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THE ROLE OF OCCUPATIONAL THERAPISTS IN THE NEONATAL
INTENSIVE CARE UNITS

by

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Advisor: Jan Stube, OTR/L, PhD, FAOTA

An Independent Study

Submitted to the Occupational Therapy Department

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Master's of Occupational Therapy

Grand Forks, North Dakota

May 14, 2011

This Independent Study Paper, submitted by Sarah Mathieu and Gwendalyn Mollerud in partial fulfillment of the requirement for the Degree of Master's of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisor under whom the work has been done and is hereby approved.

Faculty Advisor

Date

PERMISSION

Title: Role of Occupational Therapy in Neonatal Intensive Care Units

Department: Occupational Therapy

Degree: Master's of Occupational Therapy

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ABSTRACT

The purpose of this research is to explore the role of occupational therapy (OT) within neonatal intensive care units (NICUs). There has been limited research pertaining to the current overall role of OTs in the NICU. In order to explain/demonstrate the multifaceted role of OTs within the NICU, a survey was created and, using a stratified random sample, distributed to 90 NICUs in hospitals throughout the United States (U.S.).

A non-experimental exploratory survey research design was used to gather and analyze information from respondents. A survey was created by the researchers based on a thorough literature review of the topic and development of 4 hypotheses statements. The survey consisted of 16 quantitative and qualitative items, which were divided under three main headings: NICU work setting and staffing level, OT professional background, and description of the NICU OT practice role, including theoretical models used. After pilot testing and UND Institutional Review Board approval, the survey was mailed out to 15 occupational therapy departments of hospitals in six regions of the United States (U.S.), totaling a sampling frame distribution of 90 hospitals. Of the 90 occupational therapy departments receiving the survey, there were 19 respondents for a response rate of 21%. No follow-up requests for survey completion were sent out. Thirteen surveys fully completed by occupational therapists were included in the final analyses. Quantitative survey item responses were descriptively analyzed using Microsoft Excel 2007™ and SPSS 18®;

qualitative responses were compiled into thematic areas using Microsoft Word 2007™.

OTs are employed in 68% of the U.S. NICU settings sampled in this survey research study. There is a multifaceted role served by OTs in the NICU, such as providing parental education, stress signal education, positioning, feeding/pre-feeding, as well as many other interventions. Al's Synactive Theory (Als, 1982) was used by the majority (46.15%) of the OT respondents as a guiding theoretical practice model. Because of the specialized knowledge base and skill necessary, the OTs employed in the NICU have an average of 4.9 years of pediatric experience prior to employment in the NICU. Due to the low response rate (21%), comparison of the interventions utilized by OTs in the NICU across the U.S. could not be completed. Conclusion: This survey and its results are recommended to form the basis for further study of the employment of occupational therapists in NICUs across the U.S., including the value of OT brought to the NICU team and client outcomes. These study results are intended to be presented in a poster format and/or publication for occupational therapy audiences in order to promote awareness and further research of this important specialty area of occupational therapy practice.

CHAPTER I

INTRODUCTION

Rationale and Problem Statement

More than a half million babies in the United States—that's 1 in every 8—are born premature each year (Centers for Disease Control and Prevention, 2009). The diagnoses of these preterm infants (i.e., birth before 36 weeks gestation) include chromosomal abnormalities; birth defects; hyperbilirubinemia; respiratory, cardiovascular, central nervous system, and digestive disorders; as well as others (Vergara & Bigsby, 2004). Once born these infants are transported to the Neonatal Intensive Care Unit (NICU), in order to facilitate development. The NICU is a specialized care unit dedicated to providing care to preterm or medically fragile infants. The NICU is critical for all involved: the infant, family, and staff. Much is known about the medical treatment regarding fragile infants; however, little is known about the current interventions utilized in the NICU related to the role of occupational therapists. Within the NICU the roles of professionals overlap; however, in order to ensure that optimal care is provided to preterm infants and their families, it is important to define each individual's professional role. According to the American Occupational Therapy Association (AOTA), the role of Occupational Therapists (OT) in the NICU includes acknowledging the interaction among the physical and social environments, educating

caregivers on the NICU process, and developing individualized intervention plans and staying competent (AOTA, 2006b).

The purpose of this survey is to provide more information as to the role of OT in the Neonatal Intensive Care Units (NICUs) across the country as well as interventions used and the experience needed before working in the NICU. The literature regarding this role is scarce and calls for added research. Similar studies with reference to the role of staff in the NICU include Caretto, Francois Topolski, Mckinneg Linkous, Koontz Lowman, & McKeever Murphy (2000) and Limperopoulos, & Majnemer (2002). The study conducted by Caretto (2000) investigated the role of OTs on parental education regarding feeding. Limperopoulos and Majnemer (2002) conducted a study in Canada investigating the roles among physical, occupational, and speech therapists in the NICU. This study found that the main role of OT within the NICU was splinting and feeding.

In order to understand the current roles of occupational therapists in the NICU, in this independent study, 90 surveys were sent to occupational therapists in randomly selected hospitals with NICUs across the United States (U.S.). The design of this study was based on a previous study from Caretto et al., 2000, in which surveys were sent to NICUs across the U.S with registered neonatologists. The present independent study's survey consisted of 16 questions that inquired about the different aspects of occupational therapists working within a NICU. Based on the types of questions designed for the survey purpose and hypotheses, questions were categorized into: the NICU work setting and staffing levels, OT professional background, and the NICU OT practice role and descriptions. The reasoning for these categories included logical order, similarity of questions, and organizational purposes.

Theoretical Framework

Theory is the foundational knowledge of occupational therapy. According to many resources [Als (1982); Als, Lawhon, Duffy, McAnulty, Gibes-Grossman, & Bickman (1994); American Occupational Therapy Association (2006b); Bader (2010); Holsti, & Grunau (2007); Roy Grenier, Bigsby, Vergara, & Lester (2003); Vergara, & Bigsby (2004)], the theory that drives OT practice in many NICUs is the Als Synactive Theory (Als, 1982). This theory focuses on the hierarchical developmental stages of an infant and considers the influence of the environmental and social factors of the NICU on the infant (Als, 1982). These considerations correlate with the practice of occupational therapy in the NICU because of interactions of the infant with their environments and their developmental stages/levels are taken into account during interventions.

Hypotheses

After completing a review of literature four hypothesis were formed: (1) each Neonatal Intensive Care Unit (NICU) sampled in the U.S. will employ at least one occupational therapist; (2) occupational therapists will have at least a year of work experience in pediatrics before starting work in a NICU; (3) the role of occupational therapists in the NICU is multifaceted (i.e., occupational therapists provide more interventions than feeding and positioning); (4) occupational therapists survey responses will not differ significantly depending on the geographical region of the U.S..

Assumptions

Based on the literature regarding OT interventions in the NICU, it was assumed that the role of occupational therapists is viewed as vital to the care team and to the overall development of fragile infants. As a result of the information gathered from the literature review, OTs alter and adapt the environment based on the infants needs, provide individualized interventions, and educate families on the overall NICU process, all of which encourage optimal opportunities for proper infant development. OTs, in addition, bring specialized skills and knowledge that cannot be performed by other health care professionals, such as nursing, physical therapy, and speech therapy.

Terminology

- A Systems Perspective: the organization of an infant is through systems (Vergara, & Bigsby, 2004).
- Assessment of Preterm Infant Behavior (APIB) (NIDCAP Level II): an assessment that takes a look at the neurobehavioral subsystems and the interaction of the environment (Vergara, & Bigsby, 2004).
- Autonomic motor state: visible signs of distress displayed by the infant in response to the environment or handling (i.e. hiccups, gagging, tone changes, skin color changes, sweating, heart rate increase/decrease, watery stools, etc.) (Vergara & Bigsby, 2004 & Als, 1982).
- Caregivers: those directly involved in providing care to infants, parents or NICU personnel (Vergara & Bigsby, 2004).
- Certified Lactation Consultant (CLC): Trained personal that assist mothers with stimulating sufficient amounts of milk, encourage breast feeding and/or pumping, and assist with the breast feeding process (Vergara & Bigsby, 2004).

- Creating Opportunities for Parent Empowerment (COPE): a program provided to caregivers regarding maternal coping and infant cognitive development (Melnyk, Alpert-Gillis, Feinstein, Fairbanks, Schultz-Czarnial, Hust, et. al., 2001).
- Extremely low birth weight: weight of 1000 grams/2.2 lbs or less at birth (Vergara & Bigsby, 2004).
- Goodness of Fit Model: the interaction between temperament and environment (originally, nine temperament characteristics were study; sleeping and eating patterns, initial reaction, adaptability, intensity of emotion, mood, distractibility, persistence and attentions span, and sensory sensitivity. "When the properties of the environment and its expectations and demands are in accord with the organism's own capacities, characteristics, and style of behaving" (Chess & Thomas, 1999, p. 3; Thomas & Chess, 1989).
- Infant Behavioral Assessment (IBA): a certified neurobehavioral assessment that includes observation of infant's neurobehavioral organization and self-regulatory abilities (Hedlund & Tatarka, 2003).
- Infant Massage: an intervention that provides tactile and proprioceptive stimulation to infants (Vergara & Bigsby, 2004).
- Kangaroo Care (KC): an intervention consisting of personal contact among caregiver and infant, also known as skin-to-skin care (Vergara & Bigsby, 2004).
- Low birth weight: weight of 2500 grams/5.5 lbs to 1501/3.4 lbs at birth (Vergara & Bigsby, 2004).
- Macrosomia: weight of 4000 grams/8.8 lbs or more at birth (Vergara & Bigsby, 2004).

- Naturalistic Observations of Newborn Behavior (NONB) (NIDCAP Level I): This assessment measures the interaction and maturation of neurobehavioral systems. It is used for infants that are too fragile for handling and is based on Als Synactice Theory of Development (Hunter, 2005).

- Neonatal Behavioral Assessment Scale (NBAS): This assessment measures the neurobehavioral capacity of the infant and their interactions with the caregiver. This assessment requires a four step certification that is good for three years (Hunter, 2005).

- Neonatal Intensive Care Unit (NICU): specialized care unit dedicated to providing care to preterm or medically fragile infants. There are three different levels of NICUs.

- Level 1: infants who are healthy or require minimal care (Vergara & Bigbsy, 2004).

- Level 2: infants may require an IV, gavage feedings, phototherapy, oxygen through nasal cannula or oxyhood (Vergara & Bigbsy, 2004).

- Level 3: infants may be medically fragile, ventilator support, surgical care, specialized care (Vergara & Bigbsy, 2004).

- Neurobehavioral Development of Preterm Infants by Gestational Age: how the environment and clinical interventions impact the environment (Hadley, M.A. et al, 1989; Yecco, 1993).

- Neurodevelopmental Therapy (NDT): a holistic approach that incorporates motor movement patterns of muscle function. Preparatory treatment used to address motor control. The approach is based on both acquisition and recovery of skilled movement on developmental sequences of mastery over primitive reflexes (Bobath, & Bobath, 1984).

- NICU Network Neurobehavioral Scale (NNNS): a scale that allows clinicians to complete an assessment of neurobehavioral functioning (focuses on neurologic, stress, and withdrawal signs) (Hunter, 2005).
- Normal birth weight: weight of 2500 grams/5.5lbs to 3999 grams/8.7 lbs at birth (Vergara & Bigbsy, 2004).
- Occupational Adaptation: acknowledging the need for adaptation in an environment in which an occupation is completed. An intervention process between a person and his or her occupational environment (Schkade, & Schultz, 1992).
- Occupational therapist: “Occupational therapy services are provided for the purpose of promoting health and wellness and to those who have or are at risk for developing an illness, disability, activity limitation, or participation restriction. Occupational therapy addresses the physical, cognitive, psychosocial, sensory, and other aspects of performance in a variety of contexts to support engagement in everyday life activities that affect health, well-being, and quality of life” (American Occupational Therapy Association, 2008).
- Oral motor stimulation: intervention used to arouse oral motor musculature and sensation.
- Person-Environment-Occupational Model: a client centered approach that focuses on the client, environment, and occupation (activity/task) (Law, Cooper, Strong, Stewart, Rigby, & Letts, 1996).
- Preterm infants: infants born before 36 weeks gestation (Vergara & Bigbsy, 2004).
- Preterm Neurobehavioral Organization: In-turning, Coming-out, & Reciprocity: a neurobehavioral developmental hierarchical model used to explain the advancement of

development among the interactions between and preterm infant and their environment (Gorski, Davidson, & Brazelton, 1979).

- Self regulation: an infant's ability to adjust developmental subsystems, which include; autonomic, motoric, state of arousal, and attention (Vergara & Bigsby, 2004).

- Sensory integration (SI): a model of practice focusing on the organization and integration of sensory input in the brain (Ayres, 1972).

- Sensory modification: a person's ability to adapt to sensory input.

- States of Arousal: predetermined states in which an infant may be in at any given time.

These states include; deep sleep, light sleep, drowsy, quiet alert, active awake, and crying (Vergara & Bigsby, 2004 & Blackburn, S.T., 2003).

- Stress signals: signs the infant displays when unable to self-regulate. These signs include, yawning, sneezing, hiccupping, "sitting on air", saluting, finger splaying, gaze aversion, glassy eyes, skin color changes, etc. (Vergara & Bigsby, 2004).

- Synactive Theory of Development: A theoretical model that identifies the developmental stages of infants and the interactions among various subsystems (Als, 1982).

- Very low birth weight: weight of 1500 grams/3.3 lbs to 1001/2.3 lbs at birth (Vergara & Bigsby, 2004).

Summary

In order to find out more about the comprehensive role of OT in the NICU a survey was created and sent to OTs working in NICUs across the United States. The following chapters discuss what was found about the role of occupation therapy in

NICUs through a literature review; the process of creating the survey, sending it out, and data analysis in the methodology; the results of the study; and a summary/conclusion.

CHAPTER II

LITERATURE REVIEW

The mission of occupational therapy is to provide opportunities of all people to engage in desired occupations independently, through the use of collaboration and client centered practice (AOTA, 2006b). Occupational therapists working in the NICU are specially trained health care professionals that require previous experience in pediatric therapy, especially infants that have been treated in the NICU, and collaboration with families. Specialized training such as continuing education on feeding and swallowing disorders, breastfeeding, and neonatal assessments as well as years of experience allow for better insight and consistency when performing interventions and providing information regarding fragile infants to caregivers (Limperopoulos & Majnemer, 2002). In addition, experience provides the understanding and knowledge of how the infant's mental and physical health, the NICU environment, the social/family environment, and the social-emotional development of the family interact (AOTA, 2006b).

Experience furthermore, helps the occupational therapist acknowledge particular behaviors; neurological and developmental, as well as the ability to predict the direction of interventions in order to facilitate optimal growth (AOTA, 2006b).

According to Specialized knowledge and skill for occupational therapy practice in the neonatal intensive care unit (2006b) it is important for occupational therapist to understand their roles and limitations within the NICU when working with preterm/fragile infants. For this reason, the American Occupational Therapy Association

(AOTA) has compiled an organized outline and definitions of pertinent information pertaining to the foundation of an occupational therapists' role within the NICU, to serve as a reference guide. The information provides a thorough, but short description of the knowledge needed when working in the NICU, including what to look for in infant development, adaptations for the environment, and what information to provide to the family. Caretto, Francois Topolski, Mckinneg Linkous, Koontz Lowman, and McKeever Murphy (2000) found that Occupational Therapists were involved in parent education: positioning, early intervention services, parent-infant interactions, feeding, play, environment, and infant massage. In this study the Occupational Therapists played the 3rd most important role in parent education in NICUs. Due to this role Occupational Therapists need to have an extensive background and knowledge of infants and developmental patterns.

Als synactive theory by Heidi Als (1982) provides the foundational knowledge for working in a NICU. Als synactive theory was chosen because of its attention to the hierarchical developmental process of an infant and the impact of varying stimuli. These interactions include auditory, visual, and tactile stimuli. Knowing how these stimuli affect the infants development provides the foundational knowledge for adequate and appropriate care for preterm infants. The Als synactive theory also takes into account the environment of the NICU and the interactions among caregivers and infants.

Infant Development

The preterm infants immaturity of major body systems results in an increase dependency on the environment and caregivers of which the infant is in, for example the NICU. However, the preterm infant is vulnerable and dependent on the NICU

environment to support the organization of the physiological and neurobehavioral systems (Blackburn, 1998). In Als' Synactive Theory (Als, 1982), avoidance cues are hiccups, gagging, splaying of the fingers, outstretched hand, and muscle tone and facial color change; these are important because they notify caregivers and staff members that the infant is over stimulated and unable to self-regulate which results in stress for the infant. Six specific extremity reactions were noted in a systematic review by Holsti and Grunau, 2007: hand on face, sitting on air, saluting, airplane, finger splay, and fisting. Hand on face is when the infant puts their hand on their face as a response, sitting on air is when the infant flexes the hips but completely extends the legs straight into the air. Saluting is the action of extending the arm into the air, the airplane is another movement where the infant extends its arms (laterally). Holding the hand in the air or by the face with all five fingers abducted and extended. Fisting is demonstrated by the infant making a tight fist (Holsti & Grunau, 2007). These avoidance cues are important to note/observe. These cues are clues that a stimulus is disrupting development of the central nervous system (CNS) in preterm infants and need to be altered or removed (Caretto et. al., 2000). In the NICU, communication and collaboration among staff members is important to promote normal hierarchical development of the CNS (Bader, 2010).

The development of the CNS consists of six stages, three of which are developed before gestational ages of which preterm infants are considered and the last three stages of which preterm infants are in the intensive care units (Blackburn, 1998). Of all the six stages, the CNS organizational stage is the most vulnerable to preterm infants, specifically the organization of processing sensory input. The organs for sensory develop in a certain sequence; tactile, smell, taste, hearing, and lastly vision.

The intervention techniques implemented by the occupational therapists consider the hierarchical development of the (CNS). The CNS is divided into six subsystems: tactile, proprioceptive, vestibular, olfactory and gustatory sensory, auditory, and visual systems (Als, 1982). These divisions allow little to no disruption or altering of the normal brain development in infants. The tactile system is the foundation of all experiences and is the first system that is fully developed at birth. The proprioceptive system, along with the tactile system, enhances the growth and development of the CNS. The goal of proprioceptive input is to prevent proprioceptive dysfunction later on. The use of tactile and proprioceptive input on the preterm infant helps develop the motor system and in turn stabilizes the autonomic system. The vestibular system is typically initiated through rocking and gentle movement provided by the parents. This system gives our sense of balance and offers a foundation for auditory processing and language. The olfactory and gustatory systems regard the feeding experience. The occupational therapist main focus is on positioning during feeding and communicating the idea that “quality is more important than quantity” (Bader, 2010, pg. 10). Lastly, when considering the visual system it is important to delay this stimulus until the infant is stable and able to tolerate all previous forms of sensory intervention. By acknowledging the infants developmental process the Occupational Therapists can begin to adapt the NICU to meet the infant’s specific needs.

Environmental Adaptations

Preterm infants in the NICU are exposed to the last two senses the most auditory and visual, which can provide sensory overload and stress within the infant and alter organizational development.

Other stressors that a preterm infant may experience in the NICU may include surgical procedures, pain, pathologic processes, interventions from caregiver, and the physical environment, specifically lights and sound (Blackburn, 1998). These stresses cause a response from the infant which expends energy that the preterm infant needs for growth and development.

The occupational therapist working in the NICU must acknowledge the physical and social environments of the NICU and how they interact to promote the infant's development. The physical environment includes the background noise, tone of speech, and frequency (Bader, 2010), lights, and equipment, whereas the social environment includes the family members and caregivers (nursing, physicians, etc.). It is important for people within these NICU environments to understand one another in order to facilitate proper infant development and avoid potential auditory problems. Part of the occupational therapist's role in the NICU is to educate the people in the social environment on the physical environment (AOTA, 2006b). Parents with an infant in the NICU may become more anxious or stressed. This is not productive, especially if parents (mothers in particular) are young, their infant has cardiovascular condition, and/or has a longer length of stay (Dudek-Shriber, 2004). The environment of the NICU itself can be intimidating because of the unfamiliarity of the equipment and medical procedures which may result in parents feeling incompetent and overwhelmed (Leonard & Mayers, 2008). Understanding these two environments, along with the medical care and overall developmental process of infants is the key to infant's optimal health. In the following section, environmental stressors to the developing infant in the NICU are discussed.

Noise

The NICU environment affects the preterm infant. One of the most concerning areas of stress in the NICU is the sound or level of noise (Blackburn, 1998). The noise level in the NICU may cause: hearing loss, an increase in expending energy (i.e., repeat sounds contribute to repeat arousal of the infant and therefore expending energy), decrease in sleep (leading to fatigue and irritability), and cause an additive interaction with ototoxic drugs (aminoglycosides) (Blackburn, 1998). The noise level within the NICU ranges from quiet whispers of parents and care team members to ventilators within the incubator of the preterm infants, which may further complicate the medical issues of preterm infants (Johnson, 2001). A study was conducted regarding the noise level within a ventilator-dependent preterm infant's incubator and the effects of acoustical foam. The findings indicated that the decrease in noise level within incubators due to the acoustical foam resulted in a change in the preterm infants response behaviors (Johnson, 2001). Neonates with the foam tended to demonstrate a decrease need in support from the ventilator, where as those without the noise dampening foam (i.e. a loud environment) demonstrated an increased need of support from the ventilator (Johnson, 2001). Besides foam insulation, another adaptation includes covering the isolette with a blanket in order to muffle the NICU environmental sounds (Vergara & Bigsby, 2004).

Lighting

Another concerning area in the NICU is lighting. This is due to the fact that like noise, lighting is one of the last systems to develop in infants (Bader, 2010). The lighting concerns in the NICU include the length of exposure, the intensity, and the lack of diurnal patterns (i.e., light during the day and dark at night). Interestingly, developmental

outcomes studies by Blackburn (1998) based on light cycling have been conducted and have shown positive results. These positive results include a decrease in heart rate and an increase in weight gain when in a dim portion of the light cycle. Features of lighting within the NICU should include adjustable ambient lighting, at least one source of natural light along with shading/dimming capabilities, no glare from NICU equipment (Vergara & Bigsby, 2004).

Modifying the NICU to best fit the neurobehavioral and physiologic needs of preterm infants is considered *developmentally supportive care* (Als, 1982). This idea is based on the Al's Synactive Model of Development and is in relation to the tolerance of stress experienced by the infant. The idea of *developmentally supportive care* can be accomplished in the NICU by modifying the concerns (i.e., noise, lights, and caregiving) and through continually assessing problems as well as education for caregivers and staff on environmental modification and sensory stimuli.

Individualized Intervention

Like adapting environments to promote developmental growth in infants, interventions may be altered for individual situations or settings, although there may be a standard procedure or protocol to follow (Lekskulchai & Cole, 2001). An important part of an occupational therapists role within the NICU is to develop individualized occupational therapy (OT) intervention plans that include the context of the family and the infant. As part of the individualized OT intervention plan it is important to conduct follow-up assessments post-discharge in order to determine or identify neurodevelopmental delays (Kalia, Visintainer, Brumberg, Pici, & Kase, 2009). The occupational therapist looks in-depth at occupations and activities the family values, their

culture, the infant and their limitations for participating in the occupation and/or activity, the readiness of the family and infant for engaging in those occupations/activities, and finally, the strengths/supports of the physical and social environments for both the family and infant (AOTA, 2008). The culture or ethnicity of the infant's family needs to be considered because it may be different than that of the OT and impact parental education. Parents of an ethnic minority group experienced a higher overall stress than parents who were Caucasian (Dudek-Shriber, 2004). Occupational therapists can lessen this stressor by being familiar with and considering the culture of the infant and the caregiver(s) when educating the caregiver(s) and providing individualized OT interventions. Interventions may vary from family to family because the needs of the infant and cultural differences.

In addition, occupational therapists are multimodal and consider hierarchical development when providing intervention techniques to pre-term infants (Bader, 2010). When developing an individualized intervention plan the occupational therapist must be able to read particular infant behaviors before, during, and/or after therapy interventions. These behaviors are in relation to stress and coping signs from the infant and are key to implementing OT interventions within the NICU. To decrease the amount of avoidance/stress cues, Law Harrison, Kay Williams, Berbau, Stem, and Leeper (2000) found that gentle human touch and stroking are effective ways to help calm and promote positive motor behaviors. Concerns about caregiving are: that the preterm infant may have difficulty regulating his/her arousal level even after the stimulus is gone, interrupted sleep, and little social interaction other than medical interventions (Blackburn, 1998). Helping the infant into a flexed position (i.e., holding the hands and feet while cradling) can promote the infant's self regulation (Als, 1982). When taking into effect gentle

human touch and stroking, the OT needs to consider the infant's avoidance/stress cues, as each infant tolerates stimulus differently and therefore each infant needs a program suited to their needs and tolerance levels.

In determining if an individualized OT intervention plan was effective, a randomized control study conducted by Als, Lawhon, Duffy, McAnulty, Gibes-Grossman, and Bickman in 1994 looked at the effectiveness of individualized developmental care intervention with low birth weight preterm infants. The results of this study favored the experimental group in which infants were treated by nurses who were educated on infant behavioral observations. The observations of infant responses were recorded before, during, and after interventions/caregiving. These responses were recorded and classified into two categories: stress and regulatory which included autonomic motor, state organization, and 91 other behaviors. The experimental group infants were better adapted in autonomic and motor system regulation and self-regulation. In addition the experimental group displayed autonomic stability, tone modulation, movement and posture, symmetrical motor performance, and improved daily weight gain. The greatest differences among the control and experimental groups were found in gross and fine motor modulation, overflow postures, and associated movements. By educating staff on behavioral responses, individualized intervention plans resulted in better regulation within preterm infants.

Stress and self-regulatory responses are unique to each infant and can be a result of many different stimuli within the NICU. An infant's position can influence the self-regulatory and stress behaviors elicited and should be considered when developing an individualized intervention plan. A study by Roy Grenier, Bigsby, Vergara, and Lester

(2003) found that infants lying in the prone position is more beneficial and may promote better self-regulation. This study consisted of seven male and eight female preterm infants who were monitored via videotape. The data from the videotape included: the position the infant was in, whether or not the infant was nested (i.e., provided with boundaries of any kind), the infant's state of arousal, and the time period (i.e., before or after caregiving). Fewer self-regulatory behaviors were observed in infants when they were in the prone un-nested position because of a decrease in stress when compared with side-lying un-nested, supine un-nested, and supine nested. More foot bracing was observed in side-lying un-nested than in prone un-nested. Stress behaviors were seen more in side-lying and supine un-nested when compared to prone un-nested.

In addition to positioning, other stimuli such as auditory, tactile, visual, and vestibular stimuli can evoke a stress or self-regulatory response that is unique to preterm infants. In a study by White-Traut et al. (2002), findings indicated that auditory, tactile, visual, and vestibular intervention (ATVV) had an effect on the length of stay for preterm infants. The participants in this study were all considered preterm infants and some presented with CNS injuries (White-Traut et al., 2002). ATVV intervention uses a ten minute infant massage and five minutes of horizontal rocking. Throughout both of these, the female researcher tries to make eye contact and uses a soothing female voice. For the control group the infants were observed while lying on their side. The experimental study group received ATVV intervention for 15 minutes, two times per day, five days per week until they were discharged. The study group infants were discharged an average of 1.6 weeks earlier than the control group infants (White-Traut et al., 2002). Alertness, transition to total oral feeding, and shorter length of stay were three areas that were

positively affected by the ATVV intervention. Fifteen minutes of ATVV intervention seemed to have positive effects on the infants whether they were preterm infants or preterm infants with CNS injuries. This study demonstrated that interventions can be used for healthy and impaired preterm infants and show similar, positive results. ATVV demonstrates positive effects because it considers the different sensory systems within a developing infant. The sensory interventions and considerations for tactile stimuli include firm touch, massage, stretching and kinesthesia, and touching near hypersensitive areas (Bader, 2010). The proprioceptive system includes weight-bearing activities and gentle rhythmic pressure. The vestibular system stimuli includes gentle Swiss ball exercises and bouncy seats. For the olfactory and gustatory systems, providing positioning such as chin support, swaddling with infant's hands by face, and propping/holding the infant to approximately a 45 degree angle are recommended primarily for feeding activities. The auditory system stimuli includes speaking softly and use of soothing sound machines or toys. The visual system stimuli includes looking at parents' faces or toys hanging above a crib in addition to visually simplifying the NICU environment (Bader, 2010).

The interventions completed by occupational therapists include many different areas; one area of importance is education. Occupational therapists are involved in parental education: positioning, early intervention services, parent-infant interactions, feeding, play, environment, and infant massage (Caretto et al., 2000). Education is an intervention that is individualized for each infant and their family to meet their specific needs.

Parental Education

Parental education on aspects of the NICU is an essential collaboration in order to ultimately enhance the infant's development (Limperopoulos & Majnemer, 2002). Education can be provided to parents through programs and about different OT interventions such as touch programs, feeding, positioning, etc. Of the NICU staff, occupational therapists play the 3rd most important role in parental education (Caretto et al., 2000). Having an infant in the NICU is a stressful occurrence for any caregiver especially when considering the various complications an infant may have (Dudek-Shriber, 2004). "[T]he most stressful aspect of having an infant in the NICU is an altered parent role and relationship with their baby" (Dudek-Shriber, 2004, p. 517). Part of an occupational therapist's role is to diminish that stress, which can be accomplished through education. Occupational therapists provide support through education which enables parents to feel less overwhelmed while having an infant in the NICU (Leonard & Mayers, 2008). Educating caregivers on the process of the NICU, explaining infant development, discussing and explaining interventions, and educating/teaching different techniques to caregivers are all within the jurisdiction of occupational therapists. To ensure information was received by parents with infants in the NICU, occupational therapists must continually assess the way that they provide education.

Melnyk et al. (2001) published a study where an assessment was completed based on the effects of Creating Opportunities for Parenting Empowerment (COPE), a program providing information on maternal coping and infant cognitive development. The infants of the mothers that received the COPE program demonstrated higher scores on developmental indexes, such as the Mental Development Index (MDI) and the Bayley

Scales of Infant Development (BSID-II). In addition, there were no developmental delays in the infants of the mothers that received the COPE program. The mothers in the COPE program also conveyed they had less stress while in the NICU (Melnik et al., 2001).

Skin-to-skin contact

To avoid disruption to the growth and development of infants, it is crucial to provide calming/soothing interventions such as massage, gentle human touch, and kangaroo care (i.e., skin-to-skin contact). These interventions provide skin-to-skin contact between parent (caregiver) and infant. In a study conducted by Goldstein Ferber et al. (2002) examined whether massage given by mothers was as effective as massage given by a professional. Weight gain was assessed to determine the effectiveness of the interventions. One of the treatment groups had the massage intervention being done by the mothers and the other treatment group had the massage administered by a professional female who was unrelated to the infant. The infants in both treatment groups gained weight at approximately the same rate (Goldstein Ferber et al., 2002). Other studies have demonstrated the positive benefits of providing skin-to-skin contact through massage, gentle human touch, and kangaroo care, on improving infant weight gain (Als, et al., 1994; White-Traut, Nelson et al., 2002). This reinforces the reasoning for parental training and why it is important to assist and involve the family in the treatment of their infant. This can also help to improve the parents' comfort level within this technical environment, provide further understanding of their infants responses, and facilitate quality parent-infant interaction (Dobbins, Bohlig, & Sutphen, 1994).

As noted earlier, tactile sensory processing is the first sense to develop in infants. Part of the role of occupational therapists is to facilitate this development, which can be done by way of specialized touch programs. Tactile sensation is vital for infant development, parent-infant attachment, and benefits the overall well-being of preterm infants (Law Harrison et al., 2000). Touch programs include gentle touch or kangaroo care. Kangaroo care is a program that incorporates skin-to-skin contact between infant and caregiver. This helps to promote bonding between infant and parents which is a process that is interrupted by having an underdeveloped infant in the NICU environment; it allows the parents to assume the role of primary caregiver (Leonard & Mayers, 2008). Kangaroo care can be used by fathers so that they feel more of a parenting role, and provides warmth which promotes comfort and growth.

Kangaroo care promotes parent and infant bonding by having skin-to-skin contact. By participating in kangaroo care parents or caregivers may become more acutely aware of the vulnerability of their infants. This awareness increases their desire to go beyond the boundaries of the preterm infant's needs, not only to provide for their survival but also to enable them to prosper (Leonard & Mayers, 2008, pg. 24).

An alternative method of kangaroo care may be used with multiple birth infants. This can be skin-to-skin contact between multiple infants themselves while sharing an incubator/cot also known as co-bedding (Jarvis & Burnett, 2009). The advantages of this care include providing caregiver-infant interaction, cost-effectiveness, breast-feeding improvement, better self-regulation among the infants, and a more consistent sleep-wake cycle (Jarvis & Burnett, 2009; Leonard & Mayers, 2008).

Feeding

Education can be provided to parents on different ways to feed their infant as stated by Caretto et. al., (2000). This education included the topics of infant behavioral cues, positioning, sucking skills (i.e., coordination of suck-swallow-breathe pattern), oral stimulation, nonnutritive sucking, and oral feeding. An infant may expend more energy than taken in because of disorganized oral motor skills, inability to coordinate the suck-swallow-breathe pattern, hypersensitivity to touch around the mouth, and/or the stressful environment in the NICU (Fucile, Gisel, & Lau, 2002). To decrease the length of hospital stay and improve effective oral feeding, different techniques can be applied. These techniques may involve gentle stroking of the infant's cheek, support of the cheek and chin, and peri- and intra-oral stimulation. Peri-oral stimulation is outside of the infant's mouth whereas intra-oral is stimulation inside the infant's mouth.

Fucile et al. (2002) determined how effective an oral stimulation program was in reducing length of stay, increasing intake of milk, and ability to oral feed. This study incorporated stroking of the cheeks, lips, gums, and tongue; providing a pacifier; and positioning the infant in supine during this program. The stroking aspect of oral stimulation programs is seen to strengthen oral musculature; use of pacifiers is used as a training method for sucking (Fucile et al., 2002). Placing the infant in a supine flexed position while feeding reduces the stress response of the infant, encourages head to midline, and maintains chin-tuck which is a desired position for feeding (Lekskulchai & Cole, 2001). This study found that a pre-feeding oral stimulation program was beneficial to preterm infants because they transitioned to an all oral feeding schedule (eight times a

day) sooner than infants that did not receive the oral stimulation program (Fucile et al., 2002).

A further study was conducted by Fucile and Gisel (2005) using the same principles and it was found that infants who received the oral stimulation program achieved full bottle feeding seven days sooner than the infants who did not receive the program. The program also sped the maturation rate and coordination of oral musculature among the infants.

The optimal method of feeding a preterm infant is via breast due to the known overall health advantages such as receiving better nutrients and boosting the infant's immune system (Berger, Weintraub, Dollberg, Kopolovitz, & Mandel, 2009). In the study conducted by Berger et al., (2009), the primary focus was to compare the infant's resting energy expenditure for the method of feeding either by bottle or breast. Both groups were fed breast milk and the results determined that there were no differences in energy expenditure between the groups (Berger et al., 2009). This strongly depended on the readiness and neuromuscular maturity of the infant's suck-swallow-breathe coordination. With no difference in the energy expenditure of breast and bottle feeding, the benefit of breast feeding is the skin-to-skin contact provided and the increased opportunity for parent/infant bonding.

In summary providing parental education and assessing caregiver competence while the infant is still in the NICU may help parents to feel comfortable interacting with their infant. Als (1982) provides this viewpoint:

When the parents can recapture the baby as theirs and in need for their protection and their growing trust in the infant's integrity and autonomy, then the clinician

has done the job well of supporting infant and parents in this mutual development task. (p. 242)

It is vital to provide intervention during early preterm infant developmental life because it promotes normal maturation and can improve the infant's quality of life and encourages normal bonding between parents and infant and decreases stress for both the infant and caregivers.

Summary

Through a review of literature, knowledge regarding infant development, environmental adaptations, individualized interventions, and parental education used by OTs in the NICU was ascertained. This foundational knowledge helped shape research ideas and questions for creating a survey which focused on the current roles of OTs in the NICU.

CHAPTER III

METHODOLOGY

A study conducted by Caretto, Francois Topolski, Mckinneg Linkous, Koontz Lowman, and McKeever Murphy (2000) formed the initial research design for this independent study. In their study, questionnaires were sent to 190 neonatologists in the United States (U.S.). The neonatologists were selected from the United States Neonatologists Directory 1996 published by the American Academy of Pediatrics in 1996. The current study was designed using a similar methodology; however, a different population and resources were used.

The current study was a non-experimental exploratory design with a 16-item survey developed based on existing literature found regarding the different roles of occupational therapists and interventions that have been used in the Neonatal Intensive Care Unit (NICU). The survey was created to gather information/data regarding the formed hypotheses resulting from the literature review. Questions were compiled and placed in a document using Microsoft Word™. The questions were categorized into three subtopics and itemized according NICU work setting and staffing level, professional background items, and NICU practice role and description items. The first subtopic, NICU work setting and staffing level, included questions such as: location of hospital (i.e, region), level of care (i.e., level I, level II, level III, and other), common diagnoses seen in the NICU, the average amount of NICU infants seen on a daily basis,

and the amount of full-time equivalent (FTE) OTs in the NICU including the OT completing the survey. The second subtopic, professional background items, included questions such as, total years of experience in the NICU and prior to working in the NICU, training received to prepare for working in the NICU, and special certifications or training to prepare you for working in the NICU. The third subtopic, NICU practice role and description items, included questions such as the role of OT in the NICU, assessments used to evaluate NICU infants [i.e., Naturalistic Observations of Newborn Behavior (NONB) (NIDCAP Level I), Assessment of Preterm Infant Behavior (APIB) (NIDCAP Level II), and Neonatal Behavioral Assessment Scale (NBAS)], types of Frames of Reference [i.e., Synactive Theory of Development (Als, H., 1982), Sensory integration (SI) (Ayres, A.J., 1972), and Neurodevelopmental Therapy (NDT) (Bobath, K., & Bobath, B., 1984)], interventions (i.e., parent/family education, stress signal education, and positioning), education/information provided to parents (i.e., analysis of particular interventions provided to NICU infant, hands on direction/ instruction for handling NICU infant, and role of staff members working with NICU infant), and any further information the respondent would like to express/add regarding the role of OT in the NICU.

Prior to the survey distribution a pilot study was conducted and approval was obtained from the University of North Dakota's (UND) Institutional Review Board (IRB). The pilot study involved three occupational therapists with pediatric NICU knowledge and experience, and one occupational therapy professor, who specialized in pediatrics. The four pilot study subjects read through the survey and made suggestions

regarding the survey content. Based on these suggestions the survey was altered and submitted for IRB approval.

Upon approval of the UND IRB the survey was mailed out to 15 occupational therapy departments of hospitals in each region of the United States (U.S.), totaling a distribution of 90 surveys. The six regions of the U.S. were divided according to the AOTA Workforce and Compensation Survey (2006). The regions consisted of Pacific, Mountainous, North Central, South Central, North East, and South Atlantic. The states included in the Pacific region were: Washington, Oregon, California, Alaska, and Hawaii. The Mountainous region consisted of Montana, Idaho, Wyoming, Nevada, Utah, Colorado, New Mexico, and Arizona. States included in the North Central region were: Minnesota, North Dakota, South Dakota, Wisconsin, Nebraska, Kansas, Iowa, Michigan, Illinois, Indiana, and Ohio. The South Central region contained Alabama, Texas, Louisiana, Oklahoma, Missouri, Tennessee, Kentucky, and Arkansas. The states included in the North East region were: Massachusetts, Vermont, Pennsylvania, New Hampshire, Connecticut, New Jersey, Rhode Island, Maine, and New York. The South Atlantic region consisted of Florida, Georgia, North Carolina, South Carolina, West Virginia, Virginia, Maryland, and Delaware.

In order to find hospitals in each state with a NICU division the AHA Guide® to Health Care Field by the American Hospital Association (2010) was used. The AHA Guide® to Health Care Field was organized by states and furthermore by city/county. The AHA Guide® to Health Care Field used a numerical code system, which identified the different departments/service areas within each hospital. In the index of the AHA Guide® to Health Care Field the two numerical codes that were searched included

Neonatal Intensive Care: code 73, and Neonatal Intermediate Care: code 74. This search led to the development of a sampling frame of 1,000 (n) NICUs within the U.S.. To be included in this study the hospital had to have at least one of these two codes. Once the code was identified within a facility, the name of the hospital and the mailing address, as provided by the AHA Guide® to Health Care Field, was compiled into a word document. This word document was organized according to the six regions, predefined by AOTA Workforce and Compensation Survey (2006), and then by state.

After compiling the word document, the hospitals were then individually separated and placed in groupings associated with their particular region. By separating each hospital individually, it allowed the researchers to choose hospitals according to the predetermined regions. Once all the hospitals in the states were individually divided into regions, the researchers blindly selected 15 hospitals from each region through a stratified randomized procedure. This procedure ensured a wide range and variety of data collection.

Following the stratified random selection process of the hospitals, the researchers gathered a packet of information to be sent to the selected hospitals. The packets consisted of a cover letter describing the study and questionnaire, the 16-item questionnaire, and a prepaid postage and addressed return envelope. The cover letter and survey are found in Appendix (A) and (B). The cover letter explained the background of the questionnaire and the period for completion of the questionnaire, which was one week or return by November 5, 2010. There were no reminders sent due to prohibitive costs.

Of the 90 occupational therapy departments receiving the survey, there were 19 respondents. Two of the respondents placed phone calls from facilities saying that they

had no OTs working in the NICU, and two were completed by physical therapists with the latter four responses removed, this is a response rate of 21%. The returned questionnaires were identified numerically in the order they were received. The completed surveys contained qualitative and quantitative answers. The qualitative items were question numbers 9, 11, and 16, which were compiled verbatim into a word document (Microsoft Word™) and analyzed thematically. SPSS 18® and Microsoft Excel™ were used to record the quantitative data, questions 1-8, 10, and 12-15. When compiling the data the researchers decided that only surveys that were completed by OTs were included for data analysis; if there was no OT in the NICU at the responding site, only the region and level of NICU would be recorded (regardless of how much of the survey was completed). Once all data was collected and recorded it was analyzed through comparison of all returned surveys and displayed visually in tables and graphs. Quantitative analysis consisted of calculation of counts (or totals) and percentages by survey item. All hypotheses were answered and displayed visually in tables and graphs. These results may be found in the following Chapter IV.

CHAPTER IV

RESULTS

The purpose of this study was to provide more information as to the role of occupational therapy (OT) in Neonatal Intensive Care Units (NICUs) across the country as well as interventions used and the experience needed before working in the NICU. As a result of the literature review conducted four hypotheses were formed: (1) each Neonatal Intensive Care Unit (NICU) sampled in the U.S. will employ at least one occupational therapist, (2) occupational therapists will have at least a year of work experience in pediatrics before starting work in a NICU, (3) the role of occupational therapists in the NICU is multifaceted (i.e., occupational therapists provide more interventions than feeding and positioning), (4) occupational therapists survey responses will not differ significantly depending on the geographical region of the U.S..

NICU Work Setting & Staffing Level Items:

Of the 90 surveys sent 19 facilities with NICUs responded. This is a response rate of 21%. These responses were dispersed among the six regions; Northeast (2), South Atlantic (1), South Central (4), North Central (5), Mountain (5), and Pacific (2). Table 1 displays this information.

Table 1.

Responses by Region

Region	<u>N</u>	%
North Central	5	26.31
Mountain	5	26.31
South Central	4	21.05
Northeast	2	10.52
Pacific	2	10.52
South Atlantic	1	5.26

The levels of NICU at each facility ranged from level I which is infants who are healthy or require minimal care; Level II houses infants that may require IVs, gavage feedings, photo therapy, and/or oxygen through nasal cannula or oxyhood; Level III is for infants who may be medically fragile, require ventilator support, surgical care, and/or specialized care (Vergara & Bigsby, 2004). The results of the levels of care provided at the responding facilities that responded are in Table 2. Of the returned surveys some facilities marked more than one level and some recorded no level at all. The total number of level I NICUs was 1, there were 4 level II NICUs, 13 level III NICUs, and 1 other.

Table 2.

Level of NICUs

Level of NICU	<u>N</u>	<u>%</u>
Level I	1	5.88
Level II	4	23.53
Level III	13	46.74
Other	1	5.88

On a daily basis OTs work with 1-12 infants in the NICU with a wide range of diagnoses. Common Diagnoses of NICU infants seen by each of the facilities is recorded in Table 3. The most common diagnoses that OTs work with are preterm infants (i.e., birth before 36 weeks gestation) (n = 12) and respiratory disorders (n = 12). Other diagnoses that OTs worked with in the NICU include: chromosomal abnormalities (n = 10), birth defects (n = 9), multiple births (n = 11), cardiovascular disorders (n = 9), central nervous system (CNS) disorders (n = 8), hyperbilirubinemia (n = 7), digestive disorders (n = 7), birth weights (n = 5), macrosomia (n = 6), normal birth weight (n = 7), low birth weight (n = 10), very low birth weight (n = 9), extremely low birth weights (n = 8), and other (n = 1). A diagnosis that was written in for other was diabetic mother.

Table 3.

Common Diagnoses

Diagnosis	<u>N</u>
Preterm infants	12
Birth weights	5
Macrosomia- 4,000 grams or more (8.8 pounds or more)	6
Normal birth weight- 2,500 to 3,999 grams (5.5 to 8.7 pounds)	7
Low birth weight- 1,501 to 2,500 grams (3.4 to 5.5 pounds)	10
Very low birth weight- 1,500 to 1,001 grams (3.3 to 2.3 pounds)	9
Extremely low birth weight- 1,000 grams or less (2.2 lbs or less)	8
Chromosomal Abnormalities	10
Birth Defects	9
Multiple Births	11
Respiratory Disorders	12
Cardiovascular Disorders	9
Central Nervous System Disorders	8
Hyperbilirubinemia	7
Digestive Disorders	7
Other	1

Through the analysis of the 19 responses, it was found that 13 NICU facilities employed OTs (i.e., 68%). Table 4 shows the number of an OTs time spent within the NICU as well the total time spent in the NICU by OTs at each facilities in terms of full-time equivalents (FTE). Of the employed OTs (n=13), 46.2% (n=6) worked ¼ FTE, 30.8% (n=4) worked ½ FTE, .08% (n=1) worked ¾ FTE, and .08% (n=1) worked 1 FTE. The total number of hours worked by OTs in the NICU was also calculated. The responses indicated that 30.8% (n=4) of the facilities had OTs working in the NICU totaling a time of ¼ FTE, .08% (n=1) of the facilities had OTs working ¾ FTE, and 42.2% (n=6) had OTs working 1 FTE.

Table 4.

Single Occupational Therapist’s FTEs and Total FTEs for Occupational Therapists at Each Facility.

Full-time Equivalent	FTEs Per OT		Total FTEs	
	<u>N</u>	%	<u>n</u>	%
¼ FTE	6	42.2	4	30.8
½ FTE	4	30.8	0	0
¾ FTE	1	.08	1	.08
1 FTE	1	.08	6	42.2

Professional Background Items

Working in the NICU is a specialized area of OT practice. It is continually evolving and requires occupational therapists that are competent and knowledgeable. Table 5 shows the total years of experience responding occupational therapists had working in an NICU setting. Of the 13 surveys; 3 therapists had 2 years or less

experience, 2 had 3-5 years experience, 3 had 6-10 years of experience, 1 had 11-15 years of experience, and 4 had 16 or more years of experience within the NICU setting.

Table 5.

Total Years of Experience Working in a NICU Setting.

Years of Experience	<u>n</u>
2 years or less	3
3-5 years	2
6-10 years	3
11-15 years	1
16 or more years	4

According to AOTA (2006b) previous experience in pediatric practice is necessary prior to working in the NICU. The years of prior experience was calculated and found that 5.18 years was the average prior pediatric experience completed by occupational therapists.

Qualitative responses for item 9 on the survey regarding training prior to working in the NICU included; clinical observations and/or mentoring from other therapists/ NICU staff (n=10, 77%), working with Intensive Care Unit (ICU) families; continuing education such as: Developmental care in the NICU national conference, Graven's Conference, workshops, and Developmental Interventions in Neonatal Care 4 conference (n=7, 54%); reading articles and books (n=4, 31%) , and various pediatric experience (home health, acute, inpatient, and outpatient) (n=4, 31%).

As stated earlier, working in the NICU is an area of practice that may require specialized training or certification. As shown by Table 6, training and/or certifications

may include: Infant Massage (n=6), Sensory Integration (n=3), Neurodevelopmental Theory (n=3), as well as others (n=5). The other training or certifications infant mental health, Chronically Controlled Developmental Theory (CCDT), level I and II Newborn Individualized Developmental Care and Assessment Program (NIDCAP), and Certified Passenger Safety Technician.

Table 6.

Special Certifications or Training Used in the NICU.

Special Certifications or Training	<u>n</u>
Infant Massage	6
Sensory Integration (SI)	3
Neurodevelopmental Development (NDT)	3
Certified Lactation Consultant (CLC)	0
Other	5

NICU Practice Role and Description Items:

Qualitative responses for item 11 on the survey revealed common themes among the role of occupational therapists in the NICU. One of the common roles was providing interventions such as environmental modifications (n=3; 25%), feeding (n=7; 58%), positioning (n=9; 75%), self-regulation (n=5; 42%), and parent/staff education, (n=10; 83%). Another role for OTs is to conduct assessments such as developmental, sensory motor, neurodevelopmental, feeding/pre-feeding, self-regulation, and neuromotor.

Along with specialized training and/or certifications, occupational therapists are required to be knowledgeable and competent with infant assessments. Table 7 summaries the data collected regarding these assessments: Assessment of Preterm Infant Behavior

(APIB) (NIDCAP Level II) (n= 3), Naturalistic Observations of Newborn Behavior (NONB) (NIDCAP Level I) (n=1), Neonatal Behavioral Assessment Scale (NBAS) (n= 1), NICU Network Neurobehavioral Scale (NNNS) (n= 1), Infant Behavioral Assessment (IBA) (n= 1), other (n=10). As listed on the survey by practicing occupational therapists, additional assessments used in the NICU can include the Test of Infant Motor Performance (TIMP) (n=2), faculty established assessments (n=2), Behavioral States Assessments, basic evaluations (i.e., range of motion, tone, and observations) (n=3), Nursing Child Assessment Satellite Training Program (NCAST) (n=1), criteria reference with development as the bases (n=1), Pre-term Infant Feeding Assessment (n=1), and Bayley Scales (n=1).

Table 7.

Assessments Used to Evaluate Infants in the NICU.

Assessments	<u>n</u>	<u>%</u>
Assessment of Preterm Infant Behavior (APIB) (NIDCAP Level II)	3	23.07
Naturalistic Observations of Newborn Behavior (NONB) (NIDCAP Level I)	1	7.69
Neonatal Behavioral Assessment Scale	1	7.69
NICU Network Neurobehavioral Scale (NNNS)	1	7.69
Infant Behavioral Assessment (IBA)	1	7.69
Other	10	76.92

Practice in the NICU is guided by Frames of Reference (FORs). Table 8 presents the FORs that may be used in the NICU. These FORs included: Sensory integration (SI)

(Ayres, 1972) (n=8), Neurodevelopmental Therapy (NDT) (Bobath, & Bobath, 1984) (n=7), Synactive Theory of Development (Als, 1982) (n=6), Neurobehavioral Development of Preterm Infants by Gestational Age (Hadley, et al, 1989; Yecco,1993) (n=6), States of Arousal (Blackburn, 2003) (n=6), Preterm Neurobehavioral Organization: In-turning, Coming-out, & Reciprocity (Gorski, Davidson, & Brazelton, 1979) (n=4), A Systems Perspective (Vergara & Bigsby, 2004) (n=2), Person-Environment-Occupational Model (Law, Cooper, Strong, Stewart, Rigby, & Letts, 1996) (n=2), Occupational Adaptation (Schkade, & Schultz, 1992) (n=2), Goodness of Fit Model (Thomas & Chess, 1989) (n=1).

Table 9 displays interventions used in the NICU and their frequency. The top 4 frequently used interventions were parent/family education (always n=10; frequently n=2), stress signal education (always n=10; frequently n=2), positioning (always n=8; frequently n=3; sometimes n=1; never n=2), and feeding/pre-feeding (always n=8; frequently n=2). Other interventions that were provided included developmental and early childhood referrals.

Providing information and education to parents is seen as an important role to OTs. Table 10 encompasses the education and information that is provided to parents by OTs. Education on the role of staff members working with NICU infants (n=7), analysis of particular interventions provided to NICU infants (n=10), hands on direction/instruction for handling NICU infants (n=10), and others (n=8) are provided. Others included: follow up care/developmental clinic, information specific to feeding, positioning, parenting in the NICU, transitioning to home, premature infant cues, developmental milestones, and overstimulation.

Table 8.

Frames of Reference Used in the NICU.

Frames of Reference	<u>N</u>	<u>%</u>
Sensory integration (SI) (Ayres, 1972)	8	61.53
Neurodevelopmental Therapy (NDT) (Bobath, & Bobath, 1984)	7	53.84
Synactive Theory of Development (Als, 1982)	6	46.15
Neurobehavioral Development of Preterm Infants by Gestational Age (Hadley, et al, 1989; Yecco,1993)	6	46.15
States of Arousal (Blackburn, 2003)	6	46.15
Preterm Neurobehavioral Organization: In-turning, Coming-out, & Reciprocity (Gorski, Davidson, & Brazelton, 1979)	4	30.76
A Systems Perspective (Vergara & Bigsby, 2004)	2	15.38
Person-Environment-Occupational Model (Law, Cooper, Strong, Stewart, Rigby, & Letts, 1996)	2	15.38
Occupational Adaptation (Schkade, & Schultz, 1992)	2	15.38
Goodness of Fit Model (Thomas & Chess, 1989)	1	7.69

Table 9.

Types of Interventions.

Interventions	Frequency (Count/ Percentage)				
	Always	Frequently	Sometimes	Rarely	Never
Parent/Family education	10 (80%)	2 (15%)			
Stress signal education	10 (80%)	2 (15%)			
Positioning	8 (62%)	3 (23%)	1 (8%)		2 (15%)
Touch programs	4 (31%)	3 (23%)	1 (8%)		2 (15%)
Feeding/pre-feeding	8 (62%)	2 (15%)			
Bottle feeding	5 (38%)	2 (15%)	1 (8%)		
Breast feeding	2 (15%)	4 (31%)		1 (8%)	
Oral motor stimulation	1 (8%)	5 (38%)	1 (8%)	2 (15%)	
Splinting			2 (15%)	3 (23%)	
Hand splinting			2 (15%)	6 (46%)	
Cranial splinting		1 (8%)		1 (8%)	3 (23%)
Other splinting				1 (8%)	2 (15%)
Infant massage	2 (17%)	4 (31%)	2 (15%)		1 (8%)
Sensory modification	5 (15%)	3 (23%)	2 (15%)	1 (8%)	
Kangaroo Care (KC)	4 (31%)	2 (17%)	3 (23%)		1 (8%)
Environmental modifications	6 (46%)	5 (38%)	1 (8%)		
Creating Opportunities for Parent Empowerment	4 (31%)	2 (17%)			2 (15%)
Other		1 (8%)		1 (8%)	

Table 10.

Education/Information Provided to Parents.

Types of Education/Information	<u>n</u>	<u>%</u>
Role of staff members working with NICU infants	7	54
Analysis of particular interventions provided to NICU Infants	10	77
Hands on direction/instruction for handling NICU Infants	10	77
Other	8	62

Qualitative responses for item 16 on the survey regarding more information about the role of OT in the NICU denoted a team approach to intervention; that a high level of value is placed on the role of OT in the NICU; a focus on parent education and the infants ability to tolerate handling/positioning; as well as a feeding to increase weight gain.

The survey results were analyzed according to the four hypotheses formed. Hypothesis (1) each NICU sampled in the U.S. will employ at least one occupational therapist was not supported according to the analyzed data. It was found that thirteen of 19 facilities reported at least ¼ FTE OT employed. Six of 19 facilities responded with no OTs working in the NICU (31.57%). Hypothesis (2) occupational therapists will have at least a year of work experience in pediatrics before starting work in a NICU was supported by the analyzed data. The occupational therapists had mean of 4.9 years of prior work experience. Only one respondent had no experience prior to working in the NICU. Hypothesis (3) the role of occupational therapists in the NICU is multifaceted

(i.e., occupational therapists provide more interventions than feeding and positioning) was supported by the collected data. It was found through the data analysis that the top four most frequently used interventions were parent/family education, stress signal education, positioning, and feeding/pre-feeding. Hypothesis (4) occupational therapists survey responses will not differ significantly depending on the geographical region of the U.S. was not supported or negated due to the limited number of responses (n=13; 14%).

CHAPTER V

SUMMARY

A literature review was conducted in order to obtain a foundational knowledge of occupational therapists (OT) in the Neonatal Intensive Care Unit (NICU). Information on infant development, environmental adaptations, individualized interventions, and parental education gained from the literature review evoked the main themes of the current role of OTs in the NICU. This subsequently led to four hypotheses: at least one OT will be employed in the NICUs sampled within the United States, OTs have at least a year of pediatric experience before starting work in a NICU, the role of occupational therapists in the NICU are multifaceted (i.e., provide more interventions than feeding and positioning), and occupational therapists' survey answers will not differ depending on the region of the United States where they are employed.

In order to answer/collect information that supported these hypotheses a survey was created, piloted, approved by the University of North Dakota Institutional Review Board, and sent to 90 OT departments of hospitals with NICUs. The 90 hospitals were selected through a stratified, randomized procedure. The survey was to be completed and returned via prepaid postage and addressed envelope. Of the 90 surveys sent, 19 responses were received (13 completed by OT, 2 phone calls, 1 completed by physical therapist, 3 only had the region and level on NICU filled out with a response of no OT working in the NICU). The returned surveys completed by OTs in the NICU were

analyzed by SPSS 18®, Microsoft Word™, and Excel 2007™ and compiled into tables and graphs.

The survey results were analyzed according to the four hypotheses formed. Hypothesis 1, each NICU sampled in the U.S. will employ at least one occupational therapist was not supported according to the analyzed data. It was found that thirteen of 19 facilities reported at least ¼ FTE OT employed. Six of 19 facilities responded with no OTs working in the NICU (31.57%). According to the analysis this hypothesis was not supported. Hypothesis 2, occupational therapists will have at least a year of work experience in pediatrics before starting work in a NICU, was supported by the analyzed data. The occupational therapists had a mean of 4.9 years of prior work experience. Only one respondent had no experience prior to working in the NICU. This hypothesis was supported. Hypothesis 3, the role of occupational therapists in the NICU is multifaceted (i.e., occupational therapists provide more interventions than feeding and positioning) was supported by the collected data. It was found through the data analysis that the top four most frequently used interventions were parent/family education, stress signal education, positioning, and feeding/pre-feeding. This hypothesis was supported. Hypothesis 4, occupational therapists survey responses will not differ significantly depending on the geographical region of the U.S., was not supported or rejected due to the limited number of responses (n=13; 14%).

Conclusion

In conclusion OTs are employed in some NICU settings across the United States and serve a multifaceted role, such as: providing parent education, stress signal education, positioning, and feeding/pre-feeding, infant massage, kangaroo care, and

environmental modifications. The OTs employed in the NICU consider Als Synactive Theory (Als, 1982) when planning these interventions and carrying them out. OTs serve such a multifaceted role within the NICU, it was surprising that OTs were not employed in more NICUs across the United States. Of the 21 responses received only 13 NICUs employed OTs, furthermore only six of the 13 respondents worked full time. The OTs employed in the NICU have previous pediatric experience, an average of 4.9 years. It is hypothesized that the low response rate may be due to the lack of OTs working in the NICU. The size of the hospitals was not taken into consideration and this may have contributed to the low response rate.

Recommendations

For future studies it is recommended that external funding resources be found, a reminder be sent one week prior to deadline to ensure completion and return of survey, select more facilities to send survey to (30 per region instead of 15), and/or send two surveys to random facilities with NICU in each state and categorize later according to region. To raise awareness of the value of the role of OTs in the NICU this independent study will be submitted to the American Occupational Therapy Association (AOTA) National Conference as a poster for the 2012 conference. The independent study will also be submitted to a variety of pediatric journals, specifically *Physical and Occupational Therapy in Pediatrics*, for publication as a pilot study.

APPENDICES

Appendix A
Cover Letter for Survey

October 8, 2010

Dear Occupational Therapist,

We would like to invite you to participate in a study being conducted on the role of Occupational Therapy (OT) in the Neonatal Intensive Care Unit (NICU). This study has been approved by the University of North Dakota (UND) Institutional Review Board.

The current role of an occupational therapist and their interventions utilized in the NICU across the United States has not been studied in recent years. The professional literature reports that common OT interventions provided in the NICU include feeding, positioning, and parental education. Yet, is the OT role broader than this? It is important to acknowledge the overall role of an occupational therapist in order to ensure quality care with NICU infants. This study seeks to update and provide that information to practitioner audiences through presentation and publication.

Included in this packet is a survey with 16-items regarding the NICU occupational therapy practice setting and staffing levels, professional background in OT, and the NICU OT practice role and description. The survey is estimated to take 15-20 minutes of your time to complete. An envelope with prepaid postage for return has been provided. If you choose to participate in this study please mail the completed survey back by November 5th, 2010.

Your participation in this study is voluntary. Should you choose to participate, you have the right to discontinue your participation at any time by contacting the persons noted in the confidentiality statement. By returning the enclosed survey, you are indicating your consent to participate in this study.

Confidentiality Statement:

The information collected through this questionnaire will be kept strictly confidential and anonymous and used for the purpose of providing descriptive information on the collective role of OT in the NICU in the United States. Participation is entirely voluntary and the participant has the right to withdraw consent and discontinue participation in the questionnaire at any time without prejudice. Although participants may not receive any direct benefits, the information shared will help to increase the understanding of the role(s) of occupational therapy in the NICU. There are no anticipated risks to the participant.

If you have any questions regarding the study or to withdraw from this study please contact Sarah Mathieu at (612) 730-5287, Gwendalyn Mollerud at (701) 340-7143, or Dr. Jan Stube at (701) 777-3099. If you have questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the University of North Dakota Institutional Review Board at (701) 777-4279. Please call this number if you cannot reach research staff, or you wish to talk with someone else.

Thank you for your time and willingness to assist in this project!
Sincerely,

Sarah Mathieu, MOTS & Gwendalyn Mollerud, MOTS
Graduate Students in the UND Masters of Occupational Therapy program

Jan Stube, PhD, OTR/L
Associate Professor
Department of Occupational Therapy
University of North Dakota
Grand Forks, ND 58202-7126

Appendix B
Survey

Neonatal Intensive Care Unit (NICU) Survey

The purpose of this survey is to provide more information as to the role of Occupational Therapy (OT) in the Neonatal Intensive Care Units (NICUs) across the country, including the interventions used and the experiences accrued for working in the NICU. This survey research has been approved by the University of North Dakota Institutional Review Board (IRB).

It is requested that an occupational therapist (OT) please complete the following survey. The survey should take approximately 15-20 minutes of one's time. Once completed, please place the survey in the envelope provided and mail to address given. Please mail the survey back within a week of receiving it.

Confidentiality Statement: The information collected through this questionnaire will be confidential and used for the purpose of providing more information on the role of OT in the NICU in the United States. Participation is entirely voluntary and the participant has the right to withdraw consent and discontinue participation in the survey at any time without prejudice. Although participants may not receive any direct benefits, the information gained will increase the understanding of the role(s) of occupational therapy in the NICU in order to promote further research beneficial to the recipients of OT in the NICUs.

Please check (all that apply) and/or fill in your response:

NICU Work Setting & Staffing Level Items:

1. In what region of the United States are you employed?
 - Northeast (ME, VT, PA, NH, CT, NJ, RI, MA, NY)
 - South Atlantic (FL, GA, NC, SC, WV, VA, MD, DE)
 - South Central (AL, TX, LA, OK, MS, TN, KY, AR)
 - North Central (MN, ND, SD, WI, NE, KS, IA, MI, IN, OH)
 - Mountain (MT, ID, WY, NV, UT, CO, NM, AZ)
 - Pacific (WA, OR, CA, AK, HI)

2. What is the level of care designation for the NICU at your work setting?
 - Level I (infants who are healthy or require minimal care)
 - Level II (infants may require an IV, gavage feedings, phototherapy, oxygen through nasal cannula or oxyhood)
 - Level III (infants may be medically fragile, ventilator support, surgical care, specialized care)
 - Other: Please specify _____

3. What are the common diagnoses of the NICU infants that you work with in the NICU?

- Preterm infants (birth before 36 weeks gestation)
- Birth weights
 - Macrosomia (4000 grams or more) 8.8 lbs or more
 - Normal Birth Weight (2500 grams to 3999 grams) 5.5 to 8.7 lbs
 - Low Birth Weight (2500 grams or 1501) 5.5 lbs to 3.4 lbs
 - Very Low Birth Weights (1500 grams to 1001) 3.3 lbs to 2.3 lbs
 - Extremely Low Birth weights (1000 grams or less) 2.2 lbs or less
- Chromosomal abnormalities
- Birth Defects
- Multiple births
- Respiratory Disorders
- Cardiovascular Disorders
- Central Nervous System Disorders
- Hyperbilirubinemia
- Digestive Disorders
- Other: _____

4. On average, how many NICU infants do you work with on a daily basis?

5. At your work setting, what amount of time do you spend within the NICU?

- 1/4 Full-Time Equivalent (FTE) 3/4 Full-Time Equivalent (FTE)
- 1/2 Full-Time Equivalent (FTE) 1.0 Full-Time Equivalent (FTE)

6. Including yourself, how many occupational therapists work within your NICU setting in terms of total FTEs?

A total of _____ FTEs.

Professional Background Items:

7. How many total years of experience do you have working in an NICU setting?

- 2 years or less
- 3-5 years
- 6-10 years
- 11-15 years
- 16 or more years

8. How many years of OT work experience did you have prior to working in an NICU?

Prior OT work experience: _____ years

9. What training did you receive to prepare you for working in the NICU?

10. Do you have special certifications or training that you use in the NICU?

Certified Lactation Consultant (CLC)

Sensory Integration (SI)

Neurodevelopmental Theory (NDT)

Infant Massage

Other: _____

NICU Practice Role and Description Items:

11. In a few short words, what is the role of an Occupational therapist in your NICU?

12. What assessments do you use when evaluating the infants?

Naturalistic Observations of Newborn Behavior (NONB) (NIDCAP Level I)

Assessment of Preterm Infant Behavior (APIB) (NIDCAP Level II)

Neonatal Behavioral Assessment Scale (NBAS)

NICU Network Neurobehavioral Scale (NNNS)

Infant Behavioral Assessment (IBA)

Other: _____

13. What type(s) of Frame(s) of Reference do you use in the NICU?

Synactive Theory of Development (Als, H., 1982)

Sensory integration (SI) (Ayres, A.J., 1972)

Neurodevelopmental Therapy (NDT) (Bobath, K., & Bobath, B., 1984)

Goodness of Fit Model (Thomas, A., & Chess, S., 1989)

A Systems Perspective (Vergara, E., & Bigsby, R., 2004)

Person-Environment-Occupational Model (Law, M., Cooper, B., Strong, S., Stewart, D., Rigby, P., & Letts, L., 1996)

Occupational Adaptation (Schkade, J., & Schultz, S., 1992)

Neurobehavioral Development of Preterm Infants by Gestational Age (Hadley, M.A. et al, 1989; Yecco, G. J.,1993).

Preterm Neurobehavioral Organization: In-turning, Coming-out, & Reciprocity (Gorski, P.A., Davidson, M.F., & Brazelton, T. B., 1979).

States of Arousal (Blackburn, S.T., 2003)

14. As an occupational therapist, what type(s) of intervention(s) do you use in the NICU?

On the Likert scale, please circle the frequency with which you perform these interventions each day.

___ Parent/Family education	Always	Frequently	Sometimes	Rarely	Never
___ Stress signal education	Always	Frequently	Sometimes	Rarely	Never
___ Positioning	Always	Frequently	Sometimes	Rarely	Never
___ Touch programs	Always	Frequently	Sometimes	Rarely	Never
___ Feeding/pre-feeding	Always	Frequently	Sometimes	Rarely	Never
___ bottle	Always	Frequently	Sometimes	Rarely	Never
___ breast	Always	Frequently	Sometimes	Rarely	Never
___ Oral motor stimulation	Always	Frequently	Sometimes	Rarely	Never
___ Splinting	Always	Frequently	Sometimes	Rarely	Never
___ hands	Always	Frequently	Sometimes	Rarely	Never
___ cranial	Always	Frequently	Sometimes	Rarely	Never
___ other	Always	Frequently	Sometimes	Rarely	Never
___ Infant massage	Always	Frequently	Sometimes	Rarely	Never
___ Sensory modification	Always	Frequently	Sometimes	Rarely	Never
___ Kangaroo Care (KC)	Always	Frequently	Sometimes	Rarely	Never
___ Environmental Modifications	Always	Frequently	Sometimes	Rarely	Never
___ Creating Opportunities for Parent Empowerment (COPE)	Always	Frequently	Sometimes	Rarely	Never
___ Other: _____	Always	Frequently	Sometimes	Rarely	Never
___ Other: _____	Always	Frequently	Sometimes	Rarely	Never

15. What type of education/information do you provide to parents?

- ___ Role of staff members working with NICU infant
- ___ Analysis of particular interventions provided to NICU infant
- ___ Hands on direction/ instruction for handling NICU infant
- ___ Other: _____

16. Any further information you would like to express/add regarding the role of Occupational therapy in the NICU: _____

Thank you for your participation in this survey! This information will be useful in defining the role of occupational therapy in the NICU and contributing to further research.

Appendix C
Picture Release Form

REFERENCES

- Als, H. (1982). Toward a synactive theory of development: Promise for the assessment and support of infant individuality. *Infant Mental Health Journal*, 3(4), 229-243.
- Als, H., Lawhon, G., Duffy, F. H., McAnulty, G. B., Gibes-Grossman, R. & Bickman, J. G. (1994). Individualized developmental care or the very low-birth-weight preterm infant: Medical and neurofunctional effects. *JAMA*, 272, 853-858.
- American Occupational Therapy Association. (2008). Occupational therapy practice framework: Domain and process (2nd ed.). *American Journal of Occupational Therapy*, 62, 625-683.
- American Occupational Therapy Association. (2006a). Occupational therapy salaries and job opportunities continue to improve: 2006 AOTA workforce and compensation survey. *OT Practice*. September 25, 2006.
- American Occupational Therapy Association. (2006b). Specialized knowledge and skill for occupational therapy practice in the neonatal intensive care unit. *American Journal of Occupational Therapy*, 54, 641-648.
- Ayres, J. A. (1972). *Sensory integration and learning disorders*. Los Angeles: Western Psychological Services.
- Bader, L. (2010). Intervention techniques for OTs in the NICU. *OT Practice*. 15(2), 7-11.
- Berger, I., Weintraub, V., Dollberg, S., Kopolovitz, R., & Mandel, D. (2009). Energy Expenditure for Breastfeeding and Bottle-Feeding Preterm Infants. *Pediatrics*. 124, e1149-e1152. DOI: 10.1542/peds.2009-0165

- Blackburn, S. (1998). Environmental impact of the NICU on developmental outcomes. *Journal of Pediatric Nursing, 13*, 279-289.
- Bobath, K., & Bobath, B. (1984). Neurodevelopmental treatment. In D. Scrutton (Ed.). *Clinics in developmental medicine: No. 90. Management of the motor disorders of children with cerebral palsy* (pp. 6-18). New York: Cambridge University Press.
- Brazlton, T. B. (1973). Neonatal Behavioral Assessment Scale. *Clinics in developmental medicine: No. 50*. Philadelphia: Lippincott, Williams, & Wilkins.
- Caretto, V., Francois Topolski, K., Mckinneg Linkous, C., Koontz Lowman, D., & McKeever Murphy, S. (2000). Current parent education on infant feeding in the neonatal intensive care unit: The role of the OT. *American Journal of Occupational Therapy. 54*(1), 59-64.
- Department of Health and Human Services: Centers for Disease Control and Prevention. (2009). Maternal and infant health research: Preterm birth. Retrieved on March 2, 2010. <http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/PBP.htm>.
- Dobbins, N. Bohlig, C., & Sutphen, J. (1994). Partners in growth: Implementing family-center changes in the neonatal intensive care unit. *Children's Health Care. 23*(2), 115-126.
- Fucile, S. & Gisel, E. G. (2005). Effect of an oral stimulation program on sucking skill maturation of preterm infants. *Developmental Medicine and Child Neurology. 47*, 158-162.
- Fucile, S., Gisel, E., & Lau, C. (2002). Oral stimulation accelerates the transition from tube to oral feeding in preterm infants. *The Journal of Pediatrics. 141*(2), 230-236.
- Goldstein Ferber, S., Kuint, J., Weller, A., Feldman, R., Dollberg, S., Arbel, E., &

- Kohelet, D. (2002). Massage therapy by mothers and trained professionals enhances weight gain in preterm infants. *Early Human Development*, 67, 37– 45.
- Gorski, P., Davidson, M. F., & Brazleton, T. B. (1979). Stages of behavioral organization in the high-risk neonate: Theoretical and clinical considerations. *Seminars in Perinatology*, 3, 61-72.
- Hedlund, R. & Tatarka, M. (2003). Infant Behavioral Assessment (IBA) Training Manual. Retrieved on November 1, 2010 from <http://www.ibaip.org/ibatm.pdf>.
- Holsti, L. & Grunau, R.E.(2007). Extremity movements help occupational therapists identify stress responses in preterm infants in the neonatal intensive care unit: A systematic review. *Canadian Journal of Occupational Therapy*, 74(3), 183-194.
- Jarvis, M. R. & Burnett, M. (2009). Developmentally supportive care for twins and higher-order multiples in the NICU: A review of existing evidence. *Neonatal Paediatric & Child Health Nursing*. 12(3), 2-5.
- Johnson, A. N. (2001). Neonatal response to control of noise inside the incubator. *Pediatric Nursing*, 27(6).
- Kalia, J.I., Visintainer, P., Brumberg, H.L., Pici, M., & Kase, J. (2009). Comparison of enrollment in interventional therapies between late-preterm and very preterm infants at 12 months' corrected age. *PEDIATRICS*, 123,804-809
- Law Harrison, L., Williams, A. K., Berbaum, M. L., Stem, J. T., & Leeper, J. (2000). Physiologic and behavioral effects of gentle human touch on preterm infants. *Research in Nursing & Health*. 23, 435-446.
- Lekskulchai, R. & Cole J. (2001). Effect of a developmental program on motor

- performance in infants born preterm. *Australian Journal of Physiotherapy*. 47, 169-178.
- Leonard, A. & Mayers, P. (2008). Parents' lived experience of providing kangaroo care to their preterm infants. *Health SA Gesondheid*, 13, 16-28
- Limperopoulos, C. & Majnemer, A. (2002). The role of rehabilitation specialists in Canadian NICUs: A national survey. *Physical & Occupational therapy in pediatrics*, 22,57-72.
- Melnyk, B.M., Alpert-Gillis, L., Feinstein, N.F., Fairbanks, E., Schultz-Czarnial, J.,Hust, D., et. al. (2001). Improving cognitive development of low-birth-weight premature infants with the COPE program: A pilot study of the benefit of early NICU interventions with mothers. *Research in Nursing & Health*, 24, 373-389.
- Roy Grenier, I., Bigsby, R., Vergara, E. R., & Lester, B. M. (2003). Comparison of motor self-regulatory and stress behavior of preterm infants across body positions. *The American Journal of Occupational Therapy*. 57(3), 289-297.
- Thomas, A. & Chess, S. (1989). Issues in the clinical application of temperament. In G. A. Kohnstamm, J. E. Bates, & M. K. Rothbart (Eds)., *Temperament in childhood* (pp. 377-386). New York: John Wiley & Sons.
- Vergara, E. R. & Bigsby, R. (2004). *Developmental and Therapeutic Interventions in the NICU*. Paul H. Brookes Publishing Co.: Baltimore, Maryland.
- White-Traut, R. C., Nelson, M. N., Silvestri, J. M., Vasan, U., Littau, S., Meleedy-Rey, P., Gu, G., & Patel, M. (2002). Effect of auditory, tactile, visual, and vestibular intervention on length of stay, alertness, and feeding progression in preterm infants. *Developmental Medicine & Child Neurology*. 44, 91-97.

Yecco, G. J., (1993). Neurobehavioral development & development support of premature infants. *The Journal of Perinatal & Neonatal Nursing*. 7(1), 56-65.