The effects of position change on behavioral and physiological states in preterm infants

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FINAL APPROVAL OF SCHOLARLY PROJECT
Master of Science in Nursing

The Effects of Position Change on Behavioral and Physiological States in Preterm Infants

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In partial fulfillment of the requirements for the degree of
Master of Science in Nursing

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Date of Presentation: April 22, 2004
Date of Approval: 4-29-04
The Effects of Position Change on Behavioral and
Physiological States in Preterm Infants

2004

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DEDICATION

This work is dedicated to my husband, Jamie A. Gill, who has encouraged me, taught me to believe in myself, and impelled me to know that I could accomplish this with perseverance, hard work and to never give up know matter what. I would like to thank all the members of Emmanuel United Methodist Church who understood all the missed meetings and worship services and helped my family and myself while I finished this work and had the wisdom and understanding to be so compassionate with me.
## TABLE OF CONTENTS

Dedication.................................................................................................................................. ii

Table of Contents................................................................................................................ iv

List of Figures and Tables..................................................................................................... iv

Chapter I  Introduction........................................................................................................ 1

Chapter II  Literature ......................................................................................................... 10

Chapter III  Method ............................................................................................................. 26

Chapter IV  Results.............................................................................................................. 36

Chapter V  Discussion ......................................................................................................... 45

References............................................................................................................................ 54

Appendix A............................................................................................................................. 59

Abstract................................................................................................................................. 61
LIST OF FIGURES AND TABLES

Figure 1  Schematic Map Showing Relationships Between Concepts and Variables .........................................................................................................................13

Figure 2  Histogram and Frequencies for PIPP for Groups A & B ..............................................41

Table 1  Demographic Characteristics of the Sample.................................................................37

Table 2  Two-Minute PIPP Score following reposition...............................................................39

Table 3  Two minute PIPP scores for groups A & B.................................................................40

Table 4  t Test for equality of means for PIPP scores Group A & B........................................40

Table 5  One-way ANOVA of PIPP scores for Group A Gender .............................................42

Table 5a Descriptive Group Statistics..........................................................................................42

Table 6  One-way ANOVA of PIPP2 scores for Group B Gender.............................................43

Table 6a Descriptive Group Statistics..........................................................................................43
CHAPTER I

Introduction

Touch is an inevitable part of the preterm infant’s care after the birth experience in the Neonatal Intensive Care Unit (NICU). The advances in technology have enabled more preterm infants to survive their birth. Premature infants are inadequately prepared at birth to endure the demands placed on them. The need to touch and position preterm infants occurs frequently in the care of these tiny, fragile infants. What is touch? Some have defined touch as: a part of the body, particularly the hand or fingers, as it encounters another entity. The repositioning of preterm infants is a form of touch that has shown both physiological and behavioral effects. Preterm infants expend energy in coping with stress. Because of the additional energy required, preterm infants need to conserve as much energy as possible in order for them to grow and develop.

Preterm infants experience both painful and non-painful care giving procedures in the NICU, which is a very stressful environment. The addition of nursing interventions such as touching, positioning, and position change is stressful further depleting the energy sources of these fragile, small infants. The positive outcome of the care-giving procedures is to mobilize and maximize the resources that allow preterm infants to cope with stress. Coping is key for the survival of these infants. Minimizing the amount of energy expenditure will enable the infant to have enough resources for normal growth, development, and, coping. Nursing care for preterm infants needs to accommodate the physiological differences due to the younger gestational age of birth. These preterm
infants have poorly developed organ systems that must continue to develop, mature and adapt to an environment that is filled with stress. In addition, they have to learn to cope with gravity, temperature regulation, changes in heart rate and respiration and eating.

This chapter includes a statement of the problem, the theoretical framework, the statement of purpose, the research questions, and the definition of terms, which include both conceptual and operational definitions for this study. The significance, assumptions, and limitations will be discussed as they apply to this study.

Statement of Problem

Many care-giving procedures in the critical care setting result in fatigue, stress and deleterious physical, and/or behavioral responses. Health care professionals need to be aware of the cues preterm infants generate in order to respond effectively.

The preterm infant’s response to touch and position involves both physiological and behavioral components. Handling (positioning) and touch are two of the most commonly used care giving procedures used in the NICU (Kean, 1999; Peters, 1992; Harrison, Leeper & Yoon, 1990; Harrison, Olivet, Cunningham, Bodin & Hicks, 1996; Harrison, Williams, Berbaum, Stem & Leeper, 2000; Harrison, Williams, Leeper, Stem & Wang, 2000; Gorski, Huntington, Lewkowicz, 1990; Evans, Vogelpohl, Bourguignon & Morcott, 1997; Zahr, 1998). Touch can be soothing and calming, or painful and disruptive. Numerous factors influence the infant’s response to touch and positioning. Touch and position change in preterm infants can be very disruptive and cause responses which deplete infant energy reserves.
Multiple studies have shown that infants respond differently to various caregiving procedures (Norris, Campbell & Brenket, 1982; Chang, Lin & Anderson, 2002; Kean, 1998; Evans et al., 1997). The length of stay in the hospital is dependent upon many factors for preterm infants for example, gestational age, health, and immature organ systems. Many preterm infants are exposed to a marked increase in a seemingly chaotic introduction of stressors in the NICU, such as noise, lights, and a constant bombardment of nursing procedures. The effects of nursing care procedures (e.g., touch and position change) on preterm infants need to be evaluated, and the variables influencing the infant’s responses to these procedures need to be determined. Few studies have examined the effects of position changing preterm infants. Norris et al., (1982) looked at repositioning, heel stick, and suctioning. Harrison et al., 1990; Harrison et al., 1996; Harrison et al., 2000; Harrison et al., 2000 only studied gentle human touch in regards to preterm infants. Kean, (1999) looked at the effects of both touch and handling on preterm infants.

Statement of the Purpose

The purpose of this study was to determine if position change in preterm infants 28-33 weeks gestational age (GA) results in changes in behavioral and physiological states as measured by the Premature Infant Pain Profile (PIPP) scores.

Theoretical Framework

The Roy Adaptation Model (RAM) of nursing (Roy & Andrews 1999) was chosen as the theory to guide this study. Roy’s Model focuses on the idea that nursing knowledge is based on an understanding of persons adapting within their environments.
Adaptation is the underlying principle that links the four metaparadigm concepts: person, health, environment, and nursing. The person has the ability to adjust effectively to changes in the environment. According to Roy and Andrews (1999), coping mechanisms assist the person in adapting to environmental changes. Coping mechanisms can be innate, regulator: genetically determined and automatically processed or acquired, cognator: a deliberate, learned response (Andrews & Roy, 1996). Adaptation is seen as a positive response to a stimulus, while negative response is viewed as ineffective. The goal of nursing is to promote positive and effective adaptation (Roy & Andrews, 1999).

Preterm infants are not physiologically or developmentally ready for life outside the protective environment of the mother’s womb. Their response to stimuli is often immature and disorganized, rather than adaptive. This study examines actual stressors the preterm infants responses to position change on the behavioral and physiological effects on preterm infants.

Research Questions

- What is the effect of position change on preterm infants’ behavioral and physiological states as measured by the Premature Infant Pain Profile (PIPP) score?

- Is there a difference in PIPP scores between infants of different Gestational ages (GA)?

- What is the difference in PIPP scores between genders?
Definition of Terms

The following terms are defined for the purpose of this study:

Terms

*Conceptual definitions*

- Position change - verb; is a focal stimulus, the preterm is moved by the nurse. Roy talks about manipulating the environment of the adaptive system.
- Preterm - adjective; an adaptive system that appears before the expected time of a full-term pregnancy.

*Operational Definitions*

- Position change (reposition) - the caregiver moving any part or all of the infant’s body to a different position. Examples of position changing include supine, prone, side lying, or arms and or legs moved.

Physiological States

*Conceptual definitions*

- Heart rate- (HR) defined by Roy is a physiologic adaptive mode. The number of ventricular contractions (heartbeats) per unit of time, usually expressed as beats per minute.
• Oxygen Saturation is the percentage of the amount of oxygen in the arterial blood environment bound to hemoglobin.

*Operational definitions*

• HR - the number the heart beats per minute (bpm) recorded on the computer for each care giving activity.

• Oxygenation/Oxygen Saturation - the amount of oxygen in the blood, measured by a pulse oximeter as a percentage. Oxygen saturation as recorded on the computer for each care giving activity.

Both HR and SpO₂ were monitored via Nelcor cardiac monitors and pulse oximetry in the NICU and recorded.

Behavioral States

*Conceptual definitions*

Infant behavioral states make up a cluster of behaviors that consist of arousal level, motor activity (body movement), and crying. For the purpose of this study, motor activity and crying will be defined.

• Motor Activity - The quality or state of being active, functioning, and/or moving versus being inactive (The American Heritage Dictionary 3rd edition (1996)).

*Operational Definitions*

• Motor activity - observable physical movement that involves any part of the preterm infant’s body. Motor activity for this study included eye
squeeze, nasal label furrow and brow bulge as measured by the PIPP score.

All infants were recorded via VHS videotape and each time the preterm infant had a behavioral state change, the change was coded and put into the computer database that will be used for this secondary analysis.

Significance

The study of preterm infant response to position change is clinically significant in caring for preterm infants in the NICU. Prolonged desaturation, bradycardia, tachycardia, and difficulty with behavioral state changes create demands on limited energy reserves that are needed for growth and healing. In attempting to cope with the stress, the preterm infant uses a lot of energy. The excessive energy used by the preterm infant to cope with stress frequently depletes the energy stores used for tissue repair, growth and development. This use of energy often contributes to the increased morbidity and mortality of the preterm infant. Depleted or low energy stores can lead to complications and prolong a stay in the NICU for the infant, which is costly both to the parents and to the health care system.

Nursing needs to take the initiative in understanding preterm infants’ responses to care giving. Careful assessment of behavioral and physiological cues given by the preterm infant before, during, and after touch and repositioning can eliminate future complications such as intraventricular hemorrhage, hypoxemia, bradycardia, tachycardia,
and facilitate growth and development (Jay, 1982; Evans, 1991; Norris, Campbell, & Brenkert, 1981; Peters, 1992; Harrison et al., 2000). Health Care Providers need to be aware of long-term consequences of preterm infants’ negative responses to touch, position, and other aspects of care giving and the effects responses have on the preterm infant.

Assumptions

In this study, the following assumptions were made. Certain handling and stroking interventions can cause excessive stimulation to the preterm infants, which are stressful. Some care giving interventions are stressful to the infant. Pain is a form of stress to the preterm infant. Touch is an unavoidable part of repositioning. For this study, it was assumed that preterm infants communicate through physiological and behavioral responses.

Limitations

There are several limitations, which exist for this study. Interpretation of behavioral states in preterm infants cannot be 100% objective. In measuring behavioral states subjectively, each researcher will add bias due to inter-rater reliability differences. Interrater reliability for the original study was greater than 85%.

- The sample size was small and thus will be a limitation of this study. Using a small sample size limited the extent one was able to generalize findings from the study to a population.
Theoretical limitations include the lack of a clear definition of ineffective adaptation. For example, how does one measure ineffective adaptation in a preterm infant by their behavioral and physiologic responses? Additionally, are those responses always unhealthy? It is widely known that some stress is good for people but the preterm infant literature reports that too much stress can cause unhealthy complications. (McCarthy, McCue & Walker, 1997; Evans, Vogelpohl, Bourguignon, & Morcott, 1997; Norris, Campbell & Brenkert, 1981; Zahr & Balian, 1995).

Summary

In summary, many of the life saving interventions the NICU staff perform on preterm infants cause the infant to become stressed. The infants’ limited coping mechanisms can contribute to added stress. Health care providers need to be acutely aware of the responses and signals that preterm infants send. Nurses have a responsibility to do no harm to their patients and with proper assessment and care of the preterm infants this objective can be met. This chapter included a statement of the purpose, purpose for this study, definitions of terms used, significance of the study, assumptions and limitations.
CHAPTER II

Literature

This chapter presents the theoretical framework used to guide this study and the review of relevant literature related to the physiological and behavioral effects of touch and position. The relevant concepts of the Roy Adaptation Model are explored first because it is the theoretical framework guiding this study. The remainder of the chapter includes the literature review on touch and position and the effects both have on preterm infants. Included in the literature review is information on the negative effects of touch, pain, to support the research needed on touch and position.

*Nursing Theoretical Framework*

The Roy Adaptation Model (RAM) (Roy & Andrews, 1999) is useful to conceptualize the physiological and behavioral effects of touch and position. The RAM uses a system theory approach with the persons, adaptive systems coping as the focus of adaptation (Roy & Andrews, 1999). Adaptation is the key concept that links together the four metaparadigm concepts: person, health, environment and nursing. Persons’ adaptation level is a function of the interaction between the person’s adaptation mechanisms and the environment. Stimuli from within the person and stimuli from around the person represent the element of environment. Nursing interventions are directed towards manipulation of the environment. Roy defines the goal of nursing as the promotion of adaptive responses in relation to the four adaptive modes. Adaptive responses are those that positively affect the health of the person (George, 1995).
Stimuli into the system are divided into three classifications: focal stimuli (immediate), contextual (contributing factors), and residual (unknown factors). Inputs of stimuli and the persons coping mechanism along with outputs of behavioral and physiological response affect the adaptation level, serve as feedback helping the person cope, and adapt to the input.

Output in the form of adaptation is the responses of a person to the input of stimuli. The responses are both internal and external and can be observed, measured, and subjectively reported. The output responses serve as a feedback to the adaptive system. The output responses and coping mechanisms along with the three types of input, assists to impact the person’s adaptation level and adaptive response. The responses are either adaptive or ineffective. Adaptative responses, according to Roy and Andrews (1999), advance wholeness of the person in terms of growth and survival; whereas ineffective responses do not.

The coping processes assist persons in adapting to the incoming stimuli. The regulator coping mechanism can be innate (inherited or genetic) where a person does not have to think about innate responses. The regulator subsystem responds automically though neural, chemical and endocrine coping processes. The cognator is an acquired coping mechanism and is a learned response. The cognator subsystem responds through cognitive-emotional channels: learning, judgment, coding, memory, and emotion.

The adaptation level of the person is influenced by the individual’s development and use of the coping mechanisms. Use of these skills increases the level of adaptation
and allows the person to respond more positively to a wide variety of stimuli. Coping mechanisms cannot be observed. Only by observing the responses that are produced can the researcher know that coping is taking place.

In this study, RAM was used as heuristic guide to show the effects that position change have on preterm infants (i.e., Figure 1). In the NICU, the preterm infant was conceptualized as an adaptive system that can adapt to incoming stimuli. The focal stimuli in this study were position changes of the preterm infant by the nursing staff. The contextual stimuli are all the other stimuli present such as the lights, noise, gestational age, equipment, and the health of the infant. The residual stimuli are unknown. The regulator subsystem in preterm infants is not well developed due to the preterm birth. The outputs of the adaptive system are the physiological and behavioral responses of the preterm infant. The focus of this study is on the physiological and behavioral states, as measured by the Premature infant Pain Profile (PIPP) scores, in response to position change.

Review of Research

The purpose of this study is to provide a description of the effects of position change and the outcome repositioning has on preterm infants. Eighteen research articles from the quantitative paradigm dealing with touch, position, and caregiving in preterm infants are reviewed utilizing comparison and contrast in order to provide support and background on the effects of position change on the preterm infant. Touch is an inevitable part of the repositioning and care preterm infants receive; therefore, touch with regards to caregiving is included in the literature review. The studies were examined for
integrity in sampling and methods, significant findings, and implications for care of the preterm infant. Idiosyncrasies of the studies were reported, where relevant.

*Theoretical Design*

Figure 1. Original design from Andrews & Roy, 1996, adapted by Lisa Gill to show the schematic design of the theory on the effects of position change on preterm infants.
Research regarding preterm infants’ responses to position change is limited. One reason for this is due to the medical fragility of preterm infants. Most of the research on preterm infants is done on stable preterm infants because little is known about the medically fragile preterm infant.

Konishi, Takaya, Kimura, Konishi, Fujii, Saito & Sudo (1994) studied low risk preterm infants between 31-39 weeks gestational age (GA). The purpose of the study was to determine whether preterm infants show similar predominate asymmetry towards the right side in the supine and prone positions in the postnatal. The infants were observed beginning one or two weeks post birth, 10 infants were observed longitudinally until the achieved 40 weeks GA. Five infants were placed supine, five were placed prone, and after one hour, all infants were repositioned. The infants were naked and free to move. No nursing interventions were done during the time of observation. The design and instrumentation used were not specified. The results of the research showed that low risk preterm infants have no clearly dominant preferred posture and there was no correlation between posture and GA. The authors did note that few studies have been completed on longitudinal prone positions and that further studies would be needed. Before nurses implement any care giving and positioning an individual assessment of the infant needs to be analyzed.

In a similar study Dimitriou, Greenough, Pink, McGhee, Hickey & Rafferty (2002) examined the effect of posture on oxygenation and respiratory muscle strength in convalescent infants. The purpose was to determine if differences in respiratory muscle
strength could explain any posture related effects on oxygenation. Twenty infants, median GA 34.5, were examined in three postures: supine, supine with head up tilt 45°, and prone. The results were that oxygenation was higher in the prone and supine with head tilt. The conclusion was that superior oxygenation in the prone posture in convalescent infants was not explained by greater respiratory muscle strength, as this was superior in the supine posture.

In contrast, Chang, Anderson, Dowling, and Lin (2002) compared the effects of prone and supine positions on physiological and behavioral states in 28 ventilated preterm infants 25-36 GA using a crossover design. Each infant was placed supine or prone for 2 hours, followed by the other position for two additional hours in a consecutive period. Infants were randomly assigned to starting position. Minimal care interventions were given and no changes in equipment settings were done. The infant was monitored after a 10-minute stabilization period after each position change. The oxygen saturation $\text{SaO}_2$ was measured with pulse oximetry continually. Motor activity was measured with the Woodson and Hamilton’s motor activity scale (MAS) for 30 seconds every five minutes. A desaturation episode was defined as a $\text{SaO}_2$ less than 90% and lasting longer than 20 seconds. The results of the study were that preterm infants had significantly higher mean $\text{SaO}_2$ when prone compared with supine, 96.5% versus 95.7%, $p= .003$. Desaturation occurred in 14 of the 28 infants; 14 experienced desaturation in supine position compared with five of them in the prone position. This study compared the effects of supine and prone positions on $\text{SaO}_2$, and found that prone position resulted
in decreased motor activity and may be able to stabilize $\text{SaO}_2$ for ventilated preterm infants.

In comparison, Chang, Anderson, and Lin (2002) studied the effects of prone and supine positions and their relationship to sleep states and stress responses in ventilated preterm infants. The researchers used the Anderson behavioral state scoring system and observation of infant stress signs to evaluate behavioral states. The same sample and methods as in the previous study by Chang et al. (2002a) were used. The researchers looked at how position played a role in aiding the infants in environmental stress, behavioral state, and sleep state. The results of the study found that prone compared with supine infants had a) less crying, less active sleep, and more quiet sleep states, and (b) fewer stress responses of startle, tremor, and twitch. The implications of the two studies tend to favor the prone position for preterm infants versus the supine position. Certain limitations of these studies may have affected the results. Noise and light levels were not controlled. The prone position was only examined for a short period, less than two hours. In addition, the sample was small, and the GA of the infants was widespread. Before nurses implement any of the interventions of these studies on position, a thorough assessment of the preterm infants response needs to be considered. Therefore, more studies on the effect of position are needed.

Caregiving and interventions

Observations in the NICU have generated some concern that a number of routine care giving procedures may be more harmful then beneficial to preterm infants. A number of studies have identified neonatal environmental stressors such as repositioning,
suctioning, feeding, diaper changing handling (Evans, 1991; Kean, 1999; Norris, Campbell, & Brenkert, 1981). Norris et al., (1981) evaluated the effects of three standardized routine nursing procedures (suctioning, repositioning, heel stick) on SaO\(_2\) levels in 25 preterm infants (26-35 GA). All infants were diagnosed as having respiratory distress syndrome and received respiratory assistance. The infants were monitored and observed for oxygen saturation before, during and after the procedures.

Endotracheal suctioning resulted in the greatest decrease in SaO\(_2\) with a mean recovery time of 4.4 minutes. For repositioning and heel stick mean recovery times were 4.9 minutes and 3.6 minutes respectively. Six out of 25 infants failed to recover to pre procedure SaO\(_2\) values after repositioning during the 9-minute recovery observation time.

The results were surprising that mean recovery time for repositioning was longer than for suctioning. Some possible explanations could be positional placement of the infant. Prone position has been associated with higher SaO\(_2\) levels.

In a study similar to that of Norris et al. (1981), Evans (1991) in an experimental design study showed that there was an incidence of hypoxemia associated with care giving procedures in some preterm infants. Evans defined hypoxemia as inadequate blood oxygenation tension less than 50 mmHg. Evans studied 13 preterm infants, seven 30-33 GA and six under 30 GA for the first 72 hours of life, for the purpose of determining if care-giving activities lead to hypoxemia. Suctioning, repositioning, and taking blood for gas analysis were the most frequent activities. The mean duration of hypoxemia was 6.8 minutes per episode. The infants were monitored with transcutaneous oxygen monitors and HR monitors to record the data. The Anderson State/ Activity scale was used to code
the activity levels from 1-12. Although the results of this study have to be treated with caution because not all infants received the same care-giving procedures, the duration of hypoxemia and magnitude of decrease in SaO$_2$ plus the effects of the care giving procedures create a real threat to preterm infants well being. Caregivers need to be alert in the signals that preterm infants may be giving. Caregivers can then alter the care if needed, to better care for preterm infants.

Kean (1999) examined the effects on oxygen saturation levels of handling premature infants based on the Kinaesthetic infant handling (KIH) concept, which is based on social tracking theory. Additionally, Gorski, Huntington, & Lewkowicz, (1990) examined handling preterm infants and timing of the stimulating. Both studies findings were limited due to very small sample sizes, 7 and 18, respectively. The researchers studied stable preterm infants. Gorski et al. (1990) found that there were periods of braycardia, but the instances of the braycardia did not appear to be preceded by the touch. One reason for this could have been that other interventions were taking place during the timing of the touch. Kean also found a decrease in the SaO$_2$ during routine interventions, mostly due to removal of the oxygen source, while no association was seen with infants handled in the KIH concept.

The most immature infants require the most aggressive care and frequent interventions necessitating handling and manipulation. The NICU environment is quite different from the maternal environment to which preterm infants are exposed to before birth (Ludington, 1990; Peters, 1992; Zahr, 1998).
Peters in (1992) did a quasi-experimental comparison study on routine nursing care of the physiologic status of 10 premature infants with respiratory distress syndrome (RDS). Change in position was predominantly from lateral to prone. None of the procedures resulted in bradycardia, 38.1% resulted in hypoxia, and 52.4% caused significant desaturation. The results were similar to those previously reported in the literature. Despite the introduction of many forms of continuous, noninvasive monitoring to assist in supporting the care needs and stability of the preterm infant with RDS, this study demonstrates that modern neonatal care continues to be associated with frequent periods of hypoxia associated with routine care.

*Touch, physiologic and behavioral states*

Touch can be calming and comforting for infants or painful and invasive. In the literature, several studies document the importance of touch (Harrison, Leeper, and Yoon, 1990; Nelson, Heitman, Jennings, 1984; Harrison, Olivet, Cunningham, Bodin, Hicks, 1996; Oehler, 1985) in bonding, coping, and overall health and well being of the preterm infant. Harrison, Leeper, and Yoon (1990) evaluated the effects of early parent touch on physiological effects (SaO₂ and HR) of 36 preterm infants 27-33 GA. Observation and descriptive exploratory design was used to answer the question. Corometric cardiac monitors and Nelcor pulse oximeters monitored the infants. The results varied widely with SaO₂ up approximately 45% from baseline and down about 19% from baseline likewise with HR as high as 43% from baseline and as low as 17% from baseline.

One type of tactile stimulation that may have a relaxing effect on preterm infants is gentle human touch (without stroking or massage). There have been studies of gentle
human touch (GHT) in preterm infants in which physiological and behavioral responses have been used to assess these infants. Four studies were found that examined the effects of a gentle human touch. (Harrison, Olivet, Cunningham, Bodin, Hicks, 1996; Moercin-McCarthy, 1992; Jay, 1982; Harrison, et al., 2000). These studies looked at more than one variable, involving GHT.

Jay (1982) provided gentle human touch to 13 preterm infants by placing one hand on the infant’s head and the other on the infant’s abdomen for 12 minutes, four times a day, for 10 days. Compared to a matched control group, the experimental group infants required less supplemental oxygen and had higher hematocrits. Jay reported that the data on SaO_2 results were often missing, thus comparison of both groups was variable. Two infants had measurable SaO_2; initially the SaO_2 decreased but then rose 10-30% after the touch had been maintained for 2 minutes. This finding suggests that preterm infants may respond more favorably to touch that is sustained rather than intermittent. The limitation to this study was the sample size was small and one cannot generalize the finding to a population.

Harrison, et al., (1996), evaluated the effects of GHT for 15 minutes a day to 30 preterm infants 26-32 GA from 7-12 days of life. The touch involved placing one hand across the infant’s head and the other hand across the infant’s arm. The researchers used the Nelcor and Corametric monitors to assess SaO_2 and HR. The behavioral states were assessed using the Brazelton neonatal assessment scale (BNAS) and coded according to the behavioral coding system by Scafidi et al., (1990). The findings suggest that GHT had
no adverse effects on the physiological state $\text{SaO}_2$ and HR. GHT was found to have soothing effects on behavioral states, for example, decreasing active sleep, motor activity, and behavioral distress. Therefore, these findings can provide NICU nurses with a basis for guiding parents in their interactions with the preterm infant. In a similar study, Moercin- McCarthy (1992) evaluated the effects of GHT intervention provided daily for 20 minutes for 10 days to 10 preterm infants 27-32 GA. The type of touch was similar to the touch provided by Harrison et al. (1996). The instruments used were the Nelcor pulse oximeter and Kontron supermon heart monitors, and direct observation on behavioral states. The results of the study were similar to that of Harrison et al. (1996), in both the physiologic and behavioral states. Similar implications could be made from this study as the Harrison et al. (1996), in that nurses in the NICU can follow these findings as a basis to aid the caregivers in touch for the preterm infants.

In a more recent study, Harrison, Williams, Berbaum, Stem, and Leeper (2000) studied 84 preterm infants (27-33 GA), 42 of those infants received the GHT intervention. The purpose of the study was to evaluate the physiologic and behavioral effects of GHT intervention. The design method used was interrupted time series; the touch was to be given for 10 minutes three times a day for 10 days. Harrison, et al., (2000) used similar instruments as in the previously discussed studies by Harrison and colleagues, and the results were comparable. No significant difference was seen in mean HR or $\text{SaO}_2$ before, during, or after the GHT. Significantly, lower levels of active sleep, motor activity, and behavioral distress were noted during the GHT intervention. Significantly, there were no differences in GHT group and control group in weight gain,
morbidity status, or behavioral organization. Findings suggest that GHT is safe and soothing for nurses or caregivers to perform on young preterm infants, but continued monitoring is needed.

In another study, Harrison, Williams, Leeper, Stem, and Wang (2000) looked at factors related to vagal tone (Vna) among preterm infants receiving GHT. The purpose of the study was to examine factors related to Vna using the secondary analysis from the above study by Harrison et al. in the previous paragraph. Harrison used coding by Scafidi et al., (1990) to measure motor activity and Nelcor and Corametric monitors for $\text{SaO}_2$ and HR. The results showed significant positive correlation between GA and Vna, leading support to the theory used in the study. The results showed no difference in morbidity scores, weight gain, or behavioral organization in infants with any level of Vna. The results suggest preterm infants may be more vulnerable to stress and not neuro-developmental outcomes. A limitation the authors found was that maybe the measures used were not sensitive indicators and that the results maybe too varied. Before implementing any finding from the study, more research should be completed.

The findings of earlier studies such as Jay (1982) and Oehler (1985) on touch of preterm infants are in contrast to the previously discussed studies. In three of the earlier studies on touch of the preterm infants, the studies found that touch needs to be considered carefully. Oehler in (1985) studied a small convenient sample of 15 preterm infants 26-30 GA and their responses to tactile stimulation. In this descriptive, quasi-experimental design, the study utilized the sickness index scale and head circumference
(growth). The review of literature in this study had only a very limited number of studies that looked at the behavioral response to tactile stimulation in preterm infants at this time. Results of the study found that well infants had more positive behaviors, for example smiles and hand-to-mouth activity, than did their moderately ill group of preterm infants. In comparison, Nelson, Heitman, Jennings, (1986) studied 30 preterm infants, weighing 1,300-2,500 gm, with respect to tactile stimulation and weight gain. In this experimental study, no specifics were given on what instruments were used to measure the effects of the tactile stimulation. The results of the stimulation on growth showed no significant difference.

Present studies lead the way in showing that preterm infants need human touch (Harrison et al. 1990, 2000; Harrison et al.1990; Modrcin-McCarthy 1992). Findings for the gentle human touch studies suggest that this type of intervention has immediate soothing/relaxing effects on preterm infants. These studied showed that tactile stimulation was needed and necessary for healthy mental and physical development of infants.

*Non-painful procedures*

A study by Beaver (1987) examined whether a simple noninvasive technique such as stroking would decrease the pain response in eight preterm infants 32-34 GA. Behavioral and physiological responses were used to assess the preterm infant response to touch and pain. The researcher did not use statistical procedures due to the small sample size, and did generalize the results to indicate that stroking during the painful
stimulus was more unpleasant than either the touch alone or the painful stimulus alone.
The findings from this study have several implications for caregiving. The findings suggest that preterm infants do in fact experience pain. This conclusion is supported by an increase in both the HR and blood pressure and decrease in SaO₂ level. In fact, preterm infants in the study appeared to respond to the amount, as well as the type, of stimulation. For example, the infants responded more dramatically to the double stimulus than a single stimulus alone.

Similarly, Evans, Voelpohl, Bourguigono, and Morcott, (1997) studied nine non-painful care-giving procedures, such as adding or withdrawing fluid from umbilical catheter, total position change, and administration of IV medication in 30 Low Birth Weight (LBW) infants and the effects the care giving had on these infants. The results showed that pain responses were observed following three non-painful procedures, 70% of the time pain response were observed following a position change, 34% of the time pain responses were observed after IV administration of medication and 60% of the time pain responses were observed after withdrawal of fluid from umbilical catheters. Total position change may be a painful experience for some infants. Some interventions may not be a benign as once presumed to be. Total position change and other non-painful care-giving procedures may be painful to LBW. Neonatal nurses need to be cognizant of the cues preterm infants give. The nurses who are providing the care need to assess any alterations in care needs to be done in response to the stimulation and act accordingly.
Summary

In summary, utilization of the Roy model as a conceptual framework for this research study was believed to have enhanced the project in several ways. One of the key features of the model is the belief that preterm infants have the capacity to adapt to the new environment, life outside the protection of the womb, and that this adaptive response can be mediated by nursing care.

The literature addresses the issues of touch and position and their effects on the preterm infant. The studies strongly point to a number of conclusions. For example, preterm infants have less active sleep, less motor activity when GHT interventions are given, and higher SaO₂ in the prone position. It is apparent that preterm infants behaviorally and physiologically respond to touch. The preterm infant’s response to touch depends on the type and amount given. When preterm infants are touched appropriately, the results are positive. Although touch is widely researched, researchers have only scratched the surface on studies of position associated with touch. As more studies continue, this author is confident that the importance of position and touch will be substantiated. The inference of this literature review further identifies gaps in current research that can be filled by the inquiry of this researcher, which will assist nurses to better care for the preterm infant. With the multiplicity of medical problems that besets the preterm infant, no area that can improve their health can be overlooked or ignored.
CHAPTER III

Method

The purpose of this study was to determine if position change in preterm infants 28-33 gestational age resulted in changes in behavioral and physiological states as measured by the PIPP scores. This chapter begins with an examination of the design chosen for the study. The setting for the study and the sample are described. The materials, and the means of data collection and analysis are examined. The chapter concludes with a summary of its contents.

Design

This study used a descriptive comparative design. This design was selected because the purpose of the research was to examine the phenomenon of the preterm infant’s natural behavioral and physiological response to position change and to compare the responses of preterm infants in two different GA groups. Secondary analysis of data from a larger NIH funded study Evans, Lawhorn, and Mc Cartney (1997).

Subjects

The setting for the original study (Evans et al., 1997) was a level III NICU in a large Midwestern Metropolitan Hospital. Inclusion criteria for the subjects in the original study were that the infants be (a) an appropriate size for GA, (b) less than 72 hours postnatal age at the time of entry into the study, and (c) within normal parameters for
hemoglobin, hematocrit, and body temperature at the time of entry into the study.

Exclusion criteria included infants with (a) known cardiovascular or central nervous system abnormalities, (b) evidence of sepsis, (c) major surgery, (d) documented intraventricular hemorrhage, and (e) those infants who had received medications including tranquilizers or neuromuscular blocking agents at the time of entry into the study (Evans et al., 1997). For the present study, a convenience sample of 40 infants, 20 infants between 28-30 GA and 20 infants between 31-33 GA was chosen from the group of 81 infants included in the original larger study. Additional inclusion criterion for the current study was that each infant had experienced a position change.

**Material**

Data were coded using the Premature Infant Pain Profile (PIPP) which is a 7-indicator instrument developed to assess pain in preterm infants (Stevens, Johnston, Petryshen & Taddio, 1996). The PIPP was further validated by Ballantyne, Stevens, McAllister, Dionne and Jack in 1999. The PIPP is a multidimensional tool designed to utilize the most specific and sensitive indicators of infant pain in such a way as to make it appropriate for use in both the research and clinical settings (Stevens et al., 1996).

The PIPP is a composite of behavioral, physiologic and contextual indicators (Stevens et al., 1996). The seven indicators are GA, behavioral state, HR, SA0₂, and three facial actions of brow bulge, eye squeeze and nasolabial furrow. Each indicator is scored on a 4-point scale (0, 1, 2, 3). GA is obtained from the infants’ chart. Behavioral state is determined by observing the infant for 30 seconds prior to the event. The infant might be
in an active/awake, quiet/awake, active/sleep or quiet/sleep state. The baseline heart rate and SA0\textsubscript{2} levels are obtained immediately prior to the event. During the 2 minutes following the event, the three facial actions are assessed to be present for (0) none, (1) a minimum, (2) a moderate, or (3) a maximum amount of the time. The maximum heart rate and minimum SA0\textsubscript{2} levels are also determined during this period, and the percentage by which each differs from the baseline is calculated. The scores for each of the seven indicators are then summed to arrive at the infant’s total pain score (Stevens et al., 1996).

The maximum possible pain score obtainable is dependent on the GA of the infant (Stevens et al., 1996). Preterm infants less then 28 GA may have a score as high as 21 compared to infants 36 GA or greater with a maximum score of 18. For any infant, a score of 6 or less is considered indicative of minimal or no pain, and scores of 12 or higher reflect moderate to severe pain (Stevens et al., 1996). Each indicator in the PIPP was evaluated for its sensitivity and specificity (Stevens et al., 1996). The researchers decided that for an indicator to be considered sensitive, it had to be present at minimum 50\% of the time following the stimulus. Since it is important to demonstrate that an indicator not be present in a non-painful situation, the criteria for specificity were more stringent. An indicator had to be present 80\% of the time following a stimulus, and less than 20\% of the time in a non-painful situation (Stevens et al., 1996).

The internal consistency of the PIPP was evaluated using a Cronbach’s alpha (Stevens et al., 1996). The alpha coefficients for the indicators ranged from 0.59 for behavioral state to 0.76 for the eye squeeze. These coefficients are in the moderate range.
The standardized item alpha for the six items (brow bulge, eye squeeze, heart rate, nasolabial furrow, behavioral state and oxygen saturation) was 0.71. The researchers proposed that the moderate internal consistency was acceptable and suggested that the indicators measure different aspects of the phenomenon of pain that are not highly correlated. (Stevens et al.).

Measuring construct validity of the PIPP was established by retrospectively evaluating infants of varying GA in three different pain/nonpain paradigms (Stevens et al., 1996). The first group of infants tested was 32-34 GA the PIPP accurately discriminated between a painful (heal stick) and nonpainful (handling) event. The mean total PIPP score was 12.9 (SD 3.4) for the painful situation and 6.0 (SD 2.7) for the nonpainful situation. The measure was also tested on a group of neonates 28-30 GA in a real versus sham heel stick, and these scores were statistically different. Finally, the PIPP was tested on a group of term male infants who underwent a circumcision. One group received a topical anesthetic prior to application of the Gomco clamp, and the other group received a placebo. The mean total PIPP score was 11.8 (SD 2.7) for the experimental group and 14.1 (SD 1.4) for the control group. In this situation, the PIPP was able to detect a treatment effect for the topical anesthetic (Stevens et al., 1996).

Like the Stevens et al., (1996) research, the Ballantyne et al., (1999) study further established the construct validity of the PIPP, this time the PIPP was used in a clinical setting. Neonates were scored during a baseline event (no handling or intervention), a nonpainful event (handling during diapering) and a painful event (heal stick, IV insertion
of venipuncture for blood sampling). Two nurses scored each infant at the bedside, the nurse providing care and a clinical nurse specialist with expertise in infant pain. The infants were videotaped and later scored by two raters who were blinded to which events were occurring as only the infant's face was visible on the tape. Repeated measures analysis of variance revealed a statistically significant main effect for the event. This confirmed that the PIPP was able to differentiate the painful event from the nonpainful and baseline events (Ballantyne et al., 1999).

Reliability of the PIPP is the degree to which it consistently measures the phenomenon of infant pain (Ballantyne et al., 1999). Interrater reliability was established when analysis for individual events scores yielded reliability coefficients of 0.93-0.96. Intrarater reliability coefficient analyses for individual event scores were also high at 0.94-0.98 (Ballantyne et al.).

The Premature Infant Pain Profile is a multidimensional measure for the assessment of procedural pain in preterm neonates that has established construct validity and excellent interrater and intrarater reliability. It is, therefore, an appropriate tool to assess the presence or absence of pain or nonpain in the preterm infants in this study.

Data Collection

All subjects recruited for the original study (Evans, Lawhorn & McCartney, 1997) were preterm infants admitted to a Level III NICU. Data were collected from 95 infants who met the inclusion and exclusion criteria, but technical problems resulted in the
elimination of data from 14 of the infants from the analysis. The 81 infants in the sample included 50 males and 31 females, which approximated the gender distribution in that unit. The percentage of minority representation in the sample was greater than 25%, which exceeded the rate of minority admission to that NICU. The sample was stratified into four groups according to GA: (a) Group I < 28 weeks, (b) Group II: 28 but < 31 weeks, (c) Group III: 31 but < 34 weeks, and (d) Group IV: 34 but < 37 weeks (Evans et al., 1997).

Groups II & III from the original study N=40 comprised the sample for the present study. The sample characteristics of the groups were as follows: group II: gender- male = 13 and female = 7, mean GA 29 (SD 0.8), mean birth weight 1077.5 grams (SD 254 gms), Apgar at 1 minute 6.1 with (SD 2.8) and Apgar at 5 minutes 8.3 with (SD 1.2) group III: gender- male = 11 and female = 9, mean GA 32.3 (SD 0.9), mean birth weight 1694.6 grams (SD 350 gms), Apgar at 1 minute 5.8 with (SD 2.4) and Apgar at 5 minutes 7.4 with (SD 1.7) (Evans et al., 1997).

Approval for the original study (Evans et al., 1997) was obtained from the Institutional Review Board (IRB) of Medical College of Ohio and the hospital from which the subjects were recruited. Only aggregate data were included in the findings, and no individual findings were reported. Only information that was essential to the research being done was disclosed. Confidentiality was insured by assigning a code number to each infant and by avoiding the inclusion of the names or the videotaping of the nametags of any of the staff nurses providing the care.
During the original study, (Evans et al., 1997) informed consent was obtained from the infants' parents. Prior to obtaining consent, an investigator questioned a staff nurse caring for the mother of a potential subject to assess the mother's level of alertness and ability to make an informed choice. If the mother was not prepared, the consent process was postponed until a more appropriate time. If applicable, the infant's father was included in the consent process. A consent form that explained the study in understandable level appropriate terms was read and discussed with the parent(s). If the parent(s) agreed to have their infant included in the study, the form was signed and witnessed. The parent(s) were provided with a summary of the study (Evans et al., 1997).

The infants were observed during the course of NICU procedures and care giving events that were a routine part of their nursery experience. Because of this, the study posed no additional risk for harm.

In the original study, the physiologic and behavioral data were collected using the Medical Graphics Digital Data Acquisition Chart Recorder with Synchronized Video Acquisition. This sophisticated system was designed to provide synchronized millisecond acquisition of physiologic and video information to permit later frame-by-frame analysis (Evans et al., 1997).

The physiologic data, including heart rate and oxygen saturation, were obtained via Hewlett Packard Merlin Monitor that was routinely attached to each neonate in this NICU (Evans et al., 1997). Each monitor was calibrated daily. The heart rate and SAO₂
were measured by the use of pulse oximetry. A Nellcor pulse oximeter with a peripheral probe was used to obtain continuous data. Behavioral data were collected by recording the infant’s responses using four small, high-resolution VHS video cameras at the bedside (Evans et al., 1997).

The PIPP scores were calculated in the following manner. Gestational age was obtained from each infant’s chart. Coders reviewed videotape of subjects’ behaviors along with physiologic data. Behavioral state was determined by observing the infant for 30 seconds immediately prior to the event, and the baseline heart rate and SAO₂ were recorded. The infant were observed for up to a two-minute interval following the initiation of the event.

An extraneous variable that posed a threat to the internal validity of this study was the maturation of the subjects. Each infant received different numbers of position changes and number of touches, so the potential cumulative effects of repeated events differed for each subjects. This may have influenced the findings. A threat to the external validity of the original and current studies exists because the research was conducted in a single setting with a convenience sample. This narrows the generalizability of the findings.

A limitation of the data collection was the lack of standardization for the delivery of the interventions. Different nurses performed procedures and provided care. This NICU was committed to providing developmentally sensitive care. Because these nurses were experienced in planning care based on their assessment of the infants’ cues, this limitation was reduced. Another limitation was the absence of control over the timing of
the interventions. The lack of an adequate rest period between procedures would influence the infant’s response. Again, the nurses’ expertise at planning care in a developmentally sensitive manner would reduce the effects of this limitation.

Assumptions for the data include reliable instrumentation and accurate coding for the physiologic and behavioral responses.

Data Analysis

Data were analyzed using the appropriate statistical test for each research question, descriptive statistics, student t test and ANOVA. The purpose of this study was to determine if position change in preterm infants 28-33 weeks gestational age (GA) results in changes in behavioral and physiological states as measured by the PIPP scores.

Question 1: What is the effect of position change on preterm infants’ behavioral and physiological states as measured by the PIPP score?

Question 2: Is there a difference in PIPP scores between infants of different GA?

Question 3: Is there a difference in PIPP scores between genders?

To answer these questions, the data were analyzed using a simple t test and ANOVA. The level of significance was set at .05.
To utilize a simple t test and ANOVA the following assumptions were met: (a) the population from which the samples are drawn have normal distributions (b) the dependent variable was measured at the interval level, (c) the two samples had equal variance, and (d) the observations within each sample were independent (Burns & Grove, 2001).

**Summary**

This chapter contained a discussion of the descriptive comparative design of this research involving the secondary analysis of a larger study on the pain response of preterm infants. The subjects involved and the criteria for their selection were described. The instrumentation used to measure the pain response, the Premature Infant Pain Profile, was examined and its reliability and validity scrutinized. Methods for the data collection and the means for insuring the protection of human subjects were explained. The chapter concludes with a description of the methods to be used to analyze the data in the study.
CHAPTER IV

Results

This chapter includes the results of this research on the effect of position change on the behavioral and physiological states of preterm infants 28-33 GA. Beginning with a description of the sample that was studied, and a discussion of that sample’s representation to the target population. The findings of the statistical analysis as they relate to each research question were examined. The chapter concludes with a summary.

Sample

The sample consisted of 40 infants of 28 but less than 34 weeks GA (see Table 1). There were 16 females and 24 males in the group. There were seven infants born at 28 GA, six infants born at 29 GA, six at 30 weeks, five at 31 weeks, five at 32 GA, and ten at 33 weeks gestation. Of the 40 subjects, 11 were African-American, two were Hispanic, and 27 were Caucasian. The infants’ mean birth weight for group A and group B was 1077.5 grams (SD= 254gms) and 1694.6 grams (SD= 350gms), respectively. The mean APGAR at 1 minute was 6.1/ 5.8 with a standard deviation of 2.8/2.4, and the mean 5 minute APGAR was 8.3/7.4 with a standard deviation of 1.2/1.7. No clinically significant differences in APGAR scores were apparent for the two groups. The percentage of minority admissions to the NICU from which this sample was taken is approximately 19%. The goal for minority representation for the larger research study (Evans et al.,
2002) was 25%. This sample for the present study contained 32.5% minority infants, and thus contained an ample minority representation to the target population.

Table 1. Demographic Characteristics of the Sample

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational Age</td>
<td>28 weeks (7)</td>
<td>31 weeks (5)</td>
</tr>
<tr>
<td></td>
<td>29 weeks (6)</td>
<td>32 weeks (5)</td>
</tr>
<tr>
<td></td>
<td>30 weeks (7)</td>
<td>33 weeks (10)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male (13)</td>
<td>Male (11)</td>
</tr>
<tr>
<td></td>
<td>Female (7)</td>
<td>Female (9)</td>
</tr>
<tr>
<td>Ethnic Group</td>
<td>Caucasian (12)</td>
<td>Caucasian (15)</td>
</tr>
<tr>
<td></td>
<td>Hispanic (1)</td>
<td>Hispanic (1)</td>
</tr>
<tr>
<td>Mean Birth weight (SD)</td>
<td>1077.5 gms (254)</td>
<td>1694.6 gms (350)</td>
</tr>
<tr>
<td>1 minute APGAR (SD)</td>
<td>6.1 (2.8)</td>
<td>5.8 (2.4)</td>
</tr>
<tr>
<td>5 minute APGAR (SD)</td>
<td>8.3 (1.2)</td>
<td>7.4 (1.7)</td>
</tr>
</tbody>
</table>

Note. Afr = African, SD = standard deviation, gms = grams.

Findings

The findings of the study were presented in relation to the research questions.

Research Question 1: What is the effect of position change on preterm infants’
behavioral and physiological states as measured by the PIPP (premature infant pain profile) score?

Descriptive statistics were used to answer the first research question (see Table 2). Pain is a form of stress to the preterm infant. Some care giving interventions are stressful to the infant; two different care situations were considered: repositioning with and without Umbilical Veinous Catheter (UVC) in place, and repositioning with and without ET tube in place. There were different infants in each situation. The PIPP score was calculated at 2 minutes after the onset of the repositioning, that is, when the caregiver moved any part or all of the infant’s body to a different position. For the 332 position changes studied, after having the Umbilical Veinous Catheter (UVC) in place, the mean PIPP score was 7.45 (SD = 2.68). The minimum PIPP score was 1 and the maximum was 15. For the 209 position changes studied, of infants without having an UVC, the mean PIPP score was 7.52 (SD = 2.5). The minimum PIPP score was 3 and the maximum was 15. These PIPP scores were indicated of a pain response (Steven et al., 1996).

There were 238 position changes when the infants’ were intubated. The mean PIPP score was 6.94 (SD = 2.24). The minimum PIPP score was 3 and the maximum was 15. For the 103 position changes in infants not intubated, the mean PIPP score was 7.84 (SD = 2.70). The minimum PIPP score was 3 and the maximum was 15. The PIPP score for the non-intubated infants was considered a pain response while the infants that were intubated and repositioned showed no pain response.
Table 2. 2-Minute PIPP Score following reposition

<table>
<thead>
<tr>
<th>Event</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re after UVC</td>
<td>332</td>
<td>1</td>
<td>15</td>
<td>7.45</td>
<td>2.68</td>
</tr>
<tr>
<td>Re no UVC</td>
<td>209</td>
<td>3</td>
<td>15</td>
<td>7.52</td>
<td>2.55</td>
</tr>
<tr>
<td>Re with intubation</td>
<td>238</td>
<td>3</td>
<td>15</td>
<td>6.94</td>
<td>2.24</td>
</tr>
<tr>
<td>Re no intubation</td>
<td>103</td>
<td>3</td>
<td>15</td>
<td>7.84</td>
<td>2.70</td>
</tr>
</tbody>
</table>

Note. Re = repositioning; UVC = umbilical venous catheter; N = number of events; Min = minimum; Max = maximum; SD = standard deviation.

Research Question 2: Is there a difference in PIPP scores between infants of different GA?

The second research question was addressed using descriptive statistics (see Table 3) and a simple t test to further clarify the differences. The t test was analyzed and p = 0.127 (see Table 4). The infants registered a pain response after position change. The groups were compared by GA and there was no statistically significant or clinical difference in the infant scores. The 2-minute PIPP scores were examined for group A and
B respectively. For the 381 position changes for group A, the mean PIPP score was 7.25 (SD= 2.48). The minimum PIPP score was 1 and the maximum was 15. For the 263 position changes for group B, the mean PIPP score was 7.58 (SD= 2.91). The minimum PIPP score was 2 and the maximum was 17.

Table 3
Two minute PIPP scores for groups A & B

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>381</td>
<td>1</td>
<td>15</td>
<td>7.25</td>
<td>2.48</td>
</tr>
<tr>
<td>B</td>
<td>263</td>
<td>2</td>
<td>17</td>
<td>7.58</td>
<td>2.91</td>
</tr>
</tbody>
</table>

Note. N= number of events; Min = minimum; Max = maximum; SD = standard deviation.

Table 4
$t$ test for equality of means

<table>
<thead>
<tr>
<th>PIPP scores</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A &amp; B</td>
<td>-1.526</td>
<td>642</td>
<td>.127</td>
</tr>
</tbody>
</table>

Approximately 60% of the responses to position change in both group A and group B were classified as painful with a PIPP score of over seven, with 57.8% in group A and 58.6% in group B.
Research Question 3: What is the difference in PIPP scores between genders?

Position changes for the preterm males and females in group A were analyzed using an ANOVA (see table 5). The PIPP scores for the genders were significantly
different ($F = 6.301; P = .012$). This indicates that the responses of the preterm male infants undergoing a position change in-group A were statistically different than the preterm female infants undergoing a position change in-group A. The mean PIPP scores for the 239 position changes for the males in group A compared to 128 position changes for females in group A were 7.02/2.54 and 7.70/2.27 respectively (see table 5a) indicating that the females in this group had significantly higher PIPP scores.

Table 5

One-way ANOVA of PIPP scores for Group A Gender

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>37.911</td>
<td>1</td>
<td>37.911</td>
<td>6.301</td>
<td>.012</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2196.013</td>
<td>365</td>
<td>6.016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2233.924</td>
<td>366</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SS= Sum of squares; df = degrees of freedom; p < .05.

Table 5a

Descriptive Group Statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPP</td>
<td>239</td>
<td>7.02</td>
<td>2.54</td>
</tr>
<tr>
<td>male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>128</td>
<td>7.70</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Note. N= number of events; SD= standard deviation.
An ANOVA also was performed to analyze the position changes of the preterm male and female infants in group B (see table 6). The PIPP scores for the genders were significantly different ($F = 16.059; P = .000$). This indicates that the responses of the preterm male infants undergoing the position change in-group B were statistically different than the preterm female infants undergoing a position change in-group B. The mean PIPP scores for the 137 position changes for the males in group B compared to 126 position changes for females in group B were 8.25/3.28 and 6.85/2.22, respectively (see table 6a). In this group, the males had significantly higher PIPP scores.

Table 6

One-way ANOVA of PIPP scores for Group B Gender

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>128.455</td>
<td>1</td>
<td>128.455</td>
<td>16.059</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2087.697</td>
<td>261</td>
<td>16.059</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2216.152</td>
<td>262</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SS= Sum of squares; df = degrees of freedom; $p < .05$.

Table 6a

Descriptive Group Statistics

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPP2</td>
<td>Male</td>
<td>137</td>
<td>8.25</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>126</td>
<td>6.85</td>
</tr>
</tbody>
</table>

Note. N= number of events; SD= standard deviation.
Summary

This chapter included a discussion of the demographic characteristics of the sample and the inclusion/exclusion criteria upon which the selection of subjects was based. Each research question was analyzed by using either descriptive means or an ANOVA. Results were reported in both narrative and table form.

The PIPP scores for the position change using the two different care situations (with and with UVC & Intubation) were analyzed to see if they invoked a behavioral and physiological response. Most of the repositioning done in routine care situations showed a PIPP score that reflected pain. The PIPP scores for gender were analyzed showing that gender made a difference in pain response in infants of the same GA.
CHAPTER V

Discussion

The purpose of this study was to determine if position change in preterm infants 28-33 weeks gestational age (GA) results in changes in behavioral and physiological states as measured by the PIPP scores. This chapter begins with an examination of the findings of this study. These findings were compared and contrasted with those described in the previous review of literature. The conclusions drawn from this research were discussed, and limitations stated. The implications for the practice of nursing that can be determined as a result of this study were examined, and recommendations for further research in this area were made. The chapter concludes with a summary of its contents.

Findings

Study findings are reported in relation to the research questions:

Research Question 1:

What is the effect of position change on preterm infants’ behavioral and physiological states as measured by the PIPP (premature infant pain profile) score?

The preterm infants in this sample exhibited behavioral and physiological responses when having a position change in two caregiving situations. These results are similar to those of previously reviewed research (Norris et al., 1981; Evans, 1991; Evans et al., 1997), in which standard two care-giving procedures were found to produce behavioral
and physiological response considered to be painful, as evidenced by an increased PIPP score over 7. Stevens, et al. (1996) reported that a score of seven or greater on the PIPP is indicative of mild pain, with scores of 12 or more indicating moderate to severe pain. According to this definition, repositioning with or without an UVC and without being intubated did produce a physiologic and behavioral pain response. Infants repositioned with an endotracheal tube in place, showed the PIPP score did not reflect a response indicative of pain.

The findings of this study were contradicted by the findings of Kean (1999) and Jay (1982). Kean in 1999 found that the removal of the oxygen source and not the handling most likely caused the response. Jay in 1982 reported that the response was favorable to sustained touch rather than intermittent touch in preterm infants.

While the results of this study of position change with regards to no intubation versus position change with intubation were found to be statistically significant, clinically they are not. According to Ballantyne, McNair, Ung, Gibbins and Stevens in their (Dec 2003) a 20% reduction (2-point change) in the PIPP score was considered clinically significant assuming an SD of 1 and 80% power, a alpha of 0.05 and with the correct sample size. The difference in PIPP scores between the intubated and non-intubated groups was 0.90 or 9% difference.

Research Question 2:

Is there a difference in PIPP scores between infants of different GA?

For this sample, regardless of the group, the infant was in; a pain response was seen (see Figure 2) but was not statistically significant or clinically significant. One may
question why infants in the older group would not exhibit a significant difference since they are more mature and are more awake and alert; but the fact that the PIPP takes state into account when the scoring is done may explain the lack of difference. These findings were similar to the study by Konishi et al., 1994 on GA and position that there was no correlation to GA and position. Chang et al., 2002a compared the effects of positions on the states of infants 25-36 GA; the findings showed that the position change had a positive effect but the GA was not discussed. Few research articles on position change in regards to GA were found to compare and contrast the results of this study which supports the need for this study.

Research Question 3:

What is the difference in PIPP scores between genders?

The findings indicate that the infants in this sample had significant differences in their responses to pain according to gender within each group separately. None of the research literature examined the preterm infants by gender alone. Most of the repositioning done in routine care situations showed a PIPP score that reflected pain. The PIPP scores for gender were analyzed showing that gender made a difference in pain response in infants of the same GA.

Some rational for the explanations for the significance could be that group A males had almost 100 more repositions than the group A females. Each group had 20 infants in the group for an equal number of infants but the distribution could be another explanation group A had 13 males and 7 females and group B had 11 males and 9 females for a gender difference. The female infants in-group B mean PIPP score was
6.85 the males score was 8.25 and the mean scores for group A male was 7.02 and female was 7.70 with scores above seven a pain response elicited. Scores on the PIPP of less than seven generally indicate minimal or no pain (Ballantyne et al., 1999). Generally, nurses are educated to help patients to achieve pain relief so any score over seven should necessitate some type of pharmacological intervention.

Theoretical Findings

The behavioral and physiologic components of the preterm infants’ responses to the input of repositioning, which were measured by the PIPP score, are representative of the adaptive systems output which serve as feedback, and control processes known as coping mechanisms as described by Roy & Andrews in 1999. Adaptive responses are those that promote the integrity of the infant. The infant’s integrity, or wholeness, is behaviorally demonstrated when the infant is able to meet the goals in terms of survival, growth and development. Ineffective responses do not support these goals (George, 1995). This study has shown that the routine care procedures such as touch and position changes that were once considered to not have a detrimental effect on preterm infants, may in fact have a greater effect than first thought.

Conclusions

This study offers further support that preterm infants perceive pain and are able to produce a physiologic and behavioral response that communicates this perception to their caregivers. This response draws on the infant’s limited stores of energy, and consumes resources that could be more effectively used for growth and development. The routine NICU caregiving procedure such as position change may also be eliciting pain in these
infants. The following conclusions have been proposed after consideration of the data analysis from this research.

1. Preterm infants undergoing position change with or without UVC in place during the position change and position change without intubation displayed a pain response with a PIPP score above seven. While preterm infants that were intubated did not elicit a PIPP score of above seven the score was 6.94 (SD2.24) and could have been slightly lower due to limitations of this study but given the SD could well have indicated a pain response as well.

2. For this study, infants in both GA groups exhibited a PIPP score above seven in response to position change. The difference between groups was not statistically or clinically significant.

3. When the two groups were analyzed together by gender they were not significant but since GA did provoke a pain response the groups were analyzed separately and each were found to be significant when age and gender were compared.

Limitations

The small sample size is a limitation of this study. The sample was one of convenience, limiting the generalizability of the results. The infants in this sample had been in the NICU for varying amounts of time and had received different numbers of care giving procedures. The care giving procedures in the NICU were clustered. For example, one infant might receive a heal stick for blood sample, a diaper change, have been suctioned, and then be repositioned while another did not receive the same care giving at that time. No account was taken for the order or amount of routine care in the cluster.
Another limitation of the study is that the infant’s responses could have been influenced by factors such as previous painful events and severity of illness. Different nursing personnel conducted the position change so the procedures lacked standardization. Some infants in this study were intubated at the time of observation. The tape used to secure the endotracheal tube obscured the nasolabial furrow and would influence the calculation of the PIPP score.

Implications

The preterm infant’s pain response is costly in terms of energy expenditure. These fragile infants can hardly afford to redirect limited resources toward enduring the adverse effects of recurring painful events. This study shows that the common NICU practice of repositioning that was previously considered innocent as possibly being painful.

Observations in the NICU have generated some concern that a number of routine caregiving procedures may be more harmful than beneficial to preterm infants. A number of studies have identified neonatal environmental stressors such as repositioning, suctioning, feeding, diaper changing handling (Evans, 1991; Kean, 1999; Norris, Campbell, & Brenkert, 1981).

Nursing Practice

The primary implication for the practice of nursing is that the position change technique should be allowed to lessen the amount of pain endured by preterm infants during their stay in the NICU. While many changes have been made in recent years to provide more developmentally sensitive care to these infants, this research indicates that a routine procedure as innocent as repositioning may have a detrimental effect. More
attention should be thought about when repositioning infants in this fragile population. In practice, nurses should be alert to the presence of pain in these infants in all caregiving events, not just the invasive procedures.

_Nursing Education_

This study supports that many routine caregiving procedures may evoke pain responses in preterm infants. Nursing personal need to be aware of the negative impact repositioning may have on preterm infants. Nurses providing care to these infants should be educated in the proper interventions to reduce a pain response from a once thought benign NICU caregiving procedure such as repositioning. Emphasis should be placed on assessment of the infants’ physiologic and behavioral responses of these infants to all forms of caregiving, and to plan interventions accordingly.

The use of the PIPP score illustrates the value of a valid and reliable tool that can be used in the clinical setting to identify infants in pain. Nurses who work in the NICU should be educated to use the tool at the bedside during care so they might be better to assess the presence of pain in the infants they are caring for.

_Nursing Administration_

The costs in terms of health care dollars may be increased, for preterm infants who suffer pain due to routine care may elongate the infants’ stay in the NICU. Coping with pain causes energy to be diverted from normal growth and development, and this many be presumed to negatively affect an infant’s progress toward discharge from the NICU. With education and effective strategies to reduce the amount of pain and suffering these preterm infants endure, health care costs may be reduced.
One intangible cost could possibly be the lack of opportunity for bonding between the preterm infant and the parents. An infant in pain is less likely to effectively bond with its parents. In general, it is known that poor attachment between infants and their parents have a great impact on the child’s future.

Recommendations for Further Research

This study looks at a questions not widely researched on repositioning in preterm infants and brings to light other questions one could research. Some of these topics are different age ranges, different types of position changes, like just certain parts of the infants body or the complete body. An additional aspect to consider in researching position change could be, whether the position change is first or last in the cluster of care and the number of position changes the infant has had. Another question to ask would be whether the repositioning is a flip or gentle roll of the body and whether it produces any significant physiologic or behavioral responses as measured by the PIPP score. As questions are answered, more arise. Since repositioning causes no tissue damage, why does it evoke a pain response in certain circumstances? Little is known of how the preterm infant’s perception of the manipulations involved in procedures of routine care might be affected by previous experience with repeated events. Do these infants learn to anticipate that handling may be followed by a painful event? Further research in the area of learned response in infants may help to clarify how previous NICU experiences could influence infant responses to procedures. The field of study of repositioning in preterm infants is not extensively researched. More studies need to be done.
Summary

This chapter included a discussion of the findings of this research on the physiologic and behavioral responses of preterm infants to position change. Although it cannot be concluded that all routine care involving position change causes pain in these infants, many of the events did result in pain and disorganized behavior that requires the infant to utilize energy. This energy could be better utilized for growth and development.

This study was limited in that it was a convenience sample of small size. The infants were in the NICU for varying amounts of time and had received different numbers of care giving procedures. Another limitation of the study is that the infant’s responses could have been influenced by factors such as previous painful events and severity of illness. The outcomes of this study can be used to implement changes in the practice of nursing. Efforts should be taken by NICU personnel to reduce the number of painful events in order to help foster growth and development of these tiny infants. Caregivers may improve their assessment skills by becoming proficient in the use of the Premature Infant Pain Profile, and consequently identify and treat pain more effectively. The reduction in pain in these infants would help lower healthcare costs by decreasing energy loss and increasing growth and development to shorten the NICU stay.
REFERENCES


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Appendix A

Premature Infant Pain Profile (PIPP)

Infant I. D. Number:_____
Date/Time:_______________
Event:__________________

<table>
<thead>
<tr>
<th>PROCESS</th>
<th>INDICATOR</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart</td>
<td>Gestational age</td>
<td>36 weeks and more</td>
<td>32-35 weeks, 6 days</td>
<td>28-32 weeks, 6 days</td>
<td>Less than 28 weeks</td>
<td></td>
</tr>
<tr>
<td>Observe infant 15 sec</td>
<td>Behavioral state</td>
<td>Active/awake eyes</td>
<td>Quiet/awake eyes</td>
<td>Active/sleep eyes</td>
<td>Quiet/sleep eyes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>open facial</td>
<td>open no facial</td>
<td>closed facial</td>
<td>closed no facial</td>
<td></td>
</tr>
<tr>
<td>Observe baseline</td>
<td>Heart rate__</td>
<td>0-4 beats/min</td>
<td>5-14 beats/min</td>
<td>15-24 beats/min</td>
<td>25 beats/min or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
<td>increase</td>
<td>increase</td>
<td>increase</td>
<td>more increase</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturation__</td>
<td>0-2.4% decrease</td>
<td>2.5-4.9% decrease</td>
<td>5.0-7.4% decrease</td>
<td>7.5% or more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min__</td>
<td>None</td>
<td>Minimum</td>
<td>Moderate</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brow bulge</td>
<td>0-9% of time</td>
<td>40-69% of time</td>
<td>40-69% of time</td>
<td>70% of time or</td>
<td></td>
</tr>
<tr>
<td>Observe infant 30 sec</td>
<td>Heart rate Max__</td>
<td>None</td>
<td>Minimum</td>
<td>Moderate</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
<td>0-9% of time</td>
<td>10-39% of time</td>
<td>40-69% of time</td>
<td>70% of time or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saturation__</td>
<td>None</td>
<td>Minimum</td>
<td>Moderate</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min__</td>
<td>0-9% of time</td>
<td>10-39% of time</td>
<td>40-69% of time</td>
<td>70% of time or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brow bulge</td>
<td>None</td>
<td>Minimum</td>
<td>Moderate</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eye Squeeze</td>
<td>0-9% of time</td>
<td>Maximum</td>
<td>40-69% of time</td>
<td>70% of time or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nasolabial Furrow</td>
<td>None</td>
<td>10-39% of time</td>
<td>Moderate</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-9% of time</td>
<td>40-69% of time</td>
<td>70% of time or</td>
<td>Maximum</td>
<td></td>
</tr>
<tr>
<td>TOTAL SCORE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scoring method for the PIPP

1. Familiarize yourself with each indicator and how it is to be scored by looking at the measure.
2. Score gestational age (from the chart) before you begin.
3. Score behavioral state by observing the infant for 15 seconds immediately before the event.
4. Record baseline heart rate and oxygen saturation.
5. Observe the infant for 30 seconds immediately following the event. You have to look back and forth from the monitor to the baby’s face. Score physiologic and facial action changes seen during that time and record immediately following the observation period.
6. Calculate the final score.

ABSTRACT

The purpose of this study is to compare the effects of reposition on preterm infants 28-30 GA and 31-33 GA and the effects the position change have on these infants physiologically and behaviorally. This study will use a descriptive comparative design. This design was selected because the purpose of the research is to examine the phenomenon of the preterm infant’s natural behavioral and physiological response to reposition and to compare the responses of preterm infants in two different GA groups. Secondary analysis of data from a larger NIH funded study conducted by Dr. J. Evans, School of Nursing; Medical College of Ohio was employed. Secondary analysis allowed for a redirection of the focus of the data to examine questions that were not previously posed.

For the present study, a convenience sample of 40 infants, 20 between 28-30 GA and 20 between 31-33 GA. These 40 infants will be chosen from the group of 81 infants included in the original larger study. In the original study, the physiologic and behavioral data were collected using the Medical Graphics Digital Data Acquisition Chart Recorder with Synchronized Video Acquisition. Data will be analyzed using a paired simple t test. Results suggested that preterm infants are significantly affected by reposition. Effects show the reposition causes physiologic and behavioral changes. These findings will be useful in future research studies on care giving procedures in preterm infants. Recommendations for further studies of preterm infants should include reposition change and other care- giving procedures.