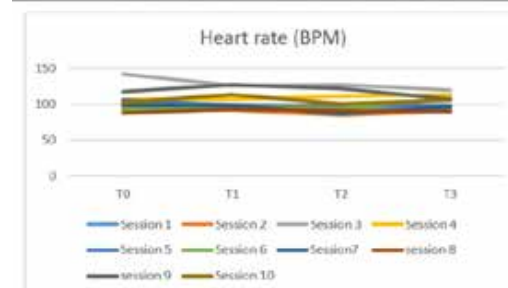


Figure 1 Heart rate (BPM). T0= Before holding, T1= 15 minutes after installation, T2 just before ending procedure, T3=30 min after the procedure

**Figure 2**

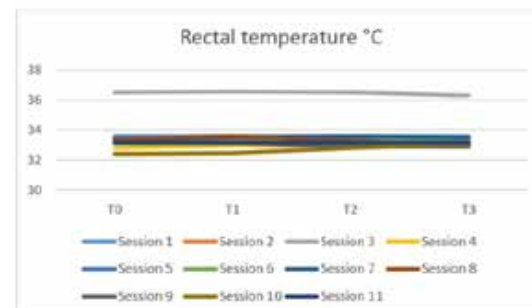


Figure 2 Rectal temperature °C. T0= Before holding, T1= 15 minutes after installation, T2 just before ending procedure, T3=30 min after the procedure

No dislocation of tracheal tubes or central lines occurred.

The cooling period was very stressful for all parents, with half of the parents experiencing bonding issues. Nurses (87%) confirmed this. According to parents, kangarooing provided a significant stress reduction and strengthened the bond with their child. Nurses observed that parents connected with their child, could access emotions, and finally feel like “parents”. Nurses (87%) saw positive changes in parents’ emotions relative to the treatment, which may have increased confidence in the treatment.

Sometimes nurses observed reactions in the neonate, such as more relaxation and opening their eyes during kangarooing.

**Conclusion:** Our results confirm the safety of kangarooing during therapeutic hypothermia. Besides that, during kangarooing there was a decline in MAP, respiratory rate and heart rate, which makes a reduction in stress plausible. Above all, kangarooing stimulates bonding between parents and the neonate and contributes to a reduction of the stress level of

parents during a very difficult period in life.

#### Problem statement:

1. Research on the safety and effect of kangarooing during therapeutic hypothermia (TH) has been limited. In the Dutch Neonatal Intensive Care Units (NICU's), no protocols or guidelines are available for kangarooing during TH. Kangarooing is often not allowed due to fear of dislocation of a tracheal tube or central venous line. In addition, there's no knowledge of the effect of kangarooing during TH on vital parameters. This may lead to a disturbed attachment between the neonate and parents.
2. Validation of the protocol "kangarooing with neonates in therapeutic hypothermia" to stimulate bonding between the child and its parents

#### Learner objectives:

1. Can kangaroo care be safely performed during therapeutic hypothermia?
2. Do vital parameters remain stable during the procedure?

#### Gravens 2023–21

**Abstract title:** Efficacy of Giving Oropharyngeal Mother's Milk in Extreme Preterm Infants in Early Transition to Breast Feeding and Duration of Hospital Stay: A Case Control Study

**Authors:** Dr. Renu Agrawal, MPT Pediatrics, CNT, c/NDT, Dr. Ajeet Kumar Saharan, Ph.D, MPT, Dr. Jyoti Patodia, MD. Dr. Jai-krishan Mittal DM, Erin Sundseth Ross, Ph.D

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**Method:** This was a prospective study conducted at tertiary neonatal unit in preterms <32 weeks across one year (2020). 182 babies were enrolled (96 cases and 86 control). The study group received 0.1 to 0.5 ml of mother's milk as early as possible (mean 3.4 days of life) every 6 hourly until 30-32 weeks of gestation and were compared to a control group. The initiation & progression of paladai and breast feeding was assessed by using SOFFI®: Supportive Oral Feeding in Fragile Infants (1). SOFFI® has been associated with fewer days to reach bottle feeding in preterm infants (2). SOFFI® uses developmentally supportive care principles to assess readiness and progression for feeding, emphasizes the need to consider oral feeding outcomes beginning at admission, and offers interventions to

improve oral outcomes beginning at birth (3).

**Results:** In the study group (mean gestation 29 weeks ± 1.62), 1st paladai feed was started at 32.8 vs 34.05 weeks ( $p < 0.001$ ) and infants achieved full breastfeeding at 33.5 vs 34.3 weeks ( $p < 0.008$ ), which was significantly earlier as compared to control group. The hospital stay decreased from 42 to 30 days in study group (95% CI -18.9, -6.2,  $p < 0.001$ ). During the intervention, there were no adverse events and no significant difference in sepsis or NEC (Necrotizing Enterocolitis).

**Conclusion:** Providing OMM to extreme preterm babies in early days of life appears safe and leads to an early and smooth transition to breastfeeding while decreasing hospital stay.

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#### Problem statement:

The objective of this case-control study was to compare the effect of oropharyngeal administration of mother's milk (OMM) in early days of life in transition to breastfeeding and hospital stay. In India where this study was conducted, no bottles are used in this hospital.

#### Learner objectives:

1. Describe paladai feeding
2. List the age at full breastfeeding for case and control groups

#### Gravens 2023–22

**Abstract title:** The i-Rainbow: A flexible, evidence-based care path for providing developmental care in the neonatal intensive care setting

**Authors:** Eilish Byrne, Melissa Scala

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**Methods:** The i-Rainbow is a 6-Stage developmental pathway that was designed to 1) be flexible in the NICU setting to easily accommodate fluctuation in infant clinical status and 2) offer a menu of evidence-based developmental activities that are easily understood and used by parents, nurses, and other developmental experts in the NICU. Prior to implementation of the i-Rainbow in our unit, training sessions instructing in the use of the i-Rainbow were conducted. Also prior to implementation, the authors 1) collected pre-implementation data on rates of developmental care (minutes/day of: total developmental care by nurse and parent, swaddled holding, kangaroo care holding, containment touch, and voice therapy) in a level 4 NICU and 2) surveyed parents (n=12) and healthcare professionals (n=200) in the NICU to assess nurse-to-nurse conflict over developmental care plans, as well as nurse and parent knowledge and comfort level with developmental activities for preterm infants.

**Impact:** After implementation of the i-Rainbow at Lucile Packard Children's Hospital Stanford, data on developmental care rates were compared to pre-care path rates. Statistically significant improvements in total minutes of developmental care ( $p<0.05$ ), swaddled holding ( $p<0.05$ ), and nurse administered developmental were found ( $p=0.05$ ), and trends for improvements in kangaroo care holding ( $p=0.06$ ) and containment touch were also seen. Feedback on the path was obtained through follow-up nurse (post n= 91) and parent survey data (n=9), and statistically significant decreases in nurse-to-nurse conflict was demonstrated ( $p=0.003$ ). In addition, 7/9 parent respondents agreed or strongly agreed to interacting more with their infant because of the i-Rainbow, and 9/9 respondents recommended the i-Rainbow for other parents in the NICU. The results from the research and development of the i-Rainbow will be shared with learners and instruction in the use of this tool will be provided and illustrated through cases, allowing the learners to see the developed tool in detail.



**Table**

	Pre path (n=19)	Post path (n=30)	P value
GA at birth (weeks) Mean (SD)	26.3 (1.37)	26.3 (1.78)	0.93
Sex-n (percent female)	6 (31%)	11 (36%)	
BW (gm) Mean (SD)	952 (268.5)	883 (272.5)	0.38
Length of stay (days) Mean (SD)	89.0 (22.8)	93.4 (37.9)	0.65
Total dev care (min/infant/day) Mean (SD)	96.6 (44.2)	123.9 (38.2)	Align Right
Total dev care by RN (min/infant/day) Mean (SD)	33.7 (44.2)	44.1 (38.2)	0.05*
Total dev care by family (min/infant/day) Mean (SD)	62.8 (40.9)	79.8 (35.5)	0.13
KC (min/infant/day) Mean (SD)	22.5 (22.2)	29.8 (15.2)	0.17
Swaddled holding (min/infant/day) Mean (SD)	54.2 (25.2)	69.7 (21.9)	<0.05*
Containment Touch (min/infant/day) Mean (SD)	17.7 (9.7)	22.6 (8.6)	0.06
Infant directed speech (min/infant/day) Mean (SD)	13.2 (12.8)	11.7 (5.5)	0.56

**Conclusions:** The i-Rainbow, a straightforward, infant-led tool that standardizes communication and approach to developmental care in the NICU, helped significantly improve developmental care rates in our unit. The continuum of stages follows the ups and downs in the infant's journey in the NICU and empowers parents through choice. It is unique in that it relies on objectively defined infant cardiorespiratory status and physiologic maturity and, because the i-Rainbow has identified developmentally beneficial interventions for even the most critically ill infant, it excels in a highly complex neonatal intensive care setting where other programs/paths may not. In addition, the i-Rainbow is free and requires minimal training for qualified health professionals. Regarding sustained successful implementation, having a plan for ongoing (perhaps annual) education on the i-Rainbow is critical. This is especially necessary in units with nurse travelers or other types of staff turn-over. Future work with i-Rainbow includes further study on the parent perspective and potential health benefits, education to enhance voice therapy/intentional speech with the infant, and adherence to the i-Rainbow in the NICU on longer term infant health outcomes.

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#### Problem statement:

Evidence demonstrates that clinically indicated and appropriately timed interventions improves infant outcome and parent-infant bonding. However, since infants develop at different rates, and with varying degrees of neurologic maturity, relying on gestationally aged-based timelines is problematic. Therefore, the authors designed and studied a novel developmental care path for providing evidence-based interventions based on objectively defined infant clinical status, not post menstrual age.

#### Learner objectives:

1. Learners will be able to describe how the implementation of the i-Rainbow changed developmental care rates in our unit.
2. Learners will understand how implementation of the i-Rainbow impacted parental comfort with providing de-

velopmental care and interacting with their infant.

3. Learners will know how to use (apply) the i-Rainbow to guide them in choosing evidence-based developmental interventions for caregivers to do with their infants, based on infant clinical status.

#### Gravens 2023–23

**Abstract title:** A Novel Texting-Based Virtual Assistant for NICU Families is Valuable and Feasible

**Authors:** Ashley Osborne MD, Srijia Reedy BA, Lorissa Snaith RN, Kyle White BS, Ryan Schumacher BA, Caleb Johnston RN MBA, Diana Worsley MPH, Catherine Cullen MD, Kirstin Leitner MD, Lori Christ MD,

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**Background:** Many parents of preterm infants feel stressed and unprepared for discharge from the neonatal intensive care unit (NICU). Little is known about the moderately preterm infant (MPTI) birth parent experience despite this population’s prevalence and cost to the healthcare system. Electronic health interventions have been shown to be accepted by NICU parents. Mobile phone texting or short message services (SMS) is preferred by many parents. MPTI parents may benefit from a texting intervention to ultimately improve child and family outcomes.

**Objectives:** (1) To design a novel, augmented intelligence, text-messaging virtual assistant for MPTI birth parents, (2) To test the feasibility and acceptability of the virtual assistant

**Methods:** To inform the design and focus the virtual assistant content, a needs assessment was performed via semi-structured qualitative interviews with English-speaking birth parents of infants born between 32-34 weeks gestation who were recently discharged from the Hospital of University of Pennsylvania (HUP) NICU (38 bed, level III unit). Two team

newly validated

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members analyzed the recorded, transcribed interviews using

**Table**

**Behavioral Signs of Respiratory Instability (BSRI)**

	Observed/Not Observed		
	2	1	0
<b>Interaction</b> (okay to wobble)	0-3 mo- * Visual focus when presented with a stimulus 2 seconds or more 3 m-6m - *Visual tracking in a vertical and horizontal plane 3x at onset of treatment 6-12 months: pt brings small toy to mouth and engages with toy	0-3 mo- *Visual focus less than 2 when presented with a stimulus 3 m-6m - *Horizontal or visual tracking 1/3 trials 6-12 months: pt grasps toy >5 sec, but not bringing to mouth or exploring	0-3 mo- *Unable to visually engage/ not alert 3 m-6m - *Unable to visually track horizontally or vertically 6-12 months: pt grasps toy <5 sec; no engagement with toy
<b>Midline</b> (unwaddled)	Term-3 mo- *able to maintain head in midline supine appropriately for CCA (over 5 sec.) 3 m-6 m: *Head sustained in midline in supported sitting >5 sec. 6-12 months: *Head sustained in midline in supported sitting >10 sec.	0-3 mo- *in supine head in midline for 2-5 seconds 3 m to 6 m: *Head in midline in supported sitting 2-5 sec. 6-12 months: *Head maintained in midline in supported sitting 5-10 sec.	0-3 mo- *unable to maintain head in midline in supine for >2 seconds 3 m to 6m: *unable to maintain head in supported sitting for >2 seconds 6-12m: *unable to maintain head in midline in supported sitting for >5 sec.
<b>Persistently Observed in 15-30 Minute Treatment Session</b>			
<b>Extension patterns of movement</b> (Sitting tolerance for 1-5 minutes)	Term-6 months: *0-15° cervical extension in supported sitting, without oxygen saturation drifting below 92.  6 months-12 months: *Tolerates supported sitting over 5 minutes	Term - 6 months: *16-45° cervical extension in supported sitting, without oxygen saturation drifting below 92.  6-12 months: *Tolerates supported sitting 1-5 minutes, but extends out of this position	Oxygen saturation drifting below 95 in supported sitting OR Term - 6 months: * occipital skull rests on cervical spine OR *inability to rest chin on chest in supported sitting. 6-12 Months: *Extends out of supported sitting within 60 seconds.
<b>Tachypnea</b> (count 30-60 seconds)	* Respiration rate is between 30-60 breaths per minute with activity	* Respiration rate is between 61-80 with activity	* Respiration rate is greater than 80 with activity
<b>Work of breathing</b>	* No evidence of head bobbing or retractions with activity	* Intercostal or subcostal retractions observed with activity	* Intercostal, subcostal, or supracoastal retractions observed with associated head bobbing, nasal flaring, expiratory grunting, or wheezing during activity.

©Nationwide Children's 2016  
 0- work of breathing interferes with ability to perform activities  
 1- respiratory effort intermittently affects ability to perform age-appropriate activities  
 2- no evidence of respiratory distress with activity

a modified grounded theory approach, and enrollment was stopped when the data reached thematic saturation. NVivo 12 facilitated the analysis.

The virtual assistant, named “Penny,” was then created to fill the gaps of knowledge and needs identified by parents with HUP’s technology partner, Memora Health. Multidisciplinary stakeholders from nursing, lactation, social work, and psychology, were engaged to aid in design. Penny’s functionality includes responding to commonly asked questions, sending scheduled educational content relating to prematurity and maternal postpartum care, and a discharge program to aid in discharge preparedness and the transition home. Penny is designed for parent use during the NICU admission and for 6 weeks after discharge. Internal iterative testing and Amazon Mechanical Turk crowdsourced testing were performed. A convenience sample of 10 birth parents were enlisted to try Penny to assess the program’s feasibility and user acceptability. Parent satisfaction was measured by the Net Promoter Score (NPS), a widely used market research metric of customer experience (range -100 to 100). The qualitative study and Penny implementation met eligibility criteria for IRB review exemption.

**Results:** 16 birth parents of MPTIs were interviewed, and 4 major themes emerged: (1) Parents had mixed feelings regarding the connection and communication with the medical team; (2) There was confusion around the NICU admission and care; (3) The discharge process felt rushed; (4) Parents would appreciate information sent via electronic methods. After discharge, parents desired more education regarding feeding, reflux, breathing patterns, and routine infant care.

10 birth parents were enrolled in Penny. No parents declined enrollment. Penny’s NPS was 80. Parents felt Penny provided “reliable,” “helpful,” and “comprehensive” information and kept “mothers updated on their (infant’s) journey after birth.” Users sent 149 messages, and Penny sent 797 outbound messages, which were all automated except 1 message. The overall survey response rate was 41% of 12 surveys sent per user. Highest engagement was seen related to breastfeeding/pumping content, with greater than 75% of parents responding to Penny’s questions. 23% of Edinburgh Postnatal Depression Scale (EPDS) surveys were completed, with no parents screening positive for postpartum depression. All responding parents agreed strongly with “Penny increased my understanding of my premature baby both during and after their NICU stay.” Time spent by a clinician overseeing the program to ensure safety was minimal (1-2 minutes/day).

**Conclusions:** Implementation of a texting virtual assistant is feasible and highly accepted by parents of MPTIs. In this small sample, Penny’s NPS is excellent by industry standards and clinician oversight time was minimal. Penny has the potential to improve MPTI parental understanding of the implications of prematurity, discharge readiness, emotional well-being and overall NICU experience.

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#### Problem statement:

When parents seek knowledge relating to their premature child, popular options are calling a medical provider or turning to the unqualified internet community. We hypothesize that a novel text-messaging virtual assistant will be feasible and well-received by birth parents of moderately preterm infants with the potential to improve their NICU experience and their understanding of prematurity implications.

#### Learner objectives:

1. Describe the methods used to create a text-messaging virtual assistant for birth parents of moderately preterm infants
2. Summarize a level III NICU's experience with virtual assistant implementation

#### Gravens 2023–24

**Abstract title:** Pandemic Pandemonium: The Implications of Visitation Restrictions Through the Lived Experiences of NICU Parents and Why We Must Redefine Their Role as Essential Care Partners

**Author:** Jaylee Hilliard, MSN, RN, NEA-BC, CPXP

#### Contact:

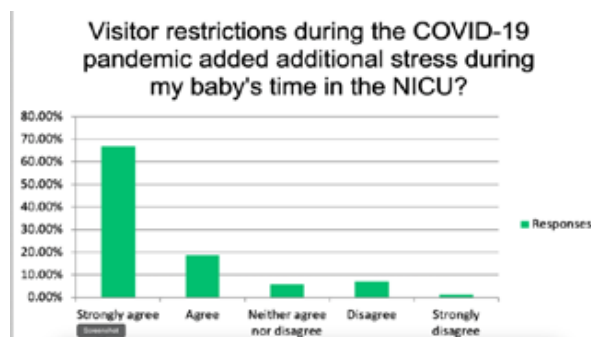
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The methodology used to research our problem was completed through a literature review and an online survey tool. Articles included in the literature review were published from 2020 to present and focused on NICU parents' experiences during the COVID-19 pandemic. Additionally, a 24-question online survey was utilized using the SurveyMonkey platform to further evaluate how the visitation restrictions in NICUs affected parental trauma, mental health, their ability to care for their infant, as well as bond with their infant individually and as a family.

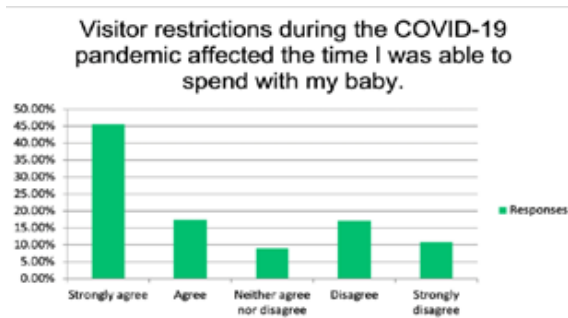
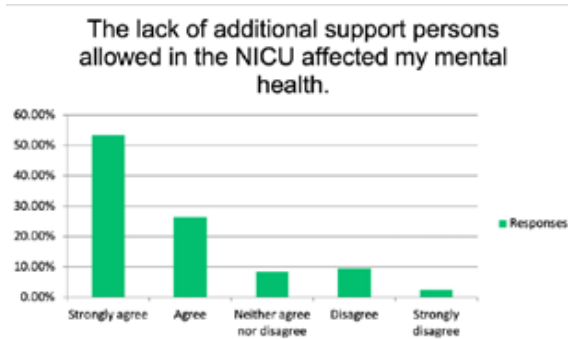
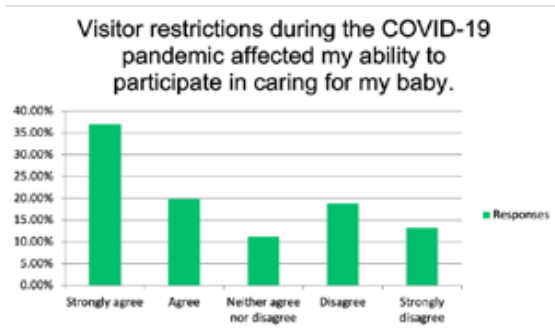
We utilized research articles and an online survey for our materials. Primarily, our data was collected from our online questionnaire. The sample size for our study consisted of 287 parents who had children admitted to the NICU during the COVID-19 pandemic. The majority of our participants' infants were in the NICU for greater than 30 days and between 25–34 years of age. The participants were obtained via several online NICU Parent groups. Demographically, the participants in our study were from a variety of countries, including the United States, Australia, Canada, China, Dubai, India, Ireland, Singapore, Switzerland, and the United Kingdom. We obtained both qualitative and quantitative data.

The main outcome measurements of our study were to evaluate the variations in visitation policies throughout NICUs globally. We measured the percentage of NICU parents who felt that the COVID-19 visiting restrictions limited the time they were able to spend with their infant, their ability to care for their infant, and bond with their infant individually and as a family. Additionally, we reviewed if the restrictive NICU visitation policies exacerbated the parent's trauma and if it had an impact on their mental health.

The results of our research confirmed that 67% of NICU parents strongly agreed that the visitor restrictions added additional stress for them during their infant's time in the NICU. Parents included in our survey agreed and strongly agreed for a combined 63% that the visitor restrictions affected the time they were able to spend with their baby in the NICU. Fifty-seven percent of parents agreed and strongly agreed that the visitation restrictions affected their ability to participate in caring for their infant. Eighty percent of parents in our study agreed and strongly agreed that the visitor restrictions affected how they were able to bond as a family. The participants in our survey also agreed and strongly agreed for a combined 85% that the visitor restrictions during the pandemic exacerbated the trauma they were already experiencing. Parents agreed and strongly agreed for a combined 80% that the lack of additional support persons allowed in the NICU affected their mental health.







In conclusion, parents who had children admitted to the NICU during the COVID-19 pandemic were both mentally and physically affected by the restrictive visitation policies in their NICU. Parents reported feeling anxious and lonely throughout their NICU journey because their significant other was unable to be present at the same time. Parents felt additional stress due to the burden of making important medical decisions without their partner's presence.

For positive impacts, our participants most commonly reported feeling comfort in knowing that their infant was kept safe from COVID. They appreciated that the restrictions allowed more one-on-one time with their infant and limited unnecessary, unwanted, and/or unannounced visitors.

The most difficult component of their NICU experience due to the limited visitation policy was the inability to visit the NICU at the same time with their parental partner or significant other. One parent stated, "Not being able to bond as a family and not being able to discuss life-altering decisions in person with my spouse was very difficult." An additional common response was the inability for the siblings to meet the infant in the NICU for several months or as one respondent stated, "My children were not able to meet their sister before

she passed away." Parents also reported that the visitation policies left them feeling very lonely, depressed, and anxious as one mother stated, "The NICU was so lonely" and another participant said, "It was detrimental to my mental health" when describing her daily visits to the NICU alone without her spouse or additional support persons.

Research has clearly demonstrated that early and consistent parental engagement in the NICU significantly influences the long-term trajectory of the infant and the entire family unit. The lack of consistent parental presence in the NICU minimizes the parent's ability to bond with their baby, which leads to decreased involvement and confidence in caring for their baby, resulting in an increase in parental anxiety which has been linked to compromised neurodevelopmental outcomes in infants. Research has shown any parent who has endured trauma and has a baby in the NICU will interact with their baby differently than a parent who has not. With the restrictive visitation policies implemented during the COVID-19 pandemic, NICU parents endured additional trauma due to the limited visitation with their infant and the lack of presence from their support system caused a compounding negative effect.

In the NICU, parental presence and engagement should be encouraged, not limited. Additionally, parents should be given additional support throughout their NICU journey and beyond to promote mental well-being, adequate bonding, and a cohesive family unit. With the next pandemic, parents must be embraced as essential care partners. Family caregivers are critical to positive and successful patient outcomes. A family-integrated model intimately involves parents in all aspects of their infant's care in the NICU. Once parents are included as respected care partners, it minimizes parental stress, promotes familial bonding, increases parental confidence, and creates a thriving environment for the infant and parents while in the NICU and post-discharge.

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#### Problem statement:

The progressive movement of Family-Integrated Care that had previously been established ensuring all NICU parents are considered partners and essential members of the care team has regressed since the COVID-19 pandemic. During the pandemic, NICU parents endured a variety of visitation re-

strictions that negatively affected their mental state and their ability to bond as a family with their infant. Previously established research findings have shown that in the NICU, parental presence and engagement promotes bonding, builds parental confidence, improves parental mental health, and positively impacts long-term outcomes for the infant and family unit; therefore, parents must be considered essential care partners and a zero separation policy must be followed with the next pandemic.

#### Learner objectives:

1. Discuss the positive impact of parental involvement and family-integrated care in the NICU and how it impacts the long-term trajectory for the infant and parents.
2. Examine how the visitation policies implemented in the NICU during the COVID-19 pandemic impacted parental mental health, the time they were able to spend with their infant, and their ability to bond as a family with their infant.
3. Identify the importance of including NICU parents as essential care partners to promote familial bonding, parental presence, confidence, and improved outcomes for the infant and entire family unit.

#### Gravens 2023–25

**Abstract title:** Socially Distant Discharge Planning Rounds, a New Model of Care

Lynda Warren, Med, RNC-LRN, Tina Di Fiore, MSN, APRN, NNP-BC, CNS

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**Background and Purpose:** The Cleveland Clinic Children's Neonatal Intensive Care Unit (NICU) at Hillcrest Hospital is a 35 bed, level III unit. The NICU is staffed 24 hours with designated experienced NICU nurses, neonatologists, advanced practice nurse practitioners, and designated respiratory therapists. Other members of the caregiver team include music, occupational, physical and speech therapy, pharmacy, nutrition, social services, spiritual care and family support. The NICU strives to deliver exceptional safe and quality care while placing emphasis on the value of family-centered care and inclusion. Our unit is considered one of the main referral centers in northeast Ohio with approximately 4,500 deliveries and about 500 admissions per year. Multidisciplinary discharge rounds (MDRs) are defined as a model of care in which multiple members of the care team representing different disciplines come together to discuss the discharge planning needs of a patient in real time. MDRs can increase communication between

team members, shorten a patient's length of stay (LOS) and have proven to be a valuable tool in improving the quality, safety, and patient experience of care. In the state of Ohio, evidence, in the form of chart reviews, of interdisciplinary discharge planning is a requirement for Ohio NICU Maternity Licensure. Additionally, discharge process parent satisfaction is assessed using a Press Ganey patient satisfaction survey. This survey asks questions regarding discharge instruction/education, discharge readiness, and coordination of arrangements. Prior to the COVID-19 pandemic, MDRs were walking rounds that included up to 20 caregivers along with the infant's parents. The team moved from bedside to bedside in the single patient room NICU, discussing any patient that may be discharged in the next two to three weeks. Once the pandemic began, having this large group did not allow for social distancing, however the multidisciplinary team needed to ensure that the same level of care was being provided while keeping the patients, families, and team member socially distanced and safe. Thus, virtual MDRs became the standard. Parents and clinical nurses remained in the patient's room, and the others were all on a secure video/audio connection; or as we like to say, the rest of the team was really socially distanced, including some members logging/calling in from home.

**Program, materials, or methodology:** Understanding the benefits and importance of ensuring an effective transition home, the team used Microsoft Teams on existing workstation of wheels to hold rounds at a scheduled time each week. The patients to be discussed were determined at least one day in advance to allow families time to prepare if they chose to attend in person. Following MDRs, a summary of the discussion and a plan of care were written in the patients' medical record. This plan of care was then shared with families electronically.

**Budget and Resources:** Costs for this project were minimal since existing equipment and communication platforms were used.

**Impact or Results:** As of September 30, 2022, the Press Ganey Parent satisfaction score in the discharge domain has continued to increase (90th percentile for the past 2 quarters) even though rounds are now held virtually. Additionally, parents provided written feedback and comments, all supporting the use of virtual MDRs. The care team has continued to build on this success and is now using MDRs to audit safe sleep practices prior to discharge.

**Conclusion:** This project demonstrated the effectiveness of non-traditional virtual MDRs as an effective and efficient tool in the discharge planning processes.

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**Problem statement:**

Can multidisciplinary discharge rounds continue despite the need for social distancing, and will these rounds be meaningful to parents and staff? Multidisciplinary discharge rounds (MDRs) are defined as a model of care in which multiple members of the care team representing different disciplines come together to discuss the discharge planning needs of a patient in real time. MDRs can increase communication between team members, shorten a patient's length of stay (LOS), and have proven to be a valuable tool in improving the quality, safety, and patient experience of care.

**Learner objectives:**

1. Caregivers will identify challenges/barriers to Multidisciplinary Discharge Rounds during a Pandemic.
2. Caregivers will gain knowledge of the benefits of virtual Multidisciplinary discharge rounds.
3. Caregivers will identify ways to enhance Multidisciplinary discharge rounds to address quality monitoring needs of NICU patients.

**Gravens 2023–26**

**Abstract title:** Targeted Developmental Interventions for 'Older' Infants in the NICU Requiring Positive Pressure Support

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Infants in the NICU with BPD, airway anomalies or cardiac conditions may require positive pressure ventilation for months past term age. Developmental interventions, including gravitational challenges, visual engagement, and opportunity for free movement can be limited for these infants for a variety of reasons. Respiratory interfaces, such as ETT, can pose a challenge to providing movement due to the primary need to maintain security of the tube. Social and visual opportunities can be impacted by the presence of an interface such as CPAP or NIV at midline. Infants requiring positive pressure support are also often challenged by reserve limitations and decreased regulatory skills for their age. Unfortunately, reduced

age-appropriate opportunities place these high-risk infants at further risk for delay and could potentially also expose these infants to higher levels of stress due to restrictions in human interaction and play.

Early mobility programs in adult ICUs, which include movement and participation in activities in daily living, have shown decreased ventilator dependent days, shorter length of stay, and better functional outcomes. A growing body of knowledge supports similar outcomes in the pediatric population, and novel programs have been noted in the literature in the NICU. In the Nationwide Children's NICU, a program has been developed to support consistent developmental opportunities for infants on positive pressure support with specific strategies to promote safety, by engaging all team members including families, and having objective measures to track tolerance and progress. With these protocols in place, infants, with a range of respiratory support interventions, are able to participate out of the crib in holding, movement and play with similar frequency and intensity as NICU peers that do not require respiratory support. With the exception of weekly reviews, data has not been collected of the frequency of developmental treatment sessions for all infants in the NICU, regardless of respiratory support measures, to ensure equal distribution of individualized sessions.

Team members collaborated to establish roles that each caregiver was responsible for providing to support developmental opportunities for infants on positive pressure support. First and foremost, families establish their primary developmental goal for their baby on a monthly basis, which is expressed verbally in rounds and is updated for all team members to note in the chart. Respiratory therapists (RTs) are responsible for ensuring ETT tube security and monitoring safety of out of bed transfers. RTs also partner with the nursing staff to maintain best NIV and CPAP hat and mask fit. Nurses communicate optimal timing for developmental opportunities based on the infant's schedule. Neonatal therapists, including OTs, PTs, Speech Therapists and Music Therapists (MTs) provide specific readiness assessments prior to initiating any movement, titrate and modify experiences as the infant demonstrates need and maintains consistent documentation and communication to the team of the infant's response with use of the Behavioral Signs of Respiratory Instability© (Table). Hands on engagement by family is primary, with all bedside caregivers present to support the parents and promote confidence in their handling and holding, and to ensure safety of interfaces. Neonatologists and Neonatal Nurse Practitioners are responsible for maintaining awareness of the treatment sessions by reading progress notes and through participation in weekly multidisciplinary rounds with comprehensive reports provided by the

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Neonatal Therapy team.

Barriers to the program include staffing challenges and the need to strategize timing of interventions. Nursing education regarding their unique and important developmental role has been critical to the success of the program, therefore the NICU therapy team has continued to collaborate with nursing leadership to maintain mentoring for new nurses. Team morale, trust between team members, and engaged family members are all factors that are continually addressed through strategic partnership meetings for the entire team and discussions and actions through a unit Developmental Committee. Ultimately, the mission of the program is to promote parent engagement, facilitate positive neurosensory experiences for the infant, and allow all infants play and free movement opportunities in the NICU regardless of their respiratory support needs.

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#### Problem statement:

Opportunities for developmental intervention for 'older' (past term) infants in the NICU on positive pressure support, including SIMV via ETT, NIV and CPAP, can be impacted by many factors including delivery of respiratory support. Creating a team approach to provide consistent, appropriately timed interventions to infants requiring positive pressure support could positively impact neurosensory development in the NICU and long-term developmental outcomes.

#### Learner objectives:

1. The learner will identify key infant behaviors that indicate readiness for developmental interventions for infants on positive pressure support.
2. The learner will identify strategies for moving and handling infants with CPAP, NIV and ETT.

3. The learner will identify at least one objective measure to monitor an infant's tolerance to activity.

#### Gravens 2023–27

**Abstract title:** Prenatal Mental Health and Emotional Experiences during the Pandemic: Associations with Infant Neurodevelopmental Outcomes

**Authors:** Cindy H. Liu, PhD, Candice Ma, BA, Amanda Koire, MD, Leena Mittal, MD, Carmina Erdei, MD,

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**Program and/or methodology:** Wave 1 of the Perinatal Experiences and COVID-19 Effects (PEACE) Study was conducted from 21 May 2020 to 15 September 2021 and consisted of an online survey. Wave 2 was conducted from 19 November 2020 to 31 August 2022 to follow up with participants and consisted of an online survey and a virtual activity session between mothers and their infants between the ages of 8–10 months. The participants of this study included 133 adults who were living in the US and were either pregnant or had given birth within the 6 months prior to their participation in the study. Quantitative survey data and behavioral data were collected remotely using REDCap and Zoom, respectively, due to COVID-19 safety guidelines. Materials included a sociodemographic questionnaire (assessing variables such as age, race, educational level, and income); the Center for Epidemiological Studies-Depression measure (CES-D) which assessed depressive symptoms; the Generalized Anxiety Disorder Scale (GAD-7) which assessed anxiety symptoms; the Maternal Fetal Attachment Scale (MFAS), which assessed maternal-fetal bonding; and adapted measures which assessed COVID-19-related pregnancy grief and pregnancy worries. The primary study outcome was infant developmental performance at 8–10 months, assessed on the five domains of development of the Ages and Stages Questionnaire, Third Edition (ASQ-3): communication, gross motor, fine motor, problem solving, and personal-social.

**Impact and results:** Of the 133 participants whose data were analyzed, mean maternal age was 32.7 years and mean pregnancy week was 32.8 at Wave 1 (Table 1). At the time of completing the survey, 2.3% of parents had been diagnosed with COVID-19; 9% reported that their infants were admitted to the NICU, and 3.8% reported that their infants were born prematurely or before 37 weeks of gestation. Average ASQ-3 scores were highest in the fine motor skills domain (48.4), fol-

lowed by problem solving (48.0), personal social (44.0), gross motor (42.4), and communication skills (37.7) (Table 2). The communication domain score of this cohort was lower than the average, though it remains within the normal range. The gross motor domain had the highest rate of infant developmental delays (28.9%) based on the ASQ-3 standard cutoffs, and the problem-solving domain had the lowest rate of delays (8.6%). A multiple regression analysis revealed that maternal generalized anxiety symptoms were positively associated with infant communication ( $\beta = .35, p < .05$ ), while maternal-fetal bonding was positively associated with infant communication ( $\beta = .18, p < .05$ ) and personal-social performance ( $\beta = .20, p < .05$ ) (Table 3). COVID-19-related worry was negatively associated with infant communication ( $\beta = -.28, p < .05$ ) and fine motor performance ( $\beta = -.25, p < .05$ ).

**Table 1**

Table 1. Key participant characteristics from T1 and T2 of the PEACE Study.

	Means (Range) or %
<b>T1 Variables (Pregnancy)</b>	
Maternal age (years)	32.7 (22.0-42.0)
Pregnancy week	32.8 (21-40)
<b>Maternal race</b>	
White	94.7%
Hispanic or Latino	2.3%
Asian and Pacific Islander	1.5%
Other	1.5%
<b>Education</b>	
Less than college	2.3%
College	27.1%
Masters	41.4%
Doctorate	29.3%
<b>Income</b>	
<\$74,999	9.0%
\$75,000-149,999	37.6%
\$150,000-224,999	27.1%
>\$225,000	21.1%
Missing	5.3%
Pandemic duration (days)	106.0 (69-192)
<b>T2 Variables (Postpartum)</b>	
Infant sex (female)	48.1%
Premature <37 weeks	3.8%
NICU admission	9.0%
Maternal diagnosis of COVID-19	2.3%
N = 133	

**Table 2**

Table 2. Key predictors from T1 and infant neurodevelopmental outcomes (ASQ subscales at 8-10 months) at T2 of the PEACE Study.

	Means (Range, SD)	Below Cutoff (%)
<b>T1 Key Predictors (Pregnancy)</b>		
Depression (CES-D)	14.80 (0-42, 9.63)	
Generalized anxiety (GAD-7)	5.72 (0-21, 4.56)	
<b>COVID-19-related experiences</b>		
Grief	20.76 (10-31, 4.76)	
Worry	27.61 (13-52, 8.94)	
<b>Maternal-fetal bonding</b>		
Attachment (MAAS)	70.76 (55-88, 6.31)	
<b>T2 Neurodevelopmental Outcomes</b>		
Communication	37.71 (5-60, 12.84)	15 (11.7)
Gross Motor	42.41 (5-60, 15.96)	37 (28.9)
Fine Motor	48.42 (15-60, 12.16)	26 (20.3)
Problem Solving	48.01 (15-60, 10.71)	11 (8.6)
Personal Social	43.95 (10-60, 12.25)	16 (12.5)
	N = 133	N = 128*

\*Infants born preterm (<37 weeks) were dropped calculation of ASQ cutoff scores, scores were determined based on 8 and 10 month old norms.

**Table 3**

Table 3. Multiple regression predicting ASQ subscales at 8-10 months (T2) based on key characteristics (T1, T2) and prenatal experiences (T1).

Predictor	Communication		Gross Motor		Fine Motor		Problem Solving		Personal Social	
	B	$\beta$	B	$\beta$	B	$\beta$	B	$\beta$	B	$\beta$
Maternal age at T1	0.57*	0.15*	-0.25	-0.05	-0.25	-0.07	0.15	0.05	0.19	0.05
<b>Maternal education at T1</b>										
College	-6.77	-0.24	3.50	0.10	-10.68	-0.37	-11.33	-0.47	0.49	0.02
Masters	-7.06	-0.30	3.89	0.12	-1.84	-0.08	-7.29	-0.34	2.96	0.12
Doctorate	-10.39	-0.37	2.31	0.07	-5.57	-0.21	-9.71	-0.41	-3.76	-0.14
<b>Pregnancy weeks at T1</b>										
0-29	0.29	0.11	0.29	0.09	-0.17	-0.07	-0.18	-0.09	0.24	0.10
<b>Pandemic days at T1</b>										
0-91	0.01	0.02	0.04	0.00	-0.03	-0.07	0.06	0.16	0.07	0.16
<b>COVID-19 diagnosis at T2</b>										
NICU admission at T2	-3.65	-0.04	14.21	0.13	-5.61	-0.07	3.27	0.05	-4.01	-0.05
<b>Prenatal Experiences at T1</b>										
Depression	-3.24	-0.18	-0.28	-0.17	-0.14	-0.11	0.02	0.02	0.03	0.03
Anxiety	<b>0.39**</b>	<b>0.25*</b>	0.63	0.18	0.38	0.14	0.24	0.10	0.20	0.07
Maternal-fetal bonding	<b>0.37*</b>	<b>0.18*</b>	-0.24	-0.09	0.10	0.10	0.16	0.06	<b>0.40*</b>	<b>0.26*</b>
COVID-19-related grief	0.52	0.19	-0.10	-0.03	0.39	0.15	0.34	0.12	-0.17	-0.07
COVID-19-related worry	<b>-0.48*</b>	<b>-0.28*</b>	-0.02	-0.01	<b>-0.34*</b>	<b>-0.25*</b>	-0.22	-0.18	0.01	0.01
N = 133, *p<.05, **p<.01, ***p<.001										

**Conclusions:** The COVID-19 pandemic has affected the mental health and emotional experiences of pregnant women in unprecedented ways, and maternal mental health and emotional experiences may have in turn contributed to infant developmental outcomes. Our findings indicate that children born during the pandemic may experience vulnerabilities in early development, which may be helpful in informing pediatricians and pediatric providers when providing guidance to families with infants and young children born during the pandemic.

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**Problem statement:**

Despite millions of children being born since the start of the COVID-19 pandemic, little is understood about the impact of perinatal experiences on infant development during the pandemic. This study sought to determine whether mental health and emotional experiences during the prenatal period are linked to infant developmental outcomes as assessed by the Ages and Stages Questionnaire (ASQ-3). Our hypothesis was that greater severity of maternal depressive and anxiety symptoms, lower maternal-fetal bonding, and higher endorsement of COVID-19-related grief and worry would be associated with lower infant developmental performance was formed after data collection began.

**Learner objectives:**

- Identify effects of the COVID-19 pandemic on maternal

mental health and emotional experiences.

2. Describe the ways in which the maternal mental health and emotional experiences during pregnancy may impact infant developmental outcomes.

### Gravens 2023–28

**Abstract title:** Use of Kangarobe™—a Novel Garment to Facilitate Safe, Comfortable, and Efficient Kangaroo Care

**Authors:** Aviva Presser Aiden, Alexandra McMillin, Jules P Sherman, Ruth Ann Crystal, William D Rhine

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**Program/Methodology:** We designed a novel garment (Kangarobe™) to enable the safe and comfortable holding of infants with medical support devices and to facilitate the safe and efficient transfer of the infant from the bed to the caregiver and back.

The Kangarobe™ is a wrap garment with multiple snap-close loops to secure medical support devices the infant requires, as well as an easy-access window to perform evaluations of the infant during KC. We tested this garment with 30 infant-parent dyads in a level IV NICU. Parent and staff were surveyed to assess their perspectives on the use of the garment as compared to the standard approach in the unit (infant devices secured with tape, foam limb holders/straps, and clamps

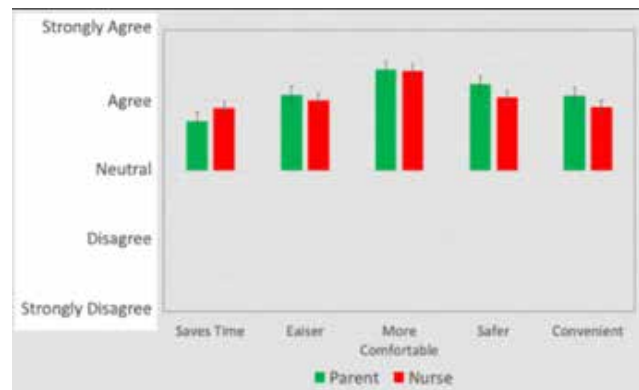
to parents' garments and chair).

### The Kanga-Robe



**Impact & results:** Transfer of infants to caregivers wearing Kangarobe™ was completed by either one or two medical providers. Transfer to caregiver took an average of 4.5 minutes and return of infant to bed took an average of 5.9 minutes. On 5 axes (time saving, ease of setup, comfort, safety, procedure access), both parents and nurses reported improvement using the Kangarobe™ as compared to the standard method in the unit.

**Figure: Parent and Nurse Satisfaction**



**Conclusions:** This study does have limitations. The average gestational age of our participants was 33w (25w–47w corrected gestational age), and the average weight was 2.2 kg (0.96–5.94 kg). The data on very small or extremely premature infants is limited. The most common respiratory support our participant infants required was continuous positive airway pressure (CPAP). We have more limited data on higher acuity support devices (e.g., endotracheal tubes and tracheostomy



tubes), whose stability is more critical to patient safety than lower acuity devices. We experienced no safety events while testing the Kangarobe™. However, given the relatively low rates of transfer- and KC-related safety events, a much larger study would be required to quantify the benefits of the Kangarobe™. Despite these limitations it appears that Kangarobe™ offers an improved KC experience for parents and nurses caring for infants in the NICU, with the potential for improving patient safety, family experience, and staff efficiency.

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2. "Challenges to skin-to-skin kangaroo care: cesarean delivery and critically ill NICU patients" *Neonatal Network* 31(4) p. 259-260 (2012)
3. "Reducing Pediatric Unplanned Extubation Across Multiple ICUs Using Quality Improvement." *Pediatrics* 149(5) p e2021052259 (2022)

#### Problem statement:

Parental holding and Kangaroo Care (KC) have been shown to have a significant positive effect on the short-term health and long-term neurodevelopmental well-being of infants hospitalized in neonatal intensive care units (NICUs). However, this needs to be done in a way that is safe, comfortable, and efficient.

#### Learner objectives:

1. Appreciation of the importance and challenge of safe Kangaroo Care
2. Benefits of using a garment designed for safe and efficient Kangaroo Care

#### Gravens 2023–29

**Abstract title:** Nurses' implementation of skin-to-skin contact in the NICU is related to their perceptions of family-centered care

**Authors:** Marilyn Aita, Gwenaëlle De Clifford-Faugère, Geneviève Laporte<sup>1</sup> Sébastien Colson, Nancy Feeley

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**Methodology:** Secondary analysis was conducted from a larger comparative international study where 202 nurses working in level III universities affiliated NICU. The FCC questionnaire

had included 20 items including 3 subscales (support, collaboration, and respect), where higher scores indicated more favorable perceptions of FCC<sup>1</sup>. The SSC questionnaire contained 20 items separated in four distinct subscales (knowledge, beliefs and attitudes, education, and training implementation)<sup>2,3</sup>. Higher scores were also indicative of favorable perception towards SSC.

**Findings:** Nurses' FCC total score was significantly correlated with all SSC subscales scores, ranging from weak (0.17) to moderate (0.31) correlations. The highest correlations were found between the nurses' perceptions of their NICU providing support to families and SSC available training and education (0.29) as well as SSC implementation on their unit (0.31). In addition, a similar association (0.30) was found between the implementation of SSC and the total score of their perceptions of care being family-centered in their NICU.

**Conclusion:** These results suggest that the nurses' perceptions of their care being family-centered are higher with greater SCC training and education and implementation of SSC in the NICU. These results shed a light on the association of these practices and might highlight a theoretical and practical perspective to better understand developmental care as an integrated concept. Thus, considering these findings, it seems possible that encouraging the practice of SSC among nurses, through the adoption of practice guidelines, training and education, and adequate implementation on the unit, would lead to a better perception of FCC, which translates into positive outcomes for preterm infants and their parents.

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#### Problem statement:

Driven by the philosophy of developmental care [DC], nurses should provide opportunities for collaboration and involvement for parents in the NICU to equally encourage both family-centered care [FCC] and skin-to-skin contact [SSC]. As optimal implementation of FCC and SSC may depend on the nurses' perceptions of these DC practices, it appeared relevant to explore the association between NICU nurses' perceptions about their unit providing FCC and SSC.

#### Learner objectives:

1. Comprehend how SCC and FCC as DC practices are related.
2. Recognize that the adoption of SCC practice guidelines, training and education, and adequate implementation in the NICU lead to better perceptions of FCC by nurses.

### Gravens 2023–30

**Abstract title:** Systematic review of neurodevelopmental outcomes of preterm infants who have experienced pain

**Authors:** Gwenaëlle De Clifford-Faugère, RN, Ph.D, Geneviève Laporte, RN, Ph.D candidate, Andréane Lavallée, RN, Ph.D, Émilie Rioux, RN, M.Sc, Marilyn Aita, RN, Ph.D

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**Introduction.** In the neonatal unit, preterm infants undergo many painful procedures (1). Preterm infants, who have immature nervous systems, show consequences of these repeated painful procedures in their neurodevelopment (2). The aim of this systematic review is to assess the association of painful procedures performed on preterm infants while hospitalized in the neonatal intensive care unit and short-, mid-, and long-term neurodevelopmental outcomes.

**Methods.** This systematic review was conducted in accordance with JBI methodology for systematic reviews of etiology and risk (3) and the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (4, 5). For this systematic review, an electronic search was conducted from inception to August 2022 in CINAHL, PubMed, MEDLINE, Embase and Cochrane Central Register of controlled trials. Inclusion criteria: participants were preterm infants (less than 37 of gestational age) who underwent painful procedure, with or without skin breaking. The primary outcome was neurodevelopment assessed by various indicators such as brain structure, brain electrical activity, neurological examinations, and developmental examinations

(motor, cognitive, sensorial, or emotional outcomes). Study selection, data extraction and critical appraisal was conducted by two independent reviewers. This review has been registered in PROSPERO (CRD42020189762).

**Results.** Of the 12,601 studies screened, 23 prospective and retrospective study designs were included in the review. The impact of pain on neurodevelopment was assessed in the short term (so before the age of the term corrected [n = 7]), in the middle term (so between the corrected age of the term and 3 years [n = 8]) and in the long term (after 3 years [n = 8]). These studies have found important consequences: hypersensitivity to pain present from a few weeks of life and always present at 7 years; an increase in the level of basic stress, reflecting an alteration of the HPA axis persisting up to 7 years; as well as a decrease in volume and brain activity, having an impact on motor, intellectual, and sensory developments in the short, middle, and long term.

**Conclusion.** Given these results, professionals are encouraged to relieve pain at every painful procedure and diminish their numbers. Higher quality studies are needed on all short, middle, and long-term neurodevelopment variables.

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#### Problem statement

What is the association between painful procedures performed on preterm infants while hospitalized in the neonatal intensive care unit and short-, mid-, and long-term neurodevelopmental outcomes?

#### Learner objectives:

1. learn about the different consequences of neonatal pain on neurodevelopment





2. be sensitive to the importance of pain management in preterm infants

### Gravens 2023–31

**Abstract title:** NICU Discharge Guideline Implementation by a Community Based Team: A Real-World Scenario

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**Workshop description:**

1. Brief formal presentation of the guidelines the pilot targeted for implementation
  - a. Familiarize participants with the content being discussed
  - b. Explanation of why the specific guidelines were chosen
2. Description of the implementation plan
  - a. Unit description including description of the broader community context
  - b. Team identification and methodology of identification
  - c. Outcomes assessed and associated metrics
  - d. Identification of resources required for implementation
  - e. Anticipated barriers and barriers encountered during implementation
3. Crowd source/think tank discussion
  - a. Interactive exploration of other considerations
    - i. What other outcomes could have been included or explored?
    - ii. What process and/or clinical gaps exist?
      - iii. Are there any other team members to include? How might the implementation methods and outcomes have differed if these persons were included or broadly represented?
  - b. Small group breakout activity
    - i. Skilled facilitation will be provided to support participant discussion.
    - ii. Participants will have the opportunity to share their

own experiences and how they might benefit from guideline implementation.

c. Sharing of resources

- i. Participants will receive open access resources provided by the NPA and Feeding Matters.
- ii. Participants will have the opportunity to share additional resources and discuss utilization of related materials.

**Problem statement:**

The National Perinatal Association (NPA) has published Interdisciplinary Guidelines and Recommendations for NICU Discharge Preparation and Transition Planning. This robust resource provides insight into what to do for NICU discharge preparation but no detail on how to implement the guidelines.

As a next step in furthering evidenced-based care, the NPA has partnered with an international non-profit, Feeding Matters, and a community Level III NICU to pilot implementation of select guidelines. This pilot's aim is to identify factors for success and to outline process barriers and pave the way for guideline implementation in other units.

This interactive workshop, facilitated by a multi-disciplinary team from the piloting NICU, will utilize didactic lecture, visual aids, open discussion, breakout sessions, and resource sharing to support participants as they are identifying pathways for guideline integration in their units and/or communities.

**Learner objectives:**

1. Attendees will be able to list 3 key steps to successful implementation of the Interdisciplinary Guidelines and Recommendations for NICU Discharge Preparation and Transition Planning.
2. Attendees will be able to identify barriers and follow a problem-solving process to support measurable change in their unique health-care systems.
3. Attendees will be able to access 2 resources designed to identify family needs for a safe transition from NICU to home.



feeding matters

# WHEN TO REFER INFANT SIGNS & SYMPTOMS OF PFD

Pediatric Feeding Disorder (PFD) is impaired oral intake that is not age-appropriate and is associated with medical, nutritional, feeding skill, and/or psychosocial dysfunction.

Geddy PS, Huh SY, Silverman A, et al. Pediatric Feeding Disorder: Consensus Definition and Conceptual Framework. *J Pediatr Gastroenterol Nutr.* 2019;68(9):124-129. doi:10.1097/MPG.0000000000002188.

## Infant and Child Feeding Questionnaire® (ICFQ) Screening Tool

### 6-QUESTION SUBSET

Does your baby/child let you know when he is hungry?	YES	NO	
Do you think your baby/child eats enough?	YES	NO	
How many minutes does it usually take to feed your baby/child?	<5	5-30	>30
Do you have to do anything special to help your baby/child eat?	YES	NO	
Does your baby/child let you know when he is full?	YES	NO	
Based on the questions above, do you have concerns about your baby/child's feeding?	YES	NO	

Red flag answers are in orange. If 2 or more of your answers are orange please contact your pediatrician.

Silverman AH, Kristoffer BE, Linn C, et al. Psychometric Properties of the Infant and Child Feeding Questionnaire. *Journal of Pediatrics.* 2020 August 2;233:91-96.e2. DOI: 10.1016/j.peds.2020.04.040

## PFD ICD CODES

Published in 2022 ICD-10-CM

R63.31 Pediatric feeding disorder, acute  
( $\leq 3$  months)

R63.32 Pediatric feeding disorder, chronic  
( $>$  than 3 months)

## INFANT SIGNS & SYMPTOMS OF PFD

### Medical

- labored breathing with and without feeding
- color changes in lips or face when eating or drinking
- sweating when eating or drinking
- gurgle or squeaking sounds with and without feeding
- reoccurring upper respiratory infections
- crying, arching, coughing, grimacing when eating or drinking
- suspected food allergies
- multiple formula changes
- vomiting
- never seems hungry
- physical discomfort when eating or drinking

### Nutrition

- unable to eat or drink enough to grow or stay hydrated
- insufficient or too rapid of a change in weight or height
- lack of a certain nutrient, i.e., iron, calcium
- need for nutritional supplements
- reliance on a particular food for nutrition
- need for enteral feeds for nutrition-NG, GT, TPN
- constipation
- limited dietary diversity for age
  - too few fruits and/or vegetables
  - limited or no protein source
  - too few foods eaten on a regular basis

### Feeding Skill (12 months or less of age)

- labored, noisy breathing or gasping
- coughing, choking, gagging or retching
- gurgles or wet breaths
- loud and/or hard swallows or gulping
- unable to eat or drink enough for optimal growth
- excessively short mealtimes ( $<$  5 minutes)
- excessively long mealtimes ( $>$  30 minutes)
- need for thickened liquids
- need for special food or modified food texture
- need for special strategies, positioning or equipment
- unable to latch to breast or bottle without help
- weak suck
- need for pacing, flow management or rest breaks
- need for special equipment to breast or bottle feed
- often too tired to eat or quickly falls asleep when eating
- breast or bottle feeds best when asleep, i.e., dream feeds
- unable to transition to solids
- unable to wean from breast or bottle

### Psychosocial

- unable to come to or stay with the family at meals
- refusal to eat what is offered or to eat at all
- disruptive mealtime behaviors
- unable to eat with others present at mealtimes
- child stress, worry or fear during meals
- caregiver stress, worry or fear when feeding child
- presence of bribes, threats, yelling at mealtimes
- need for distraction and/or rewards for eating
- unpleasant mealtime interactions between caregiver and child

### Are signs of PFD present?

If yes, refer early and often for early identification of PFD.

Recommended Referrals:

Medical  Nutrition  Feeding skill  Psychosocial

Readers can also follow

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### Gravens 2023-32

**Abstract title:** Effectiveness of Hammock Positioning on Physiological Parameters and Sleep of Preterm Infants in NICU: A Systematic Review Protocol

**Authors:** Adèle Saives, Marjolaine Héon, Marilyn Aita

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5146323189

The care offered to premature infants in the neonatal unit attempts to reproduce sensory stimulation similar to that of the intrauterine environment (1,2). This seeks to optimize the

neural development of preterm infants, and to minimize the impact of short- and long-term prematurity (1,2). Positioning in a hammock in an incubator would be an innovative intervention that could allow stimulation of the vestibular system similar to that of the uterine environment (3,4). This could promote a more neurotypical development in premature infants.

1. A systematic review will be conducted to evaluate the effectiveness of hammock positioning on preterm infants on the stability of physiological parameters of preterm infants and their sleep compared to standard dorsal positioning, standard prone positioning, and standard lateral positioning.

2. To conduct the review, the PRISMA recommendations (5) will be followed. CINAHL, PubMed, Medline, Joanna Briggs Institute, Cochrane, Web of Science, Embase, ScienceDirect, Cairn and LiSSa databases will be explored with the following keywords: neonatology, prematurity, premature babies, neonatal unit, hammock, positioning, sleep, and physiological parameters without any year of publication restrictions.

3. The Covidence © Software will make it possible to select and extract the articles that met the selected inclusion criteria. Two independent reviewers will examine the titles and abstracts, then, in a second step, the full texts in order to select all relevant articles. Any conflicts will be resolved by a third reviewer. The number of articles examined and selected, as well as the reasons for the exclusion, will be reported exhaustively.

4. An extraction grid will be developed based on the requirements of the Cochrane Institute, and the extraction will be carried out by two independent experts. Piloting will take place for five studies. The following data will be extracted: authors, year and country of publication, participants' characteristics, description of the experimental and control groups, including type and modalities (i.e., duration, frequency...) of the intervention, measurement times, outcomes, results. If appropriate, the extracted data will be entered into the Review Manager © software, and, in order to avoid quantitative errors during analysis, two reviewers will review the data before analysis.

5. The preliminary literature search resulted in the selection of 1578 articles to be further analyzed.

6. Study data will be synthesized quantitatively with a meta-analysis if at least two studies with comparable variables are available, using Review Manager © software. In case of missing data, the authors will be contacted. Due to the nature of the variables, the results will be analyzed using means and standard deviations, with a significance level of 0.05. Heterogeneity will be calculated statistically using the  $I^2$  test, where a result of 0 to 40% does not represent significant heterogeneity, 30 to 60%, moderate heterogeneity and 50 to 90%, significant heterogeneity (6), where unity of analysis is the hospitalized preterm infant. The results will also be reported qualitatively for any variable that is not quantitatively analyzable for each study.

7. The primary outcomes will be physiological param-

eters of infants. These parameters include heart rate, respiratory rate, and transcutaneous oxygen saturation. Normal values for these parameters are 100 to 200 bpm for heart rate, 30 to 60 rpm for respiratory rate, and greater than 95% for transcutaneous oxygen saturation. The secondary outcomes will be sleep; any type of sleep measurement will be considered as well as sleep duration and quality. Any type of scale quantifying sleep will be considered, including the Brazelton scale and the APiB scale.

**Impact and Results:** This systematic review has the potential to contribute to the development of knowledge about the effectiveness of hammock positioning on the physiological parameters of preterm infants and their sleep.

**Conclusion:** The conduct of this systematic review will help to have a better understanding of the effects of hammock positioning on preterm infants and will guide the development of future nursing intervention.

#### References:

1. Lavallée, A., De Clifford-Faugère, G., Garcia, C., Fernandez Oviedo, A. N., Héon, M. et Aita, M. (2019, 2019/02/01/). Part 1: Narrative overview of developmental care interventions for the preterm newborn. *Journal of Neonatal Nursing*, 25(1), 3-8. <https://doi.org/https://doi.org/10.1016/j.jnn.2018.08.008>
2. Lavallée, A., De Clifford-Faugère, G., Garcia, C., Fernandez Oviedo, A. N., Héon, M. et Aita, M. (2019, 2019/08/01/). Part 2: Practice and research recommendations for quality developmental care in the NICU. *Journal of Neonatal Nursing*, 25(4), 160-165. <https://doi.org/https://doi.org/10.1016/j.jnn.2019.03.0081>.
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4. Zimmerman, E. et Barlow, S. M. (2012). The effects of vestibular stimulation rate and magnitude of acceleration on central pattern generation for chest wall kinematics in preterm infants. *Journal of Perinatology*, 32(8), 614-620. <https://doi.org/10.1038/jp.2011.177>
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6. Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P. et Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ : British Medical Journal*, 349, g7647. <https://doi.org/10.1136/bmj.g7647>

### Problem statement:

1. Preterm infants hospitalized at the NICU are often deprived of vestibular stimulation, normally present during pregnancy during mothers' movements, which is essential for infants' brain development. We hypothesize that infants' positioning in a hammock in the incubator could help recreate a vestibular stimulation, contributing to their physiological parameters' stability and their sleep. Existing systematic reviews have methodological shortcomings and did not compare hammock positioning to specific positioning in the incubator (i.e., dorsal, prone, and lateral positioning).
2. Therefore, this systematic review aims to answer the following question: For preterm infants less than 37 weeks gestational age (P), does hammock positioning (I), compared to standard dorsal, ventral or lateral positioning (C), improve the stability of their physiological parameters (primary objective) and sleep (secondary objective)?

### Learner objectives:

1. Primary objective: The learners will be able to appreciate the existing literature the hammock positioning of preterm infants.
2. Secondary objectives: The learners will be able to appreciate the existing literature on the effectiveness of hammock positioning compared to standard positioning (dorsal, lateral, or prone) on the stability of physiological parameters and sleep of preterm infants.

### Gravens 2023–33

**Abstract title:** The Power of Reflection: Becoming a Trauma Informed Professional

**Author:** Mary Coughlin

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Caring Essentials

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**Background:** Awareness of the experience of trauma in the NICU for babies, families and clinicians is a first step to transform and humanize this fragile, yet critical care environment. Developmental care has existed for centuries; dating back to Florence Nightingale, expanded upon by Drs. Brazelton and Als and becomes even more biologically relevant within the context of early life adversity, toxic stress, and infant medical trauma. The babies, families, and clinicians are each greater than the sum of their parts. The healthcare system and pediatric service lines can no longer ignore the multidimen-

sional needs of clinicians, patients, and their families. Trauma informed developmental care is the overarching foundation encompassing all aspects of wholeness for baby, family, and professional.

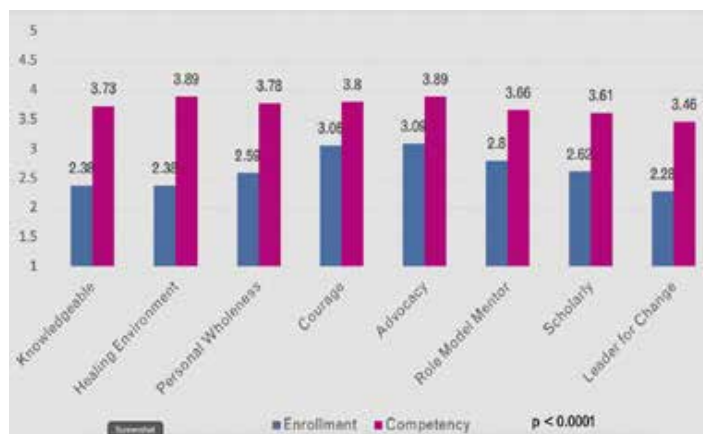
**Program/Methodology:** The study cohort comprised the first 100 graduates with complete transcript records from the Trauma Informed Professional Certificate Program. A quantitative evaluation of their pre- and post-self-assessment ratings across each of the 8 attributes of a Trauma Informed Professional was collated and analyzed for statistical significance using the paired t test. Additionally, qualitative reflections of how each attribute was perceived by the learner was evaluated through thematic analysis.

**Main Outcome Measures:** P value of the quantitative data and the identification of common themes that emerged through the thematic analysis

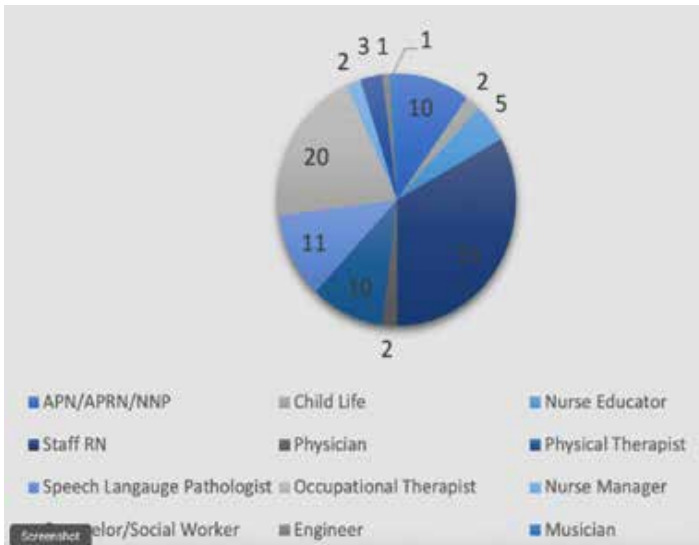
**Impact/Results:** The quantitative data demonstrated statistical significance with a  $p$  value  $< 0.0001$ . The qualitative data revealed that the graduates experienced a deeper understanding and insight into each of the eight attributes of a Trauma Informed Professional.

**Conclusions:** Graduates of the Trauma Informed Professional Certificate Program experience growth and transformation, both quantitatively and qualitatively. A next step is to evaluate how this growth and transformation translates into clinical practice.

### Trauma Informed Professional Attributes Before and After Certificate Program



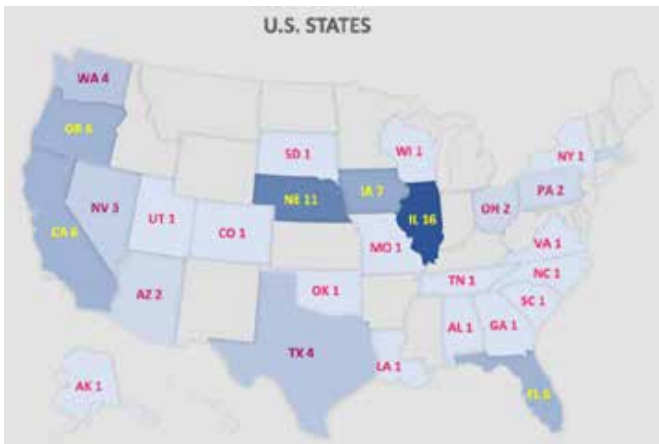
### Discipline Demographics



### Country Demographics



### US State Demographics



### References:

1. Coughlin, M. (2021). *Transformative Nursing in the NICU: Trauma-informed Age-appropriate Care Second Ed.* New York, NY: Springer Publishing Company.
2. Duffee, J., Szilagyi, M., Forkey, H., Kelly, E.T., Council on Community Pediatrics, Council on Foster Care, Adoption, and Kinship Care, Council on Child Abuse and Neglect, Committee on Psychosocial Aspects of Child and Family Health. (2021). Trauma-Informed Care in Child Health Systems. *Pediatrics*, 148(2), e2021052579. <https://doi.org/10.1542/peds.2021-052579>.
3. Forkey, H., Szilagyi, M., Kelly, E.T., & Duffee, J. (2021). Trauma-informed care. *Pediatrics*, 148(2), e2021052580; DOI: <https://doi.org/10.1542/peds.2021-052580>.
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### Problem statement:

Trauma-informed care is an effective, compassionate, and evidence-based strategy that protects and preserves the mental health and moral integrity of clinicians, subsequently improving safety and quality of care, communication, and collaboration in the NICU and beyond. Evaluating the Trauma Informed Professional Certificate Program provides insight into the growth that enables professionals to move past a procedure-driven mindset and recognize the pivotal nature of the lived human experience associated with critical care for the infant, the family, and the clinician.

### Learner objectives:

1. Participants will understand the power of reflection and reflective practice
2. Participants will discover the 8 attributes of a Trauma Informed Professional
3. Participants will describe 2 themes that emerged from the analysis

### Gravens 2023–34

**Abstract title:** Full-Spectrum Circadian Lighting in a Level IV NICU

**Authors:** James Greenberg, Daniel Kang, Richard Lang

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## Program and Methodology:

A collaboration among developmental neurobiologists, clinicians, designers, and engineers led to creation of a unique NICU lighting system that emulates the spectral distribution of natural daylight in the Critical Care building's NICU. The concept and development of this lighting system was driven by new knowledge generated by us and others documenting the significant relationship between full spectrum light, health, and wellness. Standard lighting devices do not deliver full spectrum of light, in particular, much of the blue and all violet wavelengths within the visible daylight spectrum. We now know that these blue and violet wavelengths activate non-visual opsins that are integral to key neurodevelopmental and physiologic processes, including metabolic homeostasis and thermogenesis.

Our NICU system incorporates 6 tunable LED channels to provide full-spectrum coverage. This allows for the circadian stimulation of biologically relevant opsins.

The importance of cycled lighting in the NICU is well-established. Previous studies have associations between cycled lighting exposure and:

1. Improved weight gain, shorter length of stay, improved oxygen saturation, and more developed melatonin rhythm (Vásquez-Ruiz et al, 2014).
2. Trends toward lower incidence of ROP and improved growth (Morag et al, 2013).
3. Reduced crying and fussing (Guyer et al, 2012).

However, these studies did not evaluate spectral exposure and used arbitrary light/dark programs. Our system offers the opportunity to evaluate and optimize appropriate light exposure in the NICU.

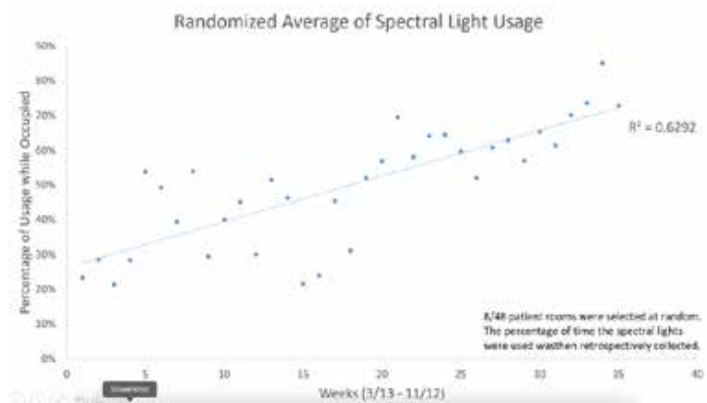
**Impact and Results:** Two challenges facing the implementation and usage of the CCHMC spectral lighting system are (1) lack of familiarity among patient families and (2) established NICU practices among the care staff. To explore the issue of low acceptance, we evaluated the following interventions:

1. Establishment of a clinical education team to share operational advice and explain the supporting science.
2. Surveys to gain feedback regarding nursing knowledge and opportunities for system improvement.

This supported subsequent modification of user interface design and interaction to optimize appropriate use.

We collected real time usage data to evaluate these approaches as shown in the Figure.

## Figure



**Conclusion:** Full spectrum cycled lighting represents a significant advance for the NICU environment of care. Its channel-specific tuning capability provides a unique platform to improve key outcomes for the NICU patient population. The use of unit-based education and modification of the user interface to incorporate an opt-out design led to significant improvement in provider and parent usage and acceptance.

## Problem statement:

The CCHMC Critical Care building NICU includes a novel full-spectrum circadian lighting system that emulates the spectral distribution of natural daylight. This system provides the opportunity to consider alternative NICU lighting standards: (1) conventional LED and (2) full spectrum circadian lighting. Despite strong biological plausibility, adoption of full spectrum circadian lighting varies among patient care staff, parents, and patients.

## Gravens 2023–35

**Abstract title:** Perinatal Characteristics and Neurodevelopmental Outcomes in a Medical Home for NICU graduates & nbps

**Authors:** Leslie Rajendran, Anna Cruz, Folasade Kehinde, Bridgid Garvin, Binta Diallo, Roschanak Mossabeb, Renee Turchi

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**Background:** Every year close to 15% of children in the United States are affected by neurodevelopmental and other related disorders (e.g., ADHD, autism spectrum disorder, intellectual disability). Although many individuals with neurodevelopmental disorders do not face significant impairment, those who do can experience challenges with employment and independent living in adulthood. These disorders are more prevalent in vulnerable populations, such as children with complicated and/or prolonged NICU stays. Preterm infants who spent time

in the NICU are at higher risk for developmental delay, motor and sensory abnormalities, learning, and behavioral problems. There are discrepancies in identification of neurodevelopmental disorders across various cultural and ethnic groups. Black and Latinx children are consistently under-identified, and this is magnified when barriers such as poverty and non-English as the primary language are considered.

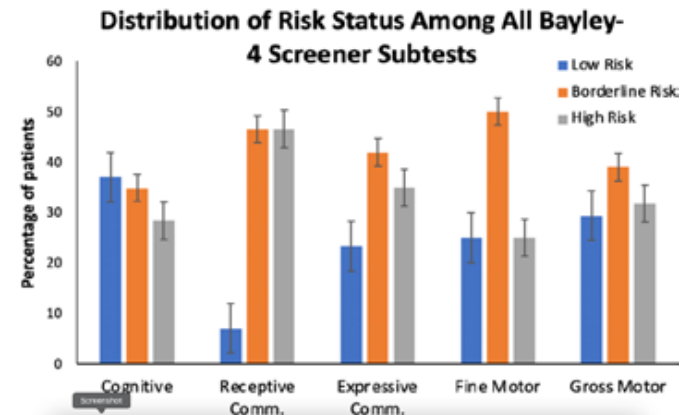
**Program and Methodology:** Patients were recruited from The Center for Children and Youth with Special Health Care Needs (CYSHCN) Next Steps Program at St Christopher’s Hospital for Children. Next Steps is a follow-up program for NICU graduates that are deemed high-risk. Located in North Philadelphia, 82% of patients presenting to St. Christopher’s Hospital for Children are covered by Medicaid. Many of the families have limited financial and community resources, with one-third of the families having limited English proficiency and primarily speaking Spanish.

Developmental screenings were administered to qualifying children (9 to 36 months) presenting to the CYSHCN for their well visits. Cognitive, communicative, social-emotional, and motor development were assessed using the Bayley Scales of Infant and Toddler Development, 4th Edition Screening Test (Bayley-IV). Screening was administered by trained professionals through clinician observation, caregiver interview, and various structured performance tasks presented to the child. No correction for prematurity was made so that all infants were compared to those at the same level, regardless of gestational age. Data collection is ongoing, but presently developmental screening has been administered to 47 patients. The main outcome measurements included sub-scores on the Bayley-IV in six different categories (Cognitive, Receptive Communication, Expressive Communication, Social-Emotional, Fine Motor, and Gross Motor).

**Impact and results:** To streamline the developmental assessment screening process, a record review and survey on various demographic and social factors was administered to parents/caregivers at the start of each visit. Data from this survey revealed an average gestational age of 31.7 weeks and average birth weight of 1.73 kg. Many infants also had prolonged NICU stays (Mean[M]=72.3 days) with many medical interventions (59.2% received oxygen, 42.9% had a feeding tube, 55.1% had respiratory distress syndrome, and 55.1% were intubated). 51% of the patient population also identifies as Hispanic and/or Latino. Patients came from a variety of family units—with caregivers such as biological parents, foster parents, aunts, uncles, and grandparents.

Preliminary data suggests greater than 75% of infants were borderline or high-risk for cognitive, expressive, and receptive communication, and fine and gross motor delay in their NICU follow-up assessments. Various analyses were conducted on medical interventions performed on the infants. Increased length of NICU stay is significantly associated with increased risk for cognitive ( $r = .361^*$ ,  $n = 44$ ), expressive communication ( $r = .310^*$ ,  $n = 44$ ), fine motor ( $r = .640^{**}$ ,  $n = 39$ ), and gross motor delay ( $r = .590^{**}$ ,  $n = 40$ ),  $p < .01$ . Patients who received supplemental oxygen during their NICU stay are also

significantly more at risk ( $M=1.14$ ,  $SD=.89$ ) for gross motor delay than infants who did not receive supplementary oxygen ( $M=.769$ ,  $SD=.43$ );  $t(39)=-1.43$ ,  $*p<.05$ ,  $**p<.01$ . No significant relationship between other medical interventions, such as intubation or apnea monitors and developmental delay was found. No racial or ethnic differences were found.



**Conclusions:** In our patient population, prolonged NICU stay ( $M = 72.3$  days) is associated with increased risk for developmental delay, as evidenced by scoring as borderline or high risk on the Bayley-IV screener. However, no effect on receptive communication was found. We postulate this may be due to the stimulation and exposure to social interaction provided to these infants by the NICU care team. Preliminary analyses in the study reveal that supplemental oxygen is associated with gross motor development. This finding may be attributed to prematurity itself, given that motor delay is well established in preterm infants. Further, supplemental oxygen tends to be associated with more severe disease in preterm infants presenting to the NICU. Data collection is ongoing. Results from this study will enable us to screen for early indicators of neurodevelopmental disorders during and post NICU stay, better understand the relationship between perinatal and sociodemographic factors and developmental outcomes, and more efficiently connect patients and their families to early intervention services and resources.

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4. Lin, S. C., Yu, S. M., & Harwood, R. L. (2012). Autism spectrum disorders and developmental disabilities in children from immigrant families in the United States. *Pediatrics*, 130 Suppl 2, S191–S197. <https://doi.org/10.1542/peds.2012-0900R>

**Problem statement:**

Many children in the United States are affected by neurodevelopmental and other related disorders, with these disorders being significantly more prevalent in vulnerable populations, such as children with prolonged and/or complicated NICU stays. The present study aims to improve identification of neurodevelopmental disorders in infants and young children with prolonged NICU stays and enhance early detection and intervention by implementing consistent developmental screening.

**Learner objectives:**

The purpose of this study includes:

1. To identify young children developing neurodevelopmental disorders accurately and early, while enhancing their medical home experience.
2. Explore validated developmental screening and assessment tools' role in identifying deficits or delays in high-risk NICU populations and monitoring developmental progress.
3. Describe sociodemographic and perinatal characteristics and assessment data associations with higher risk for neurodevelopmental disorders in young children.

**Gravens 2023–36**

**Abstract title:** Serial Brain Imaging and Targeted Neuropromotive Intervention for Very Preterm Infants in the NICU - Study Protocol and Preliminary Outcomes

**Authors:** Danielle Sharon, BS, Sriya Roychaudhuri, MD, Elizabeth Singh, CPNP, RN<sup>1</sup> Tina Steele, RN, Yvonne Sheldon, RN, BSN, MS, Deborah Cuddy, RN, Patricia Flynn, PT, CNT, Jessica Pacheco, MOT, OTR/L, CNT, Katherine Gibson, MS, CCC-SLP, BCS-S, Elizabeth Kling, MS, CCC-SLP, Mohamed El-Dib, MD, Roberta Pineda, PhD, OTR/L, CNT, Terrie Inder, MBChB, MD, Carmina Erdei, MD

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**Background and Methodology:** Babies born preterm undergo

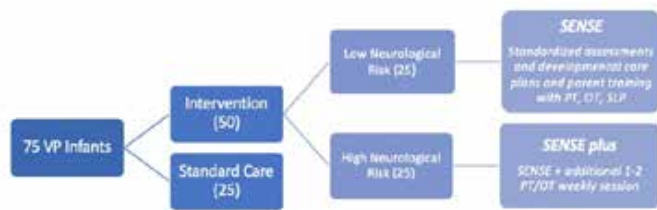
Table 1: OpenNotes survey results 3/16/2022 to 11/16/2022

Question	Number of responses (%)	
How often have you read the doctors' daily progress notes during your child's hospitalization?	Every day 28 (58%)	
	A few days a week 7 (14%)	
	Once a week 1 (2%)	
	Less than once a week 1 (2%)	
I don't know I could or I have never read 6 (12%)		
In addition to notes from your child's doctors, there are also notes from nurses and other health team members. Was it clear to you that these notes were from different team members?	Very clear 23 (47%)	
	Somewhat clear 6 (12%)	
	Somewhat unclear 4 (8%)	
	Very unclear 1 (2%)	
I don't know 1 (2%)		
What are/were your reasons for reading the doctor's daily progress notes from your child's hospitalization? (select all that apply)	To know about my child's health 28 (58%)	
	To be sure I understood what the doctor said 18 (37%)	
	I was curious 16 (33%)	
	To remember the plan of care 15 (31%)	
	To know what the doctor was thinking 11 (23%)	
	I have a right to see my child's record 9 (18%)	
	To check that the notes were right 2 (4%)	
No particular reason 1 (2%)		
How often were the doctors' daily progress notes accurate?	Always 25 (52%)	
	Usually 1 (2%)	
	Sometimes 3 (6%)	
	Rarely 1 (2%)	
Do not know 1 (2%)		
How easy was it to understand the doctors' daily progress notes?	Very easy 17 (35%)	
	Somewhat easy 8 (16%)	
	Somewhat difficult 2 (4%)	
	Very difficult 1 (2%)	
	Do not know 1 (2%)	
Did reading the notes change the way you felt about your child's doctor(s)?	I felt much better about the doctor(s) 20 (41%)	
	I felt somewhat better about the doctor(s) 2 (4%)	
	I did not feel better or worse about the doctor(s) 6 (12%)	
	I felt somewhat worse about the doctor(s) 1 (2%)	
	I felt much worse about the doctor(s) 1 (2%)	
Did you ever contact the doctor about something you read in the doctors' daily progress notes?	Yes 15 (31%)	
	No 12 (25%)	
	Considered but did not 1 (2%)	
	Do not know/Do not remember 1 (2%)	
How old is your NICU baby on the day you are filling out the survey?	Less than 7 days old 11 (23%)	
	7-30 days old 12 (25%)	
	31-60 days old 5 (10%)	
	Greater than 60 days old 3 (6%)	

rapid brain growth and development prior to term age while hospitalized in the NICU<sup>1</sup>, a critical window for intervention. Early neuropromotive intervention is essential and should be initiated as soon as possible after birth for very preterm (VP) infants in the NICU. This study aims to enhance our understanding of early brain development in VP infants in relationship to intensive neurodevelopmental care. The Supporting and Enhancing NICU Sensory Experiences (SENSE) program is a sensory-based intervention that emphasizes meaningful multisensory exposures<sup>2,3</sup> to improve infant and family outcomes<sup>4</sup>. We plan to enroll 75 VP infants, born before 33 weeks gestation, in a level-III NICU prospectively over two years. The infants will be divided into three groups (see Figure 1). Infants are assigned to a group (low-risk or high-risk) depending on whether significant neurological injury is present on early imaging (high risk defined as IVH with any ventricular dilatation, white matter injury, cerebellar hemorrhage). Implementation of the SENSE program is preferentially done by NICU families with coaching from developmental therapists and NICU staff<sup>4</sup>. Serial MRIs are performed over at least three time points until term equivalent age (TEA). Infants who met inclusion criteria but were either unable to enroll or declined enrollment were offered enrollment in the standard care group. Enrolled babies undergo standard neurodevelopmental assessments during their NICU stay and at outpatient clinical follow-ups until two years of age.

**Figure 1: Diagram of enrollment set-up for study**





**Results:** To date, 35 infants have been enrolled: 14 intervention (8 low-risk and 6 high-risk) and 21 standard care (15 low-risk and 6 high-risk). 97 MRI scans have been performed with 30 at TEA. 12 babies (86%) in the intervention group received all interventions with delivery of 75% or more of the targeted multisensory experiences. 27 infants (11 intervention and 16 standard care) had a TIMP<sup>5</sup> assessment prior to NICU discharge. To date, a total of 5 (100%) babies in the intervention group and 13 (72%) babies in the standard care group have returned to the developmental follow-up clinic at 4 months corrected age and had a TIMP completed (results in Table 1). Early data show that many infants at TEA in standard care are below average while at 4 months this is less prominent. To date, too few subjects have had outcomes in the intervention group to assess impact, although many still display below average performance despite interventions.

**Table 1: Results from the TIMP at TEA and at a 4-month follow-up visit**

		Low-risk (Intervention)	High-risk (Intervention)	Low-risk (Standard care)	High-risk (Standard care)
TIMP at TEA	Below Avg. n (%)	-	1 (20)	-	-
	Average n (%)	6 (100)	4 (80)	10 (100)	6 (100)
TIMP at 4 mo.	Below Avg. n (%)	-	-	1 (11)	-
	Average n (%)	3 (100)	2 (100)	8 (89)	4 (100)

**Conclusion:** Serial imaging provides valuable insight into the pattern of brain growth and neurodevelopment in VP infants. The impact of implementing targeted interventions in the NICU setting on improving the outcomes in VP infants with and without neurological injury continues to be investigated.

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## [tools/sense/content](#)

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## Problem statement

In this research, we are looking at whether implementing targeted early neuropromotive interventions in the NICU will improve neurodevelopment of very preterm infants.

## Learner objectives:

We aim to further develop our understanding of brain growth in very preterm infants. Additionally, we hope to investigate the outcomes of implementing targeted, age-appropriate interventions in very preterm infants with and without neurological injury.

## Gravens 2023–37

**Abstract title:** Future Intersection of NICU and Fetal Center Professionals and Facilities

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With the huge advances in care for the fetus and the increase in the number of fetal programs around the world, this information aims to educate participants on the needs of the fetal programs, open the dialogue between professionals, and invoke thought as to the impact of these programs on fetal, neonatal, obstetric and children’s hospital facilities.

The focus will be to identify the work based on experience and evidence-based design that has taken place to date. The authors and extended committee used a process similar to a different consensus committee’s approach to develop and update *Recommended Standards for NICU Design*.

The proposed recommended fetal center guidelines aim to address flexibility for future advances in fetal care that are likely to impact fetal centers and NICU facilities. Involvement

of neonatologists, NICU nurses and therapists, NICU families, healthcare designers and others can substantially inform and vet the first proposed facility guidelines related to this field and its evolving future. Examples of key drivers that are important to consider when planning or expanding a fetal center facility will be presented along with rationales (e.g., future advances on the horizon, increased collaboration, functions/volumes that need to be accommodated, ethics, locations such as adult patients in a children's hospital, funding, governance model). The presenters will include discussion of why neonatal professionals, families and others should be informed and contribute to the ongoing development of fetal center design guidelines.

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#### Problem statement:

Fetal Centers are on the rise throughout the world. The Fetal Therapy Think Tank (FTTT) is a voluntary group of physicians, nurses, planners, manufacturers, architects, family advocates and others collaborating to advance fetal medicine. A subgroup of the FTTT has taken on the process of developing recommended design guidelines for fetal centers. The intent of this presentation is to introduce the process, the results, and encourage future wider engagement in developing guidelines, especially by neonatal professionals, in support of a comprehensive continuum of care extending from fetal life to the NICU and beyond.

#### Learner objectives:

1. What are the vision and the status of the Fetal Therapy Think Tank's work?
2. What are the typical structures and compelling issues

of fetal programs including how they intersect with the NICU?

3. What are the facility needs for a fetal program and the needs of the NICU and obstetrics facilities to support fetal programs?

#### Gravens 2023–38

**Abstract title:** Evolution of the auditory environment by post-menstrual age in infants born very preterm

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**Background:** Infants born very preterm undergo brain growth and development while hospitalized in the neonatal intensive care unit (NICU) before term equivalent age (TEA).<sup>1</sup> Age- and stage-appropriate positive sensory experiences can decrease stress and optimize positive learning experiences during this important period of brain development.<sup>2</sup> Yet, the NICU auditory environment may consist of loud alarm noises, excessive silence, and insufficient meaningful auditory exposures such as human voice, especially when parental presence is limited.<sup>3</sup> The aim of this study is to examine the current auditory experiences of infants born very preterm in a level-III NICU before they reach TEA, and assess how these exposures relate with room type and parental presence.

**Methodology:** This is a prospective observational study of infants born < 33 weeks gestational age (GA) in a level-III NICU. In our unit, very preterm infants are initially cared for in single-family rooms while requiring intensive care; once they no longer require positive pressure respiratory support and enter a convalescent stage, very preterm infants transition to an open bay step-down/convalescent care unit (Growth and Development Unit). Generally, this transition occurs around 33-34 weeks. We performed sixteen-hour auditory recordings once a week over a period of up to six weeks using the Language Environment Acquisition (LENA) device.<sup>4</sup> At each measurement, the LENA device was placed in the infant's incubator or crib and recordings of the infant's auditory environment were analyzed using the LENA SP automated software. The program records the total adult word count (AWC) and classifies the auditory environment into six categories: meaningful language, distant speech, electronic, overlap, noise, and silence. Demographic data and setting of recording were ob-

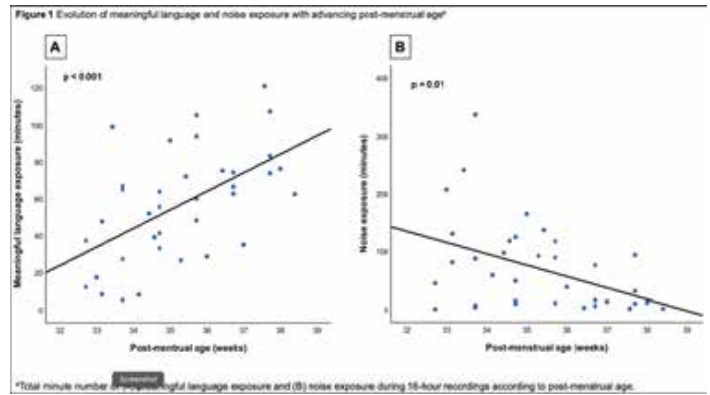
tained from medical charts. We examined room type (single-family or private room vs open bay) and parental presence (quantified as 6 hours or more vs less than 6 hours around the time of recording) at each measurement. We assessed the relationship of AWC and auditory components with PMA, room type and parental presence using linear and multiple regression analyses.

**Results:** To date, 36 auditory recordings were performed among 7 participants (of 20 projected). Mean GA was 30.9±1.2 weeks and mean birth weight was 1545±342 grams. 13 measurements (36%) were performed in a private room and 21 (58%) were recorded while parents were present 6 hours or more. Infants born very preterm were exposed to a variety of sounds in the NICU before TEA (Table 1). Overall, the majority of the auditory environment was composed of silence (69.6±13.2%), followed by electronic sounds (9.0±8.9%), and noise (7.2±8.1%), while distant speech (6.9±6.6%) and meaningful language (5.5±3.0%) represented the least predominant auditory components. As PMA increased, there was a rise in exposure to meaningful language ( $p<0.001$ ) and a decrease in noise ( $p=0.01$ ) (Figure 1). The degree of exposure to meaningful language across PMA appeared lower in private rooms in comparison with open bays (Figure 2). When adjusting for PMA, infants in private rooms were also exposed to significantly lower AWC ( $p=0.03$ ). Higher parental presence was associated with an increased exposure to distant speech ( $p=0.01$ ) and less silence ( $p=0.05$ ).

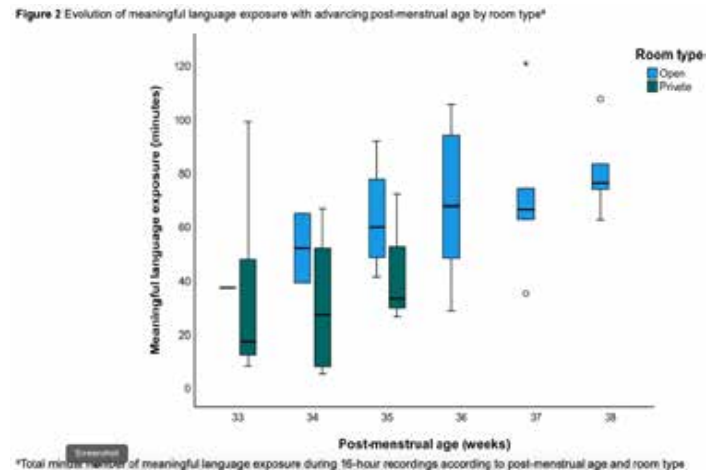
**Table 1**

Table 1 Components of the auditory environment of infants born very preterm by week of post-menstrual age							
	33 weeks (n=6)	34 weeks (n=7)	35 weeks (n=7)	36 weeks (n=6)	37 weeks (n=5)	38 weeks (n=5)	All (n=38)
<b>Meaningful language</b>							
Percentage, mean (SD)	3.5 (3.5)	3.7 (2.3)	5.6 (2.3)	7.0 (3.3)	7.3 (3.4)	6.8 (1.3)	5.5 (3.0)
Percentage, median (IQR)	2.4 (1.4)	4.0 (5.1)	5.8 (4.5)	7.0 (5.8)	8.9 (5.4)	6.9 (2.0)	5.9 (4.4)
Minutes, mean (SD)	27.0 (36.1)	37.7 (25.3)	54.9 (23.0)	68.4 (28.7)	71.9 (31.1)	80.7 (16.7)	58.8 (30.1)
Minutes, median (IQR)	27.4 (10.4)	39.3 (26.8)	55.6 (39.0)	67.7 (33.4)	66.5 (48.6)	76.1 (27.2)	61.3 (41.4)
<b>Distant speech</b>							
Percentage, mean (SD)	8.5 (11.7)	4.8 (3.2)	5.2 (5.3)	7.3 (3.8)	5.6 (2.7)	8.4 (11.2)	4.7 (6.6)
Percentage, median (IQR)	3.3 (19.3)	5.0 (8.3)	5.0 (5.0)	6.3 (6.4)	5.2 (4.8)	5.8 (16.2)	5.1 (5.7)
Minutes, mean (SD)	62.5 (113.1)	48.7 (33.2)	52.0 (30.8)	71.9 (26.1)	54.4 (28.6)	93.1 (170.2)	62.4 (64.8)
Minutes, median (IQR)	32.1 (188.1)	54.8 (89.8)	48.6 (43.3)	69.7 (37.8)	50.2 (48.2)	48.1 (156.0)	51.2 (56.2)
<b>Electronic sounds</b>							
Percentage, mean (SD)	10.0 (13.8)	12.6 (7.0)	5.7 (7.2)	6.2 (7.1)	4.4 (7.2)	13.0 (15.5)	9.0 (8.3)
Percentage, median (IQR)	4.8 (13.3)	11.0 (12.1)	4.0 (11.8)	3.0 (6.1)	3.2 (10.3)	7.7 (13.9)	6.0 (8.8)
Minutes, mean (SD)	99.0 (136.8)	124.3 (66.3)	56.5 (68.5)	60.2 (68.5)	63.8 (66.8)	125.5 (99.3)	86.0 (84.4)
Minutes, median (IQR)	49.7 (129.4)	139.6 (106.4)	40.9 (150.1)	29.1 (79.4)	31.1 (100.5)	73.8 (131.6)	62.9 (84.8)
<b>Ongoing sounds</b>							
Percentage, mean (SD)	0.9 (0.7)	0.6 (0.4)	1.0 (0.8)	1.5 (1.8)	1.8 (1.8)	0.9 (0.6)	1.1 (1.1)
Percentage, median (IQR)	0.7 (1.3)	0.5 (0.8)	1.0 (0.9)	0.9 (2.6)	0.8 (2.3)	1.0 (1.1)	0.8 (0.8)
Minutes, mean (SD)	15.7 (7.2)	8.5 (5.7)	10.9 (6.3)	16.9 (18.7)	18.9 (20.4)	9.5 (3.3)	12.2 (11.4)
Minutes, median (IQR)	3.7 (17.2)	8.8 (10.8)	12.0 (10.8)	9.0 (23.0)	7.4 (24.6)	9.8 (6.4)	9.3 (9.8)
<b>Noise</b>							
Percentage, mean (SD)	12.5 (9.8)	10.4 (11.9)	8.7 (6.5)	4.5 (5.0)	2.3 (3.2)	3.0 (3.8)	7.2 (6.1)
Percentage, median (IQR)	10.7 (19.0)	8.1 (12.0)	8.6 (13.3)	2.1 (6.3)	1.8 (4.4)	1.1 (5.8)	4.9 (10.5)
Minutes, mean (SD)	117.7 (63.7)	131.7 (113.1)	84.5 (61.5)	45.2 (47.6)	22.4 (30.5)	29.7 (37.5)	70.7 (77.3)
Minutes, median (IQR)	106.0 (82.2)	87.7 (111.2)	82.1 (123.0)	25.2 (87.7)	13.4 (42.2)	11.7 (56.7)	47.0 (102.4)
<b>Silence</b>							
Percentage, mean (SD)	62.7 (21.3)	66.3 (22.5)	72.8 (14.0)	72.5 (7.7)	75.9 (6.9)	66.2 (9.8)	68.8 (13.2)
Percentage, median (IQR)	61.6 (26.2)	70.0 (6.9)	72.3 (26.8)	73.5 (14.3)	75.9 (11.7)	68.9 (16.7)	70.0 (15.1)
Minutes, mean (SD)	662.9 (203.6)	637.8 (119.0)	705.7 (134.6)	897.8 (75.7)	733.5 (96.8)	99.0 (85.8)	667.8 (125.1)
Minutes, median (IQR)	594.3 (248.4)	671.1 (60.5)	694.4 (251.0)	707.3 (141.3)	743.3 (108.4)	661.0 (167.4)	675.6 (148.7)
<b>Adult word count</b>							
Mean (SD)	4716.7 (4639.2)	5454.0 (4232.2)	7917.0 (4180.6)	3169.0 (3906.5)	3473.8 (4036.5)	6996.2 (4732.7)	6988.0 (4050.5)
Median (IQR)	4267.0 (1699.0)	6732.0 (3968.8)	6142.0 (3597.0)	1800.5 (1027.0)	3018.8 (2711.0)	8230.0 (2689.0)	6432.5 (2781.0)

**Figure 1**



**Figure 2**



\*Total median number of meaningful language exposure during 16-hour recordings according to post-menstrual age and room type

**Conclusions:** In our study, the auditory environment of infants born very preterm before TEA in the NICU was predominantly composed of silence and undesired exposures such as electronic/alarm sounds or noise, and included a limited amount of meaningful language and distant speech. The earliest weeks of PMA when recordings were obtained were characterized by exposure to the highest levels of noise, and least amount of human voice. These current findings complement previous studies and highlight that the paucity of meaningful auditory exposures in the NICU remains a concern. Exposure to meaningful language appears to increase across PMA; however, we note that in our environment, very preterm infants transition from single-family rooms to an open bay unit after 33-34 weeks PMA, a time that coincides with increasing meaningful language exposures in our data. This suggests that the NICU environment may impact infant auditory experiences, which are known to correlate with neurodevelopmental outcomes.<sup>5</sup> The findings reinforce that parental presence may play an important role to optimize infants' auditory environment before TEA. Further data will be needed to establish the effects of the environment on the preterm infant, with direct implications for interventions in the NICU which have the potential to optimize outcomes.

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#### **Problem statement:**

Meaningful neurosensory experiences are critical to supporting optimal neurodevelopment of hospitalized preterm infants. This study seeks to understand the evolution of auditory experiences of infants born very preterm as they advance in postmenstrual age in the neonatal intensive care unit (NICU), and assess how these experiences may be influenced by room type and parental presence.

#### **Learner objectives:**

1. To understand the components of the auditory environment experienced by infants born very preterm in the NICU before they reach term-equivalent age.
2. To learn how the auditory environment surrounding infants born very preterm evolves during their NICU stay.
3. To learn how environmental factors such as room type and parental presence may influence the auditory environment of infants born very preterm in the NICU.

#### **Gravens 2023–39**

**Abstract title:** Parent Presence and Engagement in the NICU: Trends and Relationships to Infant Stress

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**Methods:** Study hypotheses were addressed via a descriptive study, using an existing dataset to conduct a secondary analysis. This quantitative dataset included parent presence, SSC and infant salivary cortisol data for 78 families with an infant that received care in a tertiary level NICU in the Midwestern United States. Of 78 infants, 41 were term and 37 were preterm infants born at  $\geq 28$  weeks gestation. Infants' level of illness was assessed using Neonatal Medical Index (NMI) scores.

Parent presence was operationally defined as amount of time one or both parents were with their infant in the NICU in hours per week and days per week through NICU discharge (median age at discharge=33 days), or over the first month of life for infants with longer lengths of stay. SSC was operationally defined as amount of time parents participated in SSC with their NICU infant in hours per week and days per week through NICU discharge or during the first month of life for infants discharged later. Parent presence and SSC data, in hours per week and days per week, were collected from infants' electronic medical records.

Infant stress was measured using resting salivary cortisol levels collected in the morning at NICU admission and discharge. For infants not discharged at or before 33 days of life, a resting cortisol was collected at one month of age.

**Impact and Results:** Mean parent presence in hours per week ranged from 34.9 to 42.35 hours in weeks one to four of life. A repeated-measures ANOVA identified a significant trend in hours per week of parent presence over time ( $F(2.45, 53)=5.02, p=.005, n^2=.09$ ), with parent presence increasing over the first two weeks of life, then decreasing. Post hoc analyses demonstrated a significant mean increase in parent presence from weeks one to two (6.42 hours,  $p=.04$ ) and a significant mean decrease from weeks two to four (10.03 hours,  $p=.02$ ). The range of cumulative parent presence in days per week over the first four weeks of life ranged from 35.7% to 100% of days in the NICU with a mean (SD) of 91.1% (13.8%) days. Trend analyses did not identify a significant trend in cumulative parent presence in days per week.

The range of cumulative SSC hours over the first four weeks of life ranged from zero to 52 total hours with a mean (SD) 5.52 hours (9.93). Mean hours of SSC per week were quite low, ranging from 1.29 to 1.81 hours in weeks one to four of life. The range of cumulative SSC in days per week over the first four weeks of life ranged from zero to 67.9% of days in the NICU with a mean (SD) of 8.63% (13.5%). No significant trends in cumulative hours or days of SSC over time were identified.

Significant negative correlations between cumulative SSC, in hours per week ( $r_s=-.25, p=.03$ ) and days per week ( $r_s=-.21, p=.05$ ) were observed. Results of hierarchical regression analyses examining timing of SSC in days per week supported a model including infant salivary cortisol at admission, NMI

score and SSC in days per week during week one for explaining infant stress at NICU discharge ( $R^2=.21$ ,  $F=3.08$ ,  $p=.04$ ). Hierarchical regression examining timing of SSC in hours per week did not yield any significant models.

Parent presence in hours per week ( $r=.11$ ,  $p=.39$ , 95% CI  $-.145$ ,  $.353$ ) and days per week ( $r=.06$ ,  $p=.63$ , 95% CI  $-.147$ ,  $.233$ ) was not significantly associated with infant stress at NICU discharge. Results of hierarchical regression analyses examining the timing of parent presence in hours per week supported a model including admission cortisol, NMI score, and parent presence during weeks one through four of life for explaining infant stress at NICU discharge ( $R^2=0.44$ ,  $F=4.11$ ,  $p=.004$ ); and in this model NMI score ( $p=.03$ ) and parent presence during weeks two ( $p<.001$ ) and three of life ( $p=.03$ ) were significant predictors. Hierarchical regression examining timing of parent presence in days per week did not yield any significant models.

This study was novel in examining trends in naturally occurring parent presence and SSC over an average NICU length of stay. In addition, this study was novel in examining potential relationships between parent presence, parent engagement (measured using SSC), and infant stress at NICU discharge.

**Conclusions:** The need for early, frequent SSC to mitigate stress in NICU infants was supported. Study results suggest that NICU infants experiencing more parent presence in hours per week during week two had higher salivary cortisol levels at discharge, while infants experiencing more parent presence during week three had lower salivary cortisol levels. During the early weeks of life, parent-infant relationships may require more support due to high levels of infant illness and parent and infant stress. More study is needed to examine potential relationships between the amount, frequency and timing of parent presence, SSC and NICU infant stress.

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#### Problem statement:

Relationships between parents and NICU infants are essential to mitigating NICU-related stressors and to preventing impacts of toxic stress that may result from cumulative NICU-related stressor exposures, which include psychosocial deprivation. The purpose of this study was to examine trends in NICU parent presence and skin-to-skin care (SSC) and to examine relationships between parent presence, parent engagement and NICU infant stress.

#### Learner objectives:

1. Discuss trends in parent presence and SSC observed over an average NICU stay.
2. Describe relationships observed in the reported study between parent presence, parent engagement and NICU infant stress.

#### Gravens 2023–40

**Abstract title:** Where you start out shouldn't determine where you end up!

**Authors:** Lynda Warren, Therese Razzante, AD

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**Purpose:** Define for staff and families, the importance of reading for early child literacy and the impact of disparities in families facing financial instability. The critical window for brain development is 0-3 years of life. A NICU Reading Program develops a child's love of books and a readiness to learn.

**Relevance:** NICU nurses support community healthcare outreach needs by engaging in reading or assisting family reading time for infants twice a day. The Leader Reader Program provides new children's books for reading and for taking home. This early beginning point helps children to develop a rich vocabulary, self-expression, and reading comprehension; all tools needed to become successful lifelong learners. Nurses remain cognizant of the need to help prepare a home environment that fosters literacy skills.

Quality

Methods

(PDCA):

**Plan**—The unit OKR project to address Child Literacy as many of the NICU babies had financially challenged families and literacy was a documented community deficiency.

**Do**—An interprofessional group established an action plan to facilitate reading to the NICU babies 2Xs a day. Average Daily census in NICU 22 infants times 10 months of reading equals an estimated sample size of 13,464 episodes of reading.

**Check**—Two outcome documents for measurement: a reader log of times and qualitative responses, and Press Ganey Courtesy and Respect Outcome measure of Nurse treated my baby as a person.

**Act**—A book drive with the hospital shared governance council, D. Pardon Books, Sororities, and local merchants for new book donations. Leader Reader invites to schedule individual reading time. Read-a-thon March 2–9.

**Outcome:** The project had great involvement with the staff and became well integrated into practice. Thousands of hours have been spent reading to the NICU babies by administrative leaders, nursing leaders, nurses, parents, grandparents, and siblings. Qualitative comments re: baby’s reaction have been positive in the calming effect for a restless baby. The data measurement for Press Ganey Courtesy and Respect question, How the nurses cared about your baby as a person—has outscored the national benchmark three out of three of the last quarters.

The successes of the program have rapidly spread through our hospital system and now has 8 nationwide hospitals who have reached out for assistance in initiating the program for their babies and children patients.

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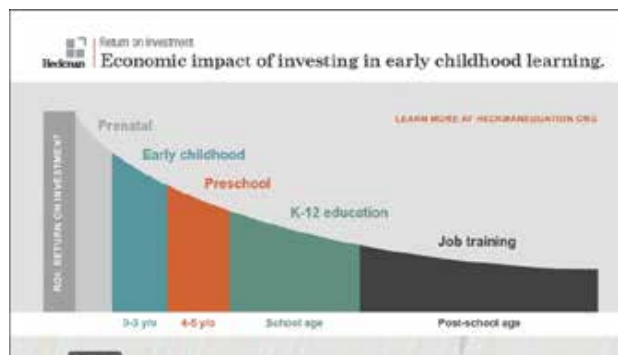
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#### Problem statement:

Nursing care review identified by gap analysis a deficit in nursing knowledge and support of early childhood literacy tools and programs to meet brain development in the Neonatal Intensive Care Unit (NICU) population. Research evidence identifies the critical window for brain development as 0-3 years of life and if the brain is not stimulated during this critical period, learning will be much more difficult for the child.

#### Learner objectives:

1. Learn how early childhood literacy matters, NICU to community, as parents want their child to be healthy, happy, and successful throughout life.
2. Develop NICU Leader Reader Program that provides the tools and activities that support language development as a lifelong investment in NICU persons who are a person no matter how small.



#### Gravens 2023–41

**Abstract title:** Provision of Positive Oral Experiences for Premature Infants by Offering Milk Drops: A Clinical Practice Change Initiative

**Author:** Barbara ORourke RN-NIC TIP

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**Introduction:** Premature infants routinely experience invasive oral procedures that may have a negative impact on oral sensory and oral motor function. Approximately 80% of premature infants will have difficulty with oral feeding, making failure to thrive a leading health issue associated with prematurity and a primary reason for readmission to the hospital.

**Objective:** The objective of this clinical practice change was

to provide positive oral experiences to premature infants by offering droplets of human milk or formula orally during gavage feedings, subsequently referred to as the Milk Drop Intervention.

**Method:** This pre- and post-implementation quasi-experimental study included a total of 198 premature infants born at 24 to 33+6 weeks' gestation.

**Staff Education:** Online learning modules were created to explain the rationale, provision, and documentation of the Milk

**Drop Intervention:** The learning module became mandatory education requirement for the NICU medical team, leadership, and nurses.

**Parent Education:** Upon admission, parents were given a brochure explaining the Milk Drop Intervention, the rationale, and descriptions of how their infant may respond when offered milk drops.

**Milk Drop Intervention:** Once all cares were completed, the infant was nested with hands to face and their parent's scent heart placed near their face. The gavage feeding was started, and the infants in the Milk Drop Intervention group were offered oral milk drops with every full gavage feeding. More milk drops were given based on the infant's response (see algorithm). If parents were present, they were encouraged and supported to observe and learn about their infant's responses and feeding cues.

**Data Collection and Analysis:** Electronic health records were used to identify gestational age at birth, pre-feeding cues, length of stay, PMA at discharge, and parent experiences. All data was compiled by staff with ethical access to the data for clinical practice evaluation. Descriptive statistics were used to analyze the primary and secondary outcomes. To further understand a preliminary cost analysis of the initiative, the hospital analytic department assessed the hospital bills of the infants pre/post implementation of the Milk Drop Intervention.

**Outcomes measured:** Average length of stay and adjusted cost differences. Parental perception and comments were also recorded.

**Results:** Nine of ten intervention groups had a shorter average length of stay, with the intervention group overall having a significantly shorter average length of stay ( $p=0.004$ ). Adjusted cost savings for the intervention group was over \$663,000.



Algorithm showing caregiver how to respond to the infant when offering milk drops.

**Conclusion:** Offering milk drops during gavage feedings is a simple, low-cost, intervention that may provide positive oral experiences for the smallest and most fragile of premature infants. The intervention also provided an opportunity for parents to observe their infant's response to the milk drops, which formed a foundation for understanding cue-based feeding.

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## Table

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### Problem statement:

The 21st Century Cures Act has mandated sharing of clinical notes electronically to patients. OpenNotes, or sharing of medical notes via a patient portal, has been studied extensively in the adult population, but less in pediatric populations, and not at all in the Neonatal Intensive Care Unit (NICU). This study aims to understand parents' interaction with and perception of the NICU physicians' daily progress notes shared with them via the hospital's patient portal (Epic MyChart) using a survey of NICU parents at a community level 3 NICU.

### Learner objectives:

1. Describe how NICU families interact with the physicians' daily progress notes shared electronically via patient portal
2. Recognize families' perception of NICU OpenNotes and how it affects their relationship with physicians
3. Apply family suggestions for improvement of NICU OpenNotes

### Gravens 2023-43

**Abstract title:** Improving Safe Sleep Practices in a Level III Neonatal Intensive Care Unit

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**Background:** In the Neonatal Intensive Care Unit at a large inner-city hospital, healthcare providers are not appropriately transitioning premature infants to safe sleep positioning (SSP) as recommended by the American Academy of Pediatrics (AAP). Based on a random bedside audit in March 2022, 40% of infants in the NICU met the eligibility criteria, and 0% of those patients were in accordance with the guidelines. No formal safe sleep policy currently exists at the site. The purpose of this quality improvement initiative is to increase the number of neonates in accordance with the AAP's safe sleep guidelines for hospitalized infants. PICO(T): In neonatal patients admitted to a level III NICU, how effective is a standardized safe sleep bundle compared to current practice based on nurse judgement in increasing the percentage of infants who are compliant with the AAP's safe sleep guidelines prior to their discharge home. The goal is that 100% of eligible infants will be in accordance with the AAP's recommendations.

**Objective:** Objectives for this poster presentation are as follows: Learner will understand the risk of Sudden Infant Death Syndrome (SIDS) in premature infants; Learner will be educated on the safe sleep guidelines recommended by the AAP; Audience will be educated on the evidence supporting a standardized safe sleep bundle in the NICU, Audience will understand how the results from this quality improvement project support the incorporation of a safe sleep policy in level III NICUs.

**Methods:** A safe sleep bundle has been implemented at the site that includes the development of an evidence-based sleep algorithm (from the AAP recommendations), standardizations of a parent safe sleep education video, as well as a parent safe sleep survey at discharge. Staff education included an introduction to the elements of the safe sleep bundle, the safe sleep algorithm and safe sleep positioning guidelines. Posters of the algorithm, and positioning guidelines have been strategically placed in various high traffic locations throughout the unit. Staff is reinforcing SSP, and at discharge parents are asked to complete a survey that assesses their knowledge of safe sleep and their comfort level with the implementation of SSP at home. There are random bedside audits throughout the implementation period to collect data. Using the safe sleep algorithm and safe sleep guidelines, the surveyor assesses each baby's safe sleep eligibility. For infants who qualify, the surveyor is using the data collection tool to gather information. That data will be used to determine if the implementation of the safe sleep bundle improves safe sleep positioning in NICU patients. Data from the parent discharge survey will also be analyzed to identify parents' SSP comfort level and intent to practice at home.

**Results:** Following seven weeks of data collection, the results have shown positive improvements throughout the unit. During the most recent audit, the NICU had a total of 35 patients. Of those patients, 51% (18) met the eligibility criteria for SSP. At time of audit, 78% (14) of those patients were appropri-

ately practicing SSP. The implementation phase is currently occurring over a 16-week period from September to December 2022. Data collection will continue through the end of the year.

**Conclusion:** Preliminary findings suggest incorporating a standardized safe sleep bundle in a level III NICU will increase compliance with safe sleep positioning in eligible NICU patients. Results indicate that this practice change will benefit the premature infants admitted to the NICU by preparing them and their families for a safe sleeping environment at home.

**Problem statement:**

In neonatal patients admitted to a level III NICU, how effective is a standardized safe sleep bundle compared to current practice based on nurse judgement in increasing the percentage of infants who are compliant with the AAP's safe sleep guidelines prior to their discharge home. The goal is that 100% of eligible infants will be in accordance with the AAP's recommendations.

**Learner objectives:**

Learner will understand the risk of Sudden Infant Death Syndrome (SIDS) in premature infants; Learner will be educated on the safe sleep guidelines recommended by the AAP; Audience will be educated on the evidence supporting a standardized safe sleep bundle in the NICU, Audience will understand how the results from this quality improvement project support the incorporation of a safe sleep policy in level III NICUs.

**Disclosures:** Conflicts of interest are disclosed by the individual authors

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