Impact of Minimizing Infant Overstimulation Post-NICU Discharge

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Abstract

Sensory neurodevelopment plays a crucial role in shaping infant development. With excessive stimulation, or overstimulation, infants may develop irreversible and life-altering deficits such as intellectual disabilities, psychiatric difficulties, attention-deficit-hyperactivity-disorder (ADHD), cerebral palsy, and behavioral and functional challenges. Although the NICU follows guidelines to reduce overstimulation, parents are often not provided with specific sensory guidelines upon discharge, despite the rapid brain development that occurs during this time. Parents face numerous barriers in accessing equitable, accurate information regarding their infant's sensory needs after NICU discharge. Recognizing this need, Union Hospital's Level III NICU sought to develop current, evidence-based educational resources for parents. To address this gap, a new educational handout was created, outlining sensory and developmental guidelines for parents to follow once they return home with their infant. A survey of licensed occupational therapists from various practice settings was conducted to evaluate the updated handout provided to parents upon NICU discharge. The findings indicated that the handout accurately represented occupational therapy practice and should be incorporated into therapy services within the NICU. This project underscores the importance of providing parents with up-to-date sensory recommendations to improve infant outcomes and mitigate sensory processing difficulties throughout the lifespan.

Keywords: neurodevelopment, NICU, sensory overstimulation, and occupational therapy

Impact of Minimizing Infant Overstimulation Post-NICU Discharge

The neurodevelopment of infants both in utero and during the early stages of life plays a crucial role in shaping their ability to engage in tasks and activities throughout their future. This is especially true when an infant is premature and requires a Neonatal Intensive Care Unit (NICU) stay. In the United States, ten to fifteen percent of all live births require specialized and critical NICU admission (Geddess, 2022). The qualifications for NICU admission include, prematurity (babies born before 37 weeks), early term infants (37-39 weeks), low birth weight (less than 5.5 pounds), sepsis, respiratory distress syndrome, heart problems, congenital anomalies, respiratory failure, birth defects, jaundice, or infections (Geddess, 2022). Union Hospital’s Level III NICU is the largest in a 70-mile radius and has provided lifesaving and compassionate care to families since opening in 1968 (Kuntsmann, 2025). A Level III NICU can care for infants that are less than thirty-two weeks gestation or weigh less than 3.3 pounds. It offers the second highest level of care, including, advanced respiratory support, minor surgeries by neonatologists, and advanced, life monitoring equipment (Stark et al., 2023) While the NICU saves thousands of lives, there are potential adverse consequences of the overwhelming medical environment to the infant. One of the main risks is sensory overstimulation. Recognizing, reducing, and preventing overstimulation is a vital part of infant care during their NICU stay and following discharge in the home environment (Lane et al., 2019).

Sensory overstimulation occurs when an infant experiences excessive amounts of tactile, auditory, visual, olfactory, gustatory, or vestibular stimuli that their brain has difficulty processing (Pineda et al., 2023). This overwhelming input can lead to physiological stress and may result in the development of maladaptive neural connections, potentially causing long-term brain injury (Hendricks, et al., 2023). A critical period of development occurs between 20 weeks' gestation and 3 years of age, in which neural connections are rapidly established (Marshall, 2011). Proper development is a dynamic process that involves both internal physiological mechanisms and external environmental factors, specifically appropriate sensory stimulation. Each sensory system undergoes continued development until birth and thereafter to prepare the infant for their new external environment. With preterm infants, their sensory systems have not fully developed, increasing the risk for developmental complications. If these systems are overwhelmed, this can lead to potential harm, which can result in lifelong difficulties (Marshall, 2011). Upon discharge, the NICU provides parents and caregivers with educational materials on emergency situations and infant medical care but often overlooks other home environmental factors that can affect development and quality of life throughout the lifespan (DiBari & Rouse, 2023). The purpose of this capstone project is to convey current research regarding sensory overstimulation to parents in the form of handouts that are unique to occupational therapy, in efforts to continue to improve infant outcomes as families return home.

The first focus area of the capstone project was education. The student aimed to provide current, evidence-based education to parents regarding sensory overstimulation. The student also provided a list of all references used during the capstone project to educate therapists and other healthcare professionals at the hospital. Union Hospital acknowledged the need for updated resources and services. Therefore, infants leaving Union's NICU are more at risk for sensory overstimulation potentially resulting in a need for long-term therapy services.

The second area of focus was advanced clinical skills. The capstone student was able to gain experience in the specialized area of Neonatal Intensive Care Unit occupational therapy. Occupational therapy services include newborn evaluations, components of infant massage, active assist range of motion (AAROM) in the neck as well as upper and lower extremities, grand rounds with the interprofessional team, and handling skills for medically fragile infants. By including this focus area into the capstone project, the capstone student was able to disperse individualized educational resources to families in a more compassionate and accessible way that centered around rapport and trust.

Needs Assessment

In initial communication with Union Hospital, it was determined that occupational therapy discharge resources needed updated in the NICU. The capstone student conducted an interview with the occupational therapist in the NICU and completed a literature review to examine current research. The goal was to develop accessible and informative handouts centered around sensory overstimulation and safe sensory recommendations. With this new eye-catching handout, the site expert and capstone student aimed to improve infant outcomes as families transition home.

Site Placement and Interview

To align with the capstone student's values and interests regarding the Neonatal Intensive Care Unit and serving the Wabash Valley community, a doctoral capstone project was proposed to Union Hospital in Terre Haute, Indiana. The Indiana University Department of Occupational Therapy Capstone Coordinator contacted this site to establish a relationship and lay the groundwork for a future collaboration, including requirements and expectations of the experience. After solidifying this partnership, the student identified this site to be the student's Fieldwork Level II B experience as well, allowing for further engagement with the site mentor and population.

The initial meeting conducted between the student and the capstone site was completed via Zoom in March of 2024 with the NICU occupational therapist and the Indiana University capstone coordinator. The purpose of this meeting was to introduce the concept of a Doctoral Capstone project and determine if the facility would be a good fit for placement. The following week a follow-up interview was completed via Zoom with the capstone site expert to get a better understanding of the facility and population. This interview was vital in the Doctoral Capstone project process as it provided the student with a framework for determining the site's needs, completing a gap analysis, and formulating a plan for the project. The questions for this interview focused on current challenges the facility faces, specific diagnoses/conditions, policies in place, caregiver/parent involvement, and potential for sustainability within the NICU. These questions are listed in the appendices below.

Current State

Union Hospital serves a rural community in Terre Haute, IN with a population of approximately 60,000 people. The median household income is $39,000, classifying this area with low socioeconomic status. Regarding education, only 23% of the population has a bachelor's degree or higher, and 9% of the area does not have healthcare coverage. (United States Census Bureau, 2023) These demographics had to be considered when developing sustainable solutions for the facility. For example, handouts must follow health literacy guidelines to ensure all parents understand the recommendations. They must be readily available as parents' schedules are unpredictable with transportation barriers. Additionally, the recommendations need to be practical to avoid financial burden. Since this facility is the largest NICU within 70 miles, overflow happens frequently, resulting in a busy occupational therapy caseload.

Current occupational therapy sessions at Union Hospital's NICU consist of range of motion, head control, infant massage, and developmental education to parents when appropriate. Along with occupational therapy, doctors, nurse practitioners, physical therapists, speech therapists, and nurses work as a collaborative team to provide care to the babies. At discharge parents are given information on safe sleep, when to call the doctor, car seat safety, and other medical safety information that is required when returning home. Occupational therapy provides verbal education regarding appropriate developmental care upon returning home, such as tummy time recommendations. Sensory overstimulation is a concern that NICU staff are cognizant of and strive to mitigate while providing essential medical care. Many of the infants return home in a fragile state and the risks of sensory overstimulation prevail (Goodstein et al., 2021).

Desired State

Once home, parents often experience a lack of confidence in their ability to care for their newborn without strict guidelines that center around infant care (DiBari & Rouse, 2023). Preferred educational resources include handouts that are easily digestible for parents, making it more likely for them to engage with. Union Hospital's goal is to provide parents with updated resources that center around overstimulation to prevent sensory processing difficulties that may occur in the future. The resources should aim to provide practical advice to provide a sensory safe environment when returning home. Due to the connection with the outpatient pediatrics clinic, the occupational therapist aimed to provide similar handouts to parents at that facility who have young children who may also benefit from this information. There is also a need to determine the best time for occupational therapists to educate parents in the NICU that maximizes understanding and follow through of sensory recommendations. Lastly, the occupational therapist aims to create a way to present research findings during grand rounds to encourage NICU staff collaboration in providing developmentally safe education to parents throughout their stay.

Literature Review

A literature review was conducted analyzing the progression of neurodevelopment from utero throughout childhood and how this may be negatively impacted by inappropriate environmental stimuli, such as strong odors, loud noises, or excessive touch. Stimuli come in the form of auditory, visual, vestibular, gustatory, tactile, and olfactory information to the body. They aim to provide infants with the appropriate amount of sensory input for healthy and typical development.

The main database used for this literature review was PubMed. Search terms included neurodevelopment, NICU, sensory overstimulation, and occupational therapy. Thirteen out of twenty articles were published within the last five years, and all articles are between levels I-III of evidence. Each research article will also be compiled into a binder to give to hospital staff to educate NICU employees on sensory overstimulation through an occupational therapy lens.

Infant Neurodevelopment

Neurodevelopment is the most essential part of a babies' growth and development. Without the brain, all other systems are unable to develop and function properly. The sensory system develops in a particular order that correlates with required functions outside of the womb as follows: tactile, vestibular, gustatory, olfactory, auditory, and finally visual sensation (Hendricks et al., 2023). Inside the womb, the infant has a safe environment to explore various soothing tactile input. The uterus provides a warm home for the baby to move their upper and lower extremities with ability to return to a flexed position to promote development. Each time the infant receives tactile stimuli, cells migrate from the spinal cord throughout the rest of the body (Marshall, 2011). After this process, these cells develop into specialized types that help the infant learn to distinguish between different kinds of touch, like hard touch versus light touch and painful touch versus a loving touch. Meanwhile, the uterus acts like a cushion, protecting the infant from large movements of the mother (Hendricks et al., 2023).

In a developing infant, the visual and auditory sensory systems are the last to develop, putting these senses at risk for overstimulation due to prematurity. The infant is at risk for overstimulation because sensory development occurs outside the womb rather than inside with protection (Lane et al., 2019). The mother's womb uses amniotic fluid to protect these systems by muffling sensory stimuli from the external environment, such as loud noises or bright lights (Aureli et al., 2022; Hendricks et al., 2023). The womb also brings comfort to the infant with the mother's voice, heartbeat, breathing, and movement of the diaphragm and intestines. Although the ideal environment for an infant is inside the mother's womb, many infants are unable to stay in that sensory rich environment the entire forty weeks for various medical circumstances. This will increase their chances of needing NICU care in the first moments of life.

The Role of Occupational Therapists in the NICU

Due to advances in medical technology, more preterm infants are surviving than ever before (Zhang et al., 2022). NICU healthcare workers are essential in the basic medical care of an at-risk infant, including nurse practitioners, physician assistants, doctors, nurses, and surgeons. However, other professions focus on life-long outcomes and quality of life that may be impacted by a NICU stay. This includes occupational therapists, who use a holistic approach that focuses on not only the current health of the infant but the physical, mental, and social health of the infant in the future. Occupational therapists' education prepares them to address the many factors that go into appropriate patient care in this setting, such as environmental factors, family support, socioeconomic status, transportation concerns, structures/functions of the infant, and the home environment at discharge (Rubio-Grillo, 2019).

Occupational therapists use evidence-based interventions to lead their plan of care, while following physician guidelines and recommendations. The profession may address infant self-regulation, feeding, sleeping, muscle tone, appropriate developmental positioning, developmental milestones, awareness, infant stress, mental health, and sensory care. To combat the effect of noxious sensory stimuli including, bright lights, noisy alarms, needle sticks, extreme cold or hot sensations, excessive handling, and even loud conversations of employees and caregivers, occupational therapists aim to set up the environment to mimic the mother’s womb through environmental modifications to promote optimal infant growth and development (Hendricks et al., 2023).

Protective Mechanisms to Prevent Overstimulation in Preterm Infants

To reduce overstimulation in the NICU, several modifications can be implemented. Healthcare workers should promptly address loud alarms and encourage both staff and parents to silence cell phone ringers. Speaking to infants in soft voices, gently closing incubator doors, using dim lighting when possible, and providing protective earwear like earmuffs can all help create a calmer environment (Hendricks et al., 2023; Pineda et al., 2019). Additionally, cycled lighting should be introduced around 32 weeks’ gestation to support the infant’s developing sleep-wake cycle.

To foster development and parent-infant bonding, close contact with caregivers is encouraged to introduce the caregiver’s scent. When physical presence is not possible, using scent cloths can help soothe the baby and may mask harsh NICU odors, such as those associated with heel lancing or venipuncture (Hendricks et al., 2023). Parents are encouraged to speak softly at the bedside, gradually introducing their voices as tolerated by the infant. Both healthcare workers and parents should strive to provide infants with at least three hours of rich auditory stimulation daily by prioritizing language exposure.

Touch and interaction are crucial to sensory development, as well as to building a sense of trust and security. Gentle touch and swaddling promote restful sleep, emotional regulation, and overall growth. A helpful method for demonstrating gentle touch is through a “hand hug,” where a caregiver places a calm, still hand on the infant (Pineda et al., 2019). When waking a baby, caregivers should do so with soothing words to help ease the transition. Safe and positive touch teach infants that not all physical contact is painful- counteracting the negative associations formed through necessary but uncomfortable NICU procedures such as intravenous catheters, cardiac patches, or blood draws. Soothing touch from caregivers, parents, and NICU staff can help calm infants during stressful events. Importantly, research highlights that involving parents in every stage of care leads to improved outcomes.

Crucial Support for Caregivers in the NICU

Support beyond the NICU is crucial for parents and caregivers to heal from the potential trauma of having an infant in the NICU. Much of the attention is put on the infant for obvious reasons in the NICU; however, support for parents is just as important. Parents’ and caregivers’ mental and physical health directly affects their ability to care for the infant. Forty to fifty percent of mothers and fathers experience elevated levels of depression and anxiety in the NICU (Treyvaud et al., 2019). Post Traumatic Stress Disorder symptoms are also prevalent in this population due to witnessing the first moments of their infant different than most parents; in an incubator with lines, drains, tubes, and doctors constantly tending to them (Treyvaud et al., 2019). Evidence shows that 34% of mothers experience psychological distress 18-24 months after a preterm birth, which can impact parent-baby bonding. This can negatively affect the infant's mental health due to sensing the caregiver's anxiety. (Treyvaud et al., 2019). To provide support and decrease anxiety for parents in the NICU, peer-to-peer support, psychoeducation for NICU staff, psychological support integrated within early intervention therapy services, and most importantly, continuous support when returning home after discharging from the NICU may be effective for the parent-infant relationship (Treyvaud et al., 2019).

In the first six months of life, it is mainly the parent's responsibility to initiate communication with the infant whereas later in life this relationship is more transactional. However, if a parent is experiencing a decrease in overall mental health, the appropriate amount of communication may not be conveyed (Aureli et al., 2022). This can negatively impact the infant in other social processes later in life such as, coordination, dialogue, interpersonal contingency, reciprocity, and synchrony (Aureli et al., 2019). Inadequate co-regulation and communication in early life can lead to sensory integration difficulties due to limited exposure to the sensory environment.

Transitioning from the NICU to the Home Environment

Many parents and caregivers report that the discharge process from the NICU is particularly distressing and anxiety-inducing for several reasons (Spence et al., 2023). These include reduced confidence in newborn care, fear surrounding the infant's medical status, and difficulty bonding due to parent-infant separation while in the NICU (DiBari & Rouse, 2023). While many parents look forward to bringing their infant home, the transition can be abrupt, overwhelming, and difficult to adjust to. To support a smoother transition, it is crucial for NICU healthcare workers to adopt a collaborative care model that promotes a parent-centered approach (Homer et al., 2023). Parents are encouraged to engage in daily rounds to understand their child's current medical status, days remaining in the NICU, and changes in medications or status, etc. (DiBari & Rouse, 2023). Parents should also be encouraged to participate in daily care of their infant, such as baths, temperature checks, diaper changes, and during feedings (Homer et al., 2023). Including parents in infant care in the NICU sets a realistic expectation of what will be required at home once discharged (DiBari & Rouse, 2023). Upon discharge, it is recommended to complete various home visits to the family's house to ensure it is a suitable environment for the new infant and provide educational handouts for the parents to increase preparedness (Homer et al., 2023). Additional support may be provided, such as direct access to healthcare providers via phone in case of emergency or any questions. Following the recommendations mentioned in this section boosts caregiver confidence upon discharge, decreases length of hospitalization, and lowers overall healthcare costs (Homer et al., 2023; Givrad et al., 2020).

Practical Applications at Home

While providing resources to parents in the NICU is important, it is essential that all information is presented in a practical manner that follows health literacy guidelines. When presenting information, parents have reported that they prefer "in the moment" information in a private environment rather than waiting until discharge to explain all educational topics (Spence et al., 2023). When parents return home with their infant, it is essential they prioritize safe and quality sleep for their new infant. Many levels of development occur during the rapid eye movement (REM) phase of sleep, including all sensory system development. A safe sleep environment requires a firm mattress in the infant's crib, tight fitted sheet over the mattress with no loose blankets or toys inside the crib, low lighting, and a supine sleeping position for the infant (Goodstein et al., 2021). Educating parents/caregivers on safe sleeping practices prior to discharge is essential in reducing fatal infant deaths and increasing quality of sleep for the parent and infant. Studies have shown that when parents/caregivers are educated on safe sleep practices in a variety of healthcare settings, their knowledge increases, and their safe sleep behavior increases at home (Goodstein et al., 2021). One of the more controversial sleep habits is swaddling babies before putting them into their crib. Swaddling has been shown through research that it can improve and support supine sleeping; however, if done incorrectly, there can be drastic consequences to the infant including, developmental hip dysplasia, restricted breathing, unsafe increase in body temperature, respiratory tract infections, increased risk of sudden unexplained infant death (SUID), and difficulties with breastfeeding. (Goodstein et al., 2021)

Potential Consequences of Inappropriate Stimulation

Overstimulation may lead to inappropriate or maladaptive pathways created in the sensory system inhibiting all five senses from integrating. Integration refers to each sense cohesively organizing information appropriately causing no disruption to the individual (Hendricks et al., 2023). One of the most consequential disruptions may come from inadequate sleep due to a variety of factors. One of them being loud noises that often startle the infant and can create changes in blood pressure and oxygen levels (Hendricks et al., 2023). Another important aspect of proper sleep is the rapid eye movement (REM) cycle of sleep, where most of development occurs. If an infant is exposed to large amounts of bright light, this can affect ocular development, including eye movement during REM sleep (Hendricks et al., 2023). Overstimulation of the eyes can damage the central visual system and reduce engagement, potentially impairing overall socialization skills (Hendricks et al., 2023). If brain development is interrupted, the infant is at risk for intellectual disability, psychiatric difficulties, attention-deficit-hyperactivity disorder (ADHD), cerebral palsy, behavioral and functional issues, and even socioeconomic challenges in the future (Hendricks et al., 2023). Parents should provide an environment for their children that is stimulating not subversive. This environment should include positive and loving touch. Marshall (2011) states, "The absence of loving touch can relate to significant growth, developmental, and behavioral deficits." This is especially important for babies who may have experienced negative touch while in the NICU (Zhang et al., 2022). Without caregivers thoroughly understanding the risks of overstimulation, infants may be at risk of death or severe neurological impairment that will affect them for the rest of their lives (Goodstein et al., 2021).

Guiding Theories

The theories that created the framework of this capstone project were Ayres Sensory Integration Theory and the Person-Environment-Occupation (PEO) model. Sensory integration theory credits the brain for organizing itself under "typical" circumstances, which occurs when there are no disturbances to the system. This theory also states that level of function is dependent on how well each sensory system is integrated with one another (Lane et al., 2019). According to Ayres, sensory development starts in utero and continues throughout childhood, highlighting the importance for a stimulating yet safe sensory environment inside the womb but also externally in the home environment to encourage proper development (Lane et al., 2019). This theory suggests that challenges with sensory integration and development can impair the ability to carry out higher level cognitive tasks, while also contributing to irregularities in emotional and behavioral regulation (Lane et al., 2019).

The Person-Environment-Occupation (PEO) model is the second occupational therapy model that was used to formulate this capstone project. This model presumes that the person, environment, and occupation have a transactional relationship, meaning that one affects the other. This is essential to consider when looking at the positive and negative effects of an infant's external sensory environment (Woodroffe, 2022). The PEO model also goes as far to say that not only do these three categories have a relationship among one another, they too have an impact on occupational performance throughout the lifetime (Woodroffe, 2022). It is important to note that this model defines "occupation" as any meaningful activity a person engages in (Woodroffe, 2022). PEO puts emphasis on the ongoing development that an individual goes through throughout a lifetime (Woodroffe, 2022). The inter-related relationships can impact development and ultimately, quality of life. It was crucial to incorporate both theories when developing an evidence-based handout for parents in the NICU, as sensory overstimulation can have life-altering consequences if not managed properly.

Gap Analysis

Although parents have access to some occupational therapy resources, these materials are often outdated and lack sensory guidelines. The dissemination of resources is also contingent upon parents' presence during the therapist's scheduled NICU time, which occurs for two and a half hours, three days a week. Sensory processing difficulties have become an increasingly significant concern at the outpatient pediatric clinic affiliated with Union Hospital, which follows all NICU babies for two months post-discharge. Before the project, sensory education was not introduced until the therapist determined that the child required long-term outpatient services. At that point, sensory re-education was initiated. However, research indicates that this approach is too late, and best practice advocates for preventative sensory education rather than corrective measures (Pinda et al., 2023). Consequently, the objective of this capstone project was to deliver sensory education during the earliest stages of life, promoting developmentally appropriate behavior despite the challenges associated with early NICU experiences.

Project Plan and Process

Project Plan

The capstone student created a plan that aligned with goals and objectives with the capstone coordinator, site mentor, and faculty mentor. This project was designed to meet the site's needs while creating sustainability for future use of this project.

Project Goals and Objectives

Following the needs assessment and literature review, project goals and associated objectives were developed in preparation for the capstone project and were used to guide the student throughout the experience and ensure the student was aligned with the capstone site's needs.

The goals and objectives are listed below:

Project Goal 1: The student will foster strong communication and collaboration between NICU staff and parents/caregivers to ensure a smooth transition and continuity of care.

Objective 1: The student will provide educational opportunities while in the NICU to encourage parents to participate in interventions with their child when healthcare providers are providing various types of care.

Objective 2: The student will draft guidelines for regular updates, key contact points, and preferred communication methods for each family while sharing and reviewing the plan with both NICU staff and parents/caregivers.

Project Goal 2: The student will create educational resources, specifically handouts along with an educational program for parents/caregivers upon discharge from the NICU related to mental health of infant and parents and reducing overstimulation in the home environment.

Objective 1: The capstone student will offer guidelines on selecting appropriate toys, managing household noise, and using calming techniques such as white noise machines or soft lighting.

Objective 2: The student will connect families with local support groups, counseling services, and community resources that can provide additional assistance and advice when they return home with their infant.

Objective 3: The student will create individualized care plans that address the specific needs and sensitivities of each family as they transition home to improve infant and caregiving outcomes.

Objective 4: The student will provide education and training for parents on recognizing signs of overstimulation and techniques to reduce it.

Project 3: The student will facilitate sustainability of educational resources through electronic files that will be compatible to all devices and allow for changes to be made as the facility's needs change.

Objective 1: The student will design a Google drive folder that is designated for all resources to be put in electronic form so that the facility is able to easily edit documents for language translation or any other change.

Objective 2: The student will compile all evidence-based articles in the most versatile file format and ensure that all educational resources are saved and shared in this format.

Objective 3: The student will create a system for receiving feedback from users on the usability and effectiveness of electronic resources and make improvements based on this feedback.

Project Process

The project process was developed based on a needs assessment, gap analysis, and an extensive literature review. It involved spending time in the NICU to better understand the caregiver population, expanding the literature review, and creating an education handout focused on sensory overstimulation. The handout was implemented in the NICU, accompanied by verbal education, and a survey was conducted to assess its efficacy. The site expert and capstone student held weekly meetings to ensure the completion of various tasks within the project process. These meetings allowed for discussions on handout revisions that the site expert deemed crucial for sustainability. The handout covered topics such as overstimulation prevention, promotion of developmental milestones, and safe sleep practices. The purpose of the handout was to update the occupational therapy educational materials in the NICU and to promote positive infant outcomes upon discharge and return home.

Week One and Two

The initial weeks of the project were dedicated to gaining a deeper understanding of the site. As Union Hospital served as the capstone student's Level II B fieldwork site, the student was already familiar with the staff and office culture. During this period, the focus was on establishing relationships with NICU doctors and nurses to facilitate the future use of the resources, as well as building rapport with parents and caregivers in the NICU. The capstone student also reviewed the current educational materials used in both the NICU and outpatient pediatric clinic to assess what had been previously implemented to educate parents upon discharge. Additionally, the student collaborated with nurses during the discharge process to ensure that the occupational therapy department's resources complemented, rather than duplicated, existing educational materials. To stay informed on the evolving status of NICU patients, the student also attended weekly grand rounds.

Week Three through Five

During weeks three through five, the capstone student developed a rough draft of the educational handout and presented it to the site expert. In the initial discussion about the handout, the site expert suggested several modifications to better address the needs of the population. In response to these recommendations, the capstone student expanded the literature review to align with the site's specific requirements. After conducting further research, the student incorporated the suggested changes into the handout. Additionally, during these three weeks, the student engaged in conversations with parents in the NICU to gain insight into their experiences and perspectives, which were used to inform and enhance the capstone project.

Week Five through Seven

Weeks five through seven involved a thorough review of the revisions made to the educational handout by both the capstone student and the site expert. The handout was reviewed and finalized during weekly meetings, with comparisons made to previous educational materials to ensure that the new version was innovative, engaging, and visually appealing. During this period, the student also developed a Qualtrics survey to be distributed to Union Hospital employees and faculty within the Occupational Therapy Department at Indiana University Indianapolis. The only inclusion criterion for the survey was current occupational therapy licensure. The survey was finalized through collaboration between the capstone student and site expert. Additionally, the student presented evidence-based education, derived from the literature review to various parents in the NICU during occupational therapy sessions. This was done to ensure the information was concise and aligned with health literacy guidelines. While the handouts were printed at this stage, both the capstone student and site mentor emphasized the importance of making this information accessible to parents as early as possible.

Week Seven through Twelve

During the initial weeks of this phase of the project, the capstone student monitored survey responses and closed the survey after three weeks. The student also collaborated with the site expert to finalize the printed handout, making any necessary revisions to ensure optimal NICU outcomes. Once completed, the handout was printed for use in the NICU. The capstone student then provided education to each new parent entering the NICU by reviewing the handout with them and their families. Additionally, the student familiarized NICU staff with the updated handout to raise awareness of occupational therapy services and ensure that the resource complemented the educational materials provided by nursing. During this time, the capstone student and site expert visited Deaconess Women's Hospital NICU to enhance their knowledge and skills regarding the latest best practices for infants in the NICU. The educational handouts were also shared with therapists at Deaconess for further feedback. Therapists identified the topic as a top concern and confirmed that the handouts aligned with best practices in the NICU. It was concluded that these materials would be a valuable resource for parents at Union Hospital, particularly during this critical stage of program development. In the final weeks of this period, the student analyzed the survey data using SPSS software to provide meaningful insights into the occupational therapists' responses.

Week Twelve through Fourteen

In the final weeks of the capstone project, the student met with the site expert to discuss the results of the survey concerning the efficacy of the handout and its appropriate representation of the profession. The capstone student compiled and provided analytic reports from the survey results to the NICU staff, ensuring that physicians and nurses were informed that all resources provided to parents were well-researched and aligned with the hospital's core values of patient care. During the last week of the project, the student presented the finalized handout during grand rounds. This presentation aimed to educate staff members about the new role of occupational therapy in the NICU and to advocate for the profession as a whole.

Project Implementation

To begin the implantation phase of the project, the capstone student printed several copies of the handout for use at the hospital. Additionally, the student provided the site expert with a Microsoft Word document containing the final version of the handout to ensure sustainability and ease of printing additional copies in the future. The handouts were stored in the "occupational therapy" folder within the NICU for easy access by staff and parents. Accessibility was a key concern for the site expert, as she only treats patients in the NICU for a few hours each day, and parents' visit schedules may vary, making it difficult for them to visit at the same time each day. When distributing the handouts, the student also led an educational discussion with parents and family members, explaining the role and value of occupational therapy services in early infant care. This discussion involved verbally walking through the handout and addressing any questions parents had regarding infant development and life after discharge from the NICU.

The capstone student also presented the finalized handout during grand rounds in the NICU to introduce the new resource alongside existing educational materials from other disciplines. The presentation included a review of current evidence-based research on sensory overstimulation and its impact on NICU infants upon returning home. Grand rounds included representatives from neonatology, nursing, lactation, pharmacy, social services, physical therapy, speech therapy, occupational therapy, and respiratory therapy. Through this educational session, the site expert and capstone student were able to educate the interdisciplinary staff on sensory-safe care practices that could be adopted within their respective disciplines when caring for infants in the NICU.

Project Evaluation

The project evaluation focused on assessing how well the educational handout aligned with occupational therapy practices and principles, particularly client-centered, holistic care. Data was collected through a Qualtrics survey distributed to licensed occupational therapists working with diverse populations in various settings.

The project was submitted to Indiana University's Institutional Review Board (IRB), which determined that the project was classified as non-human subjects' research. Consent was obtained from each participant before completing the survey, and all survey responses were anonymous.

Methodology

Quantitative research methods were employed to collect data on whether the newly developed educational handout accurately represented the role of occupational therapy in the NICU, with a specific focus on the urgent issue of sensory overstimulation. Surveys were completed by occupational therapists from diverse backgrounds to evaluate the handout. At the end of the survey, participants had the opportunity to suggest any missing information they believed would be essential to include in the handout to better support NICU parents. Several responses were received and considered during the final revisions of the handout.

Efficacy Survey

The survey was designed to assess the efficacy of the handout and ensure that it appropriately represented occupational therapy services in the NICU. The Qualtrics survey consisted of seven Likert scale style questions, with response options ranging from strongly disagree, somewhat disagree, neither disagree nor agree, somewhat agree, to strongly agree. Additionally, the survey included an initial question asking participants if they were currently licensed occupational therapists to ensure inclusion criteria were met. The questions focused on occupational therapy's scope of practice and goals in working with the NICU parents and caregivers. Refer to Appendix B for survey questions. The survey remained open for three weeks to allow for adequate responses before being closed for data analysis.

A statistical analysis of the survey responses was conducted using IBM SPSS Statistics (IBM Corp., 2020). Statistical tests, including mean averages and standard deviations, were conducted to determine the effectiveness of the educational handout as evaluated by licensed occupational therapists.

Results

The capstone student conducted an analysis of the results from the handout survey. Licensed occupational therapists indicated that they practice in a variety of settings, including, academia, mental health, inpatient rehabilitation, the school system, skilled nursing, outpatient hand therapy, outpatient pediatrics, NICU, private practice, and community-based environments. The diversity of the participant backgrounds contributed to a more representative and comprehensive dataset. Mean scores for each Likert scale item were calculated, alongside the percentage of participants who selected "strongly agree (5)" or "somewhat agree (4)". This analysis evaluates the suitability of the handout for use in occupational therapy services within the NICU. Upon reviewing the survey results, six out of seven questions achieved a mean score of four or higher, indicating a high level of agreement with the statements. Question one had a slightly lower mean score of 3.91. For questions two through seven, over 80% of participants indicated agreement by selecting either "strongly agree" or "somewhat agree." In contrast, question one had a slightly lower rate, with 77% of participants in agreement. A detailed summary of the results is presented in Figures 1-7 in Appendix C.

Discussion

The findings from the literature review, gap analysis, and needs assessment identified a significant need for updated educational services within Union Hospital's NICU. In alignment with the goals of the site mentor and the capstone site, a sensory handout and in-person education focused on preventing overstimulation was developed and implemented. The increased risk of overstimulation associated with a NICU stay prompted the capstone student to provide essential preventative information to parents upon discharge (Pineda et al., 2023). The guidelines for the handout were consistent with those found in the literature, emphasizing the importance of a safe, enriching sensory environment that promotes infant development rather than hindering it (Hendricks et al., 2023).

Additionally, the project aimed to raise awareness about the consequences of overstimulation by providing evidence-based education to nurses, physicians, and respiratory therapists on safe sensory practices during patient care. As highlighted in the literature, it is crucial to prevent sensory overstimulation both during the NICU stay and following discharge (Pineda et al., 2023). To ensure the project was effectively disseminated, feedback from practicing occupational therapists was gathered. The efficacy survey results indicated that most therapists recognized the purpose of the handout and agreed that it was consistent with the scope of occupational therapy practice.

The successful completion of the 14-week Doctoral Capstone Experience (DCE) enabled the capstone student to meet the outlined goals and objectives. This included strengthening communication and rapport between NICU staff and parents, creating reliable educational resources, and establishing a clear pathway for future sustainability. The outcomes of the project highlight the importance of providing both parents and NICU staff with occupational therapy specific education to support infant development both during the NICU stay and in the future.

Impact

Overall, this capstone project had a positive impact on the capstone site, infants in the NICU, and the capstone student. Survey results indicated that the educational initiative should be integrated into occupational therapy care within the NICU. Feedback from both parents and staff was overwhelmingly positive. Many parents reported a reduction in anxiety after receiving guidance on how to care for their infants upon discharge. Nurses recognized the educational efforts of occupational therapy and expressed that need for this information to be more widely disseminated throughout the NICU to promote safe sensory practices. Nurses became more aware of sensory care and began incorporating these practices into their care routines. By the end of the capstone experience, nurses began requesting assistance from occupational therapists during care times by providing “hand hugs,” a technique that provides comforting touch to distressed infants (Pineda et al., 2023). As the project progresses, the capstone student hopes to observe improved outcomes in the follow-up developmental clinic, particularly in terms of reduced sensory difficulties.

In addition to the impact on the capstone site and the NICU infants, the capstone student experienced significant professional growth through the DCE, advancing both clinical skills and knowledge. The capstone student enhanced clinical competencies in the specialty area of the NICU, including handling medically fragile infants, providing developmental care, conducting evaluations, and participating in grand rounds with the interprofessional team. Beyond hands-on clinical experience, the capstone student also grew professionally by advocating for occupational therapy services, facilitating interdisciplinary communication, and promoting occupational justice for all clients. This experience allowed the capstone student to develop a range of clinical skills that, while developed within the NICU, are applicable to various settings within the field.

Limitations

Although the capstone project had a positive impact on the NICU, several limitations were identified. One limitation was the part-time availability of the occupational therapist within the NICU. The capstone student and site expert were present in the NICU for two and a half to three hours, three days a week. As a result, this limited the number of parents who were able to receive the handout and education. Another limitation was the capstone student's inexperience as an educator. Further adjustments to the teaching style and approach will be made to better meet the needs of parents, drawing on previous educational experiences. The capstone student's limited experience- eight months in a specialty setting as the NICU- may have influenced the overall implementation and delivery of the project. Finally, the efficacy survey was voluntary, with only 22 responses received. A larger sample size may be necessary in the future evaluations to assess the effectiveness of the handout after long term implementation.

Sustainability Plan

Throughout the capstone experience, the capstone student provided the site expert with access to the finalized educational handout, allowing for future revisions as needed. At the site expert's request, the capstone student also compiled a binder of evidence-based resources utilized during the project. This resource was designed to enhance the site expert's knowledge and serve as a reference for educating NICU staff in the future. To further support ongoing sensory education, an additional checklist was provided to NICU staff, outlining sensory-safe guidelines for the unit. Although this checklist was separate from the capstone project, it played a crucial role in ensuring the sustainability of sensory education within the NICU. This step aims to protect infants both in the NICU and at home, ultimately contributing to improved outcomes.

Additionally, the handouts were translated into Spanish to accommodate the large number of patients at Union Hospital for whom Spanish is the primary language. Providing these translations ensures greater accessibility for a broader population, in alignment with the ethical principle of occupational justice. To increase the likelihood that more parents receive the handout, education was provided to nursing staff. This ensures that nurses can distribute the handout, along with appropriate education, to patients whom occupational therapy is unable to see due to factors such as availability, duration of stay, or weekend coverage.

Conclusion

The capstone project contributed to Union Hospital by providing current, evidence-based research on sensory overstimulation prevention, warning signs, and offering recommended post-discharge guidelines. The primary objective of the project was twofold: first, to assess the resources currently utilized and available at the facility, and second, to provide updated, evidence-based information to parents to improve infant outcomes and mitigate sensory risks in the home environment. The development and distribution of an educational handout to parents during occupational therapy session proved effective. Survey results, along with positive feedback from both parents and nursing staff, supported its continued use.

Sustaining and continuing this education is essential, as without it, infants are at an increased risk for brain injury, sensory processing difficulties, and challenges in social-emotional regulation. Sustainability was a key focus throughout the project, and the capstone student ensured the availability of resources for future use by providing the site mentor with editable materials. Additionally, nursing staff were trained to maintain the project’s impact in the absence of occupational therapy services, ensuring long-term effectiveness and integration into the NICU care process. The capstone project emphasized the importance of sensory education and made a lasting impact on the site, contributing to efforts aimed at improving the quality of life for infants both now and in the future.

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Appendix A

Site Interview Questions

1. Are there any specific topics/challenges that you would like me to address through my capstone project?

    a. Have you tried to solve these issues in the past?

    b. If so, what worked, what did not work?

2. What are typical diagnoses/conditions that you see in this setting?

    a. What is the criteria for infants to make it into the NICU?

    b. How long is the typical NICU stay?

3. How involved are parents/caregivers in the infant's care and stay in the NICU?

    a. Are most parents/caregivers susceptible to learning new information that is essential for their child's care?

    b. When are they allowed to be inside the NICU?

    c. How is the environment/atmosphere when the parents are in the NICU?

    d. What is the parent's schedule (stay at the hospital, come and go as they please)?

    e. As a parent, what do you feel is missing during your NICU stay at this facility? (for parents)

4. Is there any type of program that exists now that acts as a "transition" program from NICU to home?

a. If so, do many parents/caregivers utilize this?

b. What is involved in this program?

c. Are parents sent home with any information on their infant specific to diagnosis or status?

d. Would parents be willing to engage in a “transition” program if it were implanted?

5. What does a typical day in the NICU look like?

a. What professions are involved in the NICU?

b. What does OT already do in this setting to prepare parents for at home infant care?

6. What would success look like to you?

7. Are there any constraints that you anticipate would inhibit my capstone project (finances, time, space)?

8. What would be the best option for sustainability of my project for this facility in the future?

a. What resources are available that would enhance/support my project?

9. Has there been any concern or anxiousness brought to your attention from parents bringing their recent NICU baby home?

10. Is there anything you would like to ask me about my education, role, background, etc?

Appendix B

Handout Evaluation Survey for Occupational Therapists

- **What setting do you currently work in? (starting question to describe subject's experience and perspective)**

Please rate how you agree with the following statements regarding the educational handouts provided in this survey:

a. Strongly disagree
b. Disagree
c. Agree
d. Strongly Agree

1. **The information in this handout is clear and follows health literacy guidelines.**
    a. Strong Disagree
    b. Disagree
    c. Agree
    d. Strongly Agree
2. **The design of this handout kept me engaged and interested.**
    a. Strong Disagree
    b. Disagree
    c. Agree
    d. Strongly Agree
3. **This handout follows the principles of holistic client-centered care that is at the center of the profession.**
    a. Strongly disagree
    b. Disagree
    c. Agree
    d. Strongly agree
4. **I would feel comfortable giving this to my patients in my clinical practice setting.**
    a. Strongly disagree
    b. Disagree
    c. Agree
    d. Strongly agree
5. **The subject matter on this educational handout is within occupational therapy's scope of practice.**
    a. Strongly disagree
    b. Disagree
    c. Agree
    d. Strongly agree
6. **The importance and urgency of this topic (sensory overstimulation) is clearly relayed on this handout.**

a. Strongly disagree
b. Disagree
c. Agree
d. Strongly Agree

7. **I would recommend this educational handout to other practitioners in the field.**
   a. Strongly disagree
   b. Disagree
   c. Agree
   d. Strongly Agree

- **Are there any details that you feel were missing from this handout that would be beneficial to add to this area of focus?**

Appendix C

NICU Handout Survey Results

Figure 1

Survey Q1: The information in this handout is clear and follows health literacy guidelines.

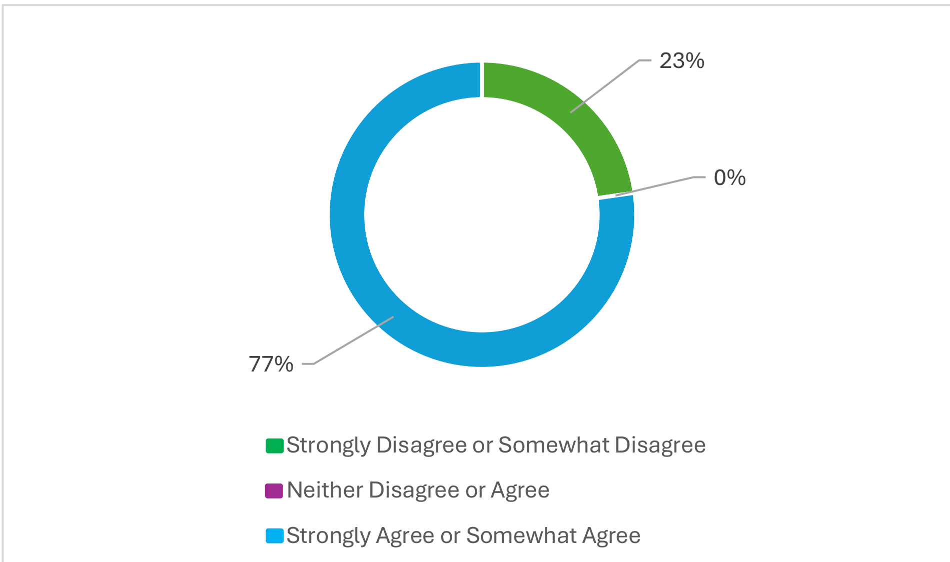


Figure 2

Survey Q2: The design of this handout kept me engaged and interested.

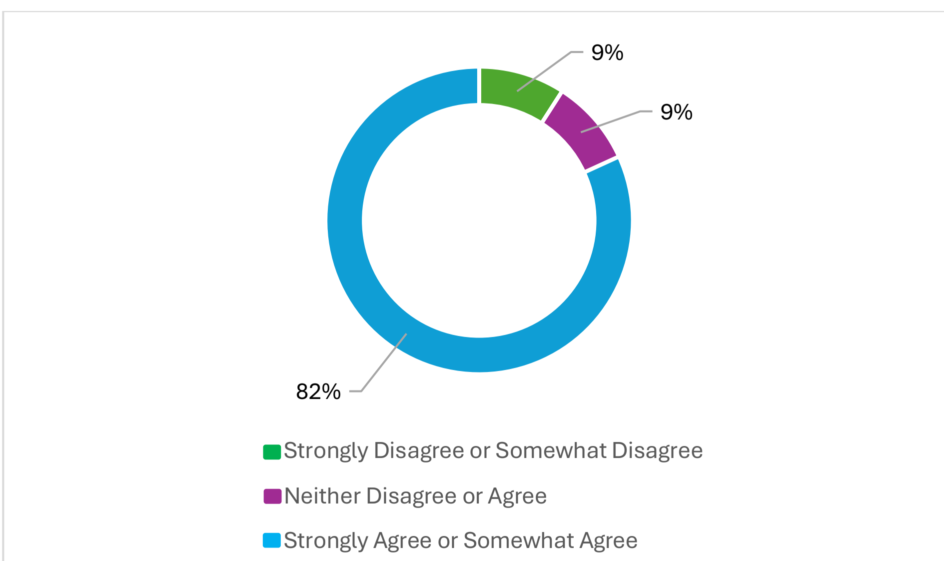


Figure 3

Survey Q3: This handout follows the principles of holistic client-centered care that is at the center of the profession.

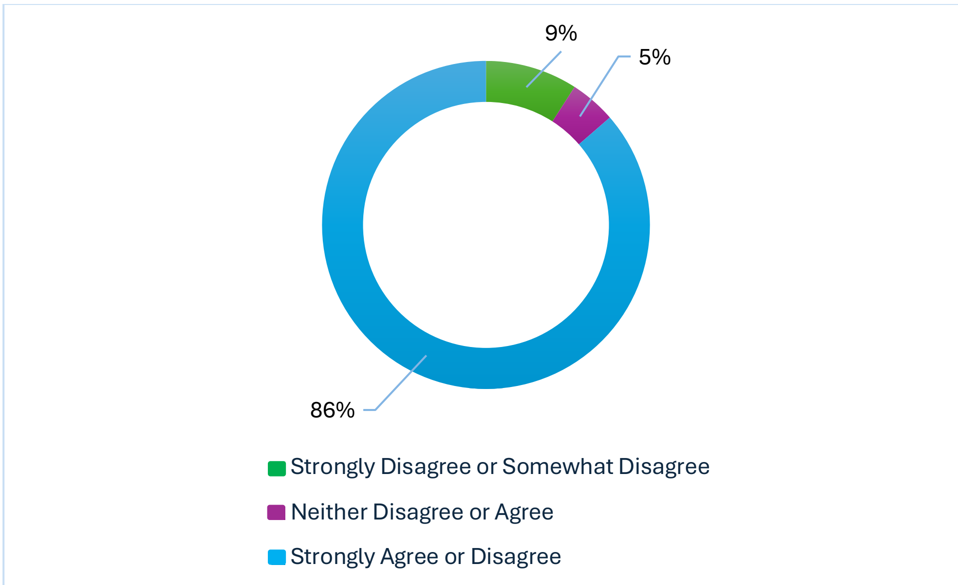


Figure 4

Survey Q4: I would feel comfortable giving this to my patients in my clinical practice setting.

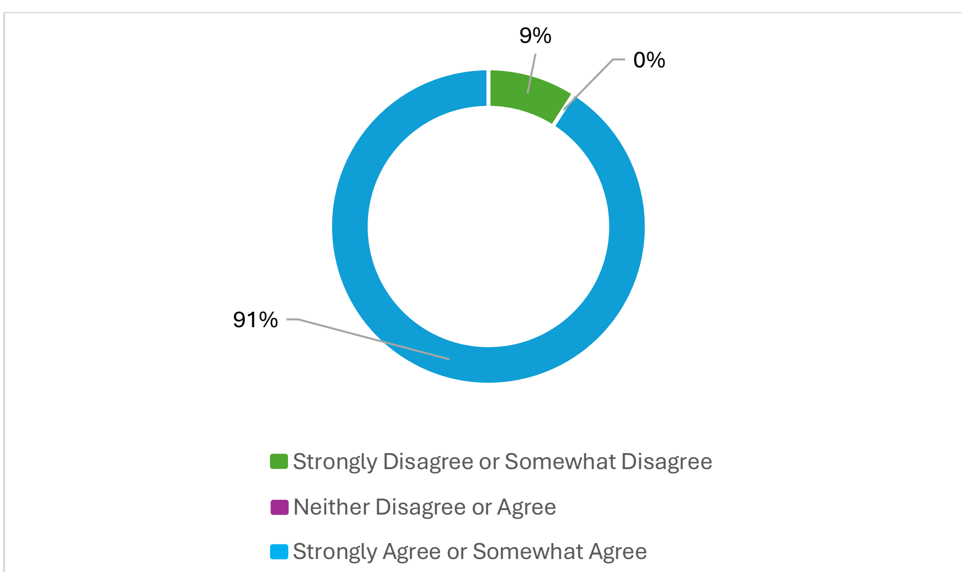


Figure 5

Survey Q5: The subject matter on this educational handout is within occupational therapy's scope of practice.

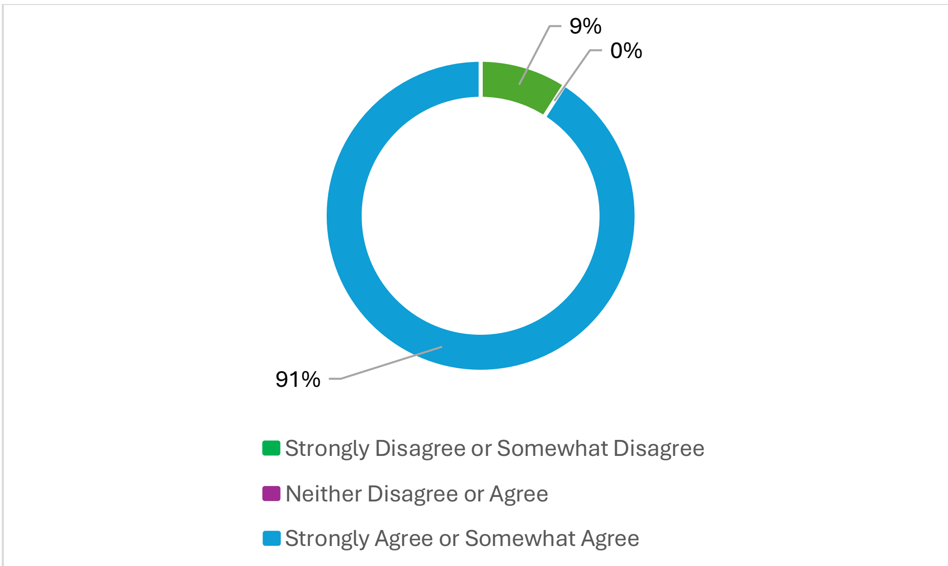


Figure 6

Survey Q6: The importance and urgency of this topic (sensory overstimulation) is clearly relayed on this handout.

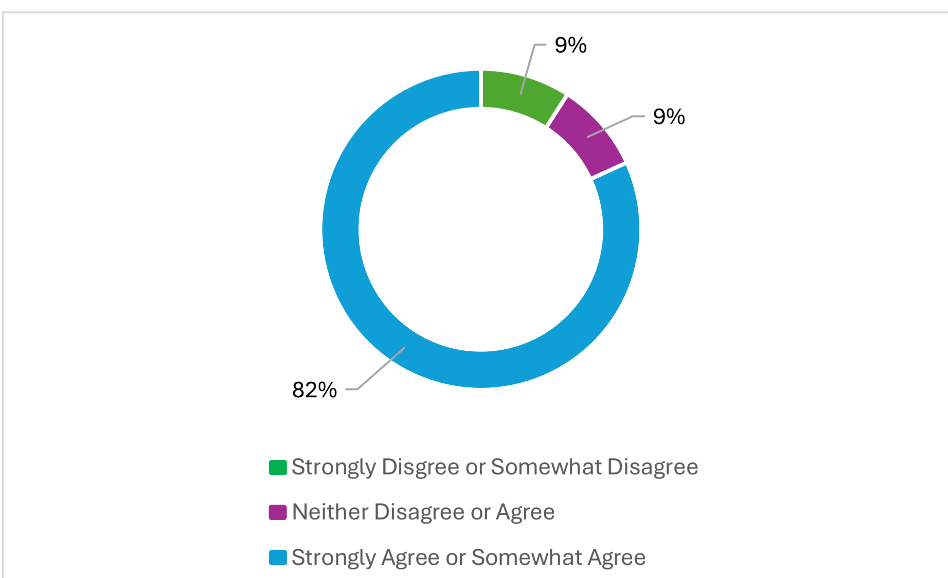
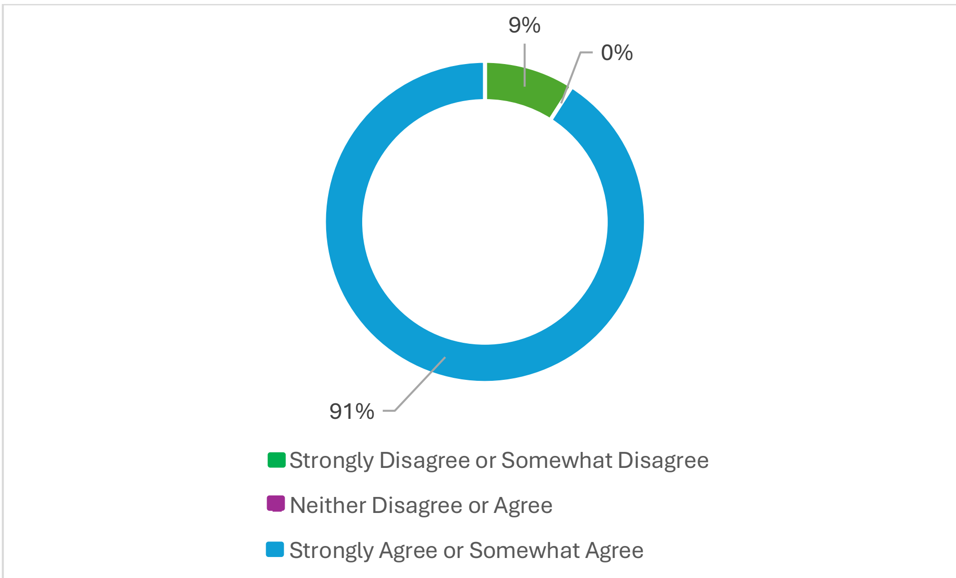


Figure 7

Survey Q7: I would recommend this educational handout to other practitioners in the field.

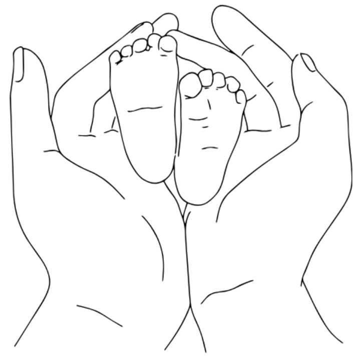


Appendix D

NICU Handout Given to Parents

Occupational Therapy

Appropriate Stimulation for Your Infant



What is Overstimulation?

Things in the environment that overwhelm the baby's brain and body

- Loud Noises
- Bright Lights
- Strong Smells
- Constant, Unnecessary Touch

What to Do at Home

- Give gentle, loving touch
- Facilitate Safe Sleep
  - Quiet Place
  - Low lighting
  - Firm Mattress
  - Infant lying on back
  - No loose toys or blankets
- Avoid Strong Smells like Perfume
- Reduce Loud Noises
- Speak directly to infant in a soft voice
- Put toys within reach outside of bed
- Avoid Johnny Jumpers and Walkers
- Supervised tummy time 2-3x per day
- Alternate turning baby's head to the left and right when you put to sleep
- Take Care of Yourself!

Occupational Therapy

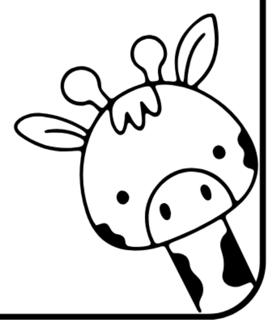
Why is this Information Important?

Overstimulation may cause...

- Disruptions in development
- Changes in blood pressure and oxygen levels
- Difficulties with socialization
- Brain Changes
  - Intellectual Disability
  - Psychiatric Difficulties
  - Difficulty Regulating Behavior and Emotions
  - Attention Deficit Hyperactivity Disorder (ADHD)
  - Attention Deficit Disorder (ADD)

Benefits of Positive Interaction...

- Promotes growth, development, and appropriate behavior
- Increases level of attachment between caregivers and infant
- Reduces infant stress and encourages brain development
- Decreases levels of stress and anxiety when returning home for parents



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