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Perceptions of Maternal Stress and Neonatal Patient Outcomes in a Single Private Room Versus  
Open Room Neonatal Intensive Care Unit Environment

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A dissertation

presented to

the faculty of the College of Nursing

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy in Nursing

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by

Lisa M. Smithgall

December 2010

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Dr. Allan Forsman

Keywords: Single Private Room, NICU, Maternal Stress, Neonatal Outcomes, Environment

## ABSTRACT

### Perceptions of Maternal Stress and Neonatal Patient Outcomes in a Single Private Room Versus Open Room Neonatal Intensive Care Unit Environment

by

Lisa M. Smithgall

Limited clinical evidence exists regarding whether the single private room Neonatal Intensive Care Unit (NICU) environment of care delivery has a positive, negative, or neutral impact on health outcomes for the high risk neonate and on maternal stress as compared to the open room design. The study purpose was to examine whether a difference exists in health outcomes in the open room versus single private room NICU environment. The factors considered were weight gain, ventilator days, hospital length of stay, incidence and grade of intraventricular hemorrhage (IVH), the number of parental visits, and perceptions of maternal stress. Infants hospitalized in an open room environment (n=52) were matched by gestational age to infants in a single private room NICU (n=52). Mothers of the infants from the open room (n=26) and the single private room (n=20) groups completed the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU) survey instrument. The *t*-test for independent groups demonstrated a difference for the number of parent visits ( $t=6.672$ ,  $df=60.13$ ,  $p<.001$ ) with a significant increase in visitation frequency for infants in the single private room NICU. Maternal perceptions of stress were not different ( $t=.154$ ,  $df=44$ ,  $p=.878$ ), and high stress scores were reported for both groups regardless of the infant's environment of hospitalization. This study demonstrates that the single private room environment promotes increased parental access to their infants. The finding of high levels of maternal perception of stress in both the open room and single private room NICU's demonstrates that the environment did not impact the perception of maternal stress. This finding

supports the implication that mothers of hospitalized infants need nursing support regardless of the type of NICU environment.

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## DEDICATION

This research is dedicated to mothers who experience the hospitalization of a preterm infant and who initiate parenting of the infant in the challenging environment of the Neonatal Intensive Care Unit.

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## CHAPTER 1

### INTRODUCTION

Continued expansion and development of the science of caring for medically fragile high risk and premature neonates has resulted in increased survival of extremely premature infants (MacDonald & the Committee on Fetus and Newborn, 2002; Stoelhorst et al., 2005). Multiple medical interventions and extended hospitalizations are required to sustain their lives. The high risk neonatal patient's requirement for multi-system support with increased technology and extended hospitalization results in decreased parental involvement in the postbirth period.

The identification of the Neonatal Intensive Care Unit (NICU) as a site for the treatment of premature and ill term newborns is a recent phenomenon. Its origins in the 1960s are related to the creation of technological, pharmacological, and specialty hospital care for small infants (Browne, 2003). The development of new technology and treatment protocols for the high risk neonatal patient has changed drastically in the past half century. Advances in technology and treatment for high risk neonatal patients include high frequency oscillation ventilator care, surfactant therapy administration, and antenatal delivery of corticosteroids (Stoelhorst et al., 2005). New treatments have resulted in increased survivability of extremely premature infants who experience extended hospitalizations in the NICU environment (Stoelhorst et al., 2005).

The provision of specialized neonatal intensive care and the significant expense associated with this type of care prohibits the placement of a NICU in every obstetric delivery facility. NICUs are categorized in a level system from I to III based on the ability to provide care to specific populations of infants. The level III NICU demonstrates the physical environment, personnel, and equipment continuously available to provide comprehensive care to moderately ill and severely ill infants at extremely high risk and with complex and critical illness

(Lockwood & Lemons, 2007). The level III NICU provides care to infants born in the same hospital or transferred from regional hospital birth facilities for a higher level of neonatal care.

The survival rate of preterm infants has significantly improved since the inception of NICU care (MacDonald & the Committee on Fetus and Newborn, 2002; Stoelhorst et al., 2005). However, according to the 2005 National Center for Health Statistic's (2007) report of births in the United States, the preterm birth rate has continued to escalate from a rate in 1990 of 10.6% to the 2005 rate of 12.7%. During this same period, timely initiation of prenatal care steadily increased and obstetric tocolysis to impede or postpone uterine activity for the management of preterm labor remained fairly constant (National Center for Health Statistics, 2007). The rise in births of premature infants and survivability of extremely premature infants has resulted in higher numbers of infants using costly NICU care for extended periods of hospitalization. The two health conditions with the longest hospital stays for all patients regardless of age in United States hospitals in 2005 were related to infants. These conditions were 1) respiratory distress syndrome, and 2) premature birth and low birth weight (Healthcare Cost and Utilization Project, 2007). Infant respiratory distress syndrome ranked first as the diagnosis with the highest average charge for all hospital conditions across disease categories with an expense of \$114,200, which is five times the average cost of all diagnoses in 2005 (Healthcare Cost and Utilization Project, 2007). Premature birth and low birth weight diagnosis ranked sixth with average hospital charges of approximately \$90,000 (Healthcare Cost and Utilization Project, 2007). In addition to the financial costs of delivering health care to the high risk neonatal population, the impact of care on morbidity, morbidity avoidance, quality of life, and the impact on the family must also be considered as costs of NICU care (Byers, 2003).

Since their inception, NICU environments have been constructed as large open room environments with multiple infant bed spaces in close proximity within a room. The multiple bed spaces within the large open room result in infants and their parents, in addition to the infant's health care equipment, being placed within six feet of each other. To enable the continuous care of the infants, lights are on 24 hours a day and the noise of the alarms, ventilators and other equipment is heard throughout the unit. The preterm infant admitted to the noisy and bright NICU following birth experiences an environment drastically different from the darkened in-utero environment (Byers, 2003). In-utero, the developing fetus experiences extremity flexion and containment, is exposed to limited light and noise, and has unrestricted access to the mother via somatosensory, auditory, and chemosensory pathways (Blackburn & Patteson, 1991; Bremmer, Byers, & Kiehl, 2003; "Position Paper," n.d.; Sizun, Westrup, & ESF Network Coordination Committee, 2004; Zahr, 1998). The physical environment of the NICU impacts the infant's physiologic status and development (Browne, 2003). The preterm infant's body systems continue to mature following birth in an environment overloaded with sensory stimuli that may affect the natural developmental sequence and result in overdevelopment or hypersensitivity of one sensory system and underdevelopment in another (Thear & Wittmann-Price, 2006). In addition to the physiological effects on the preterm infant, the NICU environment has been negatively associated with disruption in family interaction and attachment (Browne, 2003; Franklin, 2006).

Throughout pregnancy parents are preparing for the delivery of a term infant seldom considering the possibility of a problem during pregnancy, at birth, or in the immediate period following birth. The admission of an infant to the NICU frequently results in a crisis for parents. The parents are unexpectedly placed in a role where unknown health care providers assume the

total care of their infant. Parents who experience an unanticipated preterm birth or NICU infant admission identify feelings of helplessness, frustration, stress, anger, and grief (Able-Boone, Dokecki, & Smith, 1989; Riper, 2001). Further, the expertise and knowledge of the NICU physicians and nurses caring for the critically ill infant contribute to the creation of relative inequality with the parents that may increase the perceived helplessness of parents as caregivers of their infant (Able-Boone et al., 1989) and add to the parents' stress.

### **Background of the Problem**

One answer to the noisy, light, and stressful open room NICU is the recent trend toward construction of single private rooms for the care of critically ill preterm infants. The cost of constructing and maintaining single private room care is higher than a multi-patient room environment. Regulatory guidelines for health care provision and defined standards for hospital space result in an increased cost of construction per square foot as compared to general business or residential construction. The average cost of traditional construction for acute care hospital space ranges from above \$300 to approaching \$700 per square foot (Molar, 2006). The *2006 Guidelines for Design and Construction of Health Care Facilities* define the minimum standard for typical nursing units in general hospitals to be single-bed patient rooms. The construction of single-bed patient rooms significantly increases the square footage due to increased corridors, distance between patient rooms, and increased space within the rooms around the patient bed. The increased square footage of the private room design contributes to potential inefficient use of physical resources and higher costs when compared to the traditional NICU open room design.

The problem to be addressed in this study is the gap in scientific knowledge regarding the effects of single private room care on neonates' physiological outcomes and on maternal stress.



Single private room NICUs have been increasingly adopted in new construction, while evidence supporting improved health outcomes for the infant and lowered stress for mothers is absent.

Literature supports the need for the NICU environment of care to be designed to provide an optimal setting for the promotion of healing and growth and development of the high risk neonate. In addition, the NICU environment design should support mothers of high risk neonatal patients as they seek to develop a maternal-infant relationship during the hospitalization. Health care system support and recognition for parent involvement in the NICU environment includes initiatives for patient and family-centered-care in which the parents and other family members are encouraged to be deeply involved in the care of patients in the hospital. Single private room care promotes parent access to the infant 24 hours a day. In the original NICU open room model, parents often are denied access during change of shift and procedure performance, and privacy for intimacy and breastfeeding is significantly lacking. The model of single private room care may be an option to promote infant healing and maternal-infant relationship development.

### **Purposes of the Study**

The purposes of this study are to 1) describe perceptions of stress in mothers of preterm infants following infant hospitalization in the large room and the single private room NICU environment, 2) describe physiological outcomes of infants in the two different locations of NICU hospitalization, and 3) compare the perceptions of maternal stress and infants' physiological outcomes in those who received care in a large open room versus a single private room NICU setting.

An emphasis on evidenced based practice has resulted in changes in the methods through which care is delivered to high risk neonates. Practice recommendations include an increased

emphasis on providing developmental care to support optimal infant outcomes. Modifications to the open bay NICU environment through manipulation of light and sound exposure and the delivery of developmentally supportive NICU care have demonstrated improved premature infant outcomes of improved growth, decreased ventilator days, decreased hospital days and decreased number of ventilator days (Altimier et al., 2005; Brandon, Holditch-Davis, & Belyea, 2002; Field, 2003; Miller, White, Whitman, O'Callaghan, & Maxwell, 1995). One trend in neonatal care provision includes the design and development of single private room NICU care delivery. Limited clinical evidence exists regarding whether the single private room NICU environment of care delivery has a positive, negative, or neutral impact on health outcomes for the high risk neonate and on maternal stress as compared to the open room design. Evidence from the initial multi-site study comparing open versus single room NICU care demonstrates the single private room design provides solutions for increasing parent privacy and presence and support for compliance with the American Health Insurance Portability and Accountability Act (HIPAA) (Harris, Shepley, & White, 2006). Additional findings from the study included the single private rooms minimized the number of undesirable beds, increased staff and parent satisfaction, and reduced nursing staff stress (Harris et al., 2006). This study included information on average daily census, average length of stay, pneumonia, and blood stream infections but was limited in a design over a multi-year time frame where all participating sites did not submit data and acuity data were not included (Harris et al., 2006). In order to determine if the single private room NICU is associated with improved infant outcomes and reduced maternal stress, the following research questions were investigated:

- 1) Is there a difference between NICU hospitalization site (single private room versus open room) for infant weight gain, ventilator days, hospital length of stay, incidence and grade of intraventricular hemorrhage, and number of parental visits?
- 2) Is there a difference between NICU hospitalization site (single private room versus open room) for maternal perception of stress as measured by the PSS:NICU after the infant is discharged from the NICU?

### **Conceptual Framework**

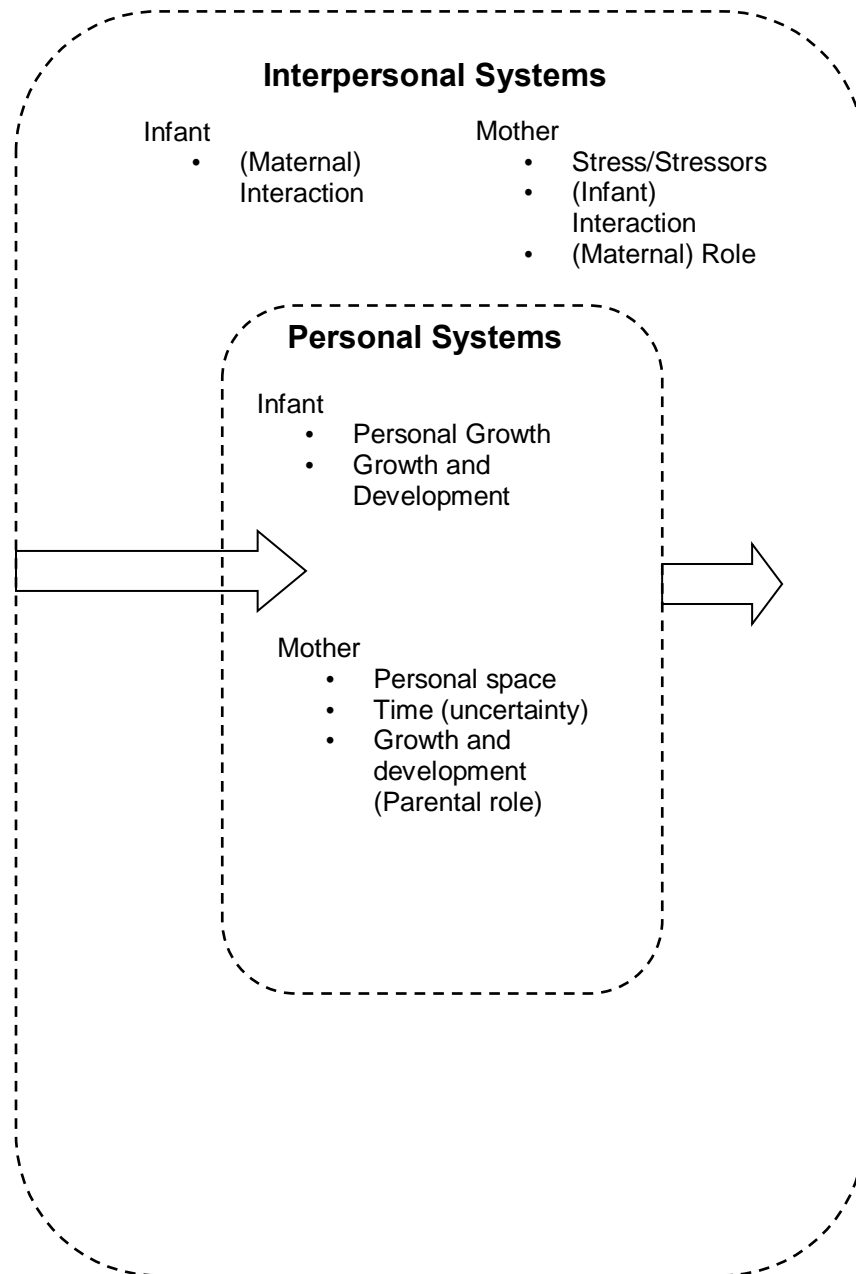
The framework for the research is based on King's conceptual system and theory of goal attainment. King (1981) described a framework of personal systems (individuals), interpersonal systems (groups), and social systems (society) in which humans interact. King (1992) identified concepts that provided knowledge about each of the systems within the framework and further identified that the concepts in all three systems are interrelated in any nursing situation. Concepts associated with personal systems are body image, self, perception, learning, growth and development, personal space, and time (King, 1992). Concepts associated with interpersonal systems are role, communication, interaction, transaction, and stress (King, 1992). Concepts associated with social systems are organization, power, authority, status, and decision making (King, 1992).

King (1992, p. 20) posited that the goal of the conceptual system and nursing "is to help individuals, groups, and society maintain health as they interact with their environment". King (2007, p. 109) identified an overall assumption that "the focus of nursing is human beings interacting with the environment leading to health".

The theory of goal attainment was derived from the conceptual system framework using the concepts from the personal and interpersonal systems (King, 1981). The theory of goal

attainment is based on the 10 major concepts of perception, communication, interaction, transaction, self, role, growth and development, coping with stress, time, and personal space (King, 1992). King's (1992) concept of transaction was implied in nurse-client interactions and her initial research indicated that when transactions occur between the nurse and client goal attainment usually results. The interactions occurring between nurse and client where information is exchanged and interpreted are characterized by both verbal and nonverbal communication through each individual's perceptions and self (King, 1992). In addition, King (1992) described the influence of stressors each individual is experiencing and the situation in time and space as impacting the interaction between nurse and client.

Goal attainment is achieved through the process of nurse-client interactions that lead to transactions and is applicable in most nursing situations. Clients who are unable to verbally communicate, as in the case of an infant hospitalized in the NICU, can send and receive messages nonverbally (King, 1992). Additionally, when clients are unable to set their own goals, nurses use their judgment and assist patients and families by setting goals for them. The focus of goal setting is for the client to achieve a state of health through attainment, maintenance, and restoration of health to promote assumption of their usual role (King, 1990). Figure 1 depicts the concepts of the theory of goal attainment applicable to the infant and mother in the NICU environment.



*Figure 1.* Personal and Interpersonal Systems of King's Theory of Goal Attainment for Infants and Mothers in the NICU Environment  
 Note: Adapted from King's (1981) conceptual framework for nursing.

## CHAPTER 2

### LITERATURE REVIEW

#### **Maternal Stress**

Bowlby (1958) defined attachment as the process of establishing an affective tie to the mother in the first 12 months. Three attributes have been identified as consistently present with the concept of attachment and include proximity, reciprocity, and commitment. Proximity is the physical and psychological parental closeness to the infant including contact, emotional state, and individualization (Goulet, Bell, St-Cyr Tribble, Paul, & Lang, 1998). In attachment reciprocity refers to the process where the capabilities and behavioral characteristics of the infant elicit a parental response and is described in two dimensions: complementarity and sensitivity (Goulet et al., 1998). The infant's response through interaction with the parents reinforces the care they are providing. This reinforcement increases the quality of the exchange taking place (Goulet et al., 1998). The attribute of commitment is related to the enduring nature of the attachment relationship. Two dimensions of the commitment attribute include centrality and parent role exploration (Goulet et al., 1998). The parents place the infant at the center of their life, taking responsibility for the maintenance of the infant's health and wellbeing and promoting the infant's safety, growth, and development.

The development of maternal responsiveness to the infant in the NICU requires promotion of reciprocal exchanges in which the mother has the ability to recognize and consistently act on the infant's cues (Amankwaa, Pickler, & Boonmee, 2007). Maternal responsiveness is evaluated by the observation of exhibited maternal behaviors including comforting the infant, talking to the infant, feeding the infant, and smiling and the infant's response to the maternal behavior (Amankwaa et al., 2007). Bonding of the parent to the child is

present when the parent actively participates in the care of the child (Wigert, Johansson, Berg, & Hellström, 2006). Additionally, the mother shows greater commitment when she receives extra contact with her child (Wigert et al., 2006). A large body of literature documents the impact of the NICU hospitalization and environment on mothers of premature infants (Davis, Edwards, Mohay, & Wollin, 2003; Dudek-Shriber, 2004; Franck, Cox, Allen, & Winter, 2005; Holditch-Davis, Bartlett, Blickman, & Miles, 2003; Miles, Holditch-Davis, Burchinal, & Nelson, 1999; Miles, Funk, & Kasper, 1992; Nyström & Axelsson, 2002; Reichman, Miller, Gordon, & Hendricks-Munoz, 2000; Ringland, 2008; Smith, Hefley, & Anand, 2007; Talmi & Harmon, 2003; Trombini, Surcinelli, Piccioni, Alessandrini, & Faldella, 2008; Wigert et al., 2006). The NICU environment, the infant's medical condition, the lengthy hospitalization of an acutely ill infant, the physical environment of the NICU, and the presence of multiple health care providers often preclude parental interaction and involvement with their infant. In addition, the immature neurological capabilities of a premature infant that affect his or her ability to participate in social interaction may impede the parental attachment to the infant (Haut, Peddicord, & O'Brien, 1994).

The birth of a child is stressful for parents related to the many physical, emotional, and social changes experienced in preparation for parenthood. The strains on parents multiply following the birth of a child with a physical defect or one who has survived perinatal hazards. Considerable psychological distress is evoked in mothers following the birth and hospitalization of the high risk preterm infant in the NICU (Davis et al., 2003; Ringland, 2008). The birth of a high risk neonate requiring multi-system support and extended NICU hospitalization can result in maternal stress and impact maternal psychological wellbeing. The stress of the NICU hospitalization may significantly affect maternal infant bonding and subsequent attachment, the

infant's cognitive and emotional development, and indirectly affect patient care and outcomes (Nyström & Axelsson, 2002; Ringland 2008). The hospitalization of a newborn in the NICU significantly interrupts the assumption of the caregiver role of the parent at birth and results in loss of control surrounding care provision and decision making. The most stressful aspect of having an infant in the NICU is an altered parent role and relationship with the baby (Dudek-Shriber, 2004; Lau, Hurst, Smith, & Schanler, 2007). The infant's NICU hospitalization results in separation of the infant from the mother after birth for extended periods of time and interrupts the traditional process of maternal role attainment. Mothers have limited opportunity to interact with the infant in the NICU and often are unable to participate in the infant's care. The parental role alteration, including not being able to help, hold, or care for the infant, protect the infant from pain, or share the infant with other family members, was the factor most strongly associated with symptoms of acute stress disorder (Shaw et al., 2006).

Posttraumatic stress response characteristics have been identified in mothers who have experienced the birth of a premature infant and NICU hospitalization (Holditch-Davis et al., 2003). Many mothers who deliver prematurely and have infants hospitalized in the NICU environment report distress and distressing memories of the NICU experience 2 months, 6 months, 9 months, and 12 months after discharge (Affleck, Tennen, Rowe, & Higgins, 1990; Holditch-Davis et al., 2003; Miles et al., 1999; Olshtain-Mann, & Auslander, 2008; Pinelli et al., 2008; Reichman et al., 2000), while some mothers continue to report symptoms of distress related to the experience after 3 years (Miles & Holditch-Davis, 1995).

Parental stress is significantly increased with the ill infant's extended NICU hospitalization, the potential for medical complications, and ongoing parental separation (Miles, 1989). The unanticipated delivery of a premature infant with alteration in the expected maternal



role, and concerns regarding the infant's survival and outcomes are specific sources of stress for parents (Doucette & Pinelli, 2004; Trombini et al., 2008). Additional stressors for parents include the foreign environment of the NICU, separation from their infant, the infant's appearance and behavior, and relationships with health care personnel (Davis et al., 2003; Doucette & Pinelli, 2004; Miles et al., 1992; Trombini et al., 2008). Mothers experience greater stress related to their relationship with their infant than fathers (Dudek-Shriber, 2004; Lee, Lee, Rankin, Alkon, & Weiss, 2005).

Studies specific to assessment of parental stress have been conducted by multiple researchers using the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU) (Miles, Funk, & Carlson, 1993). The infant's diagnosis, NICU length of stay, and gestational age have been identified as characteristics influencing the level of stress experienced by parents of NICU infants (Dudek-Shriber, 2004). Increased length of stay in the NICU and decreased gestational age increased the frequency of the occurrence of parental report of stress (Dudek-Shriber, 2004). Extremely premature infants are physiologically unstable, have demonstrable differences in physical appearance, and are less responsive to social interaction than infants born later in pregnancy. The need for supportive medical equipment and longer lengths of stay to facilitate growth and development results in higher levels of stress reported by parents of NICU infants (Dudek-Shriber, 2004). In contrast to this finding, Reid and Bramwell (2003) report the unexpected finding of their research using the PSS:NICU in which the lower gestational age and birth weight of the infant did not show a significant correlation with increased parental stress scores, contradicting the belief that sicker and smaller infants provoke higher stress levels in parents. Uncertainty surrounding infants' birth and outcome contributed to the higher level of stress perceived by parents (Lee et al., 2005).

In addition to the parents' fears and concerns about the health of their infant, the unfamiliar environment of the NICU with noise, smells, equipment, and unknown processes raises the parents' anxiety and confusion. The NICU environment has been identified as a significant source of stress for parents and this environmental stress may be a major factor contributing to the parents' overall distress and the development of parenting behaviors (Miles et al., 1993). Dudek-Shriber (2004) reported the sights and sounds of the NICU environment resulted in stress reported by parents.

The NICU hospitalization and physical separation of the mother and infant result in interruption of interaction after birth, delay in maternal closeness to the infant, and subsequent delayed bonding and relationship development (Nyström & Axelsson, 2002; Wigert et al., 2006). Additional factors that potentially limit interaction between the parents and NICU infant include the financial burden on the family, the ease or difficulty of travel to the NICU, the needs of siblings, and the quality of the marital relationships (Talmi & Harmon, 2003).

As NICU care has progressed over the last 30 plus years, the perception of family involvement during the hospitalization has also changed. The visitation frequency of parents in the NICU has increased over time. During the 1970s visitation was relegated to specific times of the day and limited by restrictive NICU policies, while recently more liberal visitation policies do not classify parents as visitors and aim to promote higher frequency of visits (Latva, Lehtonen, Salmelin, & Tamminen, 2006). Parents are no longer consistently restricted to short visits during specified visiting times regulated by health care professionals in the NICU. Parental presence in the NICU environment and involvement in care of the high risk neonate has evolved over time to the current trends which promote parental involvement in a family centered care model.

Trombini et al. (2008) reported study findings implicating environmental and relational features of the NICU as having significant influence on mothers' wellbeing, maternal distress, and effects of mothers' adaptation to the premature birth. Mothers who experienced restricted visitation and minimal support from health care personnel reported higher levels of psychological distress than mothers with free access to the unit and continuous presence of supportive health care personnel (Trombini et al., 2008). In the NICU environment with restricted time schedule visitation, the mothers' opportunity to interact with their infants and to discuss the clinical care of their infants with health professionals was limited. Specific research on individual room care in a convalescent NICU reported by Erdeve et al. (2009) demonstrated mothers of preterm infants who were hospitalized with and remained with their infants in the NICU individual room demonstrated lower mean stress scores. However, no significant difference from those mothers who were not hospitalized with their preterm NICU infant but who had unlimited opportunity to visit and spend time with their infants was found. In related research in a Pediatric Intensive Care Unit (PICU) environment, parent support in the environment resulted in lower stress levels for parents (Smith, Hefley, & Anand, 2007). Open visitation, parent sleep space in the patient room, and continual parental presence during the PICU hospitalization were components of supportive care for parents. These parents demonstrated significantly lower stress levels than parents required to leave the patient area during rounds and change of shift report and who were not provided a sleeping space in the room with their child (Smith et al., 2007).

### **Neurologic and Sensory System Physiology**

Infants also experience stress in the NICU environment. The preterm infant's vulnerabilities include the transition to extra uterine life, physiologic limitations, central nervous

system immaturity, and the need for intensive care (Blackburn, 1998). While dependent on the NICU environment for survival, maintenance of vital functions, and growth and development, preterm infants are vulnerable to the effects of this care environment (Blackburn, 1998). The extra-uterine environment poses risks to the developing brain in the premature infant (Blackburn, 2007). The central nervous system is one of the last systems to mature with neurons and glial cells migrating from the germinal matrix throughout gestation until the migration process is completed by 34 to 36 weeks gestation at which time the germinal matrix regresses (Blackburn, 1998). Prior to the regression of the germinal matrix, this area of the brain, rich in blood vessels to support the developing cells, receives a large proportion of the cerebral blood flow (Blackburn, 1998; Blackburn, 2007). The germinal matrix blood vessels are vulnerable to hemorrhage that may lead to periventricular-intraventricular hemorrhage in the preterm infant less than 34 weeks gestational age.

Developmentally supportive care has been created that is sensitive to the infant's needs and cues and is based on the amount of sensory input an infant can tolerate. Human neurosensory development occurs in a specific sequence beginning with sensations particular to skin (touch) followed by proprioception (perception of joint and body movement), vestibular, chemosensory (smell and taste), auditory, and finally visual development (Blackburn, 2007; Graven, 2000). While stimulation of the sensory system at a given period of fetal or early neonatal development facilitates and is required for normal development of the sensory system, interference in normal development may occur if the same stimulus is incorrectly timed or is too intense for the level of brain development (Blackburn, 2007; Graven, 2000).

The promotion of preterm infant neurobehavioral organization and development is provided for with appropriate sensory experiences based on the preterm infant's state, health

status, maturity, developmental level, and cues (Blackburn & Vandenberg, 1993). Sensory input provision to preterm infants should include the following considerations:

(1) the infant is vulnerable to sensory overload; (2) the infant will benefit from positive experiences; (3) the infant will recover best when sensory input is minimized or when left alone; (4) the infant will take longer to inhibit responses; (5) the infant can deal only with a small amount of stimuli at a time and at a slower rate; and (6) the infant may be able to handle only unimodal rather than multimodal stimuli (Blackburn & Vandenberg, 1993, p. 1118).

Als et al. (1994) defined a synactive theory of development that defines individualized treatment of preterm infants and describes the importance of the physical environment's contribution to health outcomes. These authors identify infants as continually striving to balance organized and disorganized behavior in response to stimulation. Neurobehavioral and physiologic organization are fostered in the preterm infant through ongoing assessment to promote individualized care for each infant (Blackburn, 1998). Initiating support for the extremely low-birth-weight infants' organizational efforts from birth onward may produce calmer infants with fewer cerebral blood flow velocity changes and subsequently fewer intraventricular hemorrhages (IVH) (Als et al., 1994). To minimize stress in the preterm infant attention should be paid to modification of the environment. These modifications should include altering sound and light to reduce infant disorganization.

### **Lighting in the NICU**

In unwritten NICU tradition nurses place blankets over the infant incubators in efforts to reduce infant exposure to bright fluorescent lighting, typical in large room hospital NICUs. Rationale provided by nursing team members included replication of the darkened in utero

environment. Research completed on the efficacy of the use of incubator covers, from multiple types of blankets to professionally constructed incubator covers, identified that 1) the amount of light reduction from incubator covers varies depending on type of fabric as well as percentage of incubator surface shielded by the cover, 2) dark-colored covers provided greater light reduction than light-colored covers when covers identical in fabric type were compared, 3) the light-reduction efficiency of the covers varied depending on the level of ambient light, and 4) covers provided less light reduction in higher ambient light levels (Lee, Malakooti, & Lotas, 2005). The practice of continuous dim lighting in most intensive care nurseries to replicate the darkened intrauterine environment ignores the fact that while in utero the fetus is exposed to “maternal time-of-day cues that synchronize the fetal clock with the external light-dark cycle” (Rivkees, 2004, p. 217). Providing continuous darkness for preterm infants in the NICU alters the time of day information they would have received had they been carried to full gestation (Rivkees, 2004).

Blackburn (1998) identified concerns about lighting in the NICU including exposure of infants to continuous high intensity light, lack of systemic, rhythmic diurnal patterns, and the potential interaction between retinopathy of prematurity and NICU lighting. Increasing evidence over the last 25 years supports the important role of lighting, apart from vision, in human biology (Rea, 2004). Light plays a critical role in synchronizing the solar clock with the biologic clock. Research studies related to circadian rhythms and light cycle exposure to high risk infants have reported positive effects including reduced heart rate during the dark and dim cycle period, improved state organization, greater weight gain and improved clinical status (Blackburn & Patteson, 1991; Brandon, Holditch-Davis, & Belyea, 2002; Lotas, 1992; Miller et al., 1995). These results suggest cycled lighting is useful as a clinical technique in the NICU.

The effects of light have been evaluated for the development of rest-activity patterns in premature infants. Infants were compared for exposure to continuous dim lighting or low-intensity cycled lighting prior to discharge from hospital to home (Rivkees, 2004). Rivkees (2004) identified the presence of day and night differences in rest and activity in infants exposed to cycled lighting prior to discharge to home, but these differences were not apparent in infants exposed to continuous dim light while hospitalized.

Lighting in a large room NICU may be difficult to regulate for individual patients even if multiple levels of lighting are present. The large room lighting requirements for multiple patients, providers, family members, and care giving activities within the patient care space may vary greatly at any given time. Lighting in a single private NICU room with one patient, family and provider, may improve the regulation of lighting in the patient care specific space. In the single private room NICU the individual care providers may regulate the lighting type and intensity based on the care to the individual patient and activity in this single space. The implications of the individual room light regulation include the potential advantages of improved sleep cycles and decreased stress for the NICU infant who may experience decreased physiologic variation and improved growth and development (Lai & Bearer, 2008).

### **Sound and Noise in the NICU**

A very-low-birth-weight infant often requires multi-system support with a large variety of health care equipment. The ventilator, incubator or radiant warmer, intravenous therapy pumps, and cardiovascular monitoring equipment all create noise from air flow, vibrations, and general function noise in addition to the various alarms these pieces of equipment may emit. The additive effect of additional preterm and high risk infants in one room of the NICU, each with

multiple pieces of equipment, the numerous health care providers from different disciplines, and family members of the patients all contribute to a high level of noise in the NICU.

High noise levels in the NICU produce stress and a negative impact on the preterm infant including physiologic changes of apnea; bradycardia; fluctuations in heart rate, respiratory rate, blood pressure and oxygen saturation; intestinal peristalsis; glucose consumption, and changes in sleep-wake states (Byers, Waugh, & Lowman, 2006; Darcy, Hancock, & Ware, 2008). Based on their immature neurologic systems, preterm infants are less able to effectively filter noxious noise stimulation and maintain self-regulation. Respiratory depression, including a decrease in respiratory rate, apnea, and hypoxemic events, occur in preterm infants with exposure to sound stimulus (Lai & Bearer, 2008). Zahr (1998) found that physiologic and behavioral responses and the infant's growth can be negatively influenced by the noisy and obtrusive NICU environment. The detrimental effects of noise on the preterm infant in the NICU may be reduced through noise reduction strategies. For example, limiting the number of individuals (family members and caregivers) present at any given time can reduce the noise in the NICU environment.

### **Respiratory System Physiology**

Depending on the degree of prematurity at birth, the infant's respiratory system is immature and often requires support ranging from supplemental oxygen delivery to mechanical ventilation. Anatomic and functional lung development for the infant continues to differentiate throughout pregnancy with alveolar development continuing from 36 weeks gestational age through the first 2 years of life (Blackburn, 2007). The preterm infant has immature alveoli, with the absence or reduced production of surfactant by underdeveloped type II pneumocytes (Blackburn, 2007). These infants also have limited development of the pulmonary vascular bed for oxygen exchange (Blackburn, 2007). As a result preterm infants are at risk for extended



respiratory support following birth until such time that the infant's lungs have developed sufficiently to support their physiologic needs independently (Blackburn, 2007). The respiratory support aimed at maintaining oxygenation and adequate ventilation necessary for sustaining life often damages the immature type I pneumocytes that may result in barotrauma to lung tissue with the need for prolonged respiratory supportive therapy (Blackburn, 2007).

Prolonged mechanical ventilation and respiratory supportive therapies for the preterm infant may impede the parental infant interaction and limit maternal physical contact with the infant. Limited interaction leads to delay of the development of maternal care-taking behavior. Mothers provide the physiologic and behavioral regulation for survival in addition to social-emotional growth of their infants through the actions of holding, feeding, and nurturing their infants in close physical contact (Browne, 2004). The NICU hospitalization necessary for stabilization and life sustaining care for the preterm infant interferes with the practice of close physical contact between the mother and the infant.

### **Weight Gain**

Weight gain assessment for the preterm infant in the NICU is a measure of growth and development. A standard of measure of growth has not been defined for the neonatal period of the first 28 days of life (Fanaro, Cristofori, Mosca, Savino, & Vigi, 2005; Olsen, Richardson, Schmid, Ausman, & Dwyer, 2002). Generally, the intrauterine weight growth goals of a normal fetus are applied to the extra uterine environment for the preterm infant of the same postmenstrual age (Fanora, et al., 2005; Olsen, et al., 2002). Multiple factors facilitate or impede the growth of premature infants in the NICU including the infant's baseline characteristics (examples: gestational age, size, race, gender, severity of illness, maternal exposures), clinical practices of care delivery (examples: temperature control, nutrition, respiratory support), and

medical complications (examples: infection, hypoxia, acidosis) (Fanora, et al., 2005; Olsen, et al., 2002).

Healthier preterm infants grow more rapidly than sicker infants (Olsen et al., 2002). A study evaluating the implications of developmental care demonstrated statistically significant higher weight at 36 weeks corrected age for infants following exposure to developmental care activities (Ludwig, Steichen, Khoury, & Krieg, 2008). Developmental care activities included infant positioning, exposure to nonnutritive sucking, clustering of infant care, and reduced exposure to continuous direct lighting and implementation of noise control (Ludwig et al., 2008). These authors suggest that improvements in care practices contribute to infant weight gain in the NICU.

### **Historical Evolution of the NICU Environment**

The environment of the NICU was relatively unchanged from its initiation in the 1960s until the late 1980s (Bowie, Hall, Faulkner, & Anderson, 2003). The first NICUs had multiple infants clustered together in rows for close observation in brightly lit rooms (Bowie et al., 2003). The early NICU replicated the delivery model of multi-patient ward intensive care similar to other patient care populations of adults and pediatrics in the hospital setting. Beginning in the 1970s with the obstetric population and based on the consumer advocacy movement, private rooms for patient care were being developed in hospitals (Floyd, 2005). In addition to obstetrics, by the end of the 1980s, private rooms became the norm for the adult and pediatric intensive care units for patient care delivery (Floyd, 2005). During this same time period, however, NICU environments continued to function as open multi-patient care provision spaces.

The single private room NICU design concept was identified in the literature in the 1990s and was modeled after the adult and pediatric intensive care unit private room design.

Recommendations were published for the feasibility and applicability of the single private room design to the high risk neonatal population (Floyd, 2005). The first single private room NICU was opened in 1997 (Floyd, 2005). While there has been an increasing trend for the implementation of this room design since the 1990s, determination of the design's impact on cost, care quality, satisfaction, or environmental control has not been documented (Sg2, 2007).

### **NICU Environment of Care**

The large amount of published literature related to the environment of the NICU and the environmental effects on infants and parents have been limited to the multi-patient NICU room design. Appendix A, Environmental Differences Table, reflects the differences in the NICU environment of the single private room and large room open model of care. Premature infants cared for in a developmentally appropriate environment demonstrate improved medical outcomes including decreased IVH, decreased number of ventilator days, decreased chronic lung disease, and decreased hospital days (Altimier, Eichel, Warner, Tedeschi, & Brown, 2005). The single private room NICU is a newly identified patient environment that may potentially improve these outcomes for high risk preterm infants and their parents.

The support for single private room delivery of patient care is identified in health and architectural resources. The single private room model of care delivery promotes compliance with the patient and family speech and acoustical privacy requirements under the Health Insurance Portability and Accountability Act (HIPAA) regulations that went into effect on April 14, 2003 (AIA, n.d.; McGrath, 2005). Additionally, privacy is important in the NICU environment where infants are developing complications and disabilities related to prematurity that must be communicated to parents. Communication between parents and health care providers in an open environment increases the risk of violating the HIPAA while a single

private room promotes free discussion without fear of another family overhearing the content of the conversation.

The provision of family-centered care is promoted in the single private room care delivery model. This room design fosters parents' participation in the care of their infant throughout the critical care phase and potentially prepares parents to care for their baby at home following discharge (AIA, n.d.). Cox and Bialoskurski (2001) proposed a link between the provision of information and the facilitation of attachment. Their findings suggest a need to break down the physical and psychological barriers that have an impact on family and mother-infant separation and the formation of attachment (Cox & Bialoskurski, 2001). Single private rooms provide parents access to the infant 24 hours a day. The single private room provides increased exposure to health care providers and information regarding the care and treatment of their infant. Privacy is afforded for physician and family conferencing at the bedside daily and promotion of family presence during daily medical rounds and shift report (Brown & Taquino, 2001). The presence of parents in the NICU promotes the likelihood that the medical team will engage them in a discussion of the infant's current condition and plans for the day (White, 2004). Additionally, parental presence in the NICU enables the staff to encourage parents to provide more direct care for those elements of care provision that are easily learned (White, 2004).

The private room environment provides for parental privacy. The private room also has the potential to isolate parents for extended periods of time as the nurse caring for the infant may be out of the patient room frequently caring for other assigned infants in the unit. A limitation of the private room NICU environment may be decreased exposure to and support from other parents in the NICU. Personal observation of parents in the NICU environment for extended periods of time includes acknowledgement of the relationships parents form with other parents

experiencing similar situations during the extended hospitalization. These relationships provide support for the parents from non-health care providers.

### **Theory of Goal Attainment in the NICU**

King's theory of goal attainment has been used to support and guide research related to the NICU environment. Norris and Hoyer's (1994) research recommended suggestions for practice change in the NICU nursing care environment based on the concepts of King's theory of goal attainment. Their research supported the identified goal of NICU nursing, maintaining the health of the family unit (Norris & Hoyer, 1994). Specifically, these researchers identified a change model for parenting in the NICU through representation of a systems approach to parenting. Through fostering interaction and eventual transaction between caregivers and parents, the optimal outcome of independent parental role attainment from admission of the infant to NICU to the infant's hospital discharge to the parents' care is achieved (Norris & Hoyer, 1994). In a subsequent study by Frank, Paredes, and Curtain (1997), the model developed by Norris and Hoyer (1994) was tested. The study findings supported the framework for parenting with results revealing parents reach the stage of transaction when nurses and parents communicate and mutually set goals.

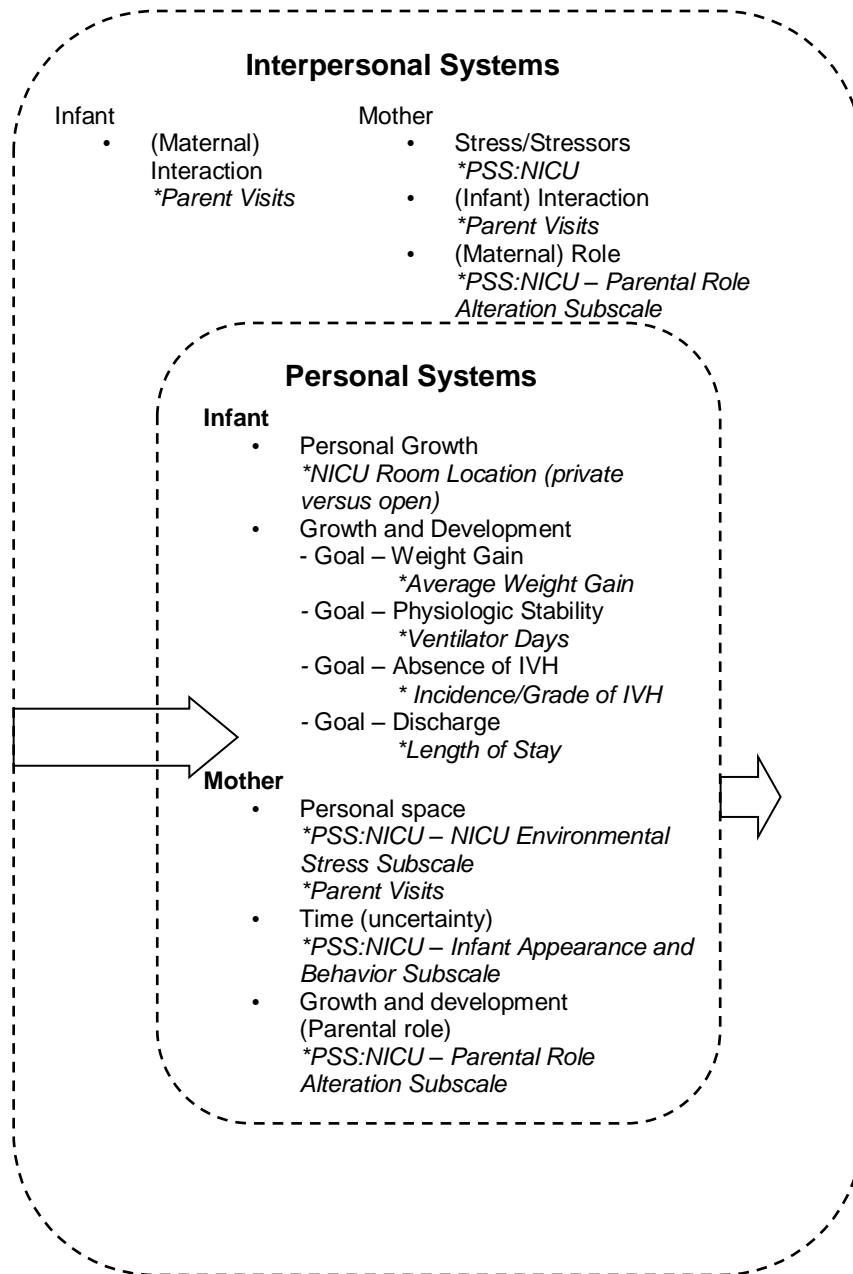
The structure and purpose of King's theory of goal attainment emphasized nursing interventions and outcomes (Frey, Sielof, & Norris, 2002). The theory of goal attainment identified the elements of the nurse-client interaction that results in outcomes and goal attainment. The theory of goal attainment is consistent with and applicable to this research in that the performance of nursing interactions with the NICU mother-baby dyad to achieve the goals of optimal health are related to specifically defined variables in the different room environments of the NICU.

The concepts identified in the theory of goal attainment are related to both the personal system of the infant and mother of the hospitalized NICU infant and interpersonal system related to the multiple interactions within the NICU. The most important personal system concept applied to NICU infants in the study is related to growth and development. Prematurity, hospitalization, and the treatment required for medical stabilization interferes with normal newborn behavior that could reduce parental interaction and potentially impact attachment (Franklin, 2006; Olshtain-Mann & Auslander, 2008).

The concept of personal space is applicable to the research for the infants and mothers in the study. The NICU environment is greatly altered from the usual postbirth environment of a newborn. The NICU is brighter and louder than a traditional quiet room in a home environment where the infant has family and potentially siblings immediately available. The large room NICU environment differs from the individual private room around the concept of personal private space where the mother can express herself and interact with the infant or other individuals. Additionally, within the personal system time reflects a continuous flow of events, and for mothers the uncertainty surrounding the infant's medical status may require continual adjustment in terms of time (Frey & Norris, 2006). The growth and development concept is also applicable to mothers as they continue to grow and develop as parents with the assimilation of the NICU infant into the family (Frey & Norris, 2006). Because the mother is not the primary care-giver of her ill infant, the maternal role may be altered when her infant is hospitalized in the NICU.

Concepts of the interpersonal system relevant to mothers in this research study include role and stress. Multiple psychological and social stressors are inherent in the NICU experience, including uncertain outcome and prognosis of the hospitalized NICU infant (Frey & Norris,

2006). Role, more specifically alteration of the anticipated parental role, is a concept of the interpersonal system that also impacts the mothers in the study. Initially the nurse providing care to the ill infant is better equipped to do so than the mother, who is new to the NICU environment and is likely not educated as a health care professional. The expertise of health care providers, with needed technological skills parents do not have, may result in mothers' perception of little status within the NICU and the perceived loss of control may threaten the mothers' sense of self (Frey & Norris, 2006). The interpersonal concepts of interaction, communication, and transaction are also relevant to the research to achieve goal attainment of optimal health for the infant and mother on infant discharge from the NICU. According to Frey and Norris (2006, p. 202), "nurses who work with parents to mutually establish and attain goals can influence health outcomes of personal and interpersonal systems". The concepts of King's theory of goal attainment applicable for the research on infant outcomes and perceptions of maternal stress are depicted in a modified conceptual framework (Figure 2).



**Figure 2.** Personal and Interpersonal Systems of King's Theory of Goal Attainment for Infants and Mothers in the NICU Environment and Study Variable Alignment

Note: Variable in Italics. Adapted from King's (1981) conceptual framework for nursing.



## Summary

The birth and hospitalization of a high risk preterm infant is a stressful experience for mothers. The immature physiology of the preterm infant, the NICU physical care environment, and the medical care required to medically stabilize and sustain the infant have a significant impact on the infant's growth and development outcomes and the process for preparation and discharge to maternal care.

Single private rooms provide families the privacy to participate in the care of their infants on a continual basis, including the practicing of new skills, breast pumping and developing the skills for breastfeeding the high risk infant, and visitation with siblings and other family members. Improved outcomes including reduced length of stay and lower readmission rates are documented for infants whose parents closely participated in their care; however, there are no specific targeted clinical outcomes of single private room NICU care (Sg2, 2007). The provision of patient care in a single private room in the NICU is perceived to greatly enhance family-centered care by promoting parental involvement in the care of the high risk preterm infant throughout the hospitalization in a private and supportive setting for care delivery (Brown & Taquino, 2001). This study evaluates differences in preterm infant physiologic outcomes and perceived maternal stress in the single private room model of NICU care versus the open large room model of care delivery.

CHAPTER 3  
METHODOLOGY

**Methods**

**Research Design**

The study used a retrospective nonexperimental design of the naturally occurring NICU infant hospitalization site event to describe and compare infant and maternal health outcomes. The study described and compared infant physiologic outcomes after discharge from the open room and single private room NICU environments in a Level III NICU. A survey of mothers of infants hospitalized in the open room and single private room NICU environments was used to determine their perception of stress following infant discharge from the NICU. East Tennessee State University (ETSU) Institutional Review Board (IRB) approval was obtained for the study. Preterm high risk infants admitted to the NICU for care were eligible for inclusion in the study after discharge from the hospital. Infant medical records were examined for the two defined groups of neonatal patients following discharge from the NICU after standard room assignment policies to either the open room or the single private room and usual care in the NICU. The infants hospitalized in the single private room section of the NICU were considered a naturally occurring “treatment” group and the infants placed in the large room section of the NICU were considered a naturally occurring “comparison” group. Infants were assigned to the single private room or open room environment on admission to the NICU based on bed availability. The single private room environment was limited to seven rooms. Infants requiring NICU care were admitted to the single private room environment upon opening the unit until the bed capacity was filled. Following a discharge from the single private room NICU patient care area, the next infant inborn or transferred into the tertiary facility requiring NICU care was admitted to the

open single private room. When the single private room environment was filled to capacity infants requiring admission were placed in the open room NICU environment. Mothers of the infants from both the open room and the single private room groups received the PSS:NICU survey instrument (Appendix B) after infant discharge from the NICU.

The NICU single private room is a 223 square foot individual patient room clinical care space including a designated family space with a sleeper sofa for parents. Parents may stay in the NICU single private room as long and as much as they desire. The NICU large room environment has a patient care space that includes the infant bed and several feet around the bed in the open unit. Privacy curtains are available to pull around the infant bedside if desired. A guest chair is available in the patient space and the parents may stay at their infant's bed side as much as they desire with the exception of the change of shift 1 hour at a time twice daily when multiple health care providers exchange confidential patient information and parents must leave the NICU. During the performance of medical procedures on infants in adjacent bed spaces, parents may be requested to leave the open room environment for confidentiality and safety. Lighting is individually controlled in the single private room but is dependent on multi-patient needs in the large room model and fully controlled by nurses. Infant equipment used in each of the patient care environments including the use of quilted incubator covers to reduce sound and light to the preterm infant was identical.

Enlistment of the neonatology physicians and NICU clinical nursing leadership was obtained to assure that care protocols and patient care processes were delivered consistently in both of the patient care areas throughout the study. Nurse staffing ratios were maintained consistently in both patient care areas per published guidelines for NICU nurse to patient ratios (Lockwood & Lemons, 2007). Because nurse staffing for the single private room and large room

NICU clinical patient care areas is distributed from one large NICU nursing team, the potential existed for nurses to work in either environment. Nurses who provide care to both groups of infants maximize the delivery of similar nursing care practice in the two physical environments. Additionally, the health care discipline team members of respiratory therapy, occupational therapy, physical therapy, and social work provided care to both groups of infants from each of their respective team groups with the same protocols and practices regardless of infant's environment of hospitalization.

The large room NICU includes a 32 bed NICU made up of one room of 20 patients and two smaller rooms with six patients each. The single private room NICU is made up of seven individual private patient rooms in a different area of the hospital with one of these rooms larger (302 square feet) and capable of accommodating twin infants with two designated infant bed spaces within the room along with the sleeper sofa for the twins' parents. Preterm infants hospitalized in the Level III NICU may have received multi-system support or had minimal interventions and care requirements in either environment.

**Population.** The study population included preterm infants admitted to a 39 bed NICU, which is a tertiary regional referral center in the Appalachian region in the southeastern United States. The sample was identified from the population of NICU infants hospitalized in the Level III NICU within the IRB approved study period. Following infant discharge from the NICU, mothers of each of the infants in the sample were invited to participate in the study by completing the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU) instrument.

**Sample Size.** A power analysis was completed to identify the number of participants needed to form an appropriate sample size to reduce the risk of a Type II error (Polit & Beck, 2004). Estimation of sample size was based on a power of 0.80, an alpha of 0.05, and the

expectation of a medium effect. A medium effect was selected as appropriate because most nursing studies have modest effects and no relevant earlier findings are present in the literature for this type of research study (Polit & Beck). The sample size identified for this study based on the power analysis was 63 subjects for the single private room group and 63 for the open room group for a total sample size of 126 infants. The mothers of the identified infant sample were solicited for participation in the research study.

**Sample Selection.** A convenience sample of 100% of the population of infants admitted to the single private room NICU care environment who met inclusion criteria were included in the sample until the desired number of single private room infants was reached. Single private room infants were matched based on gestational age at admission to the NICU with open room infants who also met the study's inclusion criteria. The composition of the open room group sample was defined by the number of single private room subjects in each subgroup classified by gestational age at admission to the NICU. Matching gestational age of subjects within the single private room and open room groups was completed to attain similar sample composition. Specifically, the infant in the single private room group was identified and matched with an infant from the open room group population. Infant participants in the open room group were chosen with a gestational age equal to or within 1 week less than or greater than the gestational age of the private room infant.

The inclusion and exclusion criteria for the study were identified based on previous research on stress in mothers of NICU infants. Infants in these research studies included preterm infants within specifically defined gestational age ranges and hospitalization length of stay in addition to excluding infants with characteristics of life-threatening congenital anomalies, infant malformation, surgical requirements, chromosomal abnormality, or congenital heart disease

(Erdeve et al., 2008; Trombini et al., 2008). Inclusion criteria for subjects in this study were: (1) preterm infants, less than 37 completed weeks gestation, admitted to the NICU for clinical patient care provision and hospitalized at least 1 week; (2) NICU infants who are discharged to home; and, (3) infants who complete the NICU hospitalization wholly in one of the two defined clinical patient care areas. Exclusion criteria for the research study are: (1) infants with chromosomal abnormalities; (2) infants with congenital malformation; (3) infants requiring surgical intervention for congenital anomalies; (4) infant death prior to discharge; (5) infants discharged to other than maternal care provider; (6) infant transfer to another facility for care. Additional exclusion criteria for infant and maternal subject participation include: (1) maternal age < 18 years; and (2) non-English speaking.

**Protection of Human Subjects.** Even though the identified sample subjects, neonates, represent a vulnerable population as classified in research ethics, informed consent was not required for the infant section of the study, and subjects did not incur any risk by their participation in this research study. To protect patient privacy, the actual NICU patient participants were not involved in this study. All standard NICU policies and procedures were followed during hospitalization. Study participation was limited to collection of data from the infants' medical records, retrospectively after discharge from the medical facility.

Mothers of the infants received an invitation letter (Appendix C) describing the intent of the study and requesting their participation through completion of the instrument in addition to providing information regarding assistance for needs that arose from their participation of the survey instrument. One invitation letter and PSS:NICU survey was sent to potential maternal participants who delivered a multiple gestation pregnancy even though both of the infants were

included in the infant sample. The return of the completed survey instrument demonstrated the mother's informed consent for study participation.

To protect patient confidentiality the infant name and medical record information and mother's name was maintained on distinct Data Code Record forms (Appendix D, Appendix E, Appendix F, and Appendix G) which are maintained separately in a locked file from the actual patient data. Data Collection Forms were identified only by the patient code with no patient identification information. Data access is limited to the study's principal investigator.

### **Data Collection Procedures**

The infant sample included 104 infants admitted to a NICU in Northeast Tennessee for the period of data collection from March 11, 2009, through March 31, 2010. The infant sample included 52 infants in the private room NICU environment group which represented 100% of the infants in this environment who met the inclusion criteria. The infant sample for the open room NICU environment included 52 infants matched by gestational age up to a maximum of 1 week before or after the private room NICU infant sample.

The population for the maternal sample included mothers of the 104 infants in the infant sample. Eligible maternal participants varied in number related to the differing distribution of multiple gestation deliveries in the two groups. Eligible maternal participants solicited for study participation included 44 mothers in the private room NICU group and 48 mothers in the open room NICU group. The maternal sample included 46 mothers of NICU infants with 20 (45.5%) in the private room NICU environment and 26 (54.2%) in the open room NICU environment. The maternal participants' sample was obtained through the invitation letter sent with the PSS:NICU survey to the mother's address identified in the infant's medical record from the NICU hospitalization. Surveys returned to the researcher as undeliverable were resent to the

potential maternal participant when a forwarding address was identified on the returned unopened envelope. A second invitation letter and PSS:NICU survey was sent to the potential maternal participants 3 weeks after the first request for participation if the first survey was not returned completed. Two eligible mothers in the open room NICU environment group did not receive the invitation letter and survey related to undeliverable initial surveys and the inability to identify a current address for these individuals.

Complete anonymity of the participants was maintained. The data coding system included only the subject number with identification of location of open room versus private room environment hospitalization.

### **Sample Characteristics**

A total of 104 infant participants were included in the study. The private room NICU group included 52 infants with a range of last maternal menstrual period (LMP) gestational age on admission to the NICU from 28.4 to 37.9 weeks gestational age and the open room NICU group of 52 infants ranged from 28.8 to 37.6 weeks. Male infants represented a larger percentage of the sample than female infants. The majority of infants in the sample were white, although black and Hispanic infants were also represented in much smaller numbers. Singleton births were the majority in both the private room (61.5%) and open room (86.5%) infant groups and demonstrated a statistically significant difference ( $\chi^2 = 8.45$ ,  $df=1$ ,  $p=.004$ ) with the open room infant group having more singleton births ( $n=45$ ) than the private room group ( $n=32$ ). The delivery method demonstrated a statistically significant difference between the two infant groups ( $\chi^2=4.87$ ,  $df=1$ ,  $p=.027$ ). Delivery method was equally distributed between cesarean section and vaginal delivery in the open room group, and cesarean delivery represented the primary method of delivery in the private room infant group. The infant groups' mean Apgar scores at 1 minute



and 5 minute of age were similar prior to the admission to the NICU. The mothers of infants in the study ranged in age from 18 years to 38 years of age in the private room NICU group and 18 years to 40 years of age in the open room NICU group. The majority of NICU mothers in the sample (47.1%, n=49) did not have other living children at the time of the NICU infant's birth and hospitalization. The distance mothers lived from the hospital where the infant was in the NICU was comparable in both groups. Single mothers exceeded married mothers in number in both the private room and open room groups. Each of the groups included mothers with documented maternal substance abuse during pregnancy with a higher incidence of substance abuse in the private room group. Tables 1 and 2 provide detailed presentation of the infant and maternal characteristics by count and percent of the total sample. Means and standard deviations for the continuous variables are included in Table 3.

Table 1  
*Infant Characteristics*

<u>Characteristic</u>	<u>Private Room</u>	<u>Open Room</u>	$\chi^2$ , <i>df</i> , <i>p</i>
<u>Gender</u>			
Female	25 (48.1%)	22 (42.3%)	0.35, 1, .554
Male	27 (51.9%)	30 (57.7%)	
<u>Race</u>			
White	47 (90.4%)	50 (96.2%)	1.76, 2, .415
Black	4 (7.7%)	2 (3.8%)	
Hispanic	1 (1.9%)	0 (0%)	
<u>Delivery Type</u>			
Vaginal	15 (28.8%)	26 (50%)	4.87, 1, .027*
Cesarean	37 (71.2%)	26 (50%)	
<u>Gestation Type</u>			
Singleton	32 (61.5%)	45 (86.5%)	8.45, 1, .004*
Multiple Gestation	20 (38.5%)	7 (13.5%)	
<u>Presence of IVH</u>			
Yes	0 (0%)	1 (1.9%)	1.01, 1, .315
No	52 (100%)	51 (98.1%)	

Note. \* $p < .05$

Table 2

*Maternal Characteristics*

<u>Characteristic</u>	<u>Private Room</u>	<u>Open Room</u>	$\chi^2$ , <i>df</i> , <i>p</i>
<u>Marital Status</u>			
Single	28 (53.8%)	29 (55.8%)	0.01, 1, .929
Married	23 (44.2%)	23 (44.2%)	
<u>Previous NICU Experience</u>			
Yes	5 (9.6%)	5 (9.6%)	0.001, 1, .973
No	44 (84.6%)	43 (82.7%)	
<u>Maternal Substance Abuse</u>			
Yes	11 (21.2%)	7 (13.5%)	1.17, 1, .279
No	40 (76.9%)	45 (86.5%)	

Note. Totals may not total 100% due to missing data.

Table 3

*Independent Samples t-test Results for Infant Sample Characteristics*

<u>Characteristics</u>	Private Room (n=52)		Open Room (n=52)		<u>t, df, p</u>
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	
Admission Weight (grams)	2013.42	689.84	2000.88	586.58	0.10, 102, .921
Discharge Weight (grams)	2322.13	456.01	2256.44	401.99	0.78, 102, .438
Average Daily Weight Gain (grams)	5.79	17.50	7.74	16.38	-0.59, 102, .559
LMP Gestational Age	32.89	2.20	33.20	1.95	-0.76, 102, .447
Ballard Gestational Age	32.86	2.38	33.4	1.99	-1.1, 77, .276
Apgar 1 Minute	6.87	1.74	7.14	1.70	-0.80, 101, .424
Apgar 5 Minute	8.31	1.28	8.37	1.11	-0.28, 101, .784
Ventilator Days	1.21	2.35	0.83	1.77	0.94, 102, .347
Length of Stay (days)	22.40	14.93	18.23	10.82	1.63, 102, .106
Parent Visits	151.71	113.42	42.13	34.06	6.67, 60.13, <.001*
Distance Home to Hospital	42.75	38.44	44.17	34.02	-0.20, 102, .843
Maternal Age	26.79	5.75	25.54	5.48	1.14, 102, .259
Maternal Pregnancies	2.46	1.49	2.5	1.44	-0.13, 102, .894
Living Children on Admission	0.83	1.08	0.94	1.04	-0.56, 102, .580

Note: \*p&lt;.05

## **Instruments for Data Collection**

Infant outcomes were gathered using the data collection tool (Appendix H) created for the study that included infant and maternal demographics and infant environmental and clinical data elements. Infant and maternal data elements include race, method of delivery, singleton or multiple gestation, Apgar scores, NICU environment, gender, gestational age at birth, weights at birth and discharge, average daily weight gain, length of stay, number of parent visits, admission and discharge dates, presence and grade of IVH, and discharge diagnoses. Single mothers in this study included those mothers who were married but separated from their legal husband and the father of the NICU hospitalized infant was not the mother's legal husband.

Perceptions of maternal stress were gathered using the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU) instrument. The PSS:NICU instrument was developed to serve as a clinical measure of parental perception of stressors arising from the physical and psychological environment of the NICU (Miles & Funk, 1998; Miles et al., 1993). The PSS:NICU instrument is classified as a generic health status measure. This instrument measures the parent's perception of stress during the hospitalization of an infant in the NICU but does not limit the NICU admission to a specific diagnosis for the infant. Permission to use the PSS:NICU instrument was obtained through completion and submission of the "Permission to Use Research Instrument" document (Appendix I).

The self-report instrument includes an overall stress score and four subscales that measure stress related to (a) the sights and sounds of the unit, (b) the appearance and behaviors of the infant, (c) the impact of the parents' role and their relationship with their baby, and (d) the parents' relationship and communication with the staff (Dudek-Shriber, 2004; Franck et al., 2005; Lam, Spence, & Halliday, 2007; Lau et al., 2007; Miles & Funk, 1998; Reid & Bramwell,

2003). As instrument development evolved the dimension of staff relationships was dropped as the authors of the instrument revised it based on continued report of parents not reporting experience with stressors in this domain (Miles et al., 1992). Parents of infants hospitalized in the NICU report whether they have experienced each of the items on the scale. Parents then rate each of the scale items experienced on a 5 point Likert type scale (1 = *not at all stressful* and 5 = *extremely stressful*) (Miles & Funk, 1998).

Three dimensions that assess parental perception of stress related to aspects of the NICU environment are assessed with the PSS:NICU (Miles et al., 1992). The three subscales include Parental Role Alterations (7 items), Infant's Appearance (13 items), and Sights and Sounds (6 items). In addition to the items categorized within the subscales, two additional items are noted on the instrument. One item requests an overall evaluation by the parent of the experience with having an infant hospitalized in the NICU, and the second item is an open ended question for parents to identify additional information regarding anything else that was stressful during the time that the baby was in the NICU. The number of stressors experienced, the stress those particular experiences generated, and the overall level of stress experienced by the parent across all items on the scale are available for each of the three scales within the instrument (Miles et al., 1992). Averaging responses to the items for each of the three scales provides for the scale score calculation (Miles et al., 1992). An instrument manual is available with this instrument and per the instrument's author should be consulted for scoring (Miles, n.d.).

Internal consistency of the scales were examined using Cronbach's alpha coefficients for each subscale and for the total instrument with an acceptable level (>.70) for all scales identified prior to analysis (Miles et al., 1993; Miles & Funk, 1998). The internal consistencies for the entire scale were substantial at .94 and .89 for Metric 1 (Stress Occurrence Level) and Metric 2

(Overall Stress Level) respectively (Miles & Funk, 1998). Construct validity for the scales in the PSS:NICU was assured using Pearson correlation coefficients with increased perceived stressors reported on the PSS:NICU consistent with measured anxiety on the State Anxiety scores. The scales demonstrated correlations were significant at the level of  $p < .001$  in all cases except for the Sights and Sounds scale, which was significant at the level of  $p < .05$  (Miles & Funk, 1998).

The PSS:NICU instrument includes eight new questions (four in the appearance and behavior of infant section and four in the parental role section) based on additional research with parents of medically fragile preterm infants that have been added to reflect the changes in NICU care and survival of smaller and smaller infants that have not been psychometrically tested (Miles, 2002). The items were used in the research as recommended by the instrument's author, and during the analysis a calculation of Cronbach's alpha on the old and new questions within the instrument was performed to determine if the questions would be used in the analysis for this study.

In addition to the PSS:NICU, data were obtained on demographic variables that may impact perceived stress and attachment for the NICU mother. The demographic data were collected from the maternal documentation included in the infant's medical record for evaluation of impact to maternal responses on the instrument and included: maternal age, parity, gravida, marital status, NICU gestation, frequency of visitation in the NICU, previous NICU experience, maternal substance abuse, and distance from home to hospital. These indicators may impact the individual's perspective and approach to the critically ill infant and the NICU experience.

### **Analysis**

SPSS/PASW Statistics for Windows version 17.0 (2009) was used for statistical analysis of data. The data items from the infant medical records and the PSS:NICU survey items were

entered into the data base and the infant and maternal data codebook files respectively and re-checked for accuracy by the investigator. The few missing data were not used in the analysis. Infant outcomes of weight gain, ventilator days, hospital length of stay, incidence and grade of IVH, and number of parental visits and perceived maternal stress scores were evaluated for the two groups to determine if there is a difference related to the environmental location of NICU infant hospitalization. The *t*-test for independent groups was used to test differences in the means for continuous study parameters and the chi-square test was used for categorical study parameters. A value of  $p < .05$  was considered statistically significant.



## CHAPTER 4

### RESULTS

#### Findings

##### Research Question 1

Research question 1, “Is there a difference between NICU hospitalization site (single private room versus open room) for infant weight gain, ventilator days, hospital length of stay, incidence and grade of IVH, and number of parental visits?” was answered in the following manner. The difference between the NICU private room and open room groups was analyzed for the variables average daily weight gain, ventilator days, hospital length of stay, and number of parental visits using the *t*-test for independent groups. Table 3 depicts the means, standard deviations, and significant differences for the *t*-test for the research question variables in addition to the continuous infant and maternal variable data. The *t*-test for difference of independent groups for the number of parent visits demonstrated significance ( $p=.000$ ) for the increased number of visits by the private room NICU parents with the value of  $p<.05$  considered statistically significant. The test for parental visits demonstrated a very large effect size ( $d=1.31$ ) which produced a power of 1.0. The *t*-test for difference of the private and open room groups did not demonstrate significance for infant weight gain, ventilator days, and hospital length of stay. The effect size for these tests were very small ( $d=.12$  to  $d=.32$ ) and the power based on the effect sizes ranged from .14 to .49. The results of the chi-square test procedure was used to assess for difference in the private room and open room NICU groups for the incidence and grade of IVH. There was no incidence of IVH in the private room group of NICU infants and only one case of IVH in the open room group. The chi-square test procedure did not demonstrate significance ( $\chi^2=1.010$ ,  $df=1$ ,  $p=.315$ ) for the incidence of IVH.

## Research Question 2

Research question 2, “Is there a difference between NICU hospitalization site (single private versus open) for maternal perception of stress as measured by the PSS:NICU after the infant is discharged from the NICU?” was answered by performing *t*-test for independent groups using the responses from the PSS:NICU questionnaire for the mothers of NICU private room infants and mothers of NICU open room infants. The statistical analysis was performed for each of the three subscales, the total scale, each individual item within the total scale, and the overall maternal evaluation for the question regarding the stressful experience of the NICU hospitalization. No statistical difference in perception of stress by the two groups of mothers for the total scale or the three subscales was found. Table 4 portrays the means, standard deviations and *p* values for the stress occurrence level for the total scale and subscales. The final item on the questionnaire asking parents to “indicate how stressful in general, the experience of having your baby hospitalized in the NICU has been for you” was not consistently answered by all respondents (13 mothers in each group provided an answer for this item). The *t*-test statistical analysis for the assessment of difference of overall perception of stress in the private room versus open room environment was not significant ( $t=-.348$ ,  $df=24.00$ ,  $p=.731$ ).

Table 4

*Independent t-test for PSS:NICU Stress Occurrence Level for Total Scale and Subscales*

<u>Scale</u>	<u>Private Room</u>			<u>Open Room</u>			<u>t, df, p</u>
	<u>n</u>	<u>Mean</u>	<u>SD</u>	<u>n</u>	<u>Mean</u>	<u>SD</u>	
Sights and Sounds	20	2.91	0.76	25	3.00	1.09	-.32, 43, .752
Baby Looks and Behaves and Treatments	20	3.82	0.79	26	3.58	1.04	0.85, 44, .398
Relationship and Parental Role	20	3.91	0.87	26	4.10	1.00	-0.70, 44, .490
Total Scale	20	3.69	0.70	26	3.65	0.97	0.15, 44, .878

Statistical analysis of each item on the PSS:NICU scale was completed using the *t*-test procedure for independent groups. Two individual items demonstrated a difference that is statistically significant when considering significance at a value of  $p < .05$ . The items related to the limp and weak appearance of the baby and being separated from the baby both demonstrated a difference in the perception of stress by mothers in the private room versus the open room environment. Table 5 depicts the stress response means, standard deviations and significant differences for these items. The mean scores for the perception of stress for these items were higher in the private room environment than the open room environment.

Table 5

*Independent Samples t-test for Individual Item Maternal Response PSS:NICU*

<u>PSS:NICU</u> <u>Item</u>	Private Room			Open Room			<u>t</u> , <u>df</u> , <u>p</u>
	<u>n</u>	<u>Mean</u>	<u>SD</u>	<u>n</u>	<u>Mean</u>	<u>SD</u>	
Limp and Weak Appearance	14	4.57	0.85	20	3.50	1.73	-1.17, 29.29, .024*
Baby Separation	14	5.00	0.00	26	4.65	0.79	2.21, 25, .036*

Note. \*p<.05

Reliability estimates, using Cronbach's alpha procedure, were calculated for the total scale and each of the subscales of the instrument for Metric 1, Stress Occurrence Level. The reliability of the total scale was calculated at .98 using only the original items; and then again with the original and newly identified (all) items currently being evaluated at .99. The reliability estimate for the Sights and Sounds subscale was 0.84; for the Baby Looks and Behaves and Treatment subscale, .98; and for Relationship and Parental Role subscale, .96.

## CHAPTER 5

### DISCUSSION

#### **Summary of Findings**

This study addressed a significant gap in the literature regarding the influence of the NICU single private room environment versus the traditional open room NICU environment on infant health outcomes and mother's perception of stress. The increasing trend for the creation and design of more costly single private rooms in new development and construction of NICU care space without evidence of improved health outcomes was the catalyst for this study. Research questions for the study were "Is there a difference between NICU hospitalization site (single private room versus open room) for infant weight gain, ventilator days, hospital length of stay, incidence and grade of IVH, and number of parental visits?" and "Is there a difference between NICU hospitalization sites (single private room versus open room) for maternal perception of stress as measured by the PSS:NICU after the infant is discharged from the NICU?" This study is the first descriptive study comparing infant weight gain, ventilator days, hospital length of stay, incidence and grade of IVH, number of parental visits, and perceptions of maternal stress in a single private room versus an open room NICU environment.

Analysis of data in answer to the first question, produced a significant difference in number of parental visits, with many more visits by parents whose infants were hospitalized in the private rooms. No difference was noted between the groups of NICU infants in the single private room versus open room environment for infant weight gain, ventilator days, hospital length of stay, or incidence and grade of IVH.

Analysis of infant weight gain did not detect a difference between outcomes in the two environments of NICU hospitalization. The two groups of infants were similar in mean

admission weight, weight gain, and discharge weight likely reflecting the health care providers' consistency in patient care practices for nutrition and feeding across the two environments.

The number of ventilator days between the two groups was not significant with the mean of the private room group at 1.21 days and the open room group at 0.83 days. The number of premature infants in the single private room and open room environment requiring artificial ventilation for respiratory distress in the sample is very low and is consistent with the trend reported in NICU research on treatment of respiratory distress (Engle & Committee on Fetus and Newborn, 2008; Ghodrat, 2006; Reininger et al., 2005). The low level of ventilator days across the sample may be impacted by the implementation of surfactant treatment for preterm infants prior to displaying symptoms for respiratory distress. Proactive treatment has resulted in a decreased number of preterm infants requiring endotracheal intubation artificial ventilation support for extended periods or at any time during the NICU hospitalization (Engle & Committee on Fetus and Newborn, 2008; Ghodrat, 2006; Reininger et al., 2005).

Length of hospital stay for the NICU infants was slightly different between the two groups in the sample, yet a statistically significant difference was not present. The length of the hospital stay was longer for infants in the private room group by just over 4 calendar days for the study sample. The single private room group had 11 infants with a history of maternal substance abuse during pregnancy as compared to the open room group that included 7 infants with this characteristic. Maternal substance abuse differed slightly in the two groups by types of substances. Private room maternal substance abuse included opiates, marijuana, cocaine, barbituates and benzodiazepines, while open room maternal substance abuse included opiates, marijuana, amphetamines, and benzodiazepines. Maternal use of methadone and illicit substances in pregnancy contributes to significantly longer neonatal hospitalizations than infants

with mothers using other types of medications (Johnson, Greenough, & Gerada, 2003).

Although slightly longer in days, the increased length of stay in the private room environment was not significantly different from the open room. A similar increase in length of stay in a private room NICU design was reported by Harris et al. (2006) with increased length of stay in a single private room versus open bay environment in a comparison multiple site study of 2 years before occupying and 2 years after occupying the new construction design. Length of stay demonstrated a 3% increase in the private room environment versus a reduction in the open bay environment of 2% (Harris et al., 2006). This study did not include acuity data or consider unit care practices or any health factors of the individual infants in the comparison groups across the units (Harris et al., 2006).

The incidence of IVH was not statistically different for the infants in the private room versus the open room environment. No incidence of IVH was present in the private room group of NICU infants and the one incidence of IVH in the open room was a grade one IVH. The low incidence of IVH across the sample may be related to improved care as a result of surfactant administration. Surfactant treatments, clinically improve respiratory function, and less artificial respiratory intervention is necessary. Independent breathing reduces stress and promotes stable hemodynamic status, leading to less risk of injury to the fragile germinal matrix vascular bed in preterm infants (Engle & Committee on Fetus and Newborn, 2008).

The number of parent visits in the private room NICU versus the open room NICU environment was significantly higher. The single private room afforded privacy, provided designated family space including a sleeping area for the parents, and the visitation practice was completely open. This environment likely facilitated the increased numbers of visits and more constant parental presence. This finding provides evidence that parents in the private room

NICU environment will spend more time with their preterm infant than those in an open room NICU environment. The higher number of visits in the private room supports the recently published anecdotal observation by researchers evaluating parent and staff perceptions of open ward versus single family room units of NICU design in which parents were observed spending more time in the single family room unit compared with the open facility (Domanico, Davis, Coleman, & Davis, 2010). Wigert et al. (2009) found that parents staying in a designated 'parent' room at the NICU spent more time with their infant than parents visiting intermittently from their home, a local hotel, or the postpartum unit. The finding of increased visitation has significant advantages for the infant, mother, and other family members. The NICU hospitalization of the infant separates the infant from the mother, interfering with normal holding and touching the infant. Establishing early and close maternal infant relationships has an important impact on the child's development (Bowlby, 1969; Kennell & McGrath, 2005). The strength of the parent-child relationship is associated with the infant's development of self-confidence, security, emotional stability, social competence, and learning readiness (Boonmee & Pickler, 2005). The single private room environment provides parents with more opportunity for proximity and potentially promotes increased interaction and thus supports the development of attachment and maternal infant bonding (Wigert et al., 2006). Further, the increased visitation promotes opportunity for early and repeated provision of maternal care-giving within the NICU environment, potentially supporting maternal role attainment and parenting skill development. Write-in PSS:NICU survey comments from mothers in the private room group support these assertions: 1) "The most helpful and wonderful thing was having a single private room where I could be with my baby all the time once I had been discharged"; and 2) "I loved the fact that my son was in his own room and I could stay. My first son was in the old NICU and I could not stay



with him and had to leave from 5:30-7:30 [shift change]. My other son [subsequent pregnancy] was in the new NICU and I love it, I never had to leave him. It was a lot less stressful on me...I feel like I bonded better with my second [born] son cause I was with him day and night [in the private room environment]”.

Mothers of infants hospitalized in the NICU environment exhibited high levels of stress regardless of the location in the single private room or open room. While mothers from private rooms responded with a slightly higher scores overall, the difference was not statistically different. The absence of a significant difference between the two maternal groups and the high level response for the mothers’ perception of stress implies that NICU experience itself produced high levels of stress for the mothers regardless of infant placement in an open or private room. Mothers from private rooms had significantly higher scores on two items, “being separated from their infant” and the “limp and weak appearance of the baby.” Mothers in the private rooms, who spent more time with their infants than those in the open room, responded with higher levels of perceived stress overall and specifically to the items regarding the appearance of their infant and related to separation from the baby. These findings conflict with previous research that found mothers with unrestricted access to their infants reported lower levels of distress than those who experienced restrictions on access to their infants (Trombini et al., 2008). Reasons for this perception in the sample group need further exploration but may potentially be related to lack of confidence as a maternal care provider for a premature infant and the relative isolation of the private room.

Many of the mothers provided comments for the open ended PSS:NICU survey question where respondents could share “anything else that was stressful” (Miles, 2002, p. 3). These write-in responses validated the high levels of perceived stress by the mothers for the NICU

hospitalization regardless of room environment. Private room NICU maternal comments identified the stress related to uncertainty with comments: 1) “just not knowing when your baby will come home”; 2) “The most stressful part for me was just never knowing what to expect next”; and 3) “leaving me outside not knowing what ... was going on with my babies”. Comments from mothers in the open room NICU group similarly included: 1) “it was a very scary and stressful time”; 2) “The NICU is hard on anyone but to not talk to them and stay with your baby and find out things after the fact is heartbreaking”; and 3) “I was so scared and worried. I couldn’t be with her until I was released and that was very hard for me. Her father went to be with her but I could not. I felt like a bad mother”. Clustering the written comments from the mothers in both NICU environments identified commonality with “the unknown” related to the infant’s care and progress, and the expression of feelings about themselves related to guilt, fear, and difficulty dealing with the infant’s NICU hospitalization.

### **Conceptual Framework**

The application of the concepts of the theory of goal attainment was proposed for this study of differences in NICU patient room environments. The concepts of the theory of goal attainment related to the infant’s personal system included growth and development and personal space. The study findings of no difference in infant outcomes of weight gain, length of stay, ventilator days, and incidence and grade of IVH appear to demonstrate that the NICU environment did not impact the preterm infants’ ability to achieve growth and development goal attainment during the period of NICU hospitalization and preparation for discharge to the mothers’ care. The consistent practices of nursing transactions in both NICU environments promoted similar acquisition of the infants’ growth and development goal attainment of physiologic stability and discharge from the NICU.

The concepts of the theory of goal attainment related to the personal system of the mother included personal space, time, and maternal growth and development. The personal space of the NICU private room contributed to the significant finding of the difference in number of parent visits documented for this group. The increased visitation finding in the private room NICU promotes maternal growth and development by providing increased exposure to the infant's care requirements and promoting development of the mother's parenting and care-giving skills and assimilation of the infant into the family. With multiple repeated visits the mother gains expertise and continues to develop parenting skills in addition to assumption and development of the maternal role.

King's theory of goal attainment interpersonal system concepts of stress and role were validated by the findings of the study. King (1992) identified that stress the individual is experiencing impacts the interactions that occur in the health care situation. The stress responses by mothers in the NICU, with significantly high responses related to separation of the infant and appearance of the infant, relate to King's (1992) concept of role goal attainment. The significant stress levels for these survey items potentially impacts the interactions of the mother with her infant and subsequent attainment of the parenting role. Mothers provided comments related to their perceived failure to implement the maternal role at the birth of their infant. A mother in the single private room NICU commented "the stress on a mother leaving their child 'behind' the first few days after birth – there are no words to describe that feeling". Similar comments from mothers in the open room NICU environment included "the hardest part was leaving here crying and not being there" and "leaving him and not being able to be 'mom' right off was very hard".

The theory of goal attainment maternal concepts of personal space, role attainment, and growth and development were supported with findings of increased visitation in the private room

NICU environment. The maternal stress concept was supported with study findings of the private room environment mothers' significantly higher scores for two survey items while both groups demonstrated high levels of stress overall. The concept of stress was validated as a concept impacting mothers with NICU hospitalized infants. These findings extend nursing knowledge for the theory of goal attainment through demonstration of the applicability of infant and maternal concepts of the personal and interpersonal systems in the private room and open room NICU environment. The concepts of the theory are applicable for describing and defining the care of mothers and infants in the environment of the NICU.

### **Strengths**

One of the strengths of the study is that the characteristics of the infant were very closely matched in the private room and open room groups of gestational age, weight, race, gender, and Apgar scores helping assure that the two naturally occurring treatment groups were as similar as possible. The sample acquisition for both the private room and open room NICU infants from the same facility was a significant strength of the study. The NICU care provided to both groups of infants in the sample included use of the same policies and practice by health care providers who were assigned according to the unit's staffing needs to care for the infants in either environment over the period of the research study. This provided consistency in care delivery methods and providers for all infants regardless of room environments.

The level of return of survey instruments by the mothers invited to participate in the study was strong. Of the eligible private room NICU mothers, 45.5% returned the survey instrument while 54.2% of the open room NICU mothers returned the survey instrument. The results of this study provide a unique addition to nursing science as it is the first to examine perceptions of maternal stress in open versus private room NICU environments of care.

Additionally, the study is one of the first to examine infant outcomes in the two different NICU room environments in the same institution with consistent providers and patient care practices, thus extending knowledge of physiological outcomes in infants and perceptions of stress in mothers.

### **Limitations**

The voluntary nature of the return of the maternal survey instruments is a limitation of the study. With a voluntary return those who completed the survey may or may not be representative of the perceptions of stress for mothers who did not choose to return the survey.

Another limitation of the study is the small sample size for both infants and mothers. The desired number of infant participants, 63 in each group, was not achieved due to the number of hospitalized infants who met the inclusion criteria in the study period. However, because this study is one of the first of its kind, the findings contribute to nursing knowledge on stress and infant outcomes in NICU environments. The sample includes primarily white infants with little racial or ethnic diversity in the groups. This distribution is reflective of the composition of the general population in the region of the care delivery facility but limits the ability to generalize the findings to diverse population groups.

### **Implications**

#### **Practice**

The study findings provide evidence that there is no difference in the single private room versus open room environment of care provision of the NICU hospitalization on the infant outcomes of weight gain, ventilator days, length of hospital stay, and incidence and grade of IVH in the study sample. The single private room provides for more control of sound and lighting and promotes increased parental visitation, but the actual infant health outcomes evaluated in this

study were not significantly different. The room environment is one factor of NICU care, but the actual provision of consistent evidence-based clinical care may have more impact on improving neonatal health outcomes than the setting. This suggests that NICU providers need to continue to rely on scientific evidence to create practice policies and procedures regardless of the type of room in which the premature infant is placed.

The mothers' overall perception of stress was not different in the open room versus single private room environment in this study. Mothers of preterm infants perceived high levels of stress related to the NICU hospitalization regardless of the location of the infant's hospitalization. Mothers in the private room environment reported higher levels of stress related to separation from their infant and viewing their infant as limp and weak. Mothers in a private room, while experiencing more privacy with their infant, may potentially feel isolated from others and experience less parent-to-parent socialization. Mothers need support from nurses to be comfortable in the highly technological environment of the NICU regardless of the room setting. NICU nurses should be particularly sensitive to communication of the care plan for the infant, teaching about the infant's appearance, and facilitating the acquisition of maternal care giving skill and development of the maternal role in preparation for discharge with equal attention in each room environment.

The increased parent visitation study findings in the private room environment demonstrate that the provision of a private care space with unlimited access to the infant promotes extended and more frequent visitation by parents. Increased access to and proximity with the infant promotes maternal infant interaction, influences maternal infant bonding, and promotes the development of maternal infant attachment (Bowlby, 1958; Wigert et al., 2006). The infant and mother interaction develops when the mother has more opportunity to talk to,

touch, and hold her infant. The increased time with her infant promotes the mother's recognition of the infant's cues for feeding and for consolation. In addition her increased presence contributes to the development of security for the infant. The increased visitation finding in the private room environment may suggest that modification of the open room NICU environment, with processes of care to promote unlimited parental access to the infant and designated parent space at the infant bedside, would increase parental visitation in this environment.

Accommodations for parents near the infant care space should be considered in any NICU environment to promote opportunities for attachment and parental role-taking.

Nursing team members and leaders must be included in design and construction recommendations for new NICU environments. Nurses' involvement in the design process assures the incorporation of evidence based knowledge of maternal infant nursing care requirements into space design that will meet the needs of parent and infants and supports the nursing that provide care to these families.

## **Education**

**Mothers.** Mothers at risk of delivering preterm infants who are hospitalized prior to delivery would benefit from anticipatory guidance of what to expect in the NICU environment. Educational preparation related to the size and appearance of the infant based on gestational age, the equipment to expect, and a description of the environment prior to the infant's birth and arrival in the NICU will assist mothers to know what to expect following the infant's birth. Once the infant is in the NICU, ongoing communication with and education of the mother regarding her infant's health status and anticipated plan of care progression is critical in order for the mother to understand what is occurring in the NICU environment. Finally, the initiation of education and support for infant care-giving and interaction in the context of the NICU should

progress from minimal involvement early in the care processes through maximal maternal care delivery at discharge.

**Nurses.** The newly graduated nurse hired to work in a NICU must have extensive orientation and mentoring for development of knowledge of neonatal physiology and the clinical skills related to technological care of the high risk neonate. In addition nursing education must include information regarding maternal stress in the NICU environment related to separation from her infant and the inability of the mother to assume the maternal role she anticipated throughout pregnancy. Information regarding how to provide emotional support for the mother to assist her with the experience of the NICU hospitalization is a necessity. Nurses' education should include an understanding of multiple teaching methods to be used with mothers to promote the care of their infants from initial interaction through discharge.

### **Research**

The findings of this study demonstrate support for the increased parental contacts with the preterm NICU infant in the single private room design. This design may promote family centered care that facilitates maternal assumption of infant care throughout the NICU hospitalization in preparation for discharge. A longitudinal study of the influence of the NICU room environment on maternal-infant interaction and attachment is warranted in the future. The study findings did not demonstrate differences between the NICU environments for the health outcomes of weight gain, length of stay, ventilator days, incidence of IVH, or maternal stress. Differences in health outcomes in the two environments may not have been detected in the small study sample.

Based on the limited racial and ethnic diversity in the study sample, further research is needed to determine if the infant health outcomes and mother's perceptions of stress differ in



private room versus open room NICU environments in other populations of NICU infants and mothers. Replication of the study with a larger and more diverse sample would strengthen the study findings. Additional areas for research related to mothers of NICU infants that are needed include the influence of the NICU environment of the private room versus open room on longer term maternal role attainment and the development of attachment.

This study did not measure the family or partner support available to the mother. Support from a partner may have had an impact on the maternal perception of stress related to the NICU hospitalization. Research that includes measurement of family or partner functioning and support is necessary to determine if supportive significant others impact mothers' perception of stress while experiencing the situation of a preterm neonate in the NICU environment.

Research to evaluate the stress perception of fathers in the environment of the single private room versus open room NICU is also needed. Fathers may visit the NICU with varied frequency and perceive the NICU environment differently from mothers. Studies to further understanding of fathers' experience of stress during the NICU hospitalization are equally important for additional research.

The expense of NICU care supports the need to construct the type of patient care environment that is cost effective yet promotes optimal infant and parental outcomes. Continuing research on the NICU environment care is important to determine if the trend toward single private room NICU environments of care is appropriate for maximizing optimal outcomes for premature infants and their families, while managing escalating health care costs.

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## APPENDIXES

### Appendix A

#### Environmental Differences

<b>Characteristic</b>	<b>Open Room NICU Environment</b>	<b>Single Private Room NICU Environment</b>
<b>Privacy</b>	Limited, multiple infants, healthcare providers, parents, and infant visitors Patient curtain may be pulled around two sides of bed Acoustic privacy limited	Infant's Assigned health care providers and parents/visitors Patient room door may be closed
<b>Physical Space</b>	Infant bed space with several feet around the bed (less than 80 square feet per infant)	223 square feet
<b>Support Areas for Parents</b>	Limited space at bedside, no telephone for parent use	Recliner/Sofa Bed for parent napping, individual room telephone
<b>Lighting</b>	Dimmed Lighting, Fluorescent Lighting, Incubator cover use	Individual room controls, Incubator cover use
<b>Acoustics</b>	Exposure to alarms, vibration and loud sounds as a result of numerous pieces of equipment (ventilators, monitor alarms, beds), in addition to numerous people	Exposure to individual infant equipment potentially one ventilator, alarm, bed. People limited to assigned provider and parents/visitors.
<b>Visitation</b>	May be continuous with the exception of change of shift report (2 one hour periods per day unable to visit). Parents may be asked to leave for procedures on adjacent infants.	Continuous 24 hours/day

## Appendix B

### Parental Stress Scale: Neonatal Intensive Care Unit

#### **PARENTAL STRESS SCALE: NEONATAL INTENSIVE CARE UNIT** c Margaret S. Miles, RN, PhD 1987, 2002

Nurses and others who work in neonatal intensive care units are interested in how the experience of having a sick baby hospitalized in the neonatal intensive care unit (NICU) affects parents. We would like to know what aspects of your experience as a parent are stressful to you. **By stressful, we mean that the experience has caused you to feel anxious, upset, or tense.**

This questionnaire lists various experiences parents have reported as stressful. Please indicate how stressful each item listed below has been for you using the following scale:

- 1 = Not at all stressful: the experience did not cause you to feel upset, tense, or anxious
- 2 = A little stressful
- 3 = Moderately stressful
- 4 = Very stressful
- 5 = Extremely stressful: the experience upset you and caused a lot of anxiety or tension

If you did not have the experience, indicate this by circling N/A meaning that you have "not experienced" this aspect of the NICU.

Now let's take an item for an *example*: The bright lights in the NICU.

If for example you feel that the bright lights in the neonatal intensive care unit were extremely stressful to you, you would circle the number 5 below:

NA 1 2 3 4 5

If you feel that the lights were not stressful at all, you would circle the number 1 below:

NA 1 2 3 4 5

If the bright lights were not on when you visited (not likely), you would circle NA indicating "Not Applicable" below:

NA 1 2 3 4 5

Now begin

Below is a list of the various **SIGHTS AND SOUNDS** commonly experienced in an NICU. We are interested in knowing about your view of how stressful these **SIGHTS AND SOUNDS** are for you. Circle the number that best represents your level of stress.

- |    |  |              |
|----|--|--------------|
| 1. | The presence of monitors and equipment         | NA 1 2 3 4 5 |
| 2. | The constant noises of monitors and equipment  | NA 1 2 3 4 5 |
| 3. | The sudden noises of monitor alarms            | NA 1 2 3 4 5 |
| 4. | The other sick babies in the room              | NA 1 2 3 4 5 |
| 5. | The large number of people working in the unit | NA 1 2 3 4 5 |

6. Having a machine (respirator) breathe for my baby NA 1 2 3 4 5

Below is a list of items that might describe the way your **BABY LOOKS AND BEHAVES** while you are visiting in the NICU as well as some of the **TREATMENTS** that you have seen done to the baby. Not all babies have these experiences or look this way, so circle the NA, if you have not experienced or seen the listed item. If the item reflects something that you have experienced, then indicate how much the experience was stressful or upsetting to you by circling the appropriate number.

1. Tubes and equipment on or near my baby NA 1 2 3 4 5
2. Bruises, cuts or incisions on my baby NA 1 2 3 4 5
3. The unusual color of my baby (for example looking pale or yellow jaundiced) NA 1 2 3 4 5
4. My baby's unusual or abnormal breathing patterns NA 1 2 3 4 5
5. The small size of my baby NA 1 2 3 4 5
6. The wrinkled appearance of my baby NA 1 2 3 4 5
7. Seeing needles and tubes put in my baby NA 1 2 3 4 5
8. My baby being fed by an intravenous line or tube NA 1 2 3 4 5
9. When my baby seemed to be in pain NA 1 2 3 4 5
10. When my baby looked sad NA 1 2 3 4 5
11. The limp and weak appearance of my baby NA 1 2 3 4 5
12. Jerky or restless movements of my baby NA 1 2 3 4 5
13. My baby not being able to cry like other babies NA 1 2 3 4 5
- \*14. My baby crying for long periods NA 1 2 3 4 5
- \*15. When my baby looked afraid NA 1 2 3 4 5
- \*16. Seeing my baby suddenly change color (for example, becoming pale or blue) NA 1 2 3 4 5
- \*17. Seeing my baby stop breathing NA 1 2 3 4 5

The last area we want to ask you about is how you feel about your own **RELATIONSHIP** with the baby and your **PARENTAL ROLE**. If you have experienced the following situations or feelings, indicate how stressful you have been by them by circling the appropriate number. Again, circle NA if you did not experience the item.

- |     |   |              |
|-----|---|--------------|
| 1.  | Being separated from my baby  | NA 1 2 3 4 5 |
| 2.  | Not feeding my baby myself  | NA 1 2 3 4 5 |
| 3.  | Not being able to care for my baby myself (for example, diapering, bathing)     | NA 1 2 3 4 5 |
| 4.  | Not being able to hold my baby when I want                                      | NA 1 2 3 4 5 |
| 5.  | Feeling helpless and unable to protect my baby from pain and painful procedures | NA 1 2 3 4 5 |
| 6.  | Feeling helpless about how to help my baby during this time                     | NA 1 2 3 4 5 |
| 7.  | Not having time to be alone with my baby  | NA 1 2 3 4 5 |
| *8. | Sometimes forgetting what my baby looks like                                    | NA 1 2 3 4 5 |
| *9. | Not being able to share my baby with other family members                       | NA 1 2 3 4 5 |
| *10 | Being afraid of touching or holding my baby                                     | NA 1 2 3 4 5 |
| *11 | Feeling staff is closer to my baby than I am                                    | NA 1 2 3 4 5 |

Using the same rating scale, indicate how stressful in general, the experience of having your baby hospitalized in the NICU has been for you:

- 1 = Not at all stressful: the NICU experience did not cause me to feel upset, tense, or anxious
- 2 = A little stressful
- 3 = Moderately stressful
- 4 = Very stressful
- 5 = Extremely stressful: the NICU experience upset me and caused a lot of anxiety or tension

Thank you for your help. Now, was there anything else that was stressful for you during the time that your baby has been in the neonatal intensive care unit? Please discuss below:

c Margaret S. Miles, RN, PhD 2001, Carrington Hall, CB 7460, School of Nursing  
University of North Carolina, Chapel Hill, NC 27599-7460



Note to Researchers:

The starred items are new and based on additional research with parents of medically fragile preterm infants. They are added to reflect the changes in NICU care and survival of smaller and smaller infants. These items have not been tested psychometrically yet. A study is underway presently. You may use the new items and then in analysis calculate your own Cronbach's alpha on the old and new items to determine whether or not to use them. Once we have psychometric data on the revised tool, we will post this information.

## Appendix C

### Maternal Study Participation Invitation Letter

Study Title: Perceptions of Maternal Stress and High Risk Neonatal Patient Outcomes in a Single Private Room Versus Open Room Neonatal Intensive Care Unit Environment

Dear \_\_\_\_\_,

My name is Lisa Smithgall. I am a doctoral candidate in the College of Nursing at East Tennessee State University. I am conducting a research study as part of the requirements of my PhD in Nursing, and I would like to invite you to participate.

I am studying the impact of the Neonatal Intensive Care Unit environment on infant health and mother's stress. If you decide to participate, a survey is attached for you to complete about your perception of stressors from the environment of the NICU.

In particular, you will be asked questions about the sights and sounds of the unit, the appearance and behaviors of the infant, and the impact of your role and relationship with your baby.

You may feel uncomfortable answering some of the questions. You do not have to answer any questions that you do not wish to.

Although you probably won't benefit directly from participating in this study, we hope that others in the community and society in general will benefit by identifying if there is a difference between the single private room NICU and open large room NICU on the infant's health outcomes and mother's perception of stress. This information will assist to identify the best environment to deliver NICU care to infants and their families.

Participation is confidential. Study information will be kept in a secure locked location. The results of the study may be published or presented at professional meetings, but your identity will not be revealed. Participation is anonymous, which means that no one will know what your answers are. So, please do not write your name or other identifying information on any of the study survey materials.

You will receive a 5 pack of Gerber Onesies t-shirts and a rattle toy for the baby to reimburse you for your time following return of the completed survey. These items will be mailed to you at your home or at the address you request.

The return of your completed survey indicates that you choose to participate in the study. Taking part in the study is your decision. You do not have to be in this study if you do not want to. You may also quit being in the study at any time or decide not to answer any question you are not comfortable answering.

I will be happy to answer any questions you have about the study. You may contact me at 423-282-5977 or by email at [ZLMS13@goldmail.etsu.edu](mailto:ZLMS13@goldmail.etsu.edu) or my faculty advisor, Dr. Joellen Edwards at 423-439-4055 or [edwardsj@estu.edu](mailto:edwardsj@estu.edu), if you have study related questions or problems. If you have any questions about your rights as a research participant, you may contact the Office for the Protection of Human Research subjects at East Tennessee State University at 423-439-6055.

Thank you for your consideration. If you would like to participate, please see the attached survey and begin completing the Parental Stress Scale: Neonatal Intensive Care Unit (PSS:NICU).

When you are done, please place the completed survey in the self addressed stamped envelope and return to me. Upon receipt of your completed survey, I will send to you the Gerber Onesies and infant toy.

With kind regards,

Lisa M. Smithgall  
7 Blackberry Court  
Johnson City, TN 37604  
423-282-5977 (Home)  
[ZLMS13@goldmail.etsu.edu](mailto:ZLMS13@goldmail.etsu.edu)

Appendix D

Data Code Record Form – Private Room NICU Infant Participants

<b>Infant Code #</b>	<b>Infant Name</b>	<b>Medical Record #</b>
PN -001		
PN -002		
PN -003		
PN -004		
PN -005		
PN -006		
PN -007		
PN -008		
PN -009		
PN -010		
PN -011		
PN -012		
PN -013		
PN -014		
PN -015		
PN -016		
PN -017		
PN -018		
PN -019		
PN -020		

Appendix E

Data Code Record Form – Open Room NICU Infant Participants

<b>Infant Code #</b>	<b>Infant Name</b>	<b>Medical Record #</b>
ON -101		
ON -102		
ON -103		
ON -104		
ON -105		
ON -106		
ON -107		
ON -108		
ON -109		
ON -110		
ON -111		
ON -112		
ON -113		
ON -114		
ON -115		
ON -116		
ON -117		
ON -118		
ON -119		
ON -120		

Appendix F

Data Code Record Form – Private Room NICU Maternal Participants

<b>Maternal Code #</b>	<b>Mother's Name</b>
MPN -201	
MPN -202	
MPN -203	
MPN -204	
MPN -205	
MPN -206	
MPN -207	
MPN -208	
MPN -209	
MPN -210	
MPN -211	
MPN -212	
MPN -213	
MPN -214	
MPN -215	
MPN -216	
MPN -217	
MPN -218	
MPN -219	
MPN -220	

## Appendix G

### Data Code Record Form – Open Room NICU Maternal Participants

<b>Maternal Code #</b>	<b>Mother's Name</b>
MON -301	
MON -302	
MON -303	
MON -304	
MON -305	
MON -306	
MON -307	
MON -308	
MON -309	
MON -310	
MON -311	
MON -312	
MON -313	
MON -314	
MON -315	
MON -316	
MON -317	
MON -318	
MON -319	
MON -320	

Appendix H

NICU Infant Outcomes in the Patient Care Environment  
Data Collection Form

Code # \_\_\_\_\_ - \_\_\_\_\_  
(PN/ON) - #

**Maternal History/Delivery Information:**

Race/Ethnicity \_\_\_\_\_ Maternal Age \_\_\_\_\_

	Yes	No	Gravida	_____
Vaginal Delivery	<input type="radio"/>	<input type="radio"/>	Para	_____
C-section Delivery	<input type="radio"/>	<input type="radio"/>	Distance from Home to Hospital	_____
Singleton Delivery	<input type="radio"/>	<input type="radio"/>	Marital Status: Single	<input type="radio"/> Married <input type="radio"/>
Multiple Gestation Delivery	<input type="radio"/>	<input type="radio"/>		
Previous NICU Experience	<input type="radio"/>	<input type="radio"/>		
Maternal Substance Abuse	<input type="radio"/>	<input type="radio"/>	If yes to substance abuse (list)	_____

**Infant Variables:**

Apgar Scores: 1 min. \_\_\_\_\_ 5 min. \_\_\_\_\_

Gender: Female \_\_\_\_\_ Male \_\_\_\_\_

Gestational Age at Birth: LMP Age \_\_\_\_\_ Ballard Assessment \_\_\_\_\_

Birth Weight \_\_\_\_\_ (grams) Average Daily Weight Gain \_\_\_\_\_  
Discharge Weight \_\_\_\_\_ (grams) (Grams)

Date of Admission \_\_\_\_\_ Length of Stay \_\_\_\_\_  
Date of Discharge \_\_\_\_\_ (in Calendar Days)

Number of Parent Visits: \_\_\_\_\_

Intraventricular Hemorrhage (IVH) Present : Yes  No

If IVH present, identify Grade: 1 \_\_\_\_\_ 2 \_\_\_\_\_ 3 \_\_\_\_\_ 4 \_\_\_\_\_

Discharge Diagnosis:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_



**Exclusion Criteria:**

**Chromosomal Abnormalities (Example: Trisomy 13, 18, 23)**

**Significant Congenital Defects (Example: Neural Tube Defects, congenital heart, disease)**

**Surgical Intervention for congenital anomalies**

**Term Infants**

**Discharge to other than maternal care**

**Transfer to another facility during NICU hospitalization**

**Death prior to discharge**

**Non-English speaking**

**Maternal age < 18 years**

## Appendix I

### Permission to Use Research Instrument

#### Permission to Use Research Instrument

From: Margaret S. Miles, RN, PhD, FAAN  
Carrington Hall, CB 7460  
School of Nursing  
University of North Carolina  
Chapel Hill, NC 27599-7460  
[mmiles.uncson@mhs.unc.edu](mailto:mmiles.uncson@mhs.unc.edu)

RE: Use of Parental Stressor Scale: NICU

You are free to download and use the Parental Stressor Scale: NICU for your research. However, the instrument is copyrighted (c Margaret S. Miles, RN, PhD 1987) and cannot be duplicated or copied without first submitting to Dr. Miles a signed copy of the permission form that follows. Requests for Any changes or alterations in the instrument should be made in writing to Dr. Miles.

By filling in your name, address, phone number, and e-mail address and signing the agreement use below and mailing it to Dr. Miles at the above address, you are hereby given permission  
\* to copy or retype the PSS:NICU for use in your research. The permission is valid only for the study named below.

The author of the tool, Dr. Miles, requests that you send back to her the following:  
\* an abstract of the findings or copy of the results of your study when completed  
\* copies of any changes or translations of the tool that you were given permission to make.

When using the PSS:NICU, you are expected to use the following reference:  
Miles, M.S., Funk, S.G., & Carlson, J. (1993). Parental Stressor Scale: Neonatal Intensive Care Unit. Nursing Research, 42, 148-152.

I agree to the above conditions for using the PSS:NICU.

Name: Lisa Smithgall  
Address: 7 Blackberry Court  
Johnson City, TN 37604  
Phone Number: 423-282-5977  
E-mail address: zlms13@goldmail.etsu.edu  
Institution: East Tennessee State University  
Title of Research Project: Perceptions of Maternal Stress and High Risk Neonatal Patient  
Outcomes in a Single Private Room Versus Open Room NICU

Signature  Date 1-25-10

Please keep a copy in your files before mailing. For students, signing this form and mailing it to me should serve as permission to use this tool for your research report, thesis or dissertation.

## VITA

LISA M. SMITHGALL

- Personal Data: Date of Birth: January 30, 1963  
Place of Birth: York, Pennsylvania  
Marital Status: Married
- Education: Bachelor of Science in Nursing, Bloomsburg University of Pennsylvania, Bloomsburg, Pennsylvania 1983  
Master of Science in Nursing, University of Tennessee, Knoxville, Tennessee 1995  
Doctor of Philosophy in Nursing, East Tennessee State University, Johnson City, Tennessee 2010
- Professional Experience: Staff Nurse, Neonatal Intensive Care Unit, Harrisburg Hospital, Harrisburg, Pennsylvania 1983-1987  
Clinical Manager, Neonatal Intensive Care Unit, Harrisburg Hospital, Harrisburg, Pennsylvania 1987-1992  
Clinical Manager, Neonatal Intensive Care Unit, Johnson City Medical Center, Johnson City, Tennessee 1992-1996  
Director, Women's and Children's Strategic Service Unit, Johnson City Medical Center, Johnson City, Tennessee 1996-2000  
Director, Women's and Children's Health, Lancaster General Hospital, Lancaster, Pennsylvania 2000  
Director, Women's and Children's Strategic Service Unit, Mountain States Health Alliance, Johnson City, Tennessee 2000-2002  
Executive Director, Women's and Children's Strategic Service Unit, Mountain States Health Alliance, Johnson City, Tennessee 2003-2004  
Assistant Vice President, Women's and Children's Strategic Service Unit, Mountain States Health Alliance, Johnson City, Tennessee, 2004-2005  
Vice President, Women's and Children's Strategic Service Unit, Mountain States Health Alliance, Johnson City, Tennessee, 2005-2010  
Vice President, Women's Strategic Service Unit, Mountain States Health Alliance, Johnson City, Tennessee, 2010 – Present
- Certifications: NCC Certification – Neonatal Intensive Care Nurse  
American Nurses Credentialing Center –Nurse Executive, Advanced (NEA-BC)  
Certified Pediatric Nurse Practitioner – National Certification Board of Pediatric Nurse Practitioners and Nurses (NCBPNP/N)

Professional Membership: American Organization of Nurse Executives (AONE) – Member  
Association of Women’s Health, Obstetric and Neonatal Nurses (AWHONN) – Member  
East Tennessee State University, College of Nursing, Community Advisory Board Member – 2005 – Present  
East Tennessee State University, College of Nursing, Curriculum Committee Member – 2008 - Present  
National Association of Neonatal Nurses (NANN) – Member  
Northeast Tennessee Association of Women’s Health, Obstetric and Neonatal Nurses – Chairman, 2005, 2006  
Sigma Theta Tau International, Honor Society of Nursing, Epsilon Sigma Chapter – Member  
Susquehanna Valley Association of Neonatal Nurses – President 1991, 1992  
Tennessee Hospital Association – Board of Directors, At Large Member – December 2006 – December 2009  
Tennessee Organization of Nurse Executives (TONE) – Member

Presentations: Poster Presentation – Association of Women’s Health, Obstetric and Neonatal Nurses, Innovate Lead Care 2006 AWHONN Convention – “Promoting Optimal Patient-Centered Care for the Newborn and Family in a High Risk LDRPN” – June 2006  
Presentation - Association of Women’s Health, Obstetric and Neonatal Nurses, Inspired to Excellence 2007 AWHONN Convention – “Heartbeat of a Family, Caring for a Woman’s Heart: A Heart Disease Program for Women” – June 2007  
Presentation – MSHA Research Council and ETSU College of Nursing Research Conference – “Infant Glucose Monitoring Frequency” – June 12, 2008  
Presentation – MSHA Research Council and ETSU College of Nursing Research, CSI (Clinical Scene Investigation) – “Assessment of Hypoglycemia in Newborns in Transition” – June 11, 2009  
Presentation – NACHRI, 2010 Creating Connections Conference – “Good Design Aids in Securing Gifts” – March 11, 2010  
Presentation – Association of Women’s Health, Obstetric and Neonatal Nurses, 2010 AWHONN Convention “Assessment for Hypoglycemia in Newborns During Transition: A Retrospective Study” – September 27, 2010  
Poster Presentation – Tennessee Hospital Association, 2010 Annual Meeting Leadership Summit, “Assessment for Hypoglycemia in Newborns During Transition in Southern Appalachia” – October 5, 2010

- Honors and Awards:
- Nightingale Awards of Pennsylvania – Finalist, Clinical Practice – Professional Nurse – October 1992
  - Betsy Brogan Award – Presented by JCMC to recognize a nursing leader pursuing graduate education – May 1995
  - Honoree – Honorarium for Women in Industry – Sponsored by Altrusa International, Inc. of Kingsport (TN) – May 1997
  - Nightingale Leadership Award – North East Tennessee Organization of Nurse Executives (NETONE) – 2007
  - Tribute to Women Award – Business – YWCA, Bristol (TN) – April 2009
  - Health Care Hero Award - The Business Journal, Tennessee/Virginia – September 2009
  - “E” Award for Economic Excellence and Equality, The Women’s Economic Council Foundation – October 2009
  - Meritorious Service Award for Executive Staff, Tennessee Hospital Association – October 2010
- Research Activities:
- Research Project “Temperature Regulation in Neonates Following Birth” – April 1994
  - Research Project “Rooming In and the Transition to Home Care from the Neonatal Intensive Care Unit” – Summer 1995
  - “Functional Status During Pregnancy and the Postpartum” – 2005 – Principal Investigator
  - “Assessment for Hypoglycemia in Newborns in Transition – 2007 to 2010 – Principal Investigator
  - “Perceptions of Maternal Stress and Neonatal Patient Outcomes in a Single Private Room Versus Open Room Neonatal Intensive Care Unit Environment” – 2010 – Principal Investigator, Dissertation Research
- Grants:
- East Tennessee State University Graduate Student Research Grant Award - received March 2010
  - Epsilon Sigma Chapter, Sigma Theta Tau Research Grant – received October 2010