A developmental care program in the Neonatal Intensive Care Unit at Arrowhead Regional Medical Center

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A DEVELOPMENTAL CARE PROGRAM IN THE NEONATAL INTENSIVE CARE UNIT AT ARROWHEAD REGIONAL MEDICAL CENTER

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
in
Nursing

by
Shirley Marie Farr
December 2005
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INTENSIVE CARE UNIT AT ARROWHEAD
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ABSTRACT

Neonatal developmental care began with a challenge of combining the technology of neonatology with an approach to individualize the developmental care of the high risk newborns in the neonatal ICU’s in order to facilitate neurobehavioral development. These interventions have focused on enhancing and facilitating the infants’ adaptation to extra uterine life. Developmental care is a philosophy, behavioral observations, and individualization of activities to manage the infants’ environment that incorporates the relationships between infant, family, and health care providers.

The purpose of this project is to develop a self-study computerized educational program that will be utilized by the staff of the neonatal ICU. The developmental care components will be incorporated into the electronic medical record as part of the computerized program in the neonatal ICU. This educational program was developed in response to a survey of nursing personnel at Arrowhead Regional Medical Center, Colton, CA which indicated a need for a comprehensive, approachable program. This program is designed for ARMC-NICU personnel which includes Registered Nurses, Respiratory Therapists, MSW, OT’s, dieticians, pharmacists and MD’s. This program
is designed to facilitate a developmental care program in the Neonatal ICU.

This program consists of a computerized educational program that is supplemented with current articles on developmental care. This program is easily accessible within the confines of the NICU computers at ARMC. The incorporation of the developmental care components in the electronic medical record is designed to adapt to the medi-tech charting system. Finally as new concepts arise the program will have the capability of being updated by the Clinical Nurse Specialist of the Neonatal ICU at ARMC in Colton, California. The EMR updates will be facilitated by the informatics team at ARMC at the request of the CNS of the Neonatal ICU.
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DEDICATION

To my three children, Drew, Amanda, and Rebekah.
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CHAPTER ONE

INTRODUCTION

Developmental care is a philosophy, behavioral observations, and individualization of activities to manage the infants' environment that incorporates the relationships between infant, family and health care providers. It is an approach of care that has an ultimate goal of promoting a stable, well-organized and competent infant. Developmental care manages the infants' environment by decreasing noise and visual stimulation. Developmental care promotes clustering of the infants' care activities. Developmental care stresses the importance of facilitating parenting and fostering a family centered care approach to caregiving.

The purpose of this project is to develop a self-administered developmental care program that can be implemented and incorporated into the electronic medical record. The basic concepts of developmental care are discussed and demonstrated in the orientation process of new employees. There has been an underlying program where several of the nurses within the Neonatal ICU promote developmental care concepts; however there has never been
a structured program. Documentation of developmental care has been sketchy.

Several attempts have been implemented on instituting developmental care within the Neonatal ICU; these attempts have met with resistance and have failed. In the past key nursing personnel along with the occupational therapist and Clinical Nurse Specialist were trained on NIDCAP (Newborn Individualized Developmental Care and Assessment Program), the program failed. Another attempt included a multidisciplinary comprehensive program that planted seeds for the team to facilitate developmental care during care of the infant and family. Developmental aids were purchased in order to enhance and reinforce what was learned. A local church group has quilted blanket covers for the isolettes in order to decrease light. Kangaroo care has been initiated and carried out by a few nurses within the intensive care unit. The basic concepts of developmental care are within the mindset of each individual nurse, respiratory therapist, occupational therapist and the other disciplines that factor into developmental care; the problem is that there is not a structured program where everyone is accountable to implement the concepts of developmental care. The challenge in providing developmentally supportive care is
the integration of technology advanced invasive care with the sensitive and individualized approach, facilitating neurobehavioral development of the infant while supporting parents as primary advocates and caregivers (Lawhon, 2003).

Theoretical Framework

The synactive theory of development that Heidelise Als developed and described in 1982 is a theoretical framework that includes individualized neurobehavioral observations of the infant, followed by care planning and consultative support to family and professional caregivers. The concept of newborn competence provides a framework for care that focuses on enhancing and facilitating newborns' development with increasing capacity for organization, regardless of their gestational age at birth or level of acuity in the intensive care unit (Lawhon, 2003). Lawhon (2003) suggests that the structure of the environment and nature of care giving in the newborn intensive-care unit should support and nurture each newborn's and family's strengths and competence.

Als synactive theory of development is a framework that outlines the main parameters of the infants' individuality in behavioral organization as they and their
parents adapt to extrauterine life. This theory integrates principles from embryology, ethnology, developmental psychology, and motor system physiology into a unified theoretical approach to the total human organism (Als & Duffy, 1983). The infants functioning is seen as in a model of continuous intraorganism, subsystem interaction and the organism, in turn, is seen in continuous interaction with the environment (Als, 1982). In 1982, Als provided the synactive model, defining competence as the degree of smoothness, modulation, regulation, and differentiation of five observable subsystems of functioning: autonomic, motor state, regulatory, attentional/interractional, and self regulatory (Lawhon, 2003). These five subsystems are interwoven as the infant continues to develop along with incorporation of the environment that surrounds the infant. Lawhon (2003) states that within this synactive context, the infant shows emerging efforts at self-regulation, or achieving balance in subsystem functioning in response to the environment.

As the infant continues to develop and mature within the newborn intensive care environment, parents are to be nurtured to develop their competence along with the infants' progress. Lawhon (2003) suggests that parents who
appreciate their own newborns emerging competence are able to enhance the newborn’s development through their own sensitive and supportive response and interaction. Als (1982) explains that from 24-27 weeks post conceptual-age on, the human fetus can be kept alive in an extrauterine environment due to the advances of medical technology. The infant is biologically expecting 13-16 more weeks of in-utero existence, with respiratory, cardiac, digestive and temperature control aided by the maternal blood flow and placental functioning (Als, 1982). Instead of the maternal organism, medical technology attempts to take care of the respiratory, cardiac, digestive, and temperature control functions (Als, 1982).

With the newborn intensive care professionals taking care of the medical aspect of the newborns development it is prudent to incorporate the parent into the treatment plan so that they do develop an understanding of their infant.

In utilizing Als’ synactive theory of development as the theoretical framework for this project, is shows that the development of one subsystem is dependent on the stability and the emergence of another; all are interrelated and interdependent (Horns, 1998). The synactive theory asserts that the infant’s behavior is the
primary route of communicating stress that behavioral interventions can make a difference in an infant’s ability to deal with the stress of the NICU environment, and that neurobehavioral support can have a positive outcome on the survival of infants in NICU (Ward-Larsen, Horn, & Gosnell, 2004). Parent involvement right after birth is incorporated into the plan of care along with the developmental interventions. Als synactive theory promotes the integration of parenting in steps as the infant progresses in growth and development in the NICU. Both the educational component of the project and the Meditech PCS charting system strive to mesh developmentally supportive care in the Neonatal ICU.

In order to integrate developmental care into the Neonatal ICU a change process needs to take place. Change is a common and important in improving patient outcomes in the current healthcare market (Buonocore, 2004). The rapid changes in the healthcare environment require effective leaders that can implement change strategies to improve patient outcomes (Buonocore, 2004). Buonocore (2004) describes that the influential nurse does not merely react or respond to change, the influential nurse navigates change through the skillful employment of strategies in each of the key change components (Buonocore, 2004).
The challenge begins once a problem is identified and defined and a decision is made that a practice is in need of change (Buonocore, 2004). Buonocore (2004) states that a primary concern when contemplating a change in practice is that there are many barriers to implementing research-based change. Change occurs in a fluid rapidly changing environment and a structured approach to planned change will assist in overcoming the barriers to change (Buonocore, 2004). Buonocore (2004) notes that there are five key reasons why nurses do not embrace evidence based change in practice, nurses do not know about research findings, nurses do not understand the research findings, nurses do not believe the research findings, nurses do not know how to use them and nurses are not allowed to use the research findings.

There are many theorists and change theories in the literature offering systemic problem solving approaches to facilitating change (Buonocore, 2004). Lewin’s Theory of Change provides the structure for understanding nurse’s behavior during change and ways to improve behavior during the change process (Buonocore, 2004). Buonocore (2004) states that according to Lewin there are three basic steps to change: the stage of unfreezing, the stage of moving, and the stage of refreezing. Lewin’s Theory of Change will
be utilized for implementing the developmental care project in the Neonatal ICU.

In the stage of unfreezing there is a degree of motivation to promote change in practice (Buonocore, 2004). The problem and the potential interventions are analyzed and based on the literature (Buonocore, 2004). Buonocore (2004) suggests that the purpose of this endeavor is to determine if the strength of evidence supports a change in practice. Knowing the literature on the subject of the intended change helps in establishing credibility (Buonocore, 2004).

In the stage of moving, the actual change process is happening, solutions are gathered and evaluated for merit before trialing the change (Buonocore, 2004). In implementing the moving stage of the change process Buonocore (2004) notes that the education of the change is treated as a process and includes the identification of the key end users of the change as well as a means of ongoing support for the change process. Buonocore (2004) suggests that there is a need to provide a supportive, non-judgmental atmosphere of mutual learning so the target audience will be able to develop the new skills without fear of failure. Buonocore (2004) further recommends to
recognize and reward forward movement in the change process.

In the stage of refreezing, the third stage, the new changes are integrated into the system and stabilized (Buonocore, 2004). During this time, outcomes data collection is a major part of the process (Buonocore, 2004). Buonocore (2004) notes that data collection helps to reinforce long-term change in practice. Buonocore (2004) states that overtime the changes become a part of the systems values. Once the change is adapted, balance must be reestablished (Buonocore, 2004). In obtaining clinical outcome data Buonocore (2004) suggests that positive results can increase credibility and increase the number of people who will be less likely in the future to resist change and can greatly help establish a culture in which change is embraced. It takes a long time to change or to go back to what once was a more holistic, humanistic, individual approach and there are many bumps, bruises and setbacks along the way (Turnage-Carrier et al., 2004). In implementing a specific change Turnage-Carrier et al. (2004) note that patience, endurance and persistence are the hallmarks of change.
Limitations of the Project

In attempt to meet the educational needs of all caregivers in the Neonatal ICU, limitations were uncovered. The limitation encountered is that only one method of instruction was utilized, a computer based education module on developmental care in the Neonatal ICU. The challenge is to deliver content in a format that enables the student to learn, think critically about the content and grow as a result of learning (Barker, 2002). Barker (2002) suggests that four basic principles are used in designing a course for adult learners: adults do not generally respond to lecturing, the traditional method of teaching, adults bring life experiences to the learning situation that influence what they learn, adults learn best if they actively participate in the learning experience, adults are more motivated to learn when they understand the usefulness of the learning and can apply the content to immediate life situations. The module was designed with these principles in mind plus the added component of time constraints on the caregivers utilizing the module. Online learning permits flexible scheduling, but does not eliminate the time required to complete the course (Cook & Dupras, 2004). Web-based learning accommodates shift schedules and distance learning, is
easily expanded and modified, facilitates assessment, encourages self-directed learning, and is inherently learner centered (Cook & Dupras, 2004).

Definitions

Apnea: apnea is the stoppage of airflow at the nostrils and mouth lasting at least 20 seconds.

Caregivers: a person who cares for someone who is sick or disabled.

Desaturation: a valid decrease in arterial oxygen (< 88%) as measured by oximetry (SaO2). Normal range is 88-92%.

Developmental care: is a broad category of interventions designed to minimize the stress of the NICU environment; interventions may include one or more elements such as control of external stimuli (vestibular, auditory, visual, tactile), clustering of nursery care activities, and positioning or swaddling of the preterm infant.

Extremely low birth weight infants: infants with birth weight less than 1000 grams (2 pounds, 3 ounces)

Family: parents and their children, considered as a group, whether dwelling together or not.
Healthcare: any field or enterprise concerned with supplying services, equipment and information for the maintenance or restoration of health.

High Frequency Ventilation (HFV): a mode of ventilation that minimizes barotraumas, or damage to the delicate tissue in the lungs; a rapid rate of ventilation using a low tidal volume.

Infant: a child during the earliest period of life.

Isolette/incubator: a brand of incubator for premature or other newborn infants, providing controlled temperature, humidity, and oxygen levels and having armholes through which the infant can be reached with minimum disturbance to the controlled environment.

Kangaroo care: skin-to-skin, or kangaroo care is a method of holding a diaper-clad infant in skin-to-skin contact, prone and upright on the chest of the parent. The parent encloses the infant in his or her clothing to insure temperature stability.

Low birth weight infants: infants with birth weight less than 2500 grams (5 pounds, 8 ounces)

Micropremie: infants with birth weight less than 800 grams (1 pound, 12 ounces).

Neonatal ICU/Newborn ICU/NICU: Intensive care units with the technology and equipment that focuses on the
micro-premie, premature infants and the skin newborn infant from birth. Newborn infants can be admitted to the NICU up until 28 days after birth.

**Neonate**: a neonate is a newborn baby in the first four weeks of life.

**Neonatology**: is the medical specialty of taking care of newborn babies, sick babies and premature babies.

**Providers**: a person or thing that provides.

**Tachycardia**: abnormally rapid heartbeat; greater than 20 beats per minute from infants baseline heart rate.

**Tachypnea**: rapid breathing; greater than 60 breaths per minute.

**Very low birth weight infants**: infants with birth weight less than 1500 grams (3 pounds, 5 ounces)
CHAPTER TWO
LITERATURE REVIEW

In designing an educational program to refresh current practice and introduce developmental care into the NICU at Arrowhead Regional Medical Center resources were selected that would fit into this project. Parents are the primary caretakers and advocates for their infants, so articles discussing parenting in the NICU were selected. Skin-to-skin care (Kangaroo care) is a popular component of developmental care and is reviewed. Infant positioning and decreasing noise in the NICU environment are interventions that are currently being utilized by a few caregivers in the NICU at Arrowhead Regional Medical Center. Developmentally supportive care is discussed in its entirety, followed by Als' Synactive theory of development. The program will be a self-learning module that is accessible on each computer based in the NICU, articles discussing design and implementation are included. Implementing this program will require a change in attitude, a change in practice, and a change in approach by incorporating parents as part of the infants plan of care, articles discussing Lewin’s change theory are presented. The last topic of the literature review
discusses the history of the Neonatal Intensive Care Units.

Parenting in the Neonatal Intensive Care Units

Becoming a parent under normal birth circumstances is a stressful event. In parenting the high risk infant, Hummel (2003) explores some of the challenges of parenting in the NICU that include depression, concern for the infants development, the anxiety that is present at discharge and ways that nursing can help. The baby they envisioned is often not the baby they see in the warmer bed or incubator, feelings of grief, loss and fear are common (Hummel, 2003). Hummel (2003) reports that in most studies, postpartum depression has been found to be more common in mothers of premature infants had in mothers of multiples. Prenatal depression, low social support, life stress, low socioeconomic status, low self-esteem, child care stress, prenatal anxiety, poor marital relationship, difficult infant temperament and unplanned/unwanted pregnancy are significant predictors for postpartum depression (Hummel, 2003). Parents concerns about future developmental outcomes are a natural response that parents whose infants have been born prematurely face. In many cases the prognosis is less certain and the parents may
have been informed that "wait and see" attitude is best (Hummel, 2003). In addition, a parent or anyone under stress filters incoming information (Hummel, 2003). Nurses can boost parent self-esteem and confidence in the NICU (Hummel, 2003). Facilitate parenting roles by encouraging visitation, teaching parents how to care for their child, and involving them in decision making are all important aspects of this process (Hummel, 2003). Parents describe non-supportive nursing actions as delaying answers to questions, responding with annoyance, giving false or misleading information, and using overly technical language (Hummel, 2003). Teaching parents how to interact with their child, how to recognize behavioral cues and techniques to enhance development are important in any setting (Hummel, 2003). Because a positive developmental outcome is dependent on the quality of the home environment and effective parenting, nurse must enhance parent-infant interaction and assist parents in their role (Hummel, 2003). It would be important for nurses to be reminded often of what the parents are going through and ways that nursing can be influential in the progress towards discharge.

Parents feel alienated from their infants in the Neonatal ICU. Jackson, Ternestedt, and Schollin (2003)
stated that the aim of this research was to study how mothers and fathers of preterm infants describe their experiences of parenthood during the infants first 18 months of life. The birth of a preterm infant has a long-term impact on both parents (Jackson, Ternestedt, & Schollin, 2003) Seven consecutively selected sets of parents of preterm infants ≤ 34 weeks of gestation with no serious congenital defects were interviewed 1-2 weeks after the infants birth and at 2, 6 and 18 months of age, and the findings were analyzed using a phenomenological method (Jackson, Ternestedt, & Schollin, 2003). Jackson, Ternestedt, and Schollin (2003), found the internalization of parent was described as a time-dependent process, with four syntheses of experiences- alienation, responsibility, confidence and familiarity. Within the syntheses, similarities in how mothers and fathers described their parental roles involved concern for the child, insecurity, adjustment and relationship with the child (Jackson, Ternestedt, & Schollin, 2003). Important turning points in parenthood experiences often occurred when the infant could be removed from the incubator, discharged from the ward and when the infant looked normal compared to full-term infants (Jackson, Ternestedt, & Schollin, 2003). Jackson, Ternestedt, and Schollin (2003) concluded that
the structure seems to be based on the parents' expectations of the parental role, the infants' health condition, and the health care environment. They also suggest that further studies are needed. Study limitations Jackson, Ternestedt, and Schollin (2003) cited were that some of the parents were interviewed together and there is a risk that they interfered in one another's stories.

The events that surround the birth of an infant prematurely are often untimely and unexpected. Integrating parents into the plan of care in the Neonatal ICU is often a challenge. The growing trend for family-centered care became the impetus for the development of parent support programs as health care providers realized that they may not be meeting all the needs of parents (Jensen, 1999). Jensen, (1999) discusses a model for parent support programs in the Neonatal Intensive Care Unit and special care nursery by encouraging and facilitating family-to-family support and networking are essential for providing family-centered care. The Together Let's Cope (TLC) program supports the hospital's commitment to family-centered care and serves as a mechanism to evaluate and address customer service issues in today's changing health care market (Jensen, 1999). The mission of TLC is to improve the well-being and quality of life of families.
experiencing the birth of a premature or sick infant
(Jensen, 1999)

Parent support programs provide a multitude of benefits to families and to the institutions in which they are based (Jensen, 1999). Studies report that mothers in support groups had less anxiety during the first 4 months post discharge than those in comparison groups who did not participate and that the self-esteem of support group mothers increased during this period while self-esteem decreased for comparison mothers (Jensen, 1999). Jensen (1999 notes that support program mothers also had more nurturing home environments at 12 months following NICU discharge than mothers in the comparison group. Research shows that an important function of veteran parents is to act as empathic listeners by recognizing and validating new parents’ feelings of anger, guilt, and confusion; only someone who has been in the same situation can do this (Jensen, 1999). The program described by Jensen (1999) supports parents with a learning library, phone support, discussion group meetings, bereavement support, an educational newsletter and a parent advisory board of volunteers. Vision and a handful of compassionate, are all that are really needed to begin a parent program (Jensen, 1999). Limitations are that this program is instituted at
one hospital. Exploration and implementation of the TLC parent support program in other Neonatal Intensive Care Units would be beneficial for further research.

Supporting parents is a part of developmental care in the Neonatal ICU. VandenBerg, (2000) states that as intensive care nurseries move toward implementation of developmentally supportive care practices, we are encouraged to focus on the relationship between parents and their infants and recognize the essential role that parents play in promoting the health and recovery of their infant. Despite the parents' fear, confusion, and inexperience, the relationship between parent and infant is biologically and psychologically essential for the survival and development of the infant (VandenBerg, 2000). VandenBerg (2000) quotes a touchpoint by Dr. Brazelton about parenting, "The parent is the expert on their own child," VandenBerg (2000) continues with we often see in the nursery behavior that tells us the infant knows when his parents are present at the bedside and can differentiate the parent by voice and smell from other bedside visitors. Professionals must remember that many parents experience strong feelings of inadequacy when they have a baby too early or one with special needs (VandenBerg, 2000). VandenBerg (2000) comments that in our
bedside encounters with parents, we are in a unique position to point out behaviors, reinforce interactions, and support mastery in parents as they get to know their infant’s patterns of responsiveness—even if this requires moving beyond our traditional role. VandenBerg (2000) provides five techniques for encouraging successful parenting by S. Weider: provide positive meaning to being a parent; support the development of uniqueness in mother and father; communicate to parents that infants have feelings and experience the outside world; interpret the infant’s behaviors, and relate them to the current stage of development; build positive feelings in parents by admiring the baby’s success. VandenBerg (2000) closes with as we acquire the information and skill to help parents in their relationship with their infant, we must join in partnership with them, working together to provide the best possible care for the infant.

Being a parent is a challenge. Being a parent of a premature or sick newborn is often met with feelings of incompetence and frustration. A major challenge facing neonatal health care providers is to combine technological intensive care for preterm infants with a sensitive and individualized approach facilitating neurobehavioral development while supporting parents in their roles as
primary advocates and long-term caregivers (Lawhon, 2002). Although most parents may initially have difficulty in relating to their preterm infant, parents typically make adjustments in their interactions as they get to know and understand their infant’s behavior (Lawhon, 2002).

Neonatal nursing care involves validation of both infant and parental competence in the provision of strategies to enhance caregiving (Lawhon, 2002). Lawhon (2002) discusses the concept of newborn competence provides the framework for nursing care of newborns, enhancing the infant’s adaptation to the extrauterine environment. Lawhon (2002) sites Dr. Brazelton as he viewed competence as the driving force within the newborn that works toward development. Neonatal competence using Al’s synactive framework for infant development, is the process of supporting the infant’s ongoing development through support and protection of the increasing modulation and differentiation of the infant’s responses in relation to the environment (Lawhon, 2002).

Lawhon (2002) states that this exploratory study examined an individualized nursing intervention, based on underlying assumptions of parental and infant competence, and its potential outcomes. The exploration of the effectiveness of the individualized nursing intervention
was done on three levels: (1) the ability of parents to appraise their infant's behavior critically; (2) the parent's ability to integrate critical appraisal into a supportive approach to handing during interaction; and (3) enhanced parent and infant competence (Lawhon, 2002). A convenience sample of infants and parents who met inclusion criteria was used (Lawhon, 2002). Inclusion criteria for infants were: birth weight ≤ 1,500 g, birth gestational age ≤ 32 weeks, appropriate for gestational age, singleton, no known congenital or chromosome anomalies, no known illicit drug exposure in utero, and admitted to a level III newborn intensive care unit (Lawhon, 2002). Criteria for parents were: at least 18 years old, planning to be involved with the infant, English speaking, free of illicit drug addiction, and able to be with the infant at least once a week (Lawhon, 2002). The study sample consisted of 10 infants and their corresponding 18 parents (Lawhon, 2002). Parent and infant interactions were videotaped at least weekly (Lawhon, 2002). The study suggests that the first level of effectiveness measured by parents' ability to appraise their infant's behavior critically may be best accomplished through the facilitation of parents' emerging competence rather than through the provision of knowledge.
as a teaching session (Lawhon, 2002). Lawhon (2002) found that just as there is transitory disorganization of an infant's behavior as her or she reaches a threshold of stress and prepares to move to the next level of differential functioning, parents, too may temporarily be less able to appraise critically as they are acquiring more complex skills in caregiving. For this reason, the individualized nursing intervention should be consistent throughout the hospitalization (Lawhon, 2002). In terms of the third level of effectiveness, this study suggests that the individualized nursing intervention positively influenced parent and infant competence (Lawhon, 2002). Lawhon (2002) states that perhaps the most important outcomes of this exploratory study are the implications for guiding clinical practice in the newborn intensive care nursery. Parents must be supported in being welcomed as active collaborators in their infant's care (Lawhon, 2002). Once parents and families have been acknowledged and welcomed as active collaborators in their infant's care, all aspects of caregiving are influenced by the family's participation (Lawhon, 2002). Lawhon (2002) recognizes that parents who appreciate their own infant's emerging competence are supported in being able to enhance
the infant's development through their own sensitive and supportive response and interaction.

Skin-to-Skin Care

Encouraging parents to participate in skin-to-skin care requires explaining the benefits for both the parent and their infant. Neu, Browne, and Vojir (2000) chose to compare the impact of two different transfer techniques use in skin-to-skin care (nurse transfer and parent transfer) on physiologic stability and other descriptive measures of physiologic stability related to energy conservation in ventilated preterm infants during and after skin-to-skin care. Fifteen ventilated preterm infants weighing a mean of 1,094 g were randomly assigned to receive either parent or nurse-to-parent transfer on the first of two consecutive days and the alternate method the following day (Neu et al., 2000). Temperature was taken before and after skin-to-skin care (Neu et al., 2000). Oxygen saturation and heart rate were recorded minute by minute, and the Assessment of Behavioral Systems Observation (ABSO) scale scores was used to measure physiologic organization, motor organization, self regulation, and need for caregiver facilitation during to and from the parent and during pre, post and skin-to-skin
periods (Neu et al., 2000). Temperature remained stable (Neu et al., 2000).

Oxygen saturation decreased and heart rate increased when the infant was transferred to and from the parent, but returned to baseline levels during and after skin-to-skin care regardless of the transfer method (Neu et al., 2000). However, during and after skin-to-skin care, infants exhibited no signs of energy depletion (Neu et al., 2000). The method of nurse to parent transfer technique that was used in the study is routine in most neonatal ICU's. The description of the parent to infant transfer will be a technique utilized in skin-to-skin care routines. Narrowing the weight range would be beneficial for repeat studies, the standard deviation in this study for weight was 423 grams.

Ohgi et al. (2002) observed that Kangaroo Care seems to stabilized the respiratory and circulatory systems and improve the physiological functions of infants, as measured by higher oxygen levels, less oxygen consumption, less apnea and periodic breathing, better body temperature regulation, and an increase in both alertness and quiet sleep, without increasing the risk of infection. This study by Ohgi et al. (2002) looked to determine whether Kangaroo Care (KC) for healthy low-birth-weight (LBW)
infants can promote better behavioral and developmental outcomes. In this historical control study 26 infants in the KC group (Gestational Age = 34.3 ± 2.5 weeks; birth weight 1833.9 ± 167.6 g) and 27 infants in the comparison group who received the standard medical-nursing care (34.6 ± 2.3 weeks, 1850.9 ± 156.7 g) were analyzed by the Neonatal Behavioral Assessment Scale (NBAS) at 40 weeks of postmenstrual age, the Bayley Scales of Infant Development and the Carey’s Infant Temperament Questionnaire (ITQ) at six and 12 months of age (Ohgi et al., 2002). The findings in this study suggest that KC in the NICU promotes the positive development of LBW infants over the first year of life (Ohgi et al., 2002). Kangaroo Care infants had significantly higher NBAS scores in Orientation, State Regulation and Supplementary items; lower intensity scores and higher Mood scores at six months on the ITQ and higher Bayley Scales score at 12 months (Ohgi et al., 2002). Kangaroo Care effectively promoted neonatal behavioral organization and enhanced developmental outcome over the first year of life for LBW infants (Ohgi et al., 2002). The study was done as a historical control study and the authors acknowledge bias including differences in care by the staff, patient sampling for a possible population that did not reflect the general population. Even though the
study held some bias, the outcomes did show evidence that KC promoted behavioral organization.

In 2003, Ludington-Hoe, Ferreira, Swinth and Ceccardi reviewed several articles regarding procedural issues for Kangaroo Care (KC) with mechanically ventilated preterm infants in order to develop a plan of safe criteria and procedure for implementing Kangaroo Care with intubated preterm infants. These criteria and the procedure resulted in safe administration of KC to ventilated infants of varying weights and postnatal ages (Ludington-Hoe et al., 2003). A summary table of all available criteria are presented to facilitate comparisons and modification of the criteria for individual units (Ludington-Hoe et al., 2003).

The need for routine use of a head cap has not been established (Ludington-Hoe et al., 2003). Some units prefer to use a head cap with infants less than 1,000 g weight (Ludington-Hoe et al., 2003). Ludington-Hoe et al. (2003) report that a guideline that has worked well in numerous studies and with ventilated infants is application of a head cap if abdominal or axillary temperature falls below 36.0° C.

Temperature stability is an important component in fostering growth and development in preterm infants.
Infants can lose body heat by convection across the surfaces of their bodies not in contact with maternal skin if insulation is inadequate (Ludington-Hoe et al., 2003). Ludington-Hoe et al. (2003) state that a standard receiving blanket folded in fourths provides 1.0 clo heat resistance, a measurement of insulation provided by clothing equal to 0.25-inch (0.5 cm) thickness of wool, to prevent body heat loss. This insulation, in conjunction with the flow of heat from the mother to the infant during KC, ensures that even infants weighing only 600-800 g will become warmer, not colder, during KC (Ludington-Hoe et al., 2003).

Transferring the preterm infant to the mother for KC and back into the isolette when KC is concluded can contribute to heat loss and infant stress. Two types of transfer can be used with KC-Vent: standing or sitting (Ludington-Hoe et al., 2003). Monitoring the infant for 10 to 15 minutes following transfer permits an assessment for physiological disruption and needed intervention (Ludington-Hoe et al., 2003). Typically, if physiological changes are seen in the infant in the 10-15 minute time period, the infant is placed back into the isolette. Adaptation periods are recommended and should be
considered part of any intervention with infants on mechanical ventilation (Ludington-Hoe et al., 2003).

The authors site that several reports of experience or research with mechanically ventilated infants receiving KC were found, but few provided detailed descriptions of selection criteria (Ludington-Hoe et al., 2003). The exact nature of the effects of KC-Vent on cardiorespiratory, thermal, and behavioral outcomes is equivocal and needs to be determined by further study (Ludington-Hoe et al., 2003). The effect of Kangaroo Care on the infant and maternal benefits are suggestions for further study.

Infant Positioning

Perkins, Ginn, Fanning, and Bartlet (2004) explored the effect of different forms of education on nurses' abilities to position neonates in a developmentally supportive way and to determine nurses' perceptions of effectiveness of educational methods to enhance their positioning abilities. The inherent nature of the NICU, with increased sound, activity, handling and light levels, places stress on infants as they struggle to survive (Perkins et al., 2004). Perkins et al. (2004) state that infants who received developmentally supportive care have been observed to have better medical outcomes with respect
to shorter duration of mechanical ventilation and supplemental oxygen support, earlier oral feeding, and shorter hospital stays than those who did not. Perkins et al. (2004) identified the goals and outcomes of developmentally supportive positioning, which is only one aspect of developmentally supportive care, by incorporating research evidence that has recently been summarized in two systematic reviews. Perkins et al. (2004) state that self-learning/professional development role for NICU practice is identification of learner knowledge and skill needs, preparation of clinical training that reflects both the baseline and expected achievement levels, establishment of training objectives and priorities, selection of teaching format and methods, communication of information, demonstration of procedures, arrangement of practice sessions and repeat demonstrations, and provision of feedback to learners regarding their performance. Strategies that might facilitate the incorporation of developmentally supportive positioning in routine care provided by NICU nurses include (1) offering technical and analytical expertise, (2) encouraging the use of reflective practice, (3) improving outcome measurement as a means of providing feedback, and (4) providing ongoing formal and informal
educational support (Perkins et al., 2004). Perkins et al. (2004) stated that the outcome of interest is positioning effectiveness, which we define as an optimal developmental position in the context of each infant’s acuity and developmental stage, based on the judgment of the rater. The aim of optimal positioning was to support the infant in a manner that promoted organized movements of the infant, optimizing the infant’s motor self-regulatory abilities, state stability, comfort and physiological flexion while not interfering with medical equipment and inviting parent interaction with their infant (Perkins et al., 2004). Perkins et al. (2004) describes that the first purpose of the current research was to determine the effect of formal and informal education on nurses’ abilities to position neonates in the NICU over a five-year period. Perkins et al. (2004) discovered that there were no significant differences between part-time and full-time nurses with respect to their methods of knowledge acquisition. Nurses ranked the interactive educational workshop and formal physical therapy in-services as the most useful methods of learning about optimal neonatal positioning (Perkins et al., 2004). Limitations discussed by Perkins et al. (2004) included some subjective consideration of each infant’s medical
situation contributed to the final assigned score of the nurse’s positioning of the infant. A second limitation of the research study is the fact that although this design is considered to be a one-group repeated-measures study, the participants are not the same nurses over the whole time period (Perkins et al., 2004). Of the final limitation, Perkins et al. (2004) states that a low number of surveys were completed by NICU nurses and returned to the investigation team. Perkins et al. (2004) suggests that future research directions should include, but are not limited to, the following areas: reliability and validity testing of the measure of positioning effectiveness, exploration of a greater range of educational strategies for adult learning, use of stronger methodological designs such as a randomized, controlled trial comparing different educational approaches with evaluation of the outcome by a rater masked to intervention, greater frequency of outcome measurement to more closely monitor patterns of decline in performance to clarify the optimal frequency of formal education approaches, and replication of this and other studies in different settings. Perkins et al. (2004) concluded that formal education provided by the physical therapist had the greatest positive effect on positioning practices of
NICU nurses when compared with other methods of knowledge acquisition available.

Positioning of premature infants for optimal growth and development has evolved as a learning paradigm. After delivery, a premature baby is at risk of developing extended postures, with limbs outstretched away from the trunk, because they lack adequate muscle tone (Young, 1994). Proper positioning and handling of premature infants may promote more normal motor development and minimize chances of developing abnormal movement patterns (Young, 1994).

Young, (1994) states that the aim of positioning management for the preterm infant is to encourage balance between flexion and extension. Frequent changes in position so weight bearing forces are never allowed to persist for any length of time in one direction would be a fundamental principle on which guidelines for supported positioning within the neonatal unit could be formed (Young, 1994). Correct positioning is dependent upon role modeling by colleagues and how motivated each nurse is to keep his/her knowledge updated with suggested practices provided through recent, valid research (Young, 1994). Young (1994) suggested that regular educational and practical sessions led by neonatal nurses and
physiotherapists with their daily input and support in the clinical area would be invaluable enhancing correct positioning practices, so that the developmental outcome for each baby is optimal. Young (1994) further suggested that frameworks to identify babies at risk or sensorimotor and skeletal deformities, and setting standards for positioning would assist nurses in looking critically at their practice methods. Young (1994) speculates that nurses will then be able to make a rationale based clinical judgment as to which position best meets the individual baby’s needs at any particular time. Young (1994) concludes that no amount of time, money or energy spent trying to give these babies optimal physical and emotional support will achieve holistic care if effects of positioning on skeletal and sensorimotor development are ignored.

Noise

Part of the environmental issues within the NICU concerns the amount of noise. In response to the growing concerns over the intensity of the sound in the nursery environment and potential effects on the neonate, the American Academy of Pediatrics Committee on Environmental Health recommended that neonatal intensive care unit
(NICU) sound levels should be monitored by caregivers and maintained at or below 45 dB (Johnson, 2003). Specific to the NICU environment, the recommendations include the developmental of a program of noise control to maintain nursery sound levels at or below the recommended noise criteria and care practices to allow parent-infant interaction (Johnson, 2003). Environmental noise is a major source of stressful stimulation that can agitate the neonate and further complicate medical management (Johnson, 2003). The purpose of this study was to develop a protocol of care to effectively reduce and maintain lower environmental noise levels with a model of evidence-based nursing practice (Johnson, 2003). Johnson, (2003) states that maintaining nursery sound levels at or below the recommended noise criteria supports parent-infant interaction, protects sleep of the most fragile infants while supporting neonatal physiologic stability, and reduces potential adverse effects on auditory development of these infants. The research of Thomas, recognized as the hallmark study of environmental noise in the NICU, reports sound level measurements ranging from 58 to 117 dB in the patient care environment of a Level III NICU (Johnson, 2003). Johnson (2003) reports that sound level measurements made the nursing
staff cognizant of noise in the nursery environment and thus able to decrease noise by adopting protocols to control noise by limiting activities. Application of an intervention to decrease noise in clinical practice would follow a 5-step process as outlined: (1) Assessing the NICU environment: an environmental assessment is completed to determine normal sound levels of a specific NICU setting, (2) Development of a protocol: the protocol outlines specific modifications of caregiving activities and categorizes changes in the physical environment on the basis of all factors analyzed, (3) Educational preparation of the staff: the educational component focuses on making the staff more aware and attentive to sources of environmental noise while increasing the awareness of caregiving behaviors that contribute to noise, (4) Implementation of the protocol: cooperation of the staff is essential for successful application of the protocol, implementation occurs at the completion of the inservice component and, (5) Evaluation of progress: intermittent sound level monitoring of the caregiving environment is the most effective evaluation of progress (Johnson, 2003). The initial environmental survey was completed as part of a pilot study of neonatal response behaviors to changes in incubator noise (Johnson, 2003).
Johnson, (2003) continues with all sound level measurements were recorded concurrently with caregiving activities and events. In developing the protocol to reduce the noise, all caregiving activities and noise events documented in the survey were further classified according to necessity and adaptability to protocol. The protocol identified the primary contributors of noise and outline specific modifications to decrease noise (Johnson, 2003). In addition, gentle reminders for staff and visitors to maintain the quiet environment were determined the most feasible method to curb the noise from high volume traffic, as visiting and staffing trends were not likely to be changed (Johnson, 2003). Johnson, (2003) notes that before implementation of the protocol, inservice educational sessions were provided for the staff to encourage cooperation and increase awareness and attention to environmental noise. Intermittent sound level monitoring continued each week for six consecutive weeks, then tapered off to one week a month (Johnson, 2003). One week following implementation, overall environmental noise levels decreased 9.26 dB to equal a mean of 54.85 dB (Johnson, 2003). Environmental noise has since leveled out to a mean of 56.29 dB, this represents a change of 7.82 dB maintained over a 14-month period (Johnson, 2003).
Johnson, (2003) did describe limitations to the case study (1) this large unit has a considerably larger multidisciplinary staff, more traffic from ancillary support personnel and visitors, and more equipment in use that contribute to the overall noise levels than do smaller units, (2) staffing changes that require orientation is an ongoing contributor to the noise levels that was not accounted for in the original assessment, (3) equipment changes that keep pace with technology contribute to the persistent problem of noise, and (4) regardless of the reinforcement strategies and feedback, a select few staff members remain resistant and unable to adopt a protocol that limits personal conversation. Johnson, (2003) concludes with changing caregiving behaviors and modifying the physical environment of the NICU are essential components for controlling noise consistently identified.

Premature infants in the neonatal intensive care unit often are exposed to continuous loud noise (Bremmer, Byers, & Kiehl, 2003). Bremmer et al. (2003) state that this excess auditory stimulation creates negative physiological responses, such as increased heart and respiratory rates and decreased oxygen saturation. The article by Bremmer et al. (2003) review literature that
addresses the pathophysiology and physiological changes of the premature infant in response to stress and discusses the practice interventions for decreasing noise levels in the NICU. A potent stressor for the premature infant, noise has been compared with aminoglycosides as an equal detriment to the developing cochlea (Bremmer et al., 2003). Bremmer et al. (2003) note that although environmental noise in the NICU cannot always be controlled because of the use of equipment necessary to sustain life, there are numerous methods of decreasing sound levels in the NICU. Bremmer et al. (2003) state that one study examined a simple and inexpensive way to reduce noise heard by the premature infant, that of covering and the incubator with a blanket. An additional method to decrease noise in the NICU is the implementation of a quiet hour (Bremmer et al., 2003). Bremmer et al. (2003) suggest that hospitals first must thoroughly assess the noise levels in their NICU’s. Although altering the existing environment can reduce much of the noise, this is often a difficult and costly task (Bremmer et al., 2003). Bremmer et al. (2003) note that it is helpful to make changes gradually, track the benefits of these changes, and to present the results in subsequent educational sessions. Bremmer et al. (2003) in their conclusion state
that various studies have demonstrated that excessive auditory stimuli negatively affect the premature infant by increasing heart rate, blood pressure, and respiratory rate and decreasing oxygen saturation. Although these changes are sporadic, multiple episodes can result in apnea and bradycardia, thereby increasing the risks of hypoxic episodes (Bremmer et al., 2003). It is known that premature infants expend a great deal of energy mediating unwanted stressors (Bremmer et al., 2003). If this energy could be reserved for the primary purpose of growth and healing, these infants could improve sooner, resulting in a more timely discharge to their families (Bremmer et al., 2003).

Developmentally Supportive Care

Developmental care has been evolving through the years. Lawhon (1997) describes that nearly every intensive care nursery in the United States and other developed countries has had some exposure to the concept of individualized, developmentally supportive care and has made at least some beginning attempts to integrate the concept into clinical practice. The history of developmentally supportive care began with the challenge of attempting to combine the necessary technologic
intensive care for preterm and high-risk newborns with sensitive and individualized approach to facilitate neurobehavioral development (Lawhon, 1997). Lawhon (1997) points out that the most successful interventions involve the parent understanding the infant's developmental needs, reading the infants behavioral cues, and deriving satisfaction from caring for and interacting with the infant. One of the overriding aspects of providing developmentally supportive care in the newborn intensive care unit has to do with the complexity of such a comprehensive approach (Lawhon, 1997). Lawhon (1997) states that there is a general reluctance to expend the initial time, energy, and cost to understand fully the underlying principles of the synactive theory and take a thoughtful and considered approach to its integration in clinical practice. Lawhon (1997) mentions that if there were one simple aspect of care that could deliver the heart of the message; it would be that each caregiver must be helped in seeing the experience of the care recipient, especially the preterm infant, requiring intensive care. The concept of developmental support of the infant manifest in the nature of the individualized assessment and support of the infant's ongoing maturation and development in becoming an increasingly active participant
in his or her own caregiving (Lawhon, 1997). In more systemwide terms, it is crucial that beside nurses have support from developmental specialists, psychologists and administration to be able to prioritize developmentally supportive care in the unit (Lawhon, 1997). Once it was realized that infants are extremely responsive to and in continuous interaction with the environment, it became crucial that nurses be thoughtful in the creation of the environment in which infants and their families receive care (Lawhon, 1997). Lawhon (1997) notes that the changes in the environment have come in the form of reduction in lighting, sound, and overcrowding and in the effort to create more homelike, inviting atmospheres to support family members being with their infants and actively participating in their care while being cared for themselves. There is, however, no shortcut to the work of increasing the awareness and sensitivity of each professional caregiver in continuously being aware of the sound that he or she contributes to the overall noise levels within the unit (Lawhon, 1997). Lawhon (1997) describes that in the most family-sensitive and developmentally designed nurseries, there are no more than four or six infants in any one care room. Lawhon (1997) further describes the ideal unit environment as that there
is space between beds, and families are supported in personalizing and taking over the infant’s bed space as they become increasingly comfortable in providing care in the intensive care environment. Lawhon (1997) discusses that the best bedding for the infant outside of the uterine environment is the parent’s body. There has been a strong interest by both families and professionals in promoting the practice of skin-to-skin holding of newborns by parents (Lawhon, 1997). The key to optimal positioning and support is the individualized and thoughtful assessment of each infant on an ongoing basis with sensitivity to subtle signs of disorganization, which are then attended to in a timely fashion (Lawhon, 1997). Clusters of caregiving are planned that take into account the infant’s level of acuity, the extent of necessary interventions, and the infant’s tolerance of handling (Lawhon, 1997). Lawhon (1997) suggests that the actual caregiving is done in as supportive a manner as possible, with careful attention being paid to the individual infant’s response to handling while attempts are made to minimize disorganization and maximize the infant’s self-regulatory abilities. Consistency in the caregiving approach not only enables a professional caregiver to understand behavioral functioning of an infant but also
enhances the developing collaboration with families (Lawhon, 1997). In conclusion, Lawhon, (1997) states that providing developmentally supportive care in the newborn intensive care unit is an area of practice that has been, and will continue to be, challenging and rewarding.

The practice of providing developmentally supportive caregiving is familiar to nurses but often is not practiced until after the infant's stabilization in the neonatal intensive care unit (NICU) (Horns, 1998). Horn (1998) explored with 20 experienced NICU nurses the constructs that describe the characteristics of physiologically stable extremely low-birthweight infants and the process of caregiving to these infants. Horn (1998) states that most nurses do not know how to operationalize developmentally supportive caregiving in view of all the principal priorities of physiologic care. The data set came primarily from unstructured interviews (Horn, 1998). The expert caregivers were interviewed in focus groups (Horn, 1998). Horn (1998) stated that in all, five separate focus group interviews were tape recorded. A focus group process was used to derive descriptive information from nurses regarding the construct of physiologic stability and nurse caregiving interventions (Horn, 1998). Horn (1998) discovered that two separate
constructs emerged: individually defined stability and being "in-tune" caregiving. Horn (1998) states that being available for the infant, protecting the infant from immediate physical environment, and providing care to reduce stress may also have inherent flaws. Some caregivers choose to "be in-tune" with infants, whereas others do not (Horn, 1998). The NICU is a social and technologic world and is full of loud conversation, activity, laughter, and incessant alarms (Horn, 1998). Horn (1998) suggests that a reduced-intervention nursing caregiving environment needs to be created that is different from anything we know now.

During the past several years, many factors including advancements in technology, pharmacology, and increased understanding of preterm infant development and behaviors have influenced and modified the practices of neonatal nurses (McGrath, 2000). The concept of newborn intensive care was fostered out of the belief that high-risk infants were more likely to experience an optimal outcome if they were initially cared for in an environment that supported their unique physiologic, developmental and psychosocial needs (McGrath, 2000). McGrath (2000) recognizes that technological advances can be dangerous and unreasonable without a context of skillful, compassionate caring.
Medical and technological advances are essential to the foundation of neonatal care, yet these scientific advances do not provide guidance to caregivers in aspects of human interactions or relationships, especially when managing the uniqueness of each infant and family situation (McGrath, 2000). Providing optimal care for the critically ill infant requires integration of technology with developmental caregiving, however, the two concepts are often believed to be on opposite ends of the continuum (McGrath, 2000). Neonatal nurses struggle with the dilemma of increased dependency on equipment to support the infant as well as ambivalence related to using clinical assessment skills to detect subtle problems before a crisis develops (McGrath, 2000). McGrath (2000) suggests that with the addition of each new technology, the nurse must continue to balance the needs of the infant with those of the equipment needed to support the infant. McGrath (2000) reminds us that it is critical to remember that even with all the technological advances and the neurobehaviorally based interventions, nothing can substitute for the normal environment of the womb. Technology may have “birthed” the NICU but it has also created an increasingly difficult environment where complex decision-making results in increased stress for
patients, families and caregivers (McGrath, 2000). The NICU has become quieter, darker, and a more peaceful, warm and welcoming place to be for infants, families and staff (McGrath, 2000). McGrath (2000) state that caregiving interventions include clustering of caregiving to increase rest periods, providing medical and supportive interventions based on the individualized behavioral cues of the infant, supporting the infant’s long-term development by acknowledging the infants postconceptional age when choosing interventions, pacing of procedures, and integrating the family into the interdisciplinary caregiving team. Instituting these types of changes often is more difficult to accomplish because they require a change in the caregiving philosophy of the entire NICU (McGrath, 2000). For the most part, NICU environments are task oriented, technology focused, and polarized toward doing to the patients (McGrath, 2000). With a shift to a developmental, supportive approach the care is individualized, infant driven, and provided by a caregiver who is fully engaged with the infant and their family (McGrath, 2000). For developmental interventions to become routine, however, the culture of developmental caregiving must be located within the context of the technological environment of the NICU, on the same plane with shared
goals and outcomes (McGrath, 2000). Developmental interventions are meant to be responsive to the infant’s behaviors and must be integrated into routine practices to have the greatest effect (McGrath, 2000). McGrath (2000) concludes with developmental interventions can be likened with the art of neonatal nursing; moreover, to be effective they are fluidly integrated into all aspects of neonatal nursing care.

Shortened hospitalizations and improved medical, as well as neurodevelopmental outcomes, have recently been observed with the use of individualized developmental care for premature infants in the neonatal intensive care unit (NICU) (Hendricks-Munoz et al., 2002). Over the past 10 years, medical research has provided evidence that premature infants with a developmentally appropriate environment, through individualized developmental care, can have improved medical outcome (Hendricks-Munoz et al., 2002). Hendricks-Munoz et al. (2002) suggest that this is associated with decreased intraventricular hemorrhage, decreased numbers of oxygen and ventilator days, decreased development of chronic lung disease, and decreased days of hospitalization. Hendricks-Munoz et al. (2002) looked at an intervention where Wee Care Neonatal Developmental Care was used to specifically design an educational program for
the hospital staff that provided didactic and hands-on education related to developmental needs of the premature infant. The program worked with the NICU medical and nursing staff to tailor instruction in three aspects of developmental care practices: (1) the physical environment, (2) understanding infant developmental needs, and (3) integration of these practices in an already functioning family-centered care program (Hendricks-Munoz et al., 2002). Hendricks-Munoz et al. (2002) noted that emphasis was placed on inclusion of parents as part of the NICU care team, as well as strategies to educate the NICU staff and parents in accepting altered parental roles to facilitate participation in developmental care practices. Hendricks-Munoz et al. (2002) also noted that at the end of the training sessions, developmental care committees were formed and contact was maintained with the Children’s Medical Venture Wee Care team for one year to reinforce the training program and address ongoing specific environmental questions. Hendricks-Munoz et al. (2002) explored the effect of a comprehensive developmental care training program on the medical outcome and cost of care for premature infants. The population that Hendricks-Munoz et al. (2002) explored were premature infants less than 34 weeks’ gestation admitted to 2 regional neonatal intensive
care units were prospective studies 6 months before and after implementation of the Wee Care program. The sample consisted of 242 infants (139 pre-and 103 post intervention) (Hendricks-Munoz et al., 2002).

Hendricks-Munoz et al. (2002) reported that although the medical outcomes of chronic lung disease, infection rate, mild retinopathy of prematurity, and intraventricular hemorrhage were significantly decreased, there was no change in incidence of severe retinopathy of prematurity. Hospital stay and hospital costs were significantly decreased (Hendricks-Munoz et al., 2002). Hendricks-Munoz et al. (2002) concluded that a multidisciplinary, structured program in developmental care can lead to alterations in the neonatal intensive care unit environment associated with improved medical outcome, and decreased cost of care. Hendricks-Munoz et al. (2002) speculated further that formal implementation of even partial developmental care practices in NICU’s could potentially lead to improved outcome by decreasing stress in the premature infant, which can also be associated with significant cost savings.

Robison (2003) states that many newborn intensive care units have put a great deal of energy and resources into their efforts to provide developmentally supportive
care. Robison (2003) notes that without consistent leadership and clear accountabilities, developmental care will depend on the individual philosophy, or even the mood of the health care professional at the bedside. This inconsistency makes life in the NICU unpredictable and confusing for fragile infants and their vulnerable families and leads to frustration among professionals working to improve the quality of care (Robison, 2003).

Nursery leaders with influence include those with knowledge, insight, and understanding of the principles and practice of developmentally supportive, family-centered care (Robison, 2003). The accountabilities of NICU leaders with influence include (a) provision of staff education and support in a variety of forums regarding the principles and practice of developmentally supportive, family-centered care; (b) performance of individualized assessment and care planning for infants at highest risk; (c) provision of consultative support to family and professional caregivers toward implementing developmentally supportive care for individual infants; and (d) participation in program development and evaluation. Robison (2003) derived from the research that four standards of developmental care have provided a sound foundation for successful programs in the NICU:
(1) caregiving is flexible, individualized, and responsive to the competencies, vulnerabilities, and thresholds of every infant, (2) parent-infant relationships are supported from birth, (3) all caregivers practice collaboratively and (4) a developmentally appropriate environment is provided. Along with establishing standards of care the standards need to be operationalized. Robison (2003) notes that accountabilities for the quality of individual practice must be clear for all professional and ancillary caregivers who interact with infants and families in the NICU. As professionals come to visualize behaviors that represent developmental practice standards, they are equipped to evaluate their own practice continuously (Robison, 2003). Providing emotional support to the NICU caregivers is part of implementing a developmental care program. For bedside professionals to provide truly emotionally attuned care to infants and families, they will need regular opportunities to reflect on the often overwhelming emotional demands (Robison, 2003). Robison (2003) notes that as care in the NICU becomes increasingly successful in sustaining the lives of ever smaller and more vulnerable children, health care professionals are recognizing that the quality of life in the NICU has a significant effect on the development of
high-risk infants. Within a framework of professional accountability, every infant and family served in an NICU can count on receiving relationship based care that is consistently respectful, responsive, and supportive of their individual needs (Robison, 2003).

The survival rate of infants born prematurely and hospitalized in Neonatal Intensive Care Units (NICU’s) has increased due to improvement of the technology in obstetrics and neonatology that allows saving preterm infants at earlier gestational age (Aita and Snider, 2003). It has been recognized that the NICU environment is not suited to fulfil the developmental needs of these babies and that increased rates of survival due to hospitalization may cause important neurodevelopmental sequelae for these infants (Aita & Snider, 2003). The NICU team members are challenged to create an environment that promotes the growth and development of these fragile infants. This conceptualization of care provided in the NICU environment is at the core of the developmental care philosophy, which is currently a central concept in neonatal care (Aita & Snider, 2003). Aita and Snider (2003) used a concept analysis approach to review developmental care from different standpoints in Psychology, Social Science, Health Science, Medicine and
Nursing. Aita and Snider (2003) note that the concept of developmental care has three critical attributes: (a) interaction, (b) individualization, and (c) evolving process. Developmental care emerges from an interaction, and this is an essential attribute of the concept (Aita & Snider, 2003). The interaction can be observed by the existence of a reciprocal action-reaction between the infant and professionals, as well as the infant and parents (Aita & Snider, 2003). Aita and Snider (2003) note that in order to be confident that interventions are promoting the development of the preterm infant, neonatal nurses and health professionals should individualize their caregiving interventions according to gestational age and the infant’s cues and behaviors communicated during interactions. Providing developmental care is an evolving process where there is continuous assessment and evaluation of the infant’s developmental needs (Aita & Snider, 2003). Aita and Snider (2003) suggest that developmental care is predicted on principle of interprofessional collaboration and represents a step toward the establishment of multidisciplinary caregiving, where knowledge is shared in common goals. At the same time, the implementation of developmental care promotes family centered care where parents are involved in the
care of their preterm infant immediately after birth (Aita & Snider, 2003).

The impact of the care received by infants in the NICU on morbidity, morbidity avoidance, and quality of life must be considered, as must the impact of NICU experiences on families (Byers, 2003). Byers (2003) describes developmental care as a variety of activities that manage the environment and individualize the care of the premature infant based on behavioral observations, with the goal of promoting as stable, well-organized, and competent an infant as possible. In an NICU without developmental care, this noisy, bright environment continues, with caregiving and invasive procedures occurring 24 hours a day to the premature infant who already suffers from neurologic immaturity and physiologic instability (Byers, 2003). Byers (2003) notes that the usual bright and noisy NICU environment has been found to be physiologically stressful to the premature infant, to negatively impact growth and development, to disrupt sleep-wake states, and to negatively impact parental bonding. Clustering of care is believed to support infant development by decreasing infant energy expenditure and promoting sleep (Byers, 2003). Early studies demonstrated that neonatal nonnutritive sucking using a pacifier during
gavage feedings decreased time to nipple feeding, improved gastrointestinal motility, decreased hospital length of stay, promoted weight gain, and decreased activity and heart rate (Byers, 2003).

Byers (2003) discusses the benefits kangaroo care as the preponderance of evidence seems to support immediate and long-term positive effects on thermoregulation, oxygenation, weight gain, and behavioral state in infants of at least 28 weeks postconceptional age. Discovering research on the total concept of developmental care Byers (2003) states that the findings included improved short-term growth, decreased respiratory support, decreased length of stay, and decreased hospitalization costs with developmental care. Byers (2003) also noted that improved neurodevelopmental outcomes were sustained to 24 months of age. Byers (2003) states this about the clinical implications of developmental care that we can say with certainty, based on the evidence from numerous research studies and meta-analyses, that the use of developmental care in the NICU results in a trend toward improved infant growth, decreased respiratory support, decreased length of stay, and decreased hospitalization costs. Importantly, no negative outcomes have been reported when developmental care is used (Byers, 2003).
Byers (2003) concludes with questions for further and future research (1) what is the future impact of developmental care on parental bonding, satisfaction with the NICU experience, and parental competence following discharge, (2) do the positive results of developmental care extend to school age and beyond, (3) which aspects of developmental care are most efficacious, (4) is there a difference in efficacy of developmental care by gestational age or birthweight, (5) what is the impact of developmental care on the work environment and job satisfaction of the NICU healthcare providers, and (6) what is the optimal personnel infrastructure and NICU physical design for implementation of developmental care. Each NICU caregiver should strive to use developmental care interventions that are clearly supported by evidence, and use others based on their best professional and clinical judgment and on the infant’s responses (Byers, 2003).

The challenge in providing developmentally supportive care is the integration of technologically advanced invasive care with a sensitive and individualized approach, facilitating neurobehavioral development of the infant while supporting parents as primary advocates and caregivers (Lawhon, 2003). As Lawhon, (2003) explains in
1982, Als provided the synactive model, defining competence as the degree of smoothness, modulation, regulation and differentiation of five observable subsystems of functioning: autonomic, motor, state regulatory, attentional/interactional, and self-regulatory. The infant's five subsystems of functioning are in continuous interplay with each other and the environment (Lawhon, 2003). Lawhon, (2003) continues that within this synactive context, the infant shows emerging efforts at self-regulation, or achieving balance in subsystem functioning in response to the environment. When a caregiver trusts in the meaningfulness of the newborn's behavior, the traditional task-oriented care model is transformed into a collaborative model, with the newborn guiding the caregiver as an active participant (Lawhon, 2003). As for the parents, Lawhon (2003) states that parents who appreciate their own newborn's emerging competence are able to enhance the newborn's development through their own sensitive and supportive response and interaction. Nurses who facilitate parents' understanding of their newborn's behavior and experience are acknowledging and respecting parents in their primary role as advocates for their newborn (Lawhon, 2003). Lawhon (2003) provided a case presentation of a 30 week
gestational age twins, one that was severely growth restricted and the other twin was appropriate for gestational age. The details involving the severely growth restricted infant over the seven days of her life are outlined in the case presentation. The outcome of both of the infants, the interactions with the family and the multidisciplinary team was also discussed in this case presentation. This case presentation demonstrates the value of an integrated approach to intensive care that combines necessary technology with a humane and sensitive appreciation for the newborn's parents as primary advocates and long-term caregivers (Lawhon, 2003).

Preterm infants are dependent upon neonatal intensive care units (NICU's) for survival, and are vulnerable to the effects this environment has on their physiologic and neurobehavioral organization (Larsen, Horn, & Gosnell, 2004). Larsen et al. (2004) note that this increasing survival of fragile premature infants has created a strong interest in investigating intervention strategies within the NICU environment for improving their developmental/behavioral prognosis (Larsen et al., 2004). Infants in NICU undergo many painful procedures and are exposed to nociceptive stimuli for therapeutic purposes, which often result in acute and chronic pain, as well as
prolonged stress during a critical window associated with brain development (Larsen et al., 2004). Larsen et al. (2004) compared the efficacy of a behavioral pain reducing intervention (facilitated tucking) with standard NICU care for decreasing procedural pain (endotracheal suctioning) in very low birthweight (VLBW) infants. The study design by Larsen et al. (2004) was a prospective randomized crossover design with infants as their own controls were used. The sample consisted of 40 VLBW infants, 23-32 weeks gestation, and weighing 560-1498 g with tracheal intubation (Larsen et al., 2004). The infants were observed twice during each endotracheal suctioning experience; one suctioning was done according to normal nursery routine; another was done using facilitated tucking (the caregiver “hand-swaddling” the infant by placing a hand on the infant’s head and feet while providing flexion and containment) (Larsen et al., 2004). Larsen et al. (2004) utilized the Premature Infant Pain Profile (PIPP); the Score for Neonatal Acute Physiology (SNAP) and the NTISS (Neonatal Therapeutic Intervention Scoring System) while observing the infants during these two procedures. Larsen et al. (2004) reported that there was a significant difference between the PIPP scores for tucking and nontucking positions (p = 0.001) and
nonsignificant interaction with order (p = 0.64) as well as a nonsignificant main effect for order (p = 0.46). In the regression analyses, all predictors taken together did not significantly predict PIPP scores in the tucked position (p = 0.11) or nontucked position (p = 0.57) (Larsen et al., 2004).

The clinical implications that Larsen et al. (2004) noted were that facilitated tucking is a developmentally sensitive, nonpharmacological comfort measure that can relieve procedural pain in VLBS infants. Nurses need to be increasingly aware of infant pain during daily care taking, and to use validated pain assessment instruments (Larsen et al., 2004).

Premature infants are affected by all aspects of the environment. Nair, Gupta, and Jatana (2003) note that the physical environment should include attention to sound, light, position, touch and other variables. In discussing sound Nair et al. (2003) state that loud or sharp sounds can cause physiological changes like tachycardia, tachypnea, apnea, oxygen desaturation and sudden increase in mean arterial blood pressure, disturb sleep, startle the baby and may even produce intracranial hemorrhage in a micorpremie. To counter the light environment Nair et al. (2003) suggest that the amount of light should be reduced
by covering isolates by laying a blanket over the top with baby hooked to multisystem monitors. Positioning infants is the next concept that Nair et al. (2003) looked at noting that while sometimes, it is difficult to place the premie in a curled up, flexed position because of attachments of lines and sensors, nesting is one of the key factors in maintaining beneficial position of a neonate and should be practiced routinely. The NICU should provide supportive, nurturing environment that will improve developmental outcome of hospitalized neonates (Nair et al. 2003). Nair et al. (2003) point out that interventions may include one or more elements such as control of external stimuli, vestibular, auditor, visual, tactile etc., clustering of nursery care, activities and positioning or swaddling of preterm infant. Nair et al. (2003) note the contribution that caregivers should use as guidelines for parental involvement to teach parents signs of stress and stability, provide ‘parent friendly’ area to be with their infant, provide for privacy for breast feeding and kangaroo care, delegate as much responsibility as they are comfortable with, encourage parents to use their hands to provide support to the infant and provide grasping opportunities, parents in the transition of caring for their preterm infant. The attitude of the care
provider has to become more humane amidst state of the art technology, to deliver the right mix of art and science of neonatal care to groom more humane, useful citizens of tomorrow (Nair et al. 2003).

The organizational climate and social structure of each neonatal intensive care unit (NICU) is as individual as the different personalities of the people who work there (Turnage-Carrier, Ward-Larson, & Gates, 2004). Climate, according to Turnage-Carrier et al. (2004) takes into account the temperament, attitudes and outlook of the members with an organization. The climate allows members to understand the general direction of the team, what it means to be a part of the group, what actions are appropriate or inappropriate, how others are likely to react, and other information that helps guide behavior and relationships with in a group (Turnage-Carrier et al., 2004). Turnage-Carrier et al. (2004) note that changes that 'break the spell' by affecting interactions, are needed to redirect the group. Looking at organizational climate the authors suggested that the organizational climate be observed, diagnosed, be able to seek out the leadership of the unit, how and what conflict styles are utilized including a process to begin to implement change in the unit environment. One of the possible barriers or
contributors to negative NICU cultures is the assumption that 'it has always been this way' or 'we tried that before, and it did not work' (Turnage-Carrier et al., 2004). Change is also dependent on the leadership of the organization or unit (Turnage-Carrier et al., 2004). Turnage-Carrier et al. (2004) suggest that the ongoing changes that are occurring in the healthcare environment are creating the need for a multidimensional leadership model that incorporates rapidity of change and proactive attitudes as well as enhancing shared leadership and decision making autonomy. Leaders empower their staff to explore new methods of care (Turnage-Carrier et al. 2004). The NICU culture has placed value on conformity, mastery of technical skills, efficacy with tasks, control (by health professionals, not families) and rapid assimilation of data (Turnage-Carrier et al., 2004). Turnage-Carrier et al., (2004) note that in the face of increase acuity levels, and increase patient census as well as changing staffing patterns, healthcare providers in the NICU's are realizing the need to change the focus of infant care from survival to optimizing long-term health and development and developing a team approach that acknowledges and partners with families. Everyone might not embrace a paradigm shift or change in philosophy from traditional
NICU to developmental care overnight (Turnage-Carrier et al., 2004). A minimum of 3-5 years and even 10 years might be necessary because unit culture and individual attitudes of caregivers can create significant resistance to change (Turnage-Carrier et al., 2004). Turnage-Carrier et al. (2004) state that change is never easy, but the approach to change is just as important as the change itself. The change must be developmentally supported and measured along the way (Turnage-Carrier et al., 2004).

Synactive Theory

Als (1982) notes that clinical work with infants necessitates a theory from which to understand the individual organism and his/her development. Its focus is on the dynamic, continuous interplay of various subsystems within the organism: the autonomic system, the motor system, the state organizational system, the attentional-interactive system, and the self-regulatory system (Als, 1982). The organism forges ahead negotiating emerging developmental agenda while simultaneously seeking to attain a new level of modulated, functional competence (Als, 1982). Als (1982) states that developmentally salient aspects of the environment are actively sought as fuel in this process. This synactive model of development
promises to be helpful in identifying specific ingredients of the early developmental process and in structuring specific supports for preventive and ameliorative work when difficulties in differentiation and regulation are identified (Als, 1982). This kind of assessment of the infant’s current level of organization seems important for our preventive and supportive structuring of the environment and for the identification of an infant’s individual progression (Als, 1982). Als (1982) notes that by utilizing this synactive theory it permits us to provide opportunities for the parents and others working with the infant to take pleasure in the infant’s competence and their own competence, no matter how difficult or different the infant may be.

In regards to their studies and considerations Als and Duffy (1983) arrived at the formulation of a synactive theory of development, postulating that at any stage in development there is a drive for modulation and integration of subsystems functioning fueled from within the organism and impinged upon, facilitated or potentially hindered from the environment. They noted that from fetal development on, the goal of the organism appears to be to actively structure his environment to allow him successive reintegrations, following expansion and differentiation.
(Als & Duffy, 1983). It appears from our clinical work with newborns and young infants that we can improve our provision of more appropriate environmental input when we take seriously the infant’s thresholds of integration and his strategies of reorganization and self-regulation at each level and when we allow him to develop and practice his active, self-instituted return to modulated balance, autonomously closing the hierarchical feedback loops of goal setting, goal accomplishment, and the realization of goal attainment, this making them increasingly easy to institute (Als & Duffy, 1983). Als and Duffy (1983) stated that it is only beginning to become apparent, as we are allowing ourselves to see the integrative complexity of the organism at every stage. This theory and model has set the standards for developmental care of the neonate in practice today.

Web Based Learning

When offering a Web-based course, the challenge is to deliver content in a format that enables the student to learn, think critically about the content, and grow as a result of the learning (Barker, 2002). The classic principles of adult learning, mutuality and collaboration underpin Web-based design (Barker, 2002). Barker (2002)
discusses the four basic principles for adult learning: (1) adults do not generally respond to lecturing, the traditional method of teaching, (2) adults bring life experiences to the learning situation that influence what they learn, (3) adults learn best if they actively participate in the learning experience, and (4) adults are more motivated to learn when they understand the usefulness of the learning and can apply the content to immediate life situations. Barker (2002) examines the instructional design in a case study for a nursing program offering all RN to BSN courses online. Barker (2002) describes the processes and steps taken to design these online courses. Structuring the course involves the instructor reviewing the syllabus and designing the course a semester prior to instruction. Barker (2002) states that faculty members are given release time and the assistance of the instructional design consultant during this phase. Barker (2002) suggests that the instructor maintain similar required readings and course assignments so that designing exercises and activities mirror the content covered and time spent in the classroom. The instructors design the modules, develop performance objectives, content summary, specific readings pertinent to the course, assignments and class discussion (forum) that
encourages dialogue in the virtual classroom. Under lessons learned, Barker (2002) suggests that instructors need to keep the technology simple, meet with the students at least twice during the program and that on line students are the architects of their learning, faculty are supporters, mentors, guides and evaluators.

To remain viable, nursing education programs must change or face possible extinction (Simpson, 2003). Simpson (2003) argues that nursing schools must collaborate, sharing experts and other limited resources and standardizing course content to make it more readily transferable. And that's where technology can help (Simpson, 2003). Simpson (2003) states that distance learning can increase access to education for the adult, working student who represents a growing proportion of the undergraduate nursing population. Professors can teach at both traditional and virtual universities, reaching a larger audience of nursing students and practicing nurses and meeting both fundamental and continuing education needs (Simpson, 2003). Besides making information more accessible, easier access to research. Simpson (2003) states that the internet also makes available such tools as shared documents, simulations, and interactive environments that can provide hands-on experience without
risking live subjects. Simpson (2003) does note that there’s still a critical challenge of finding ways to provide more practical experience. The relative amount of clinical experience given to student nurses has decreased considerably over the last two decades as nursing schools struggle to keep up with changes in nursing practice by adding more theoretical courses, while also reducing the length of basic programs so graduates can enter the workforce that desperately needs them sooner (Simpson, 2003). Whether they’re taking an online education course or earning a degree in nursing through an Internet class, nurses today have life-ling learning at their fingertips (Simpson, 2003). Through viewing goggles and a mouse-driven simulation, students can slowly and carefully practice potentially painful or risky procedures in the computer laboratory, minimizing their own-and patients’ potential discomfort (Simpson, 2003). Simpson (2003) surmises that nursing remains a high-touch profession, not just a high-tech one, and the overall learning environment must reflect this important balance by providing traditional lecture and discussion using such tools as videos, overheads, and presentation slides, combined with hands-on practice supervised by an expert.
In a narrative review, Cook and Dupras (2004) discuss a practical guide to developing effective web-based learning. The key steps in developing an effective educational website are: Perform a needs analysis and specify goals and objectives; determine technical resources and needs; evaluate preexisting software and use it if it fully meets your needs; secure commitment from all participants and identify and address potential barriers to implementation; develop content in close coordination with website design (appropriately use multimedia, hyperlinks, and online communication) and follow a timeline; encourage active learning (self-assessment, reflection, self-directed learning, problem based learning, learner interaction, and feedback); facilitate and plan to encourage use by the learner (make website accessible and user-friendly, provide time for learning and motivate learners); evaluate learners and course; pilot the website before full implementation; and plan to monitor online communication and maintain the site by resolving technical problems, periodically verifying hyperlinks, and regularly updating content (Cook & Dupras, 2004). Cook and Dupras (2004) state that web-based learning accommodates shift schedules and distance
learning, is easily expanded and modified, facilitates assessment, encourages self-directed learning, and is inherently learner centered. Cook and Dupras (2004) conclude with effective online learning requires the teacher to carefully construct a program that integrates principles of active learning, motivation and evaluation with creative Web design.

Creating a Change Environment

Change is common and important in improving patient outcomes in the current healthcare market (Buonocore, 2004). The challenge begins once a problem is identified and defined and a decision is made that a practice is in need of change (Buonocore, 2004). Buonocore (2004) acknowledges that leadership involves influencing others to contribute to a positive outcome. The influential nurse does not merely react or respond to change; the influential nurse navigates change through the skillful employment of strategies in each of the key change components (Buonocore, 2004). Buonocore (2004) states that there are five key reasons why nurses do not embrace evidence-based change in practice: nurses do not know about the research findings, nurses do not understand the research findings, nurses do not believe the research
findings, nurses do not know how to use them, and nurses are not allowed to use the research findings. As Buonocore (2004) notes there are many theorists and change theories in the literature offering systematic problem solving approaches to facilitating change, Buonocore (2004) chose Lewin's Change theory. Lewin's theory of Change provides the structure for understanding nurses' behavior during change and ways to improve behavior during the change process (Buonocore, 2004). According to Lewin, there are three basic steps to change: the stage of unfreezing, the stage of moving, and the stage of re-freezing (Buonocore, 2004). Buonocore (2004) discusses the during the state of unfreezing, diagnosing the problem is part of the process. Data collection and review of the literature also is incorporated in the un-freezing stage. The purpose of this endeavor is to determine if the strength of evidence supports a change in practice (Buonocore, 2004). During the process of diagnosing the problem, it should become evident who are the key stakeholders to the intended change (Buonocore, 2004). Communicating with other stakeholders outside of the change team can also help to facilitate the process, once the change is to occur (Buonocore, 2004). These solutions usually take place during the stage of moving, and Buonocore (2004) states
that they take the form of a protocol, procedure, or practice guideline. Buonocore (2004) notes that one certainty regarding the change process is that there will be resistance. Resistance must be identified and taken seriously, for it can foil even the best constructed plans (Buonocore, 2004). Buonocore (2004) suggests to provide a supportive, non-judgemental atmosphere of mutual learning so the target audience will be able to develop the new skills without fear of failure. Continue to educate the staff in the reason for the change and enforce the change in practice (Buonocore, 2004). Once the change is adapted, balance must be reestablished (Buonocore, 2004). Positive results can increase credibility and increase the number of people who will be less likely in the future to resist change and can greatly help establish a culture in which change is embraced (Buonocore, 2004). Buonocore (2004) concludes with by working with nurse managers, other APN's, nurses, and our physician colleagues, we can create environments that utilize the best practices in patient care and embrace change.

The History of the Neonatal Intensive Care Units

Lussky (1999) explored the history of neonatal medicine beginning in the 19th century with the first
incubator. Lussky (1999) states that before the late 19th century, physicians essentially ignored infants. There were no institutions dedicated to the care of infants except foundling homes, where mortality rates were as high as 85% to 95% (Lussky, 1999). Lussky (1999) notes that other significant accomplishments occurred in obstetrical and newborn care during this era, Jean Louis Paul Denuce in 1857 reported the first use of an incubator in the care of a premature infant. The early 1900’s saw pediatricians beginning to contribute to the science of newborn medicine (Lussky, 1999). Lussky (1999) notes that Thomas Rotch’s “percentage” feeding method, with precise proportions of milk, cream and sugar modified and mixed daily to meet individual infants; needs gave pediatricians the role of supervising the use of artificial infant formula when breast milk was unavailable. Misplaced concerns about infectious complications spelled the temporary downfall of the incubator in the 1920’s (Lussky, 1999). Advances in diagnosis include N. McAlister Gregg’s 1941 discovery of the link between maternal rubella infection and congenital rubella syndrome, and Louis K. Diamond’s 1942 description of the link between Rh factor and erythroblastosis fetalis (Lussky, 1999). In the 1950’s several important discoveries happened, Lussky (1999) notes that Richard
Pattle discovered the surface-tension-lowering properties of the alveolar lining layer and John Clement’s finding that surface tension depends on surface area; Mary Ellen Avery and Jere Mead’s description of surfactant deficiency as the etiology of HMD; William A. Silverman demonstrated that maintaining body temperature by controlling the thermal environment significantly decreased low-birth weight mortality. In this decade, newborn infants came to be viewed as patients, Virginia Apgar, developed the Apgar Scoring System, which changed the newborn form a delivery room “byproduct” to a new patient (Lussky, 1999). Lussky (1999) states that in the 1960’s most physicians consider this decade the start of the current “modern practice” of newborn medicine, the actual organization of an ICU for prematures, newborns, and young infants began in October 1960, at Yale-New Haven Hospital. Lussky (1999) also notes that in the 1960’s sparked by the much-publicized 1963 birth and subsequent RDS death of President Kennedy’s son, Patrick Bouvier Kennedy, at 32 weeks gestation, the focus of preterm infant care shifted from temperature control, feeding and vulnerability to diseases to more comprehensive and scientific approach to newborn infant care. Remarkable advances in the respiratory management of the premature infant occurred during the 1970’s (Lussky,
This decade witnessed the introduction of routine eye exams to evaluate for retinopathy of prematurity, head ultrasounds to assess for intraventricular hemorrhage, organized follow up of the high risk graduate (Lussky, 1999). Lussky (1999) states that the single most significant accomplishment of the 80’s was Tetsuro Fugiwara’s first successful administration of surfactant to a newborn in 1980. The 90’s has been the decade of the micropreemie (Lussky, 1999). Heidelise Als introduced the Newborn Individualized Developmental Care Assessment Program, which supported family-centered, individualized developmental care for premature infants while shortening ventilator days and improving developmental outcomes of NICU graduates (Lussky, 1999).
CHAPTER THREE
DESIGN AND DEVELOPMENT OF THE PROJECT

Preterm birth and subsequent hospitalization of the infant in the Neonatal Intensive Care Unit (NICU) create an abrupt disruption in the environment in which the preterm infant must grow and develop (Aita & Snider, 2003). Developmental care should be integrated within all aspects of care for the neonate. Yet, wide variability and inconsistency remain in the quality of experience for infants and families in the NICU (Robison, 2003). Robison (2003) suggests that developmentally supportive care may be perceived as “nice” yet optional. The primary design of this project is to develop a self-learning educational program that can be utilized by the multidisciplinary team of the Neonatal ICU. The secondary project is to incorporate this program into the computer based charting system called Meditech.

As the primary point on developing clinical guidelines in an educational power point presentation on developmentally supportive care based on gestational age, the National Association of Neonatal Nurses (NANN) has set up guidelines for practice. These guidelines that are set up by NANN are outlined in Chapter 22- Organizational
climate, implementation of change, and outcomes in the text of Developmental Care of Newborns and Infants (2004). The clinical guidelines were set up according to the needs and readiness for implementation of developmental care at Arrowhead Regional Medical Center (ARMC), Neonatal ICU.

A review of current literature was conducted on all aspects of developmentally supportive care for Neonatal ICU's. The five areas of focus were infant handling during procedures, infant positioning, the environment for the infant and the NICU, early incorporation of parents into the plan of care, and implications for clinical practice for the caregivers. Perkins et al. (2004) suggest that clinical education and self-learning/professional developmental role for NICU practice is identification of learner knowledge and skill needs, preparation of clinical training that reflects both the baseline and expected achievement levels, establishment of training objectives and priorities, selection of teaching format and methods, communication and information, demonstration of procedures, arrangement of practice sessions and repeat demonstrations, and provision of feedback to learners regarding their performance. Reliability and validity of the computer based self-learning program and the subsequent Meditech developmental interventions for
The second component involving the computer is enhancement of the computerized charting system already in place. The patient care system is the Meditech charting system. The guidelines set forth by NANN for developmental interventions were converted to developmentally age specific items to be selected by the caregiver for intervention and documentation. The guidelines were presented to the unit specific Meditech support personal. The support personal on the Meditech team has placed the developmental interventions into the Meditech system in the test mode on the computer and hard copies are to be printed and placed in the unit. Caregivers will be able to access the computer system prior to final implementation into the Meditech patient care system and be able to visualize the entire documentation program via hard copy that is placed on the unit education bulletin board. Final implementation will take place after caregivers have reviewed and taken a post-test of the educational program.

To incorporate the five principles of developmental care selected, handling of the infant during procedures is the first key point. Intuitively, caregivers strive for stress reduction through minimal intervention and provision of protective environments that promote physiologic stability (Horns, 1998). Horns (1998) suggest
that nurses provide supportive and individualized caregiving depending on the infant’s ability to cope with the stress of interventions. Horns (1998) described nurses’ first priority as conserving the infant’s energy and oxygen consumption while providing necessary support for survival and optimal outcome. Clustering of care is believed to support infant development by decreasing infant energy expenditure and promoting sleep (Byers, 2003). In order to be confident that interventions are promoting the development of the preterm infant, neonatal nurses and health professionals should individualize their caregiving interventions according to gestational age and the infant’s adaptation to interventions, as well as the infant’s cues and behaviors communicated during interactions (Aita & Snider, 2003).

The second educational component expressed is developmentally positioning the infant. Perkins et al. (2004) suggests that to successfully implement developmentally supportive positioning the the NICU, a variety of strategies and expertise in education and consultation is likely needed. Proper positioning and handling of premature infants may promote more normal motor development and minimize chances of developing abnormal movement patterns (Young, 1994). Young (1994)
explains that the aim of positioning management for the preterm infant is to encourage balance between flexion and extension. Frequent changes in position so weight bearing forces are never allowed to persist for any length of time in one direction would be a fundamental principle on which guidelines for supported positioning within the neonatal unit could be formed (Young, 1994).

The third point of discussion is the environment of the NICU that the infant is brought into. The environment that surrounds the infant is crucial for the infants development. The usual bright and noisy NICU environment has been found to be physiologically stressful to the premature infant, to negatively impact growth and development, to disrupt sleep-wake states, and to negatively impact parental bonding (Byers, 2003). Aita and Snider (2003) state that it has been recognized that the NICU environment is not suited to fulfill the developmental needs of these babies and that increased rates of survival due to hospitalization may cause important neurodevelopmental sequelae for these infants.

Parents are the forth component in the program. The events that surround the birth of an infant prematurely are often untimely and unexpected. It is critical to remember that even with all the technological advances and
the neurobehaviorally based interventions, nothing can substitute for the normal environment of the womb (McGrath, 2000). In helping parents and infants adapt to the technology driven surroundings of the NICU, caregivers will need to relinquish a few roles. An intricate part of this is stepping back and facilitating the parents in their roles, allowing them to feel is just as vital to the survival of the infants in the NICU as the nurse has been (McGrath, 2000).

Finally, the last component for the program design is the integration of the implications for care given by the caregivers. Some caregivers choose to "be in-tune" with infants, whereas others do not (Horns, 1998). Robison (2003) states that the quality of interactions with infants and families may depend on the individual philosophy or mood of the professional at the bedside at the moment. This inconsistency makes life in the NICU unpredictable and confusing for fragile infants and their vulnerable families (Robison, 2003). Robison (2003) notes that professional can only be held accountable for practice behaviors that are clearly articulated. The self-learning, self-paced program reviews the importance of developmental care in the Neonatal ICU, and the
Meditech patient care system will incorporate this practice into the documentation system.

Personal goals and objectives for this project are to integrate developmental care as part of the routine care for all staff members in the Neonatal ICU, for the staff to individualize developmental care concepts and incorporate these concepts into their Meditech patient care system documentation. All Neonatal ICU staff are to review the program and complete the post test. Incentives, depending on the type of change needed, may be helpful (Buonocore, 2004). The objective for implementation of this program is to have all regular staff in the Neonatal ICU review and complete the post-test within three weeks. Incentives will be utilized, and a drawing for prizes will be done each week for those who have completed the program that week. Prizes will be awarded for three consecutive weeks only.

One long-term goal is to create a multidisciplinary developmental care committee with a Masters prepared developmental specialist leading the team. With a multidisciplinary team in place this would lead the way for developmental care rounds to continue to hold staff accountable for the developmental interventions of the infants.
Outcomes of the program implementation will be measured by two indicators that of decreased length of stay and decrease neurological sequelae. These indicators can be obtained by data that is already collected yearly by the Neonatal ICU. Effectiveness of the program will be observed by the developmental care specialist and the multidisciplinary team in developmental rounds.

The educational processes utilized are the computer based, self-learning, self-paced program. Simpson (2003) suggests that computer learning should be complement, rather that replace traditional methods. By instituting this self-learning, self-paced program on all of the Neonatal ICU computers, the staff will be able to participate at their own pace. When offering a web-based course, the challenge is to deliver content in a format that enables the student to learn, think critically about the content and grow as a result of learning (Barker, 2002). One of the advantages in web-based teaching is the classroom never fills up and handouts never run out (Cook & Dupras, 2004). Cook and Dupras (2004) state that the key to active learning is involvement of the learner in the learning process encouraging them to apply the new information. Buonocore (2004) recognizes that there are five key reasons why nurses do not embrace evidence-based
change in practice: nurses do not know about the research findings, nurses do not understand the research findings, nurses do not believe the research findings, nurses do not know how to use them, and nurses are not allowed to use the research findings.
Fostering developmental concepts and programs in the Neonatal ICU is beneficial to parenting, collaborative care within the disciplines and most important to the positive neurodevelopment of the very low-birth-weight infant. Implementing individualized developmental care requires a team of nurses, occupational therapists, respiratory therapists, a developmental care expert, physicians and parents all collaborating to achieve the optimal outcome for the infant. Celebrating small victories in the change process will aid in maintaining momentum and keep the team focused (Buonocore, 2004). We can say with certainty, based on the evidence from numerous research studies and meta-analyses, that the use of developmental care in the NICU results in a trend toward improved infant growth, decreased respiratory support, decreased length of stay, and decreased hospitalization costs (Byers, 2003).

Implementation of the program has been supported by the Clinical Nurse Specialist and the Medical Director of the Neonatal ICU, as well as the Information Management and Meditech implementation teams. It is recommended that
the Clinical Nurse Specialist have the only access to update the program as new evidence-based research is available. New methods of care, new therapies, and new technologies are on the horizon of the critical care arena almost daily (Buonocore, 2004). It is also recommended that a Masters prepared developmental care specialist become a part of the Neonatal ICU team, and then create a multidisciplinary team that will focus on the developmental needs of the Neonatal ICU. Nursery leaders with influence, power, and authority can identify and provide supports necessary for all health care professionals in the NICU to consistently followed defined standards of care (Robison, 2003).

The program will be evaluated by a post-test at completion of the self-study, self-paced computerized program on developmental care. Evaluation of the program will be included in the post test questionnaire. Opportunities for input into the documentation on the Meditech patient care system are accepted presently and future suggestions are not foreseen as a problem.

Future suggestions include incorporating a Masters prepared developmental care nurse to head up the multidisciplinary developmental team that focuses on the needs of the Neonatal ICU by implementing developmental
care rounds weekly in the Neonatal ICU and providing educational opportunities for the entire team. Aita and Snider (2003) note that the implementation of developmental care promotes family centered care where parents are involved in the care of their preterm infant immediately after birth. The outcomes that are currently measured in the Neonatal ICU can be compared to past statistics as well as benchmarking against like Neonatal Intensive Care Units.
Developmental Care

Neonatal ICU
Arrowhead Regional Medical Center

Developmental care is a philosophy, behavioral observations, individualization of activities to manage the infant's environment that incorporates the relationships between infant, family and health care providers. It is an approach of care that has a goal of promoting a stable, well organized and competent infant.
Management of the Environment

The objective is to decrease the noise level and decrease visual time.

Visual stimulation

At birth, the premature infant is thrust into a high technological, noisy, and bright environment, which is the exact opposite of the uterine environment.

- Lighting
  - bright environment is physiologically stressful
  - negative impact on growth and development
  - negative impact on parental bonding
  - reported to decrease oxygen saturation
**Noise Level**

- Neonatal ICU's are noisy secondary to isolettes, high frequency ventilators, multiple alarms and staff activities.
  - Recommended noise level = 50 decibels
    - Average noise level in NICU's = 90 decibels
  - Infants' response to noise = changes in behavioral state
    - Cover isolette
    - Minimize noise level

**Positioning**

- Side-lying
- Prone
- Supine
- Containment
- Positional support
Positional Support

Clustering Care

- Decreases infant energy and expenditure
- Coordinate activities with respiratory therapy and other care givers
- Parent involvement
Non-nutritive sucking

- Non-nutritive sucking prior to breast feeding/bottle feeding has been shown to improve oxygen saturation, behavioral state and improved duration of first nutritive sucking burst.
- Consistent trend of decreased length of stay
- Encourage:
  - Pacifier use during gavage feedings
  - non-nutritive sucking at the mom’s breast

Co-bedding of Multiples

- Mother’s report less fussiness and more sleep wake synchronicity
Co-bedding of twins

Kangaroo Care
- Decreases neonatal energy expenditure
- Promotes growth
- Increases oxygenation
- Behavioral state
- Maternal-child bonding
- Promotes increase in breast milk supply
Kangaroo care

Swaddling

- Swaddle infants during procedures
  - Weighing, bathing, and invasive procedures
  - Less physiological distress
  - Better motor organization
  - More effective self-regulatory activity
Family

- Active partnership of the parents in the infants plan and delivery of care
- Parents are the single constant in the infants life
- NICU environment is not “natural” for infants and families
- Anticipate parents needs of support

Family (cont.)

- Bonding is essential to caring and must be sustained throughout hospitalization
- Parents need time to grieve the loss of perfect pregnancy.
- Provide lactation consult for those who desire to breast feed.
- Provide access to social worker, CNS
Family (cont.)

- Provide Neonatal ICU information packet, general guidelines for developmental care and kangaroo care.
- Orientate parents to neonatal ICU environment.
- Remind parents that no question is to small to ask.
- Anticipate parents need for information from the entire team.

24-28 weeks gestation
Infant characteristics

- During this time, babies are fragile. They need maximum technologic support. Too much stimulation, such as bright lights, touching, changes in temperature, or loud noise can stress the baby.
  - Babies sleep a lot at this stage and seldom open their eyes
24-28 weeks gestation
Infant Characteristics (cont.)

- Babies sleep better in a warm, dim and quiet environment.
- Babies respond to pain and discomfort with increased blood sugar, changes in heart rate and irregular breathing.
- Babies respond to stress by hiccoughs, yawning, and pale color.
- Twitches or limpness in the arms and legs represent immature nerves and muscles.
- The skin is so fragile that touching and handling must be done carefully.

Caregiver Role (24-28 wks.)

- Promote sleep and rest by clustering care.
- Provide midline orientation, flexion, containment and boundaries.
- Protect the baby from noise and light.
- Assess and promote comfort measures and medication to minimize pain and agitation.
- Admit infant to verselete, utilize humidity and Aquaphor as indicated for skin care.
- Introduce Social Services to the family.
Caregiver Role (continued)
24-28 weeks

- Help parents find their role and feel significant in that role.
- Encourage parents to write down their observations about and activities with their baby in a journal.
- Encourage and support mothers decision to breast feed.

Infant Characteristics
27-31 weeks gestation

- During this time, babies acquire autonomic stability. This means the baby’s brain is learning to control breathing, heart rate, and blood pressure. Because the baby’s brain is still developing, noise and activity can easily overwhelm the baby.
  - Increased periods of awake state and will become more alert for short periods of time.
  - Developing increased strength in arms and legs.
Infant Characteristics (cont.)
27-31 weeks gestation

- Babies may start to suck on a pacifier, which promotes awareness and improves digestion.
- Babies respond to gentle vocal stimulation, which promotes quiet sleep.
- Babies respond to stress with paleness, apnea, and limpness.

Caregiver Role
27-31 weeks gestation

- Assess babies before, during and after care; modify care and environment accordingly.
- Position babies to support flexion and midline orientation. Add the flex prone positioning.
- Offer babies a pacifier when they are awake and during tube feedings.
Caregiver Role (cont.)
27-31 weeks gestation

- Support autonomic stability by allowing the baby to become acclimated to environmental or physiologic change one step at a time
  - Speak to the baby before position change
  - Allow rest periods between vital signs, diaper change and feedings

Caregiver Role (cont.)
27-31 weeks gestation

- Encourage parents to appreciate their role and integrate their activities into the plan of care
  - Continue the protective environment
  - Continue to promote and support maternal interest in breast feeding
- Introduce Kangaroo care
Infant Characteristics
29-33 weeks

- During this time, babies are in transition from mostly sleeping to a time of sleep and wake cycles. Babies are more alert and awake longer and begin to cry spontaneously.
  - Babies gain more control over movements, first their legs and then arms.
  - Babies open their eyes for brief periods of time and make eye contact.
  - Babies respond to stress with paleness, apnea and limpness.

Caregiver Role
29-33 weeks gestation

- Encourage sucking on a pacifier during tube feeds.
- Provide positioning and comfort measures when the baby is restless or agitated.
- Kangaroo care
- Discuss anticipated time line for discharge.
Caregiver Role
29-33 weeks gestation
- Schedule parents to watch CPR, car seat safety, infant safety and RSV films
- Continue to encourage and support parents in their role.
- Encourage parental participation in infants caregiving routines

Infant Characteristics
32-35 weeks gestation
- During this time, babies begin to communicate the need for food and attention
  - Babies begin developing the ability to coordinate sucking and swallowing.
  - Increased muscle strength and control.
  - Develop visual attention, fix and focus on faces and bright objects
  - Continue to respond to stress with apnea, irregular breathing, paleness and limpness
Caregiver Role
32-35 weeks gestation

- Evaluate readiness for transition to open crib
- Assess suck-swallow-breathing coordination
- Introduce breastfeeding at adjusted age of 32-33 weeks according to infants readiness.
- Assess bottle-feeding infants at adjusted age of 33-34 weeks
- Schedule eye exam, hearing screen
- Baseline OT/PT evaluation

Caregiver Role
32-35 weeks gestation

- Support parents in their expanded role of caregiving
- Evaluate for anticipated home needs
  - Monitor O2, medications, car seat testing
- Solicit parents' reaction to and interpretation of the baby's behavior and their readiness for discharge
Infant Characteristics
34-40 weeks gestation

- During this time, babies mature enough to be capable of social interaction and cry differently when they are tired, hungry or in pain.
  - Vision is maturing still take longer than older children to focus on an object
  - Begin to be awake before feedings
  - Awake longer periods, make eye contact, follow movement and sounds

Caregiver Role
34-40 weeks gestation

- Consider demand versus scheduled feedings based on calories per day
- Evaluate ‘back to sleep’ positioning
- Instruct parents regarding medications
- Help parents anticipate and plan for the stress of transition from NICU to home
- Evaluate readiness for immunizations
Our Goal

To send home, to well informed parents a neurologically intact, developmentally appropriate infant.
APPENDIX B

WEB SITE
<table>
<thead>
<tr>
<th>27-31 WKS Developmental Cares</th>
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<tbody>
<tr>
<td>Developmental Cares</td>
<td>( ) Cluster Care</td>
</tr>
<tr>
<td>(27-31 Weeks)</td>
<td>( ) Offer Pacifier when Awake</td>
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<tr>
<td>Select all that apply</td>
<td>( ) Offer Pacifier W/O GT Feed</td>
</tr>
<tr>
<td></td>
<td>( ) Support Flexion Position</td>
</tr>
<tr>
<td></td>
<td>( ) Support Autonomic Stable</td>
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<tr>
<td></td>
<td>( ) Midline Orientation Assist</td>
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</tbody>
</table>

*Assess Before, During & After Care: Modify care & environment as appropriate

**Support Autonomic Stability: Allow Baby to become acclimated to environmental/physiological change

Developmental Cares Comment (27-31 Wks) ( ) Enter Text

Bear, Baby 7M 19D / Female
M000000231 / V00000001100
DOB: Oct 4, 2004
Admitted Inpatient NICU 27WKS

Document Developmental Cares NICU 27WKS
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<td>Parent Video: Car Seat Safe</td>
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<td>Parent Video: Infant Safety</td>
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<td>Parent Video: RSV</td>
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29-33 Wks Developmental Cares

- Select all that apply

- Developmental Cares

- Comment (29-33Wks)
### 32-35 Wks Developmental Cares

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<thead>
<tr>
<th>Developmental Cares (32-35 Weeks)</th>
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<td>CK: Readiness to Open Crib</td>
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<tr>
<td>CK: Suck-Swallow-Breathing</td>
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<td>Baseline OT:PT Evaluation</td>
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<td>Introduce to Breast Feed</td>
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<tr>
<td>Introduce to Bottle Feed</td>
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<tr>
<td>Introduce Breast feeding at adjusted age 32-33 weeks</td>
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<tr>
<td>Introduce Bottle feeding at adjusted age 33-34 weeks</td>
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<table>
<thead>
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<th>Anticipated Home Needs</th>
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<td>Home Monitor</td>
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<td>Gavage Feedings</td>
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<tr>
<td>Home O2</td>
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<tr>
<td>Tracheostomy Care</td>
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<td>Medications</td>
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**34-40 Wks Developmental Cares**

<table>
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<tr>
<th>Developmental Cares</th>
<th>34-40 Weeks</th>
<th>( ) Demand Feedings</th>
<th>( ) Follow Up Care Discussion</th>
<th>( ) Teach “Back To Sleep”</th>
<th>( ) Car Seat Test Completed</th>
<th>( ) Teach “Back To Sleep” Positioning: Bed Flat, No Supports, No Swaddling</th>
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<tbody>
<tr>
<td>Select all that apply</td>
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**Document Developmental Cares NICU 34WK**
APPENDIX C

ARROWHEAD REGIONAL MEDICAL CENTER COMPUTER

SYSTEM ENHANCEMENT REQUEST
ARMC Computer System Enhancement Request

**Department:** Neonatal ICU  
**Cost Center:** 6070  
**Date:** 11/17/2005

**Contact Name:** Shirley Farr, Aida Rodriguez  
**Phone:** 03425

**Email Address:** farrs@armc.sbcounty.gov

**Item(s) Requested:**
A permanent file folder on NICU's desktop for purposes of education in NICU only. All staff, including respiratory therapy, float personal, registry, OT, MSW will have the capability to participate in this educational program. After program is installed, the CNS of the Neonatal ICU (Aida Rodriguez) is the person who would have access to the file to update and alter the program as new information comes out. This file would also be utilized for future educational programs.

**Room Number(s):** 3B323A

**Current Process:** (explain, in detail, how the tasks that this request will effect are currently being completed.):
No current process on the computer desktop.

**Justification:** (What benefits are expected to be realized from the requested changes?):
By having a folder on the desktop of all Neonatal ICU computers, that is designed specifically for education in the Neonatal ICU, that a multidisciplinary team would be able to utilize, education that is pertinent to the Neonatal ICU will be able to be disseminated to all personal and they would be able to participate in the education/inservices at their convenience without leaving the unit.

**Technical Training Needed:** None

**Ongoing Support Needed:**

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<th>Total Cost</th>
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**APPROVALS:**

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<tr>
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<tr>
<td>Compliance Officer:</td>
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<td>o</td>
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<tr>
<td>Chief Operating Officer:</td>
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</tr>
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</table>

Revised 8/2004  
Original – I.M. Department, Completed Copy – Dept.
APPENDIX D

DEVELOPMENTAL CARE QUIZ
Developmental Care Quiz

1. List five components of developmental care:

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

2. Bright lights help the infant to adapt physiologically. True/False

3. Cycling of lighting has a positive impact on growth and development. True/False

4. The AAP recommends that the noise level in the NICU be >90 decibels. True/False

5. What can you do to decrease the infants energy expenditure?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

6. Kangaroo care is time consuming and has absolutely no benefit for the infant or the family. True/False.

7. What are ways to promote active participation of families in the care of their infant?

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

8. List characteristics of 24-28; 27-31; 29-32; 32-35; and 34-40 week gestation infants.

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

9. What are the care givers roles for each gestational age:

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
REFERENCES


