
ARTICLE

Teamwork in the Neonatal Intensive Care Unit

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ABSTRACT. Medical and technological advances in neonatology have prompted the initiation and expansion of developmentally supportive services for newborns and have incorporated rehabilitation professionals into the neonatal intensive care unit (NICU) multidisciplinary team. Availability of therapists specialized in the care of neonates, the roles of rehabilitation professionals, and models of service delivery vary from hospital to hospital based on philosophy, resources, and other considerations. To provide quality care for infants and families, cohesive team dynamics are required including professional competence, mutual respect, accountability, effective communication, and collaboration. This article highlights the contribution of each member of the NICU team. The dynamics of team collaboration are presented with the goal of improving outcomes of infants and families.

KEYWORDS. NICU, newborn infants, therapy services, teamwork, collaboration

As medical and technological advances in neonatology have occurred, neonatal care has become increasingly specialized (Vergara & Bigsby, 2004). Increased survival rates among extremely premature and sick infants have led to regionalization and specialization to promote more cost-effective and efficient neonatal care. Regionalization of perinatal services in the 1970s promoted the initiation and expansion of developmental services for newborns and incorporated developmentally supportive care practices and the services of rehabilitation professionals as integral aspects of the multidisciplinary team in the neonatal intensive care unit (NICU).

Regional perinatal centers and area hospitals are designated by the level of care they provide (Pettett, Sewell, & Merenstein, 2002):

Level I: a nursery that serves infants from uncomplicated pregnancies who require no or minimal specialized care, usually found in small community hospitals.

Level II: an intermediate care nursery designed to care for infants who require more complex medical management, such as intravenous feedings and

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medication, supplemental oxygen, phototherapy for jaundice, and some diagnostic workups. These units usually function as “step-down” units for an NICU and are essential in providing care close to home for infants recovering from extreme prematurity or critical illness.

Level III: a nursery that serves the sickest and most fragile newborns, provides highly specialized services to infants who are critically ill and require life support, and provides complex medical and nursing intervention, including mechanical ventilatory support, advanced diagnostic services, and surgical services.

The availability of support services and personnel, including neonatal therapists, varies depending on the level of the nursery, with more specialized personnel available in the Level II and III nurseries. This article is part of a special issue of *Physical & Occupational Therapy in Pediatrics* on Care Paths for Physical Therapy Practice in the Special Care Nursery. The purpose is to discuss the contribution of each member of the NICU team based on their education and competencies. Emphasis is placed on team characteristics and dynamics required to achieve a clinical partnership and the ultimate goal of improving outcomes of infants, supporting families, and promoting team satisfaction.

DEVELOPMENTAL CARE

Developmentally supportive care is the prevailing philosophy in most NICUs throughout the United States (Vergara & Bigsby, 2004) and is a conceptually unifying framework for all neonatal therapy services. Developmental care is defined as a broad category of interventions designed to minimize the stress placed on the infant and the family by the NICU environment. It is based on the principle of understanding each infant’s neuroregulatory capacities to guide interventions that are developmentally supportive, family-centered, sensitive, evidence-based, and collaborative. The focus of developmental care is to promote infant organization as indicated by homeostasis between the physiologic and behavioral systems (D’Apolito, 1991). A variety of general environmental, behavioral, and care strategies such as dimmed overhead light, noise-mitigating strategies, and clustered caregiving procedures can be used for this purpose.

A more individualized approach to newborn developmental care was proposed by Als and is called the Newborn Individualized Developmental Care and Assessment Program (NIDCAP; Als, 1986). This approach is based on the synactive theory of infant development (Als, 1986, Als et al., 1994), a conceptual model which focuses on the interplay of an infant’s autonomic, motor, state-organizational, attention-interaction, and regulatory subsystems with each other and with the environment. Based on ongoing observations of an infant’s response to caregiving procedures, individualized recommendations and strategies are provided for caregiving in order to support the infant’s physiological stability, self-regulation, behavioral organization, and development (Als, 1986). The provision of consistent and appropriate interactions is intended to optimize neurodevelopmental outcomes (Als et al., 1994; Lotas & Walden, 1996).

In addition to the NIDCAP, infants who are at higher risk for developmental problems and are not performing according to age expectations may benefit from a

combination of consultative services proposed by developmental care experts and direct therapeutic services. During early infancy, neurologic connections are made or pruned in an activity-dependent fashion (Sporns & Edelman, 1993). Research has shown that the sensorimotor areas of the brain reorganize in response to lesions (Byl et al., 1997) and in response to specific practice opportunities (Nudo, Milliken, Jenkins, & Merzenich, 1996). Individualized assessment is used to determine developmental needs and the extent an infant is able to tolerate rehabilitation interventions (Sweeney, Heriza, Blanchard, & Dusing, 2010). This is particularly important for babies with central nervous system (CNS) insult resulting in impairments such as paucity of movement and impairments in posture and muscle tone. Intervention and handling should provide the just right challenge to ensure both maintenance of physiologic stability and proper nurturance of developmentally appropriate activities, including daily care activities, playing with parents, feeding, and resting.

THE MULTIDISCIPLINARY TEAM

Parents, of course, are central team members in their infant's care. Family-centered care, which emphasizes collaboration, is widely recognized as an essential aspect of care in the NICU (Conway, Celenza, & Abraham, 2010; McGrath, 2007). Parents and other family members are acknowledged to be the most important and consistent influences in the infant's life. Their roles as primary caregivers and nurturers constantly need to be recognized and reaffirmed in the NICU setting. Health care professionals are encouraged to establish equal partnerships in practice with parents in order to assist them to develop confidence and effective parenting skills. This collaborative partnership empowers families to become competent caregivers for their infants (Dunst & Trivette, 1996).

Parents' participation in their infants' care should be voluntary and within their comfort level. Involvement of families in their infant's care is a focus of both the NICU Care Path for physical therapists (PTs) and the NICU Discharge Path for parents and is discussed in detail by Campbell (2013), Byrne and Campbell (2013), Byrne and Bridgford Garber (2013), Bridgford Garber (2013), and Goldstein (2013). A useful resource for parents is the Premature Infants Bill of Rights, available from the Foundation for Premature Infants (<http://www.foundationforprematureinfants.org/>). Another resource is the work of Mills, Sims, and Jacob (2006) who successfully implemented an Internet-based parent satisfaction survey for use in improving discharge planning.

Professionals on the NICU team can be grouped into *medical* (i.e., physicians, nurse practitioners, nurses, nutritionists), *developmental* (i.e., developmental specialists [DSs], physical therapists [PTs], occupational therapists [OTs], psychologists, speech and language pathologists [SLPs], social workers [SWs], lactation consultants [LCs]), and *support team* (i.e., clerical staff, environmental services) members (Vergara & Bigsby, 2004). Physicians and nurses are represented on all NICU teams. Developmental and support team members vary from institution to institution. Team composition may be dependent on financial constraints for hiring different professionals (Ashbaugh, Leick-Rude, & Kilbride, 1999) as well as on the organization's culture and values regarding how they function and practice, including decision-making processes, resource allocations, division and alignment of power,

authority, and sources of influence and funding (Brown, Ohlinger, Rusk, Delmore, & Ittmann, 2003; Foley, 1990; Gilkerson, 1990; Ohlinger, Brown, Laudert, Swanson, & Fofah, 2003; Petryshen, Stevens, Hawkins, & Steward, 1997).

The type of facility in which the NICU exists is another likely contributor to the type and diversity of professionals involved. Teaching hospitals and private institutions are more likely to have rehabilitation professionals on their NICU team as compared to public institutions (Ashbaugh et al., 1999). Pediatric hospitals are more likely to have at least one rehabilitation specialist providing services in the NICU (100%), as compared to general hospitals (adult hospital with pediatric wards—87%) and adults' centers (adult hospital with an NICU—57%; Limperopoulos & Majnemer, 2002). Also, the majority of pediatric hospitals provide multidisciplinary therapy services (OT, PT, and SLP), whereas general hospitals or facilities for adults only are less likely to have more than one therapist in the team (Limperopoulos & Majnemer, 2002).

Although not documented in the literature, our experience suggests that the disciplines that compose the developmental members of the team are often dependent on the discipline of the professional who initiated rehabilitation services in the institution's NICU. For example, some NICUs are mostly served by PT, whereas in others, OT is the primary rehabilitation service. A national survey of the rehabilitation specialist departments (OT, PT, and SLP) in the tertiary level NICU in all Canadian health care institutions ($n = 38$) revealed that over half of the OT and PT departments provide weekly coverage, whereas only 5 out of 38 SLP departments provide coverage (Limperopoulos & Majnemer, 2002). In a survey of 20 NICU's in the United States, 14 provided OT, 10 provided PT, and only 2 provided SLP (Ashbaugh et al., 1999). Unfortunately, many institutions view PT and OT as interchangeable professionals so it is incumbent upon therapists working in these NICUs to clearly define their unique as well as their overlapping roles.

MODELS OF SERVICE DELIVERY

The NICU is a unique environment that functions as an independent community with its own medical culture, personnel, equipment, terminology, and policies. The role of the rehabilitation professional, however, has expanded beyond direct services for minimizing impairment to include a multidimensional model of practice, incorporating different levels of integrated and coordinated care for the child, family, and professionals involved in the NICU (Gilkerson, 1990; Thomas, Sherwood, Mulhollem, Sexton, & Helmreich, 2004; Vergara & Bigsby, 2004). As a result, a network of clinical partnerships must be formed. Developmental team members must collaborate closely with other members of the NICU team to provide care in different forms according to the needs of the babies and families.

The NICU represents a highly specialized area of practice that requires competent, experienced professionals with advanced knowledge and skills. This is particularly important given the fragility of the infants, the vulnerable emotional status of the families, and the intricacy of medical and social factors that affect the child and family unit as a whole. Several publications describe the level of competence required for DSs (Gilkerson & Als, 1995), OTs (American Occupational Therapy Association [AOTA], 1997, 2006; Dewire, White, Kanny,

& Glass, 1996; Vergara & Bigsby, 2004), PTs (Sweeney, Heriza, & Blanchard, 2009; Sweeney, Heriza, Reilly, Smith, & VanSant, 1999; Sweeney et al., 2010), and SLPs (American Speech-Language-Hearing Association [ASHA], 2004, 2005; Ziev, 1999) practicing in the NICU, including standards of practice developed by each discipline's professional organization (AOTA, 2006; ASHA, 2004; Sweeney et al., 2009, 2010; Association of Paediatric Chartered Physiotherapists in the UK at <http://www.apcp.org.uk/Portals/1/APCP%20Publications/2011%20-%20Neonatal%20Competencies.pdf>).

Information regarding the current roles and responsibilities of specific professionals is limited, but some institutions provide a guide to local standards (e.g., Los Angeles Children's Hospital at http://www.chla.org/site/c.ipINKTOAJsG/b.3768713/k.688A/Copyrighted_Products.htm#competency).

The common use of developmental care as a unifying framework for neonatal therapy services in the NICUs (Vergara & Bigsby, 2004) renders striking similarities among team member functions. Role assignment may vary from institution to institution based on policies, professionals' specialized training, and individuals' background. In some NICUs, service delivery is divided among the various specialties based on professional training, using a multidisciplinary or interdisciplinary approach. For example, splinting and feeding might predominantly be performed by an OT and range of motion and positioning primarily by a PT, with both professionals actively involved in education and case management (Limperopoulos & Majnemer, 2002). Other institutions, due to considerable overlap and cross-training among team members, provide transdisciplinary services based on professional availability rather than on specific needed interventions or the background of each professional.

The transdisciplinary approach to service delivery is based on the perspective that the infant must be understood as a whole person in an environmental context requiring an integrative approach. The transdisciplinary approach is a "deliberate pooling and exchange of information, knowledge, and skills, crossing and re-crossing traditional disciplinary boundaries by various team members" (Foley, 1990, p. 274). Transdisciplinary services also allow for flexibility in scheduling coverage, while keeping to a minimum the number of people that handle an infant on any given day (Foley, 1990; Haynes, 1976; Ziev, 1999). On the other hand, the lack of role delineation created by transferring specific skills, strategies, and techniques across disciplines might be a source of frustration for some therapists. Friction can arise when a team member feels entitled to a role that has been assumed by another professional (Ashbaugh et al., 1999; Limperopoulos & Majnemer, 2002; McCannless, 1994).

Research delineating the benefits and drawbacks of different methods of service delivery and professional role assignment would help to clarify each profession's role and prevent duplication of effort and excessive costs. Nevertheless, it is important that team members reflect on their role within the context of their professional disciplines and practice guidelines as well as the philosophy of the NICU in which they work in order to maintain their own professional identity and individuality within a matrix of shared knowledge and skills. Moreover, it is imperative that professionals are cognizant of the scope of their practice defined by state licensure and collaborate with other members of the NICU team.

ROLES OF PROFESSIONALS IN THE NICU

Medical Team

Medical care is the primary concern of physicians and nurses in the NICU who are responsible for the infant's primary health care. Other professionals involved in the medical aspects of care are respiratory therapists, nutritionists, and pharmacists.

Physicians are usually organized in a hierarchical structure: attending physician, fellow, resident, and medical student, according to their stage of training and depending on nursery level and the type of institution. Attending physicians are ultimately responsible for the care provided in the NICU, and they offer guidance and training for the neonatology fellows, residents, and medical students.

Nurses are the front line for implementing care plans in the NICU. Neonatal nursing practice consists of at least three components: 1) implementing nursing therapy, 2) assisting with medical care, and 3) collaborating with other health care providers. The interrelationship of these three components centers on improving or maintaining neonatal and family health (Harrigan & Perez, 2003). Nurses assess, plan, and provide intervention for newborns and their families in order to provide a developmentally appropriate environment, physical care, feeding, and support to parents. The role of the neonatal nurse evolves depending on the course of the baby's development in the NICU as well as on the career stage of the neonatal nurse, from beginner to experienced and advanced practitioner, including nurse managerial roles (Harrigan & Perez, 2003).

Neonatal nurse practitioners (NNPs) are often members of the NICU team. The role of the NNP in the NICU evolved in the 1970s in response to increased technology, medical coverage shortages, and regionalization of NICUs (Beal, 2000). In many nurseries, NNPs are hired instead of medical residents. Although subtleties may vary from NICU to NICU, NNPs with a blend of medical and nursing skill have a holistic perspective on neonatal care and assume a role combining both medical and nursing models of care. NNP roles include diagnostic/patient monitoring, management of patient/health/issues, administering/monitoring therapeutic interventions and regimens, monitoring/ensuring quality of health care practices, organization and work role, teaching/coaching, effective management of rapidly changing situations, and the consulting role of the nurse (Hunsberger et al., 1992).

The NNPs are primary care providers and have a role in clinical management of neonates and their families, including license to prescribe and administer medication with the approval of an attending physician. As NNPs practice from a holistic approach, they many times have a better understanding and appreciation for therapists' roles and contributions to the NICU team and therefore make referrals for therapy services. They are also a good resource for therapists in learning more about the pathophysiologic conditions of the babies and how these conditions impact the babies' ability to participate in a therapeutic activity.

Respiratory therapists are responsible for careful monitoring of the respiratory status of babies for provision, adjustment, and maintenance of the various ventilatory supports in use in the NICU. They can assist therapists in understanding the infants' respiratory function as a basis for intervention appropriate to the infants' health status.

Nutritionists are registered dietitians who are included on multidisciplinary teams in many NICUs. Nutritionists working in collaboration with physicians and nurse practitioners help to determine when and how to initiate enteral feedings to meet the babies' nutritional and growth needs. Nutritional outcomes, including weight at discharge, total weight gain, and head circumference growth, were reported to be greater after inclusion of a registered dietitian in the NICU (Sneve, Kattelmann, Ren, & Stevens, 2008).

Discharge planners, generally a nurse by background, follow the progression of babies and assist the whole team, including the family, in preparing for the infant's discharge to home or another level of the NICU in the same or another hospital. Effective discharge planning involves establishment of transition points that span the entire hospital stay (Mills et al., 2006). The professional role includes assuring that the baby received all the services necessary while in the hospital (i.e., eye exam, hearing test, vaccination), that the parents are educated regarding the infant's specific needs (i.e., medication, oxygen supplementation, formulas), that the infant has the equipment needed to go home (e.g., oxygen, monitors, pumps), and that necessary follow-up appointments with care providers from the general pediatrician to specialists such as ophthalmologist, cardiologist, and developmental follow-up clinics are in place at discharge.

A discharge planner is also generally responsible for communication with health care insurance personnel to ensure services availability, coverage, and provision according to each individual's needs and health care plan. The discharge planner works closely with all team members, constantly getting their feedback to synthesize the information to meet the specific needs of each infant and family. In some institutions, the discharge planner also completes a comprehensive discharge summary to be used by the infant's family and community healthcare personnel. The discharge planner should have detailed knowledge of early intervention services available in the community and establish lines of communication that facilitate an efficient transition to needed care (Gilkerson, 1990).

Developmental Team

The developmental team consists of professionals who are involved in infant care through a referral or standing order. The role of these professionals is to support nurses, medical staff, and family members in providing care that is developmentally appropriate within the context of the NICU environment. The role is shared and many times overlapping and as a result requires collaboration, consultation, and shared responsibility that is best achieved through cohesive teamwork.

Research supports the effectiveness of developmental interventions in the NICU (Als et al., 1994; Lotas & Walden, 1996; White-Traut et al., 2004), but studies on interventions provided by PT, OT, and SLP are more limited (Mahoney & Cohen, 2005). Table 1 lists different intervention approaches and techniques and the professionals who usually provide them. The overlap among different professionals is obvious. Nevertheless, each profession has its unique set of skills to contribute to the health care team. In the table, whenever an intervention is listed for one profession, our intent is to emphasize the unique role of that particular profession. For example, a unique role of the psychologist based on professional training is providing psycho-emotional support to parents and thus it is listed accordingly. In contrast,

TABLE 1. Potential Roles of Members of a NICU Team.

	ds	pt	ot	slp	lc	sw	psy	dp
Provide developmental care								
Environmental modifications	✓	✓	✓	✓	✓			
Lighting	✓	✓	✓	✓				
Sounds	✓	✓	✓	✓				
Facilitate behavioral organization								
Physiological	✓	✓	✓	✓	✓			
State regulation	✓	✓	✓	✓	✓			
Motor system	✓	✓	✓	✓	✓			
Interaction skills	✓	✓	✓	✓	✓			
Promote optimal positioning								
Respiratory support	✓	✓	✓	✓				
Head shape	✓	✓	✓	✓				
Skin integrity	✓	✓	✓	✓				
Contained movement	✓	✓	✓	✓				
Provide therapeutic interventions								
Handling/NDT/movement therapy		✓	✓	✓				
Sensory intervention		✓	✓	✓				
Splinting		✓	✓					
ROM/prevent contracture		✓	✓					
Chest physical therapy		✓						
Facilitate oral motor skills								
Prevent oral hypersensitivity	✓	✓	✓	✓				
Non-nutritive Sucking	✓	✓	✓	✓	✓			
Nutritive sucking	✓	✓	✓	✓	✓			
Breast-feeding	✓	✓	✓	✓	✓			
Bottle-feeding	✓	✓	✓	✓				
Support family-centered care								
Family education	✓	✓	✓	✓	✓	✓	✓	✓
Support family as decision makers	✓	✓	✓	✓	✓	✓	✓	✓
Parents participation in caring for infant	✓	✓	✓	✓	✓	✓	✓	✓
Parental role—occupation/co-occupation			✓					
Anticipatory guidance for developmental needs	✓	✓	✓	✓	✓	✓	✓	✓
Family support (coping skills, end of life)	✓	✓	✓	✓	✓	✓	✓	✓
Discharge planning—transition to home	✓	✓	✓	✓	✓	✓	✓	✓
Community resources	✓	✓	✓	✓	✓	✓	✓	✓
Therapeutic home program		✓	✓	✓				
Follow-up appointments	✓	✓	✓	✓	✓	✓	✓	✓
Being an active team member								
Collaborate	✓	✓	✓	✓	✓	✓	✓	✓
Communicate perspectives	✓	✓	✓	✓	✓	✓	✓	✓
Assume shared responsibility	✓	✓	✓	✓	✓	✓	✓	✓
Engage in process of care	✓	✓	✓	✓	✓	✓	✓	✓

Note: DS, developmental specialist; PT, physical therapist; OT, occupational therapist; SLP, speech and language pathologist; LC, lactation consultant; SW, social worker; PSY, psychologist; DP, discharge planner; NDT, neurodevelopmental treatment.

the psychologist may take the role of DS, and, as such, the interventions are listed in the table as the role of the DS rather than the psychologist.

Developmental specialist (DS): DS roles vary among institutions depending on the needs of the unit (Ashbaugh, 1999). Important functions of the DS are to provide resources for educating and involving physicians, nurses, and ancillary staff in developmental care, family integration, environmental issues and planning, continuous quality improvement, and review of developmental team goals and progress.

Another important role of the DS is to foster infant–caregiver interaction by providing psychosocial support and interactive guidance for caregivers within a framework that recognizes the primacy of the family’s needs, assisting families in recognizing and responding to their baby’s needs, and supporting their relationship with their infant (Als, 1986; Als et al., 1994). This role is in agreement with the recognized benefits and expectations that health care delivery in the NICU should be patient- and family-centered (Conway et al., 2010).

The DS may have a professional background in developmental psychology, early childhood education, nursing, PT, OT, or SLP, but he/she needs above all to be conversant in typical neonatal and infant development and to embrace the developmental care philosophy of the unit. The DS develops a care plan, including modifications of the environment such as decreasing excessive light and noise levels, providing bedding for adequate positioning, responding to an infant’s cues by planning for and adjusting the best times for handling, and promoting family–infant interactions. Sharing information with the caregiving team and the family is a key to coordinated care; an example based on the NIDCAP is given in the article on Physical Therapy Observation and Assessment (Byrne & Campbell, 2013). The DS also can serve as a bridge to assist the family in moving from the medically oriented NICU to the developmentally oriented community-based early intervention system (Gilkerson, 1990).

Physical Therapist (PT): Sweeney et al. (2009, 2010) have published clinical practice guidelines for pediatric PTs in the NICU that are endorsed by the Section on Pediatrics, American Physical Therapy Association (APTA). These guidelines expand on the scope of practice as defined in the Guide to Physical Therapist Practice (APTA, 2001). The uniqueness of PT in the NICU is its focus on optimizing functional posture and movement of infants in the context of the infant–family system (Sweeney et al., 1999). PTs provide interventions to prevent physical impairments and promote activity and participation within the context of the infant’s capacity, the family, and NICU environment. This approach is consistent with the conceptual framework of the International Classification of Functioning, Disability and Health (ICF; World Health Organization, 2001). The PT’s role is grounded in the developmental and movement sciences, frequently including the dynamic systems theory, and applied within a behavioral and environmental context to provide preventive care and collaborative family-centered care to enhance the quality of life of the neonate and family (Sweeney et al., 1999).

The PT provides interventions to infants in the NICU for impairments and functional limitations associated with practice patterns for the cardiovascular/pulmonary, musculoskeletal, and neuromuscular systems in the Guide to Physical Therapist Practice (APTA, 2001). Intervention often focuses on techniques that promote neuromuscular development including positioning, range of motion, therapeutic neuromotor handling, and use of multimodal sensory stimulation within the tolerance of the infant. The PT also supports feeding through interventions that promote the infants’ physiologic stability and motor organization.

Among the roles of PT are the following: (1) to screen to identify infants at risk for sensorimotor impairment and provide input in the care plan of infants to prevent sensorimotor impairment (Campbell, 1999); (2) to promote sensorimotor development in infants born preterm including postural tone, range of motion,

automatic postural reactions, quality of movement, regulation of behavioral state, and achievement of developmental milestones such as midline orientation and head control; (3) to share information and provide instruction to families on caring and sensorimotor development (Mahoney & Cohen, 2005); and (4) to participate in discharge planning and supporting the transition to home and community-based services (Campbell, 1999; Gilkerson, 1990; Sweeney et al., 2009, 2010).

The PT can assume various roles in the NICU (e.g., consultant, educator, and provider). Jonkey and Solava (1990) propose that the role of the PT can range from consultant for orthopedic and feeding problems to daily therapist for neurologic concerns. The PT is always a source of information and support, enabling parents to care for their infants both during the hospital stay and at home. A detailed description of the role of the PT, including developmental care in collaboration with the NICU team, is described in this special issue by Campbell (2013), Byrne and Campbell (2013), Byrne and Bridgford Garber (2013), Bridgford Garber (2013), and Goldstein (2013).

Occupational Therapist (OT): The role of the OT is most similar to, and overlaps with, that of the PT in the NICU and, therefore, is described in detail. Although we present in this issue a care path for PT care in the NICU, we hope to clarify the areas of significant overlap with OT as well as the unique philosophy and practice of OT. Despite the overlap in roles, OTs and PTs are not interchangeable professionals in NICU practice. Understanding the expertise of the OT is necessary for the PT to engage in dialogue regarding role delineation among the members of the NICU team.

The main focus of OT is supporting the *development of infant and family occupations* related to infant care in the NICU (Vergara & Bigsby, 2004). A unique philosophy and education provide the foundation for the role of the OT in neonatal practice. Occupational therapy encompasses biological, developmental, and social-emotional aspects of human function as expressed in daily activities and occupations, making it particularly suited to address the needs of the developing infant and family (AOTA, 1997, 2006). The AOTA practice guidelines (2006) list the specialized knowledge and training for OTs to provide services in the NICU, including the performance of developmentally appropriate roles or occupation and the performance components underlying function.

The occupations of neonates include responding to the environment, maintaining homeostasis, beginning social interactions with parents, and taking in nourishment. Specific competencies of the neonate in the NICU environment include the ability to (1) cope with and participate in caregiving activities such as medical routines and procedures, feeding processes, bathing, dressing, and diapering; (2) establish an interrelationship between medical and developmental domains; and (3) engage in nurturing interactions such as skin-to-skin care (also called kangaroo care), physical and social dialogue, and the social aspects of feeding (Anzalone, 1994; Holloway, 1998, 2008).

In the NICU, emerging competencies in infant occupation are dependent on a variety of underlying performance components including (1) the infant's intrinsic biological factors (i.e., postmenstrual age and weight, physical and developmental maturation, physiological status and medical conditions, neurobehavioral organization, sensory processing, biomechanical, and neuromotor function), (2) the social

environment in which professionals and the family interact with the infant, and (3) the physical environment with bright lights, loud sounds, and a host of supportive equipment, all of which are rapidly changing and complex. The infant's competence also depends on how these components are organized in relation to each other. Thus any component can facilitate or constrain an infant's occupational performance.

A typical infant occupation addressed by OT is feeding. Whereas feeding is an effortless function for most newborn infants, babies who are at risk for or have a developmental disability often have problems in feeding (Glass & Wolf, 1998). These problems can include poor intake, excessive time needed to feed, abnormal motor patterns, inappropriate progression of feeding skills, and physiologic compromise associated with feeding. Feeding, however, is a shared occupation, which requires both the baby's skills and the caregiver's ability to adjust to the baby's needs.

Occupations that are shared and implicitly involve two or more individuals are termed co-occupations (Zemke & Clark, 1996). Thus caregiving for a baby is a co-occupation that involves active participation on the part of the caregiver (nurse, mother, therapist) and the recipient of care (baby). Co-occupations required during caregiving and mothering, such as the socially interactive routines of feeding and comforting, are reciprocal, interactive, and interdependent "co-occupations" (Dunlea, 1996; Esdaile & Olson, 2004; Fraits-Hunt & Zemke, 1996), involving contingent skills of both the parent (or any other caregiver) and the child (Olson & Baltman, 1994). The OT assists infants in making the transition from tube to oral feeding both through direct intervention that supports babies' suck-swallow efficiency (e.g., providing good postural support, selecting appropriate nipples, imposing resting breaks) and through indirect intervention—working with caregivers in recognizing and implementing these supportive techniques (Caretto, Topolski, Linkous, Lowman, & Murphy, 2000).

In addition to assisting each baby in their occupations and development, the OT may engage with mothers on bed rest prescription before their infant is born. As mothers are placed on bed rest, usually an unexpected event, they are faced with the possibility of a premature birth for the first time, having to adjust their expectations and dreams about a "normal" pregnancy and full term delivery. Mothers on bed rest also have to adjust to rapidly occurring changes in their lives, daily routines, family, and societal roles. A number of negative emotions are associated with bed rest for pregnant women such as feelings of anxiety, fear, uncertainty, depression, anger, guilt, boredom, and loneliness along with a decrease in social interactions (Leichtentritt, Blumenthal, & Rotmensch, 2005; Maloni & Kutil, 2000; Sprague, 2004).

The OT collaborates with women who have high-risk pregnancies and are confined to a hospital bed to decrease stress and prepare them for the birth of a premature infant. The OT supports women coping with the loss of previous roles and adjusting to this new life situation and assists them to identify and implement coping strategies during bed rest. This includes establishing and/or sustaining daily routines and roles such as self-care activities, improving state of mind, and decreasing boredom. The OT also provides expectant mothers an understanding of premature babies and how to parent a baby in the NICU environment (including a visit to the

NICU prior to delivery) in support of emotional bonding between each mother and their expected premature infant.

The OTs role with parents continues after delivery to facilitate parental coping and adjustment to the birth of a premature or sick infant and focuses on the promotion of the parents' occupational roles (Anzalone, 1994; Holloway, 1998, 2008) when they are unable to engage in the occupations so important to them (e.g., cuddling, feeding, dressing, and bathing their infants). The OT collaborates with family members by helping them assume a modified parental occupational role that helps them to feel comfortable in handling their infant and fostering parent–infant relationships while considering the often fragile medical and physiologic status of the infant (Caretto et al., 2000; Holloway, 1998, 2008). As much as possible, OTs match care to parental needs and styles to support them in fulfilling their roles as parents, thus promoting a meaningful child/parent co-occupation and reinforcing the role of the family as the constant in the life of the infant (Conway et al., 2010).

A number of approaches to intervention, modified according to the infants' medical status, physiologic homeostasis, and developmental and family needs, are applicable to the role of the OT within the NICU environment. These interventions can be (1) developmentally supportive techniques as described under the developmental care section, including family-centered care; (2) common rehabilitation techniques such as neuromotor and biomechanical handling intervention techniques used by PT, OT, and SLP to provide optimal body alignment and postural supports addressing the neurological and musculoskeletal components of performance when appropriate; and (3) specific OT approaches such as (a) sensory integration for addressing sensory processing and sensory organization to evoke age-appropriate adaptive responses and develop motor planning skills, (b) splinting, (c) adaptation of infants' daily life activities as, for example, provision of under chin support and imposing frequent breaks to enable the infant to accomplish the developmental task of feeding, and (d) environmental (social and physical) modifications in which the activities take place (Case-Smith, 2005; Holloway, 1998, 2008). The OT may intervene in one or several of these areas to support infant development.

The OT also participates in discharge planning to ensure successful transition of the infant and family to the home and community. The process involves addressing parent concerns including helping parents to participate in the babies' care routine in the nursery in order to feel more prepared to take their babies home, updating parents on their babies' developmental progress, and providing anticipatory guidance for facilitating development and participation in infant–family occupation. OTs often suggest ways parents can make their baby more comfortable both at the hospital and at home as well as guide what to do when things seem wrong and babies need community services to address developmental needs. OT services are offered under team collaborative categories with other professionals in the NICU, including direct observation, intervention, consultation, education, and research to provide the infant with the most effective and appropriate social and physical environment (AOTA, 2006).

Speech and language pathologist (SLP): The main role of the SLP in the NICU is the identification of infants at risk for and with existing developmental problems in communication, cognition, feeding, and swallowing. SLPs provide direct intervention to these babies and assist others in determining the ways that everyone who

comes in contact with the infant can facilitate early prelinguistic communication and feeding (ASHA, 2004).

In the NICU, SLP services generally include feeding (Ziev, 1999). SLPs are involved in the assessment and interventions to promote nipple readiness; feeding and swallowing function, including videofluorescence study to assess risk of aspiration; and parent education.

SLPs fulfill their role through assessment of the infant and family, providing support and intervention for the infant and providing education, counseling, and support to families, other caregivers, and staff regarding preferred practices in the NICU. SLP roles are to (1) support communication, cognition, feeding, and swallowing skills; (2) collaborate with other team members in identifying the need for assessments and consultations; (3) collaborate with the family and other team members regarding management decisions for care of the infant and family; and (4) maintain quality control/risk management programs, and provide discharge/transition planning and follow-up care (ASHA, 2004, 2005).

Audiologist: Audiologists are the professionals responsible for performing a newborn hearing screening. The vast majority of newborn hearing screening programs are now using automated auditory brainstem response (AABR), distortion product otoacoustic emissions (DPOAE), or transient evoked otoacoustic emissions (TEOAE; American Academy of Pediatrics, Joint Committee on Infant Hearing, 2007). Whether one technique is best is unknown.

Left undetected, hearing impairments in infants can negatively impact speech and language acquisition, academic achievement, and social and emotional development. If detected, however, these negative impacts can be diminished and even eliminated through early intervention. Because of this, the U.S. National Institutes of Health's Consensus Development Conference on Early Identification of Hearing Loss (1993) recommended that all infants should be screened for hearing impairment, preferably prior to hospital discharge (Early Identification of Hearing Impairment in Infants and Young Children, 1993).

Lactation Consultant (LC): Lactation specialists, usually with a professional training in nursing, help mothers with pumping and milk production, as well as helping the baby at the breast (National Association of Neonatal Nurses [NANN], 2009). Due to the health benefits of breast milk as well as to the psycho-emotional benefits to both babies and mothers, health care professionals consider breast-feeding the preferred infant feeding method (Greer, Sicherer, Burks, American Academy of Pediatrics Committee on Nutrition, & American Academy of Pediatrics Section on Allergy and Immunology, 2008; NANN, 2009). Mothers who decide to breast-feed can be assisted throughout their infant's NICU stay by the LC staff. The LC helps mothers achieve their breast-feeding goal by providing individualized information, consultation, and support (Payne & Tully, 2008).

An LC is often available through an appointment when mothers have questions about breast-feeding or pumping. The LC meets with mothers soon after the infant's birth to begin the education process. Many infants admitted to the NICU are not able to nurse right away, so the lactation professional has a variety of resources available to help with pumping and storage of breast milk.

This first stage involves providing the mother information on how to obtain and use breast pumps, proper cleaning of pumping equipment, storing and transporting

breast milk, maintaining a good milk supply, and performing appropriate breast care. The LC is involved with helping mothers learn to handle their infant, including learning to provide skin-to-skin care and to position the baby at the breast and latch correctly first for suckling at the emptied breast and then for nutritive sucking as the baby matures and his/her clinical condition permits (Payne & Tully, 2008).

The LC can also help mothers avoid weaning the infant off early because of problems that are either avoidable or manageable, including prevention and management of sore nipples and engorgement, sucking difficulties that interfere with breast-feeding, and maintaining mother's milk and/or breast-feeding when the mother and infant are separated (NANN, 2009). The role of the LC also includes providing educational materials for mothers and healthcare professionals and providing in-service education for health professionals.

Psychologist: As professionals uniquely qualified to work with families in crisis, psychologists provide valuable nonmedical support to parents of infants in the NICU. The birth of a premature and/or sick infant challenges even the most stable, intact families. If the baby is admitted to the NICU, the family is further challenged (Bachman & Lind, 1997). The parents with neonates in the NICU experience fluctuating emotions and needs at different stages of their baby's stay in the NICU, and these psychological factors play an important role in their ability to (1) cope with the arrival of a baby different from their expectations and requiring intense medical care, (2) adapt to changing parental roles and emotions, and (3) establish a loving attachment with their fragile infant (Lubbe, 2005).

Some psychology intervention programs emphasize parents' empowerment to manage their own needs and the needs of their neonates (i.e., communication, emotional, learning, discharge, and individual needs) while in the NICU and after discharge (Lubbe, 2005) using an electronic database to provide information for parents. Other programs have focused on helping parents cope with the trauma of premature birth (Jotzo & Poets, 2005) by providing psychological intervention in the first days after birth, offering additional psychological support throughout the infant's hospitalization, and actively approaching parents at critical times during the infant's NICU stay. Parents involved in this program showed lower levels of symptomatic response to the traumatic stressor "premature birth" than those in the control group (Jotzo & Poets, 2005). Utilization of psychological supports, however, is dependent on the family's own support system (Nottage, 2005), and it seems that parents use these services less often than would be anticipated based on the reports of their utility.

Many psychologists are trained as NIDCAP professionals and as such assume wider and broader roles on the NICU team, including DS. Psychologists typically provide assistance to families in recognizing strengths and vulnerabilities and in establishing a loving attachment to their fragile infant (Thompson, 2004; Vergara & Bigsby, 2004). Psychologists may also provide individual and family counseling to assist family members in adjusting to their altered parental and sibling roles while the infant is in the NICU and during the transition to home (Jotzo & Poets, 2005).

Other roles psychologists might assume in the NICU are providing support for staff members who are constantly working in a critical care environment and have their own difficulties in processing emotions and tension commonly encountered in this environment (Hall, Kronborg, Aagaard, & Ammentorp, 2010); working with

depressed mothers in helping them establish attachment with their infants (Diego, Field, Jones, & Hernandez-Reif, 2006; Fonseca, Silva, & Otta, 2010); and providing end of life support for families whose babies do not survive (Gold, Dalton, & Schwenk, 2007).

Social worker (SW): The SW has a primary role in the coordination of multiple systems to meet the needs of the infant and family (Carson, 1996) that is accomplished through (a) understanding of family dynamics, (b) evaluating family strengths and needs, and (c) providing the family emotional and psychological supports. Some roles of the SW may overlap with the psychologist and role differentiation is dependent on the particular NICU.

A distinctive role for SWs in the United States is assisting families in accessing material resources including applying for social security cards and for supplemental nutrition programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children, better known as the WIC Program. SWs also play a prominent role in communicating with health plan/insurance company case managers to assist families with financial coverage for the enormous expense of the NICU and follow-up health care. Families with an infant cared for in the NICU experience a variety of social and legal issues that can be exceedingly difficult to negotiate. Some institutions supplement the services of SWs with legal counseling (often offered pro bono) by attorneys familiar with tax, entitlements, and other issues faced by families with children with special needs.

Support Team

Support personnel include secretarial and clerical staff, housekeeping personnel, and volunteers (e.g., concierge personnel and cuddlers to hold babies, including grandmothers). Collectively their contributions support operations in the NICU including greeting visitors, scheduling appointments and consultations, following up with laboratory procedures, maintaining high standards of cleanliness, and providing developmental supports to babies.

TEAM DYNAMICS

The multifaceted and multidimensional nature of care provided in the NICU requires efficient teamwork and planning in order to function effectively and avoid duplication of services (Limperopoulos & Majnemer, 2002). A team is a number of people committed to a relevant shared purpose, with common performance goals and complementary and overlapping skills (Manion, Lorimer, & Leander, 1996). Team members are mutually accountable for assuring continuity of services and achievement of desired outcomes. Accordingly, the NICU with its unique culture and personnel is a community in which every team member is invested in the best possible outcome for infants and their families. A team approach is essential for incorporating developmental and therapeutic goals and intervention strategies into the nursing and medical care (Anzalone, 1994; Vergara & Bigsby, 2004). For this community to function effectively, however, professionals must share an understanding of the baby's conditions (including benefits and risks of interventions) and the shared and unique roles of each team member.

Teamwork needs to be theory-guided (Brown et al., 2003; Gilkerson & Als, 1995; Ohlinger et al., 2003) such that theory forms the basis for a group culture that provides a cohesiveness mechanism for the team. A helpful theory to support teamwork in the NICU is the systems theory which recognizes the systems orientation nature of the nursery. Accordingly, understanding of the nursery as whole and of the interconnectedness of all aspects of care involved in this unit must be incorporated into practice (Brown et al., 2003; Gilkerson & Als, 1995). Thus, in applying systems theory, each team member together with the babies and their families interacts to lead to successful outcomes. Each facet of this system involves relationships established between professionals and infants and families, as well as among different professionals, so that every member in this community is connected and related to every other (Gilkerson & Als, 1995). The interdependencies (i.e., babies, families, and professionals) in the nursery require that team members stay engaged and are accepting of different perspectives while working toward the common goal of improving outcomes for the infants and families and promoting staff satisfaction with their work (Foley, 1990; Haynes, 1976).

Relationship-based theory also supports teamwork in the NICU. Team members are encouraged to listen intently with an accepting openness to learning from each other on the nursery system and the services provided (Gilkerson & Als, 1995). This approach can help new team members in building trust, gaining respect, and forming a close relationship with other members with no preconceived assumptions. This trust is earned individually and it takes time to build, as trust is not being readily given on the basis of credentials or prior experience alone (Anzalone, 1994; Gilkerson & Als, 1995; Vergara & Bigsby, 2004).

Finally, practices to enhance teamwork in the NICU are supported by health care and business team organization theory (Brown et al., 2003; Hobar, Plsek, & Leahy, 2003; Ohlinger et al., 2003). Successful teamwork and a collaborative NICU culture require a clear purpose shared by the entire health care team, whereby each individual team member has unique skills; is accountable for his/her work; and is committed to personal growth, collective work products, and performance results. Accountability and communication holds the team together, consequently a collaborative NICU practice is an ongoing process (Ohlinger et al., 2003).

Collaboration is the cornerstone for teamwork. Collaborative practice is the delivery of care to patients and families by using the resources of a variety of health care providers (Brown et al., 2003). Once collaboration is established, it institutes a mechanism of information and power sharing among professionals, promotes active participation of all team members, and increases staff satisfaction as it leads to a feeling of ownership (Froehlich, 1996).

Collaboration involves communication and negotiation among different team members in planning and providing services. Communication is effective only if the message is received, understood, remembered, and responded to appropriately. Open communication accommodates the constant change in the nursery and in the baby's needs. It is imperative that team members share information and communicate what is to be done, how, and why it should be done. Improving the accuracy and consistency of the information provided offers the opportunity for enhanced performance and outcomes and increases satisfaction with the decision-making process and the experience of care (Ohlinger et al., 2003). It also decreases duplication of

services and documentation and thus promotes an increased interest in the specific contributions of team members (Froehlick, 1996).

The behavioral and communication skills of individuals are critical to development, implementation, and evaluation of team practices in the NICU (Ohlinger et al., 2003). Conflict is inevitable in any team that is working toward its goals, but it should not be inherently good or bad. A successful team is one in which all members make the commitment to and take responsibility for managing conflict. If not well managed, conflict between professionals can sabotage team progress, resulting in a tangled web of tensions and disagreements that are difficult to loosen (Brown et al., 2003; Ohlinger et al., 2003). It is important for team members to explore together the dynamics underlying the feelings and any implications these feelings have for the work of each professional. For example, cooperation between therapists and nurses sometimes is challenging due to the perception that therapists' work is an unnecessary interruption to routine nursery care or threatening to their roles, or entails extra work to be performed by nursing staff.

Lastly, leadership is vitally important to a team's functioning (Brown et al., 2003). Leaders need to value all professionals and staff in NICU care, promote availability of interpersonal supports for all team members, and foster an environment in which collaboration is emphasized. Identification of problems and solutions to problems, including change in attitudes and beliefs, requires sensitivity to the interdependency among members of the NICU team, so that solutions have the desired impact.

Feeding provides a good example of team collaboration in the NICU. Feeding is integral to neonatal care and parenting, important for discharge to home, and involves many team members. The physician ensures that the infant tolerates food, is able to digest it, and takes the total fluids and calories needed for growth. Feeding has been historically a task that nurses perform. Nurses are in charge of making sure that the infant takes in his/her food and are generally concerned with the total volume of oral intake in a timely fashion. As such, for the nurses, consumption of an expected volume of food could be seen as a reflection of their professional ability to feed a baby, and they may tend to be hesitant in accepting rehabilitation professionals' recommendations regarding feeding. When babies have difficulties in transitioning to oral feeding, members of the developmental team are consulted. Depending on the hospital, professionals might take on different roles related to feeding. The SLP's emphasis is on the integrity of the baby's oral and gastroesophageal structures and on the baby's ability to swallow without difficulties. The PT focus is on the baby's motor skills (global and oral) and endurance needed to participate in a feeding activity, whereas the OT is concerned with the baby's ability to participate in the developmentally appropriate activity and occupation of feeding. OTs are concerned not only with the baby's intrinsic features (physiological stability, oral-motor skills, postural and neuromotor control, and sensory experience) that allow or hinder his/her ability to feed, but also with the external/environmental variables that contribute to these activities (physical: nipple type, formula thickness, and social: different caregivers and demands placed on the baby), and how all of these different factors interact so that the baby can safely and efficiently eat. The psychologist is concerned with parents' emotional availability for caring for themselves and their children, while the SW is concerned with family supports and coordination of community services such as resources to provide the milk/formula upon discharge.

Team rounds provide an opportunity to use a multidisciplinary approach to prevent conflicting information, problem solve, and promote safe and positive feeding experiences. Coordinated care is essential to prevent complications such as oxygen desaturation, bradycardia, aspiration, high energy consumption, and poor weight gain as well as to support parents' competence and feelings related to their ability to feed their infants. Through open dialogue during rounds, professionals share information and express concerns in order to develop a feeding care plan that is supportive of infant and family needs. This might include decisions on the best milk/formula and volume needed to promote growth and using infant behavioral readiness to guide decisions on oral feeding rather than using either an oral volume requirement or a fixed schedule. This approach shifts the emphasis from the caretakers' ability to feed the baby to the baby's own skills to take bottle. This type of progression to oral feeding is intended to provide the baby opportunities to learn how to suck, swallow, and breathe, as well as to increase his/her endurance for higher volumes while maintaining physiological stability. As part of the process, therapists, nurses, and parents collaborate to discuss nipple recommendations, feeding positions, feeding techniques (i.e., pacing, chin support, etc.), and postural supports needed for a more efficient and positive feeding experience. The whole team then agrees in implementing such a plan, which is documented on the baby's chart for accountability and continuity of care among professionals and shifts. Nurses and therapists work with parents during feeds for a week. A week later, the team meets again, re-evaluates the recommendations, and makes updates to the plan according to the baby's progresses. This cycle is repeated until the baby makes a full transition to oral feeding and the family is ready to independently care for and take their baby home. As the baby gets closer to discharge, SW provides assistance to the families in need to obtain milk/formula upon discharge.

CONCLUSIONS

There are tremendous opportunities as well as challenges to improve the experience of families and care providers for infants in the NICU. This article highlighted the unique contribution of each member of the NICU team, as well as interrelationships among professionals and families engaged in the pursuit of ever-improved outcomes for high-risk infants. A collaborative, multidisciplinary team approach that emphasizes shared responsibility, practices effective communication, and respects and recognizes that no one functions independently in the NICU is recommended to promote the best possible outcome for infants and families. Research is recommended to better understand how to implement collaborative approaches to service delivery in the NICU.

Declaration of Interest: The author teaches workshops on the Test of Infant Motor Performance (TIMP) for Infant Motor Performance Scales (IMPS).

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