To the Graduate Council:

I am submitting herewith a dissertation written by Mary Anne Modrcin-McCarthy, entitled "The Physiological and Behavioral Effects of a Gentle Human Touch Nursing Intervention on Preterm Infants." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Nursing.

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THE PHYSIOLOGICAL AND BEHAVIORAL EFFECTS OF A GENTLE HUMAN TOUCH NURSING INTERVENTION ON PRETERM INFANTS

A Dissertation

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Doctor of Philosophy

Degree

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DEDICATION

This work is dedicated with my deepest love to those individuals who have touched my life most profoundly:

my parents, Matt J. and Ann Modrcin,

my husband, Vincent P. McCarthy,

and

my son, Logan Spencer Modrcin McCarthy.

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ABSTRACT

This study examined the physiological and behavioral effects of a gentle human touch nursing intervention on medically-fragile, preterm infants (27 to 32 weeks gestational age) through the lens of the Roy Adaptation Model of nursing. Infants were assigned randomly to either a non-touch control group (N=10), or an experimental touch group (N=10). Infants in the experimental group received 20 minutes of gentle human touch for 10 days from 7 through 16 days of life. The touch intervention was administered by a trained individual (a Registered Nurse with Neonatal Intensive Care experience). The principal investigator directly observed the infants and coded baseline and post-touch data (on day 6 and day 17) for both groups, and collected all data before, during, and after the touch interventions for infants in the experimental group.

Comparisons (t-tests) of group differences on day 17 of the study revealed significantly less time spent in active sleep, and some evidence of decreased motor activity, by infants in the experimental group. Analysis of variance for a two within-subjects repeated-measures design for infants in the experimental group showed no significant differences before, during, or after touch for either, heart rate or oxygen saturation levels. There were highly significant differences from phase to phase for five behavioral variables: motor activity, no movement, behavioral distress cues, quiet sleep state and drowsy sleep state. Post hoc comparisons (Fisher's LSD)

revealed: decreased motor activity during touch as compared to before and after touch; and less movement, decreased behavioral distress cues, more quiet sleep, and less drowsiness during and after touch than before the touch intervention.

In conclusion, the results of this study suggest that the immediate and short-term effects of a gentle human touch nursing intervention were not adversive or stressful to preterm infants of 27 to 32 weeks gestational age. In fact, the findings document the positive, beneficial effects of a gentle human touch nursing intervention on preterm infants and indicate this alternative type of touching <u>is</u> <u>appropriate</u> for these infants in the neonatal intensive care unit.

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CHAPTER I

INTRODUCTION

Where touching begins, there love and humanity also begin--within the first minutes following birth.

Ashley Montagu
1986, p. XV

Introduction

What is touch? Webster's (1986) dictionary defined touch as "to contact"; "to relate to"; "to lay on hand(s)"; "to perceive or experience through the tactile sense" (p. 2415). Montagu (1986) called touch the "mother of the senses" as it is the first sensory system to mature, with the embryo reacting to stroking at approximately 6 weeks of age. Touch can be viewed as appropriate for the infant (e.g. calming and soothing), or inappropriate (e.g. painful and intrusive) (Brazelton & Field, 1990). Spitz (1945) hypothesized that an infant could survive without the mother's voice, eyes, taste, and smell but suggested that infants would not survive if they were denied tactile contact such as holding, fondling, and caressing.

It is well known that premature infants are deprived of soothing and calming touch at birth. Rather, painful and intrusive handling occurs as medical and nursing personnel attempt to stabilize and transport the infant to the Neonatal Intensive Care Unit (NICU). The loving touch and attachment process between infant and parent(s) is interrupted to be replaced by attachment to equipment, invasive procedures, noxious stimuli, and hospital staff.

There is much literature documenting the significant role that touch plays in promoting parent-infant attachment and the overall, healthy well-being of the infant (Frank, 1957; Harlow, 1958; Klaus & Kennell, 1982; Montagu, 1986; Schanberg, Kuhn, Field & Bartolome, 1990). Reite (1990) stated that "touch is a fundamental, possibly necessary component of the development of the earliest social attachments bonds" (p. 196). The results of the classic study by Spitz (1945) suggested that infants who were deprived of touch or affection simply wasted away and died. Other classical studies described the protest-despair behavioral pattern seen in infants and children who were separated from their mothers and deprived of touch and affection (Bowlby, 1953; Bowlby, 1960; Robertson, 1953).

It is only in the past decade that tactile stimulation in the very premature and medically-fragile infant has received attention. However, the optimal types, amount, and relative timing of stimulation, including 'touch' or tactile stimulation, on preterm infants of 27-32 weeks gestation remain unknown despite recent studies (Harrison, 1985). Additionally, there is conflicting research on the effects of stimulation, including touch, on preterm infants. Some (Cornell & Gottfried, 1976; Glass, Avery, Subramanian, Keys, Sostek & Friendly, 1985; Gorski, 1985; Gottfried, Wallace-Lande, Sherman-Brown, King, Coen, & Hodgman, 1981; Lucey, 1984) have posited that intensive care units may provide too much stimulation for the preterm infant, whereas, others (Field, Schanberg, Scafidi, Bauer, Vega-Lahr, Garcia, Nystrom, & Kuhn, 1986; Korner, Schneider & Forrest, 1983; Rausch, 1990; Rose, 1984; White-Traut & Tubeszewski, 1986) have proposed that tactile and kinesthetic stimulation are beneficial to the preterm infant's development.

Thus, many neonatal intensive care units limit tactile stimulation and discourage frequent handling of preterm infants, by both parents and staff alike, due to their concern about the effects of touch and the preterm infant's inability to handle excessive stimulation. The philosophy seems to be "if you don't know if touch is good, it must be bad, so don't do it!" The minimal-handling policies that are used in many NICUs are based on this philosophy.

Nurses are the primary care givers and "handlers" of these preterm infants, and thus, are especially interested in this ongoing debate. It is important for nurses to know the effects of touch on preterm infants in order to determine routine care and unit policies, and to evaluate the potential of tactile stimulation as an effective intervention to promote overall growth and development in the preterm infant.

THE PROBLEM

The Purpose and Need for the Study

Is this concern regarding excessive handling and stimulation in the NICU warranted or can touch be beneficial to fragile, very premature infants? The results of several recent studies (Harrison, Groër, Modrcin-McCarthy & Wilkinson, 1992; Jay, 1982; Tribotti, 1990a) suggested that certain types of touch may in fact be beneficial to these preterm infants. Harrison et al. (1992), Jay (1982) and Tribotti (1990a) used "gentle human touch" which was defined as the investigator or nurse placing hands on the infant's body for a designated period of time, without any other types of stimulation. The preterm infants in these studies were observed with responses measured on a variety of parameters to examine the effects of this type of tactile stimulation. This dissertation research was a modified replication of the Harrison et al. (1992) pilot study in which I participated.

The purpose of this study was to investigate the physiological and behavioral effects of a gentle human touch nursing intervention during the first weeks of life in medically-fragile, preterm infants of 27 to 32 weeks gestation. The study replicated, with modifications, methodology previously developed by Harrison (1990). The purpose of this study was to further knowledge of the effects of touch on preterm infants and assist in determining whether minimal handling policies in NICU's are appropriate. Additionally, the researcher strove to posit a guide for nursing interventions using touch in preterm infants, and to provide a foundation for exploration of variables to be considered in future research.

Statement of the Problem

The incidence of prematurity is estimated to be approximately 7% of all infants born (Catlett & Holditch-Davis, 1990; Wegman, 1988). Nearly 8½% of white infants compared to 18 percent of black infants were reported to be born prematurely (less than 37 weeks gestation) (Wegman, 1989). The South Atlantic and East South Central regions, geographically, had the highest infant mortality rates with the New England region having the lowest. Although the District of Columbia and Mississippi ranked highest, number one and two respectively, eight states had infant mortality rates of at least 15 percent greater than the national average (Wegman, 1989). Tennessee (where this study was implemented) is one of those eight states.

Wegman (1991) reported that provisional data from the National Center for Health Statistics suggested the infant mortality rate for 1990 declined to 9.1 per 1,000 live births, down from 9.8 in 1989. Hack et al. (1991) reported on neonatal outcomes of infants weighing less than 1500 grams at birth. Survival was 34 percent for infants weighing less than 751 grams at birth, 87 percent for those having birthweights of 1001 through 1250 grams, and 93 percent for those with birthweights of 1251 through 1500 grams (Hack et al., 1991). Lower birthweights were associated with higher mortality (residual disease or problems) primarily from respiratory distress (67%). The average length of hospitalization was 59 days for survivors contrasted to 15 days for non-survivors (Hack et al., 1991). Thus, it is crucial for the health profession to embrace an ongoing research commitment for preterm infants to ensure their right to a quality life.

Research Questions and Hypotheses

The following hypotheses were tested in this study.

Hypothesis #1

Compared to infants in a randomly assigned control group, preterm infants who receive 20 minutes of gentle human touch daily (from days 7-16 post birth) will display:

a. a greater increase in periods of inactivity (as measured by the percent of time of no movement) from day 6 to day 17;

b. a greater decrease in motor activity (as measured by frequency of limb movements, body movements, head turnings and startles) from day 6 to day 17;

c. a greater decrease in the frequency of behavioral distress cues (as measured by frequency of facial grimacing, clenching of hands and feet, and mouthing behavior) from day 6 to day 17;

d. a greater increase in weight gain from day 6 to day 17;

e. a greater increase in the percent of time in quiet sleep from day 6 to day 17;

f. a greater decrease in the percent of time spent in active sleep from day 6 to day 17.

Hypothesis #2

Preterm infants who receive 20 minutes of gentle human touch (from days 7-16 post birth) will display no change in heart rate or oxygen saturation levels before, during, and after touch.

Hypothesis #3

Preterm infants who receive 20 minutes of gentle human touch daily (from days 7-16 post birth) will display increased inactivity (or no movement), decreased motor activity, decreased behavioral distress cues, and an increased percent of time spent in quiet sleep, during touch as compared to before and after touch.

The following research questions were asked in this study.

Research Question #1

Are there differences between infants in the experimental and control groups on the following variables measured during the 10 day study period: caloric intake, number of days on supplemental oxygen, number of blood transfusions, and number of days on phototherapy?

Research Question #2

Are there differences between infants in the control and experimental groups on length of hospitalization and discharge weight?

Delimitations and Limitations of the Study

The delimitation (a factor controlled by the researcher) of the study was the small sample size (of 20 preterm infants meeting the elibigility criteria) obtained from the NICU of the University of Tennessee (UT) Hospital Medical Center in Knoxville, Tennessee. In addition, the infants were touched only once a day versus 3 or 4 times daily. Limitations (factors not under control by the researcher) of the study included: voluntary participation by parents of their preterm infant, the type and duration of additional handling received by all infants during the study period, direct observation which allowed recording of data once per 30 second intervals, and the physiological monitoring equipment available at UT. Also, there was possible "contamination" of the study by nursery personnel and parents/visitors who may have consciously or unconsciously provided extra touch to the control group. Therefore, generalizations of the findings of this study may be limited. In addition, this study was not designed to examine all possible effects of tactile stimulation.

Theoretical Definition of Terms

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

1. Gentle Human Touch--The continuous, gentle contact of one hand on the preterm infant's head and the other hand on one of the infant's shoulders and arm at the specified intervals of the research project.

2. Preterm Infant--"A premature (preterm) infant is born before the end of the thirty-seventh week (of gestation)" (Korones, 1981, p. 104).

3. Gestational Age--Gestational age of the infant is calculated in weeks from the first day of the mother's last menstrual period (Korones, 1981). One system frequently used by nursery personnel in postnatal estimation of gestational age was developed by Dubowitz (1970). In this system, the baby is examined for certain external characteristics and neuromuscular signs from which a score is obtained and a corresponding gestational age (in weeks) is determined.

4. Post-conceptional Age -- Post-conceptional age of the infant is determined in weeks by taking the calculated gestational age and adding the weeks (days) lived since birth.

5. Roy Adaptation Model (RAM)--A conceptual framework for nursing that states that the goal of nursing is "to promote adaptation in each of the four adaptive modes, thus contributing to the person's health, quality of life, and dying with dignity" (Roy, 1984, p. 12). These four adaptive modes are: physiological, interdependence, self-concept, and role-function.

6. Physiological Mode--One of four modes that Roy classified as ways of coping that manifest regulator and cognator activity (Roy, 1984). Factors considered for physiological adaptation by Roy (1984) include oxygenation, nutrition,

elimination, activity and rest, skin integrity, the senses, fluid and electrolytes, neurological function, and endocrine function.

7. Interdependence Mode--One of four modes that Roy classified as ways of coping that manifest regulator and cognator activity (Roy, 1984). The interdependence mode is one of Roy's (1984) three psychosocial modes and is defined as "the close relationships of people that involve the willingness and ability to love, respect, and value others, and to accept and respond to love, respect and value given by others" (p. 306).

8. Adaptation Level--"A constantly changing point, made up of focal, contextual, and residual stimuli, which represents the person's own standard of the range of stimuli to which one can respond with ordinary adaptive responses" (Roy, 1984, pp. 27-28).

9. Stimulus--"That which provokes a response" (Roy, 1984, p. 27).

10. Adaptive Responses--"Responses that promote integrity of the person in terms of the goals of survival, growth, reproduction, and mastery", whereas, inaffective responses do not contribute to these adaptive goals (Roy, 1984, p. 28).

11. Heart Rate--The frequency of cardiac contractions, which is an index of physiological integrity and stress responsiveness.

12. Oxygen Saturation--"The actual amount of oxygen bound to hemoglobin divided by the maximal possible amount of oxygen that could be bound to that amount

of hemoglobin" (Merenstein & Gardner, 1985, p. 97), and which is an index of physiological integrity and oxygenation status.

13. Weight Gain--The increase in heaviness in the infant measured in grams, indicating growth.

14. State Classifications (e.g. sleep-wake states) -- "The differentiation of a wide range of states of consciousness and the ability to maintain states by selectively inhibiting exogenous and endogenous stimulation" (Gottfried & Gaiter, 1985, p. 137).

15. Motor Activity--The quality or state of being active, functioning, and/or moving versus being inactive (Webster's, 1986).

16. Neonatal Intensive Care Unit (NICU)--The space in the hospital specifically equipped for care and treatment of critically-ill infants less than 1 year of age. These infants may be born within the hospital or transferred from an outside facility.

SUMMARY

The known benefits of touch or tactile stimulation for medically-fragile, preterm infants in the NICU is a "gray" area in the literature today. Do preterm infants receive too much stimulation in the NICU or can tactile stimulation be beneficial to the preterm infant's development? It is clear that "minimal handling policies" and "do not touch" philosophies should be supported by scientific research. The purpose of this study was to examine the physiological and behavioral effects of a gentle human touch nursing intervention during the first weeks of life in preterm infants of 27-32 weeks gestation.

This study used RAM (see Chapter II for conceptual framework) as a heuristic guide to propose a middle-range theory of gentle human touch for preterm infants. Specifically, this theory posited that gentle human touch can be used by the nurse to positively promote adaptation to extrauterine life in the physiological and interdependence modes. Additionally, this research provided knowledge of the effects of touch on preterm infants, made recommendations for nursing interventions using touch in preterm infants, and explored implications for future study.

CHAPTER II

REVIEW OF LITERATURE

Introduction

This chapter presents the theoretical framework and reviews the literature related to the dissertation topic. 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 a general overview of the historical perspectives of touch, a review of literature related to stimulation of the preterm infant, the sensory environment of the NICU, and the effects of tactile stimulation, alone and in combination with stimulation of other sensory modalities on preterm infants. Particular findings relevant to the variables of interest in this study are emphasized.

Theoretical Framework

The Roy Adaptation Model (RAM) is one of the most commonly implemented conceptual models of nursing today and it provided the framework for this study. It is well-known and well-utilized and has been presented by Roy, not only in the United States, but also in other countries (Schorr & Zimmerman, 1988). Since its conception in 1964, RAM has been constantly evolving. In 1968, Roy (1980) began operationalizing her model at Mount Saint Mary's College where the model was adopted as the nursing curriculum's philosophical foundation. In a 1970 article entitled "Adaptation: A conceptual framework for nursing," Roy first published the basic ideas for her conceptual model. Since 1970, "over 1500 faculty and students working with Sister Callista Roy have contributed to the theoretical development and practical application of the Roy Adaptation Model" (Roy, 1984, p. 23).

The Roy Adaptation Model has been critiqued by many nurse authors (Duldt & Giffin, 1985; Fawcett, 1989; Fitzpatrick & Whall, 1989; Marriner-Tomey, 1989; Meleis, 1985) and has withstood their close scrutiny. Fawcett (1989) concluded that this "conceptual model makes a significant contribution to nursing knowledge," "presents a distinctive view of the person, one developed within the discipline of nursing," and through continuing efforts by Roy and colleagues, "only a few gaps and omissions are apparent at this time" (p. 339).

The Roy Adaptation Model uses a systems theory approach with the person (defined as biopsychosocial) as the core of an adaptive system. The scientific assumptions are based on both systems and adaptation theories. The philosophical assumptions about the adapting person in society are founded within humanistic values and the principle of veritivity. Adaptation is the key concept that links the four metaparadigm concepts--person, health, environment, and nursing--together. Roy's theory of person as an adapting system was developed from the Roy Adaptation

Model; the proposed middle-range theory of gentle human touch is rooted within this theory.

From RAM, the theory of the person an adaptive system (see Figure 1) views nursing as a process for promoting adaptation.

The following figure is taken from Roy & Andrews (1991) and illustrates Roy's description of a person as an adaptive system (p. 17).

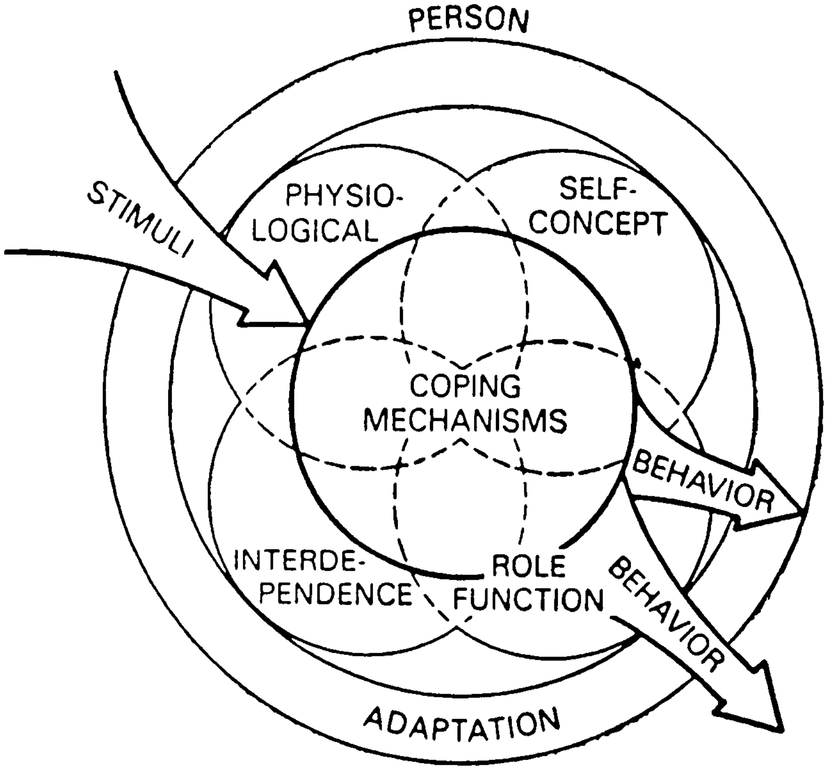

Figure 1. Person as an Adaptive System (Roy & Andrews, 1991, p. 17).

Input to the system in the form of stimuli-focal (immediate), factor contextual (contributing factors), and residual (innate, unknown factors) determines the person's adaptation level and adaptive response. Adaptive responses, according to Roy (1984), "promote integrity of the person in terms of survival, growth, reproduction, and mastery," whereas, ineffective responses do not (p. 28).

According to Roy and Andrews (1991), coping mechanisms assist the person in adapting to environmental changes. These coping mechanisms can be **innate** (genetically determined and automatically processed) or **acquired** (a deliberate, learned response) (Roy & Andrews, 1991, pp. 13-14). These are further categorized into the regulator and cognator subsystems. Roy (1991) posited that the **regulator** subsystem is a "basic type of adaptive process" and "responds automatically through neural, chemical, and endocrine coping processes" (Roy & Andrews, 1991, p. 14). The **cognator** subsystem coping process "responds through four cognitive-emotive channels: perceptual/information processing, learning, judgment, and emotion" (Roy & Andrews, 1991, p. 14). Additionally, neurological function is essential to regulator and cognator processing, and thus, important to a person's adaptation (Roy & Andrews, 1991).

In many areas there are "norms" or standards from which a nurse can effectively determine adaptation. Where these "norms" are not known, Roy has posited signs of ineffective adaptation.

Some signs of pronounced **regulator** activity are:

1. increase in heart rate or blood pressure,
2. tension,
3. excitement,
4. loss of appetite,
5. increase in serum cortisol.

Signs of **cognator** ineffectiveness include:

1. faulty perception/information processing,
2. ineffective learning,
3. poor judgment,
4. inappropriate affect. (Roy & Andrews, 1991, p. 32)

The cognator and regulator coping processes act to maintain adaptation in the four adaptive modes: physiological, self-concept, role function, and interdependence. These modes provide the manifestations of cognator and regulator activity by the person (infant). Thus, the nurse observes adaptive and ineffective behavior in each of the four modes by which people (infants) manifest their levels of adaptation (Roy, 1984, p. 33). Additionally, the nurse can be instrumental in managing stimuli to assist the person (infant) in adaptation.

Roy (1984) believed that a baby is born with two adaptive modes, **physiological** and **interdependence** (p. 310). According to Roy (1984), "out of the interactions that are primarily affectional or nurturing in nature arises the beginning self-concept (self-concept mode), and finally roles (role function mode) are learned" (p. 310). Thus, the firm establishment of the physiological and interdependence modes are pivotal for overall growth, development, and general well-being of the individual. Additionally, due to the holistic nature of the person, Roy and Andrews (1991) posited that the adaptive modes are "interrelated" and affect the other modes. Thus, adaptive responses may be characteristic of more than one mode.

The physiological mode encompasses the physiological needs of the person necessary for survival, growth, reproduction, and mastery. Roy and Andrews (1991) described "five basic needs inherent in physiological integrity, oxygenation, nutrition, elimination, activity and rest, and protection" (p. 59). Additionally, four processes have been identified as essential in determination of physiological adaptation: the senses, neurological function, fluid and electrolytes, and endocrine function (Roy & Andrews, 1991). Roy and Andrews (1991) viewed these four processes "as mediating regulator activity, integrating many physiological functions of the person and affecting the integrity of the other modes" (p. 57).

The interdependence mode, on the other hand, is a social mode because social interaction is necessary for adaptation in this mode. Tedrow (1991) stated "the interdependence mode is one in which affectional needs are met" (p. 385). This involves close relationships of people, having the will and ability to love, respect, and value others, and to accept and respond to love, respect, and value given by others (Roy & Andrews, 1991). Roy (1984) cited studies that document the infant's need for love, attachment, physical contact, and touch. Factors of particular importance to the infant's development of interdependence behaviors are nurturance, interaction, presence of "other" in the physical environment, and developmental age and tasks. **Significant others** and **support systems** are the central relationships of the interdependence mode. The critical behaviors characteristic of this mode are **receptive** (receiving) **behaviors** (the ability to receive nurturance) and **contributive** (giving) **behaviors** (the ability to give nurturance) (Roy & Andrews, 1991). Andrews and Roy (1986) previously described these behaviors: the allowance of another to care for or express love (receiving behavior), and touching, caring, and thoughtful gestures (giving behaviors).

In this study, RAM and Roy's Theory of Person as Adaptive System were used as heuristic guides to develop a middle-range theory of the effects of gentle human touch (placement of hands upon infant) for preterm infants. This theory proposes that gentle human touch of preterm infants promotes adaptation in all adaptive modes. The study examined whether management of the focal stimulus of gentle human touch would effect adaptation in both the physiological and interdependence modes. Roy posited that special efforts or assistance by the nurse are critical in promotion of adaptation in persons who are facing many and/or extreme changes, and/or are compromised by illness.

Therefore, in this study, the focal stimulus of touch was a "special effort" by the nurse to assist the preterm infant in adaptation and was managed by the nurse. Specifically, the sensation of touch (via a gentle touch nursing intervention) was used to promote adaptation to extrauterine life in the physiological and interdependence modes. It was hypothesized that the infants' coping mechanisms could be assisted by the nurse via this touch intervention.

The preterm infants' innate coping mechanisms are indeterminate at birth with no/few acquired mechanisms yet learned. An important complicating factor is the preterm infant's immature neurological functioning. The immaturity of this regulator subsystem limits the infant's automatic response to extrauterine life through neural and chemical means, and thus may interfere with adaptation. Concurrently, the preterm infant's cognator (coping subsystem) learned response is influenced primarily by intrauterine learning (if learning occurs during intrauterine life), or by learning in response to the many noxious stimuli in the NICU. These learned responses may or may not promote health and assist in adaptation to extrauterine life.

In summary, to ensure the preterm infant's overall growth and development, many medical and nursing interventions are warranted in the NICU. The nursing intervention of gentle human touch was utilized in this study because many researchers (Harrison, 1991a; Harrison et al., 1992; Jay, 1982; Tribotti, 1990a; Weiss, 1992) considered it non-aversive (e.g. safe, soothing, and calming) and espoused its potential benefits to the preterm infant. Additionally, it was posited by Roy (1991) that **touch is fundamental for adaptation (to extrauterine life).** Roy and Andrews (1991) identified touch as one of the mediating processes crucial for regulator activity in the physiological mode; touch was also described as a foundation for cognator activity in the interdependence mode (Andrews & Roy, 1986). Additionally, the stimulus of touch, "may affect more than one mode or a particular behavior may be indicative of adaptation in more than one mode" (Roy & Andrews, 1991, pp. 17-18). This complex interrelatedness reflects the holistic nature of the infant/person (Roy & Andrews, 1991).

General indications of adaptation difficulty are apparent in the hospitalized, preterm infant. Exaggerated regulator activity (e.g. increased heart rate, behavioral distress, and hyperactivity) and cognator ineffectiveness (e.g. ineffective learning and information processing) are frequently exhibited by these infants. Specific signs of ineffective adaptation seen in the preterm's physiological (mode) status include: heart rate instability, oxygen saturation instability, inappropriate sleep patterns, increased motor activity, increased behavioral distress, and decreased weight gain.

A specific sign of ineffective adaptation reflected through the interdependence mode is the infants' inability to receive nurturance from central relationships. This difficulty may be demonstrated immediately through the infants' pronounced regulator activity (e.g. increased heart rate, oxygen saturation instability, increased motor activity and increased behavioral distress) when confronted with interaction, particularly interactions involving touch. Because the preterm infant can only communicate needs non-verbally, these signs are exhibited physiologically. It is important to recognize that these signs are indicative of two distinct adaptation concerns: the easily measured, apparent physiological instability **and** the interdependence (or nurturance) ineffectiveness.

Signs of continued ineffective adaptation (over time) in both the physiological and interdependence modes may include: pronounced physiological signs of regulator activity and evidence of cognator ineffectiveness. These include inappropriate sleep-wake patterns, decreased weight gain over time, increased number of days on treatment regimens (e.g. phototherapy, oxygen supplementation, blood transfusions) and prolonged hospitalization.

The dependent variables [heart rate, oxygen saturation, state classifications (e.g. sleep-wake patterns), motor activity, behavioral distress, weight gain and caloric intake, number of days on supplemental oxygen and phototherapy, number of blood transfusions, and discharge weight and length of hospitalization] were viewed as indicators of adaptation. Gentle human touch was provided as a focal stimulus to assist the infant's coping mechanisms in adaptation to extrauterine life, as evidenced by adaptive physiological mode and interdependence mode behaviors.

Historical Perspectives of Touch

According to Bottorff (1991), "most researchers have defined touch in relation to the physical contact or tactile stimulation it encompasses and its communicative role" (p. 304). Touch is one of the fundamental processes that occurs in the relationship between the nurse and patient/client. Weiss (1979) purported that "nurses' tactile intervention with patients is, perhaps, the most important to analyze and understand; for, as professionals, nurses represent a reservoir of individuals who touch people throughout their life cycles" (p. 76). She concluded that much of the touch literature focused on the beneficial effects of touch--enriching, comforting, and crucial to the general well-being and development of the individual (Weiss, 1979).

As early as 1957, Frank reported on the significance of touch and communication. Additional support for the importance of touch in communication was posited by Barnett (1972) and Montagu (1986). Rubin (1963) believed that human contact was critical for growth and learning, as well as for providing essential human comfort. Harlow (1958) discovered "that contact comfort was an important basic affectional or love variable" (p. 677) and "from this intimate attachment of the child to the mother, multiple learned and generalized affectional responses are formed" (p. 673). Additionally, over the decades, Bowlby (1969), Brazelton, Tronick, Adamson, Als and Wise (1975), Klaus and Kennell (1976), Ainsworth (1982), Siegel (1982), and Reite (1990) validated the importance of touch in maternal-child attachment and described the effects of non-attachment (e.g. failure-to-thrive, and child neglect and abuse).

The results of recent studies further support the significance of early touch and attachment and the subsequent development of social competence (Hartup, 1989; Hodapp & Mueller, 1982). Hartup (1989) posited that early relationships provide the foundations for social and emotional development. He concluded that "children with secure relationships in infancy often turn out to be more popular", "engage more frequently in social contact", take suggestions, and are less dependent on teachers for emotional support (Hartup, 1989, p. 124).

Brazelton (1990) summarized that touch "functions on many levels of adaptation, first to make survival possible and then to make life meaningful" (p. 561). If touch or tactile contact is absent or lacking, "abnormal behavior will result" (Montagu, 1986, p. 46).

The Preterm Infant and Sensory Stimulation

Transition to Extrauterine Life

Newborns need and desire the warm, human touch of their loving parents. Unfortunately, preterm infants are removed from this loving touch and taken to the NICU where life-saving measures are implemented. Preterm infants are placed on radiant warmers or in "isolettes", where their first tactile experiences are invasive procedures by nursery personnel. Thus, "a premature baby is born into an environment for which he is not yet adapted" (Cole, 1985, p. 24).

In utero, the baby is provided with the warm, safe environment of the mother's womb. The baby has an intrauterine diurnal cycle with sensory links to the mother via several modalities. For example, the baby hears the mother's voice and heartbeat, is touched and swaddled by the amniotic fluid, and receives kinesthetic stimulation through position changes.

At birth, in adjustment to extrauterine life, the baby's "womb" is now the mother's arms (Montagu, 1986). The preterm infant, however, bypasses mother's arms and is suddenly faced with the chaotic environment of the NICU. The preterm infant's diurnal cycle is lost to be replaced by "24 hours of bright lights and constant sound" (Cole, 1985, p. 25). Cole (1985) reported studies revealed a preterm infant was handled as many as 134 times within a 24-hour period--just for routine care! Unregulated sensory stimulation abounds for the premature infant upon transition to extrauterine life.

Preterm infants differ from full-term infants in both maturation and preparation for extrauterine life. Additionally, preterm infants differ from full-term infants "in their perceptual and information-processing abilities" and "are less active, alert, and socially responsive" than full-term infants (Lott, 1989, p. 22). Preterm infant's needs center energy around the life-sustaining functions of oxygenation, nutrition, elimination, activity and rest, and protection (Roy & Andrews, 1991).

History of Infant Stimulation

Webster's (1986) defined stimulation as "the act of stimulating or the condition of being stimulated", that is, "to excite, arouse, or animate to action" with the stimulus being "that which stimulates, excites, or animates to action" (p. 2244). Studies (Barnard, 1987; Kramer, Chamarro, Green, & Knudtson, 1975; Rice, 1985) have shown that positive stimuli may promote normal development, whereas, early exposure to inappropriate stimuli may be detrimental to development.

Prior to 1960, premature infants were thought to be too fragile for stimulation and "minimal handling policies" were standard. Infant stimulation programs were then initiated to compensate for the sensory deprivation of the NICU environment (Barb & Lemons, 1989). These first infant stimulation programs "included a variety of tactile, vestibular-proprioceptive, auditory, visual, and social stimulation" interventions (Lott, 1989). By the late 1970s, infant stimulation issues were once more a central concern. Subsequent evaluation revealed that the high-tech NICU environment provided an overabundance of sensory stimulation; thus, "minimal handling policies" were initiated once again.

Barb and Lemons (1989) concluded "the general consensus is that most infants receive neither sensory deprivation nor sensory overstimulation, but an inappropriate pattern of interaction that includes components of both" (p. 9). In addition, timing and types of stimulation to meet developmental needs, are also being scrutinized (Gorski, 1985; Horowitz, 1987). Als (1986) stressed the importance of modifying the environment in response to the infant's behavioral cues. Korner (1987) reiterated that the purpose of providing appropriate stimulation for preterm infants is to promote normal growth and development that was interrupted by their premature birth and stay in the NICU.

The Sensory Environment of the NICU

Historical Perspectives of the NICU Environment

One concern of the past two decades has been the role of sensory stimulation in the NICU. Do preterm infants receive too much, too little, or inappropriate sensory stimulation? These concerns are now relevant due to the development of high-technology and its impact on the care of these infants.

From 1900 through 1930, the foci of premature care were temperature regulation, nutritional requirements, and infection control (O'Donnell, 1990). O'Donnell (1990) stated that by 1930, oxygen support and infant respirators were available for preterm infants, and around 1950, worldwide concern for infant mortality was raised (because nearly half of all premature infants died). As technology advanced, research on prematurity increased. Emphasis on the inclusion of parents and families in the NICU characterized the 1970s with the additional focus on the siblings in the 1980s (O'Donnell, 1990).

Current Analysis of the NICU Environment

According to Gottfried and Hodgman (1984), it has been "suggested that contemporary management of newborns receiving intensive care may be responsible for newly recognized iatrogenic complications and may contribute to developmental deficits associated with prematurity" (p. 292). There appeared to be three schools of thought concerning the quality of the NICU environment in relationship to the preterm infant: excessive stimulation, minimal stimulation, and inappropriate stimulation (singly or in combination with one of the others). Review of recent literature revealed the general consensus was that excessive-inappropriate stimulation and minimal-inappropriate stimulation were the major concerns.

Researchers (Cornell & Gottfried, 1976; Glass et al., 1985; Gorski, 1985; Gottfried et al., 1981; Gottfried & Hodgman, 1984; Lucey, 1984; Speidel, 1978) supporting the excessive-inappropriate stimulation stance proposed that the NICU provides too much stimulation for the immature, physiologically stressed preterm infant. These researchers further suggested that even routine procedures may be inappropriate, hazardous, and excessive for these infants. Indicators of stimulation intolerance by the preterm infant as suggested by these researchers included: temperature instability, changes in cardiac and respiratory rates, decreased oxygen saturation, changes in sleep-awake patterns, and behavioral disturbances (such as gagging, vomiting, and frantic finger, body, and extremity movements).

Gorski (1985) and colleagues' observational research "verified hazardous medical events frequently coinciding with episodes of peak caregiver activity" (p. 10). Gottfried and Hodgman (1984) concluded that the preterm infant is not deprived of tactile, visual, and auditory stimulation from the NICU environment. They suggested that NICU's "are startling nonsocial environments for newborns" and there is no coordination "of physical and social stimulation built into the treatment plan" (Gottfried & Hodgman, 1984, p. 294). In a recent nursing article by Tribotti (1990b), she emphasized the necessity to plan nursing care contingent upon the preterm infant's age, state of wellness, and individual cues.

The findings of other researchers, however, (Field et al., 1986; Harrison et al., 1992; Korner, Schneider, & Forrest, 1983; Rausch, 1990; Rose, 1984; White-Traut & Tubeszewski, 1986) suggest minimal-inappropriate stimulation. These researchers stressed the need to provide appropriate tactile and kinesthetic stimulation to preterm infants because the NICU environment is lacking in appropriate stimulation critical to the growth and development. Indicators of the preterm infant's tolerance of stimulation as suggested by these researchers included temperature stability, stability of cardiac and respiratory rates, appropriate sleep-wake patterns, weight gain, and absence of behavioral changes.

There is general consensus among both groups of researchers that the timing, types, and amounts of stimulation appropriate for individual preterm infants vary from one infant to the other. In addition, Field (1986) cautioned that "any forms of early intervention need to be carefully researched before being practiced to ensure that there are no undesirable side effects" (p. 190).

The Preterm Infant's Response to a Stressful Environment

"Researchers have reported that preterm babies are responsive to their environment and interact with it for brief periods" (Lott, 1989, p. 22). However, preterm infants may be stressed by the NICU environment because of their physiological immaturity, instability, and lack of reserves. The premature infant may present with both physiological and behavioral changes in response to environmental stress (Catlett & Holditch-Davis, 1990).

Catlett and Holditch-Davis (1990) described three common physiological responses to environmental stress seen in preterm infants:

1. variation in oxygenation (as measured by pulse oximetry or transcutaneous monitors); when stressed, the preterm infant's oxygen saturation decreases as reflected in decreased pulse oximetry or transcutaneous oxygen monitor readings
2. variable sleep states; when stressed, the preterm infant demonstrates increases in both awake and crying time

3. variable cardiac and respiratory rates; when stressed, the preterm infant **initially** has **increases** in both cardiac and respiratory rates, but if stressors continue, bradycardia and apnea may ensue (Catlett & Holditch-Davis, 1990).

Some behavioral responses that indicate stress include finger movements, stiff extension of extremities, and/or "frantic diffuse movements occurring singularly or in any combination" (Gunderson & Kenner, 1987, p. 41).

PHYSIOLOGICAL AND INTERDEPENDENCE MODES: RELEVANT TACTILE INTERVENTION STUDIES

Animal Studies and Tactile Stimulation

The study of touch in animals has provided direction for human studies. The classic work of Harlow (1958) with rhesus monkeys has guided human research on physical contact and attachment. In Harlow's (1958) study, infant monkeys demonstrated a strong preference for the "contact comfort" of the artificial terrycloth mothers versus the milk provided by the artificial wire mothers. The baby monkeys explored when in the presence of the terrycloth mother; when in the presence of the wire mother (or when alone) they huddled in a corner. Additionally, baby monkeys sought comfort from the terrycloth mother--but not from the wire mothers.

Seay and Harlow (1965) studied rhesus monkeys (mothers and infants) and concluded that even if visual, auditory, and olfactory contact were maintained, separation reaction was still observed, reinforcing the importance of the role of tactile contact. "In most cases, the results obtained in deprivation studies with other primate species have paralleled the findings for rhesus monkeys" (Suomi, 1984, p. 47).

Levine and Stanton (1984) found that physical contact between mother and infant squirrel monkeys acted as a buffer to stress responses. Separation for 30 minutes resulted in increased serum cortisol (a stress related hormone) in both mothers and infants. When reunited, the mother's cortisol level went down; the infant's cortisol level did not go back down but did not reflect the sharp rise associated with long separation (Levine & Stanton, 1984).

Weininger (1954) studied the effects of stress on gentled (frequently handled and stroked) and ungentled (not handled or stroked) rats. One group of rats was gentled for 3 weeks after weaning. Both groups were exposed to stressful stimuli before an autopsy was performed. Findings revealed that the gentled rats had less ACTH output and cardiac and gastrointestinal damage than the ungentled rats. Thus, "gentling" modified or lessened the stress response to the noxious stimuli.

Rosenweig, Bennett, and Diamond (1972) concluded, after 16 replications between 1960-1969, that rats kept in an "enriched" environment when compared to those in an "impoverished" environment had a greater weight and thickness of the cerebral cortex, larger brain cells, and more activity of cholinesterase (an enzyme found in glial cells). An "enriched" environment was defined as one with objects and "toys" for interaction, in addition to food and water.

Diamond (1984) summarized:

> In the rat, environmental enrichment can increase the thickness of the cortex not only during infancy, but throughout life. Whether the increase is due to touch, pressure, temperature or other factors is not known. All these modalities are probably involved when animals huddle together or investigate new surroundings or objects (p. 22).

Studies of Multimodal Stimulation for Preterm Infants

Harrison (1985) summarized "in an effort to decrease the adverse neurological effects of premature birth and prolonged hospitalization, a number of investigators over the last 20 years have studied the effects of providing various types of supplemental stimulation to preterm infants" (Harrison, 1985, p. 69). Multimodal intervention studies are those which included some combination of tactile, visual, auditory, and/or kinesthetic stimulation.

The earliest supplemental stimulation study done for preterm infants was reported by Hasselmeyer (1964). In this study there were 60 medically-stable infants, 30 in the control (C) group and 30 in the experimental (E) group--with birthweights between 1501 and 2000 grams. The infants in the control group did not receive any supplemental stimulation and were kept in a sitting position in their cribs during feedings. Infants in the experimental group received supplemental handling each day in the form of stroking and rocking; additionally, they were held during feedings. The intervention regime was initiated between 7 and 14 days of age and was provided for 14 days. The results revealed that infants in the experimental group were more quiescent and gained more weight. However, because the study failed to control who provided the touch and standardize the intervention regime, the study cannot be replicated or validated.

Scarr-Salapatek and Williams (1973) studied the effects of early tactile (touch and holding), visual (mobiles), and vestibular (rocking) stimulation on 30 infants less than 1800 grams (at birth) and of 28 to 36 weeks gestation. Although they did not say they gave supplemental auditory stimulation, the investigators did say that nursery personnel were instructed in the procedure and "the practical nurses rocked, talked to, fondled, and patted" the experimental group infants (p. 97). The 15 preterm infants in the experimental group received the intervention protocol upon admission to the nursery and for 6 consecutive weeks, whereas, the control group infants received routine care. Upon discharge, the mothers of the experimental group were instructed regarding supplemental stimulation and given a mobile to take home with their baby; the control group mothers received no additional instructions. Weekly home visits were made to the experimental group families until the infants were 1 year of age, in order to instruct mothers on appropriate developmental stimulation. Greater developmental progress (at 4 weeks of age) and higher Cattell IQ scores (at 1 year) were reported for the experimental group. The investigators admitted that the effects seen could not be attributed or isolated to a specific sensory modality--but rather were due to the stimulation of several senses together. This study was flawed in that there was no standardized stimulation protocol that could be replicated and no account for other factors occurring that first year of life. In addition, data analysis and specific scores for groups were unclear and the issue of attrition was not included.

White and Labarba (1976) studied twelve preterm infants of 32 to 36 weeks gestation with birthweights ranging from 1588 to 2041 grams. The six preterm infants in the control group received routine nursery care. The six preterm infants in the experimental group received four 15 minute sessions of tactile (rubbing the neck, trunk, and extremities) and kinesthetic (gentle, passive flexion of arms and legs) stimulation for 10 consecutive days, starting at 2 days of age. Although data were collected on eight dependent variables, significant differences were seen only in increased weight gain and increased formula intake for the experimental group infants. Again, it cannot be determined which sensory modality was beneficial or if it was a combined effect. Due to the small sample size, results may be questionable and limited in use.

In a study of 30, 32 to 37 week gestation preterm infants, weighing 1420 to 2245 grams at birth, Rice (1976) investigated the effects of both tactile (massage and stroking) and vestibular (rocking) stimulation. Stimulation was initiated the day after hospital discharge and was provided for 20 minutes, four times each day. The 15 infants in the experimental group scored higher on the Bayley Scales of Infant Development at age 4 months and gained more weight.

Visual (mobiles), tactile (rubbing), vestibular (rocking), and auditory (talking) and supplemental stimulation were administered in the study by Leib, Benfield, and Guidubaldi (1980). There were 14 infants in the control and experimental groups, with birthweights ranging from 1200 to 1800 grams. The stimulation was initiated when the infants were medically stable and weighed at least 1700 grams. Although there was neither a difference in weight gain per day nor over the course of hospitalization between groups, the experimental group infants ingested fewer calories per day. "Treated infants had significantly higher developmental status than control infants, as measured by the Bayley Scales of Infant Development, at 6 months past the maternal expected date of confinement" (Leib et al., 1980, p. 83). This study was more rigorous in methods, used appropriate analyses, and addressed nursery standing orders. But once again, no mention was made of providing the stimulation based on the infants' cues and no physiological parameters were explored.

Rausch (1981) also studied tactile (gentle body rubbing) and kinesthetic (gentle limb flexion) stimulation. This intervention consisted of 15 minute sessions once daily on a matched sample of 20 control group and 20 experimental group infants. The preterm infants were medically-stable (not requiring intubation) and weighed between 1000 and 2000 grams at birth. The stimulation was initiated within 24 to 48 hours after birth and administered once daily for 10 consecutive days. The results revealed that the experimental group infants had increased oral intake and increased stooling. Additionally, although infants in the experimental group gained more weight per day than did infants in the control group, this difference was not statistically significant. This study had a detailed supplemental stimulation protocol that could be replicated and data analyses were appropriate. However, it is unclear if one or both sensory modalities accounted for the positive effects seen from the intervention.

Field et al. (1986) examined the effects of supplemental tactile and kinesthetic stimulation. The mean gestational age of infants in the study was 31 weeks with a mean birthweight of 1280 grams. The sample size consisted of 40 preterm infants (20 in the control, and 20 in the experimental group). The stimulation began when the infants were medically stable and transferred to the transitional nursery. The stimulation protocol included 5 minutes of massage, 5 minutes of flexing the limbs, and 5 minutes of massage, repeated three times per day. Infants in the experimental group gained 47 percent more weight and had a shorter hospitalization (by 6 days). They also were more awake, active, and performed better on the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) in orientation, motor, mature habituation, and state behavior. This was a well-designed, well-defined, and replicable study.

White-Traut and Tubeszewski (1986) examined supplemental multimodal stimulation of 36 stable preterm infants. The stimulation included massage, vestibular, auditory, and visual sensory modalities. The mean gestational age of infants in this study was 31.5 weeks and they weighed less than 1800 grams at birth. When they attained a weight of 1750 grams they were randomly assigned to a control (N=16) or an experimental (N=17) group. The intervention was given once a day for 15 minutes for 10 days (or discharge). "The results indicated no significant differences between groups, although trends for greater weight gain and shorter duration of hospitalization were noted" (White-Traut & Tubeszewski, 1986, p. 90). This study reported multiple limitations including unit expansion and acuity-level upgrade which may have confounded the results.

In a replication of the Field et al. (1986) study, Scafidi et al. (1990) examined tactile (massage) and kinesthetic stimulation in 40 stable, preterm infants. There were 20 infants in both the control group and the experimental group with a mean gestational age of 30 weeks and a mean birthweight of 1176 grams. The stimulation began when the preterm infants were transferred to the transitional nursery (mean weight at onset of intervention was 1313 grams). The physiological results revealed 21 percent more weight gain per day and 5 less days hospitalization in the experimental group. There was an increase in urinary norepinephrine, but no changes in urinary cortisol and growth hormone levels. Behavioral effects seen in the experimental group (as compared to the control group) included mature habituation on the BNBAS, less active sleep and less REM sleep, and fewer periods with no movement during stimulation. This was another well-designed study which included measurement of stress and growth hormones. Although the weight gain for the experimental group was not as significant as seen in the Field et al. (1986) study, there was a significant difference between the weight gain among infants in control and experimental groups. Additionally, experimental group infants exhibited more mature habituation on the BNBAS exam. This was an important study as the investigators attempted to replicate their previous findings.

Studies of Tactile Stimulation on Preterm Infants

The following studies have been done examining the effects of tactile stimulation, or touch, alone, without any other supplemental sensory stimulation. The tactile interventions were usually either a form of stroking or rubbing (more arousing in nature), or gentle touch (more calming in nature).

1. Stroking or Rubbing Tactile Stimulation

Solkoff, Yaffe, Weintraub, and Blase (1969) did a pilot study of ten preterm infants (5 control; 5 experimental), weighing within a range of 1190 to 1590 grams at birth. Infants in the control group received the normal routine care; the experimental group infants received 5 minutes of stroking in their isolettes each hour for 10 days. This intervention was initiated during the first day of life. The investigators reported that the experimental group infants were more active and regained their birth weights faster. Additionally, "there was some indication that the experimental infants cried less than the controls" (Solkoff et al., 1969, p. 766). Upon a 7 to 8 month follow-up after discharge, the experimental group infants scored higher on the Bayley in gross and fine motor development. Due to the small sample size, the investigators were unable to use formal statistical analysis. Thus, the study and its findings were limited.

Kramer et al. (1975) provided supplemental stroking to eight experimental group infants, and gave routine care only to six control group infants. The intervention was implemented before and after each feeding for a total of 48 minutes per day (if fed every 2 hours the preterm infant would receive 2 minutes of stroking before and after feedings; if fed every 3 hours, the infants would receive 3 minutes of stroking before and after feedings). The mean birthweight was 1418 grams for the control group infants and 1441 grams for the experimental group infants. The mean gestational age was 33 weeks for both groups. Findings revealed no physiological differences in either plasma cortisol levels or weight gain. Experimental group infants showed enhanced social development. This was one of the first tactile stimulation studies that investigated plasma stress hormone response levels.

2. Gentle Human Touch Tactile Stimulation

Three studies over the past decade (Harrison et al., 1992; Jay, 1982; Tribotti, 1990a) have evaluated the effects of gentle human touch. Jay (1982) used the phrase "gentle human touch" for the first time to describe the tactile intervention of skin-to-skin contact between the infant's head and abdomen and the researcher's hands. The sample size consisted of 26 medically-fragile preterm infants who were intubated and mechanically ventilated. The 13 infants in the matched control group received the normal routine care; the 13 infants in the experimental group received the gentle human touch (initiated within the first 96 hours of life) in addition to the normal routine care. This intervention was given for 12 minutes, four times a day for 10 consecutive days, for infants in both groups. The mean gestational age was approximately 29.5 weeks; the mean birthweights were 1323 grams for the control group and 1287 grams for the experimental group.

The results of this first study of gentle human touch revealed no differences between groups for temperature range, weight gain, tolerance of feedings, or complications. The experimental group infants demonstrated some behavioral changes during the touch intervention: decreased overall activity with observable quiescence

during the touch intervention: decreased overall activity with observable quiescence
during touch, fewer startle responses, and more openness of both hands (perhaps indicating a more relaxed state). This study was one of the first studies of supplemental stimulation conducted on medically-fragile preterm infants. The study examined a variety of variables and was initiated within the first 4 days of life. It was instrumental in paving the path for others to question the effects of touch on this unique population.

Tribotti (1990a) used gentle touch on four, stable, preterm infants ranging from 32 to 35 weeks of age when the study was done. The intervention was comprised of a 15 minute pre-intervention baseline, 15 minutes of the touch intervention, and 15 minutes post-intervention. The stimulation was given three times a day with the infants serving as their own controls. The variables examined in the study included: oxygen saturation (T_cPO_2 readings), respiratory regularity, and motor activity. Tribotti (1990a) examined the infants' individual responses. It was observed that the infant's T_cPO_2 dropped during the first session, remained the same during the second session, and had a slight increase by the third session. Respiratory regularity gradually increased over the three sessions; whereas, motor activity showed a gradual, slight decrease over the three sessions. Tribotti (1990a) suggested that these results might be because the infants reacted in a slightly stressed way until they learned that this stimulation was safe and non-aversive. Although the sample size was small, and they were medically-stable preterm infants, this study examined both physiologic and behavioral variables before, during, and after touch.

A recent pilot study was reported by Harrison (1991a) and Harrison et al. (1992) on six (C=3; E=3) medically-fragile preterm infants of 27 to 32 weeks gestational age and provided the methodology which was used, with modifications, in this dissertation research. The gentle human touch intervention was initiated at 6 to 9 days of age, provided three times a day (at least 45 minutes apart) for 15 minutes, and continued for 10 consecutive days. The investigator's hands were placed on the infant's head and right arm and shoulder instead of on the abdomen (or chest/thorax) as done by Jay (1982), because the neonatologist was concerned that abdominal (or chest/thorax) placement could impair respiration (Harrison, 1991a). A video camera was used to observe and record the touch intervention as well as to collect 10 minutes of pre- and post-intervention data. Heart rate and oxygen saturation readings were obtained continuously via computerized equipment.

The mean birthweight for the control and experimental group infants was 1215 grams and 1420 grams respectively. The mean gestational age was 29 weeks for infants in the control group and 30.7 weeks for infants in the experimental group. The infants in the experimental group, compared to the control group, had lower serum cortisol levels, greater weight gain, lower morbidity scores, and fewer days on phototherapy or oxygen supplementation, fewer blood transfusions and shorter hospitalizations. Additionally, Harrison (1991a) reported few changes in heart rate or oxygen saturation levels when comparing before, during and after touch periods. Motor activity for the experimental group decreased during the touch intervention. This study was important because it examined both physiological and behavioral effects of touch in very-young, medically-unstable, preterm infants.

Variables of Interest for this Study

Jay's (1982) procedure for gentle human touch and Harrison et al.'s (1992) modification of this procedure and use of behavioral and physiological dependent variables provided the foundations for this dissertation research. This study differed from the studies by Jay (1982) and Harrison et al. (1992) in four respects: (1) duration of touch (20 minutes versus 12 or 15 minutes), (2) frequency of touch (once a day versus three or four times a day), (3) data collection using direct observation (versus videotaping) and control of four additional extraneous variables (position, restraints, pacifiers and eye patches), (4) use of RAM as a conceptual framework. Support for these modifications came from the review of literature, the Harrison et al. (1992) pilot study, and the principal investigator's clinical expertise in this area and her knowledge of RAM (see Chapter 3).

The dependent variables of interest were derived from the Harrison et al. (1992) pilot study, the conceptual framework (RAM), and the review of literature (presented earlier in this chapter). These variables included: heart and oxygen saturation stability, state classifications (e.g. sleep-wake patterns), motor activity, behavioral distress cues, weight gain and caloric intake, number of days on supplemental oxygen and phototherapy, number of blood transfusions, discharge weight, and length of hospitalization. The Harrison et al. (1992) pilot study suggested the need for further investigation of these variables and their relationship to a gentle human touch intervention.

SUMMARY

In conclusion, supplemental tactile stimulation such as gentle human touch has been associated with beneficial outcomes for the preterm infant's overall development. It is clear that further examination of the physiological and behavioral effects of tactile stimulation for the 27 to 32 week gestational age, medically-stable, preterm infant is warranted. It has also been discussed that much of the previous research was limited due to small sample size, non-standardized touch intervention, lack of control of intervening variables, inappropriate statistical tests, and the wide range of gestational ages and birthweights. Additionally, few replications and long-term studies have been done.

More studies need to be done examining the type, timing, and duration of gentle human touch--and stimulation by other sensory modalities--based upon the physiological and behavioral cues observed in the premature infant. Appropriate nursing interventions and hospital policies could then be developed that are based on research. Such interventions and policies will ultimately aid the preterm infant's adaptation to extrauterine life and promote an optimal quality of life.

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the design of the study, the population and sample, the research questions/hypotheses, data collection methods, and treatment of the data. The purpose of this study was to investigate the physiological and behavioral effects of a gentle human touch nursing intervention during the first weeks of life in fragile, preterm infants of 27 to 32 weeks gestation.

Design of the Study

This study was an experimental, repeated measures design examining the effects of gentle human touch on preterm infants' adaptation to extrauterine life in the physiological and interdependence modes.

The Population and Research Sample

The population of the study was comprised of all preterm infants who were between 27 and 32 weeks gestational age at birth and who were admitted to the NICU of the University of Tennessee (UT) Hospital Medical Center in Knoxville, Tennessee, during the study period. This population was selected because little is known about the effects of touch on this age group. The sample included male and female preterm infants whose parents agreed to have their infants participate in the study. No exclusion was made based upon race, sex, or Human Immunodeficiency Virus (HIV) status.

The NICU at UT has an average census of 48 (24 in intensive care and 24 in intermediate care). The general layout of the unit is "L" shaped with the nurses station and storage space located in the angle of the "L". Each preterm infant has its own bedside unit equipped with individual monitors, supplies, and clipboard for charting. Nurses are assigned to one (to three) preterm infant(s) to care for (depending on the infant's medical status) per 12 hour shift. All infants are placed on a radiant warmer upon admission and moved into an isolette (usually) within a week after admission. Staffing patterns vary in relationship to the census.

As per UT's policy, all parent(s) were initially approached by a staff nurse in the NICU. The Principal Investigator (P.I.) could not approach parent(s) until the nurse conveyed whether the parent(s) would be interested in having their infant participate in the study. Approximately 30 percent of the parents approached by staff nurses declined participation in the study. Although no data were allowed to be collected on these families, parental age, education, and socio-economic status appeared to vary. Reasons shared to the nurses regarding non-interest/participation in the study were: concern for over-stimulation of their infant, not wanting themselves or their infant bothered, extended family members told them not to participate, not wanting to make any more decisions, and being able to say "no" to this study when they (parent[s]) had no control or choice over anything else going on with their infants.

Operational Definitions

A. Preterm Infant. Infants who met the following criteria as defined by Harrison (1990), were eligible to participate in this study:

1. Gestational age 27-32 weeks at birth, as determined by the scoring system utilized at UT and performed by the admitting physician.
2. No congenital anomalies.
3. Not having undergone surgery.
4. No medical orders contraindicating the administration of gentle human touch as stated in the research proposal.
5. Hematocrits above 38 percent on admission to the NICU.
6. Cardiac and oxygen saturation monitors in place, or infants could be attached to these monitors, for the purpose of this study.

B. Heart Rate (HR). Normal range is 120 to 160 beats per minute. HR was measured by the Nellcor Pulse Oximeter monitor already attached to the infant and recorded every 30 seconds during data collection by the principal investigator (PI) on the Neonatal Assessment Coding Sheet (NACS) (see Appendix A). This monitor was left in place at the bedside for the duration of the study period (see Figure 2).

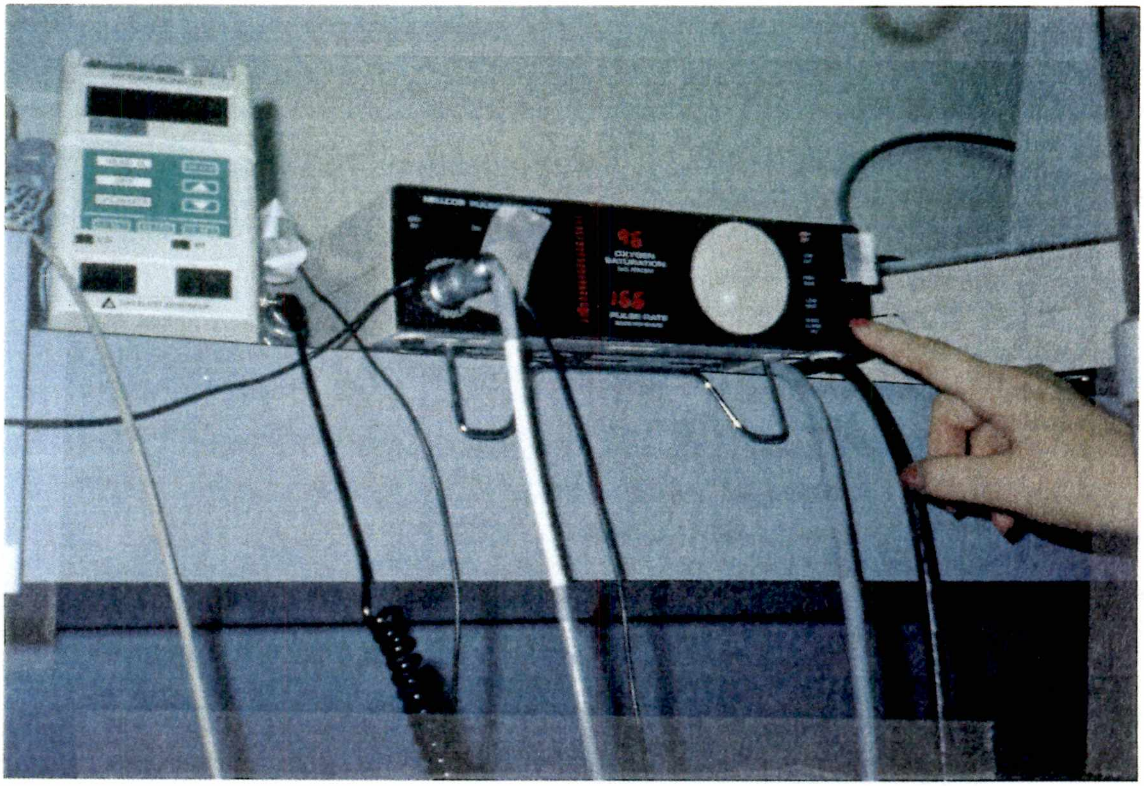

Figure 2. The Nellcor Pulse Oximeter (used with permission).

The reliability of the Nellcor monitor was determined by several methods:

1. Calibration of the equipment was ascertained by the respiratory therapist upon initial attachment of the monitor to the infant.
2. Correlation of the HR digitally displayed on the Nellcor monitor was compared to the Kontron Supermon HR monitor (also attached to the infant) and the apical pulse when taken by the nurse every 1 to 2 hours. The PI compared the two monitors every 30 seconds when data were collected. Reliability was accepted when the apical pulse and/or monitors were within 2-3 heart beats of each other (see Figure 3). On the infrequent occasions when the monitors didn't concur, no data were charted for that time interval.
3. Preventative maintenance was routinely provided every 6 months by the Biomedical Department at UT.

C. Oxygen Saturation (O_2 sat). Defined as "the relative amounts of oxyhemoglobin and reduced hemoglobin" and expressed in a ratio in terms of percent (Fuhrman & Zimmerman, 1992, p. 100). The policy at UT was to maintain oxygen saturation levels at 88% or greater. Oxygen saturation was measured by the Nellcor pulse oximeter and recorded every 30 seconds by the PI during data collection on the NACS. As previously stated, this monitor

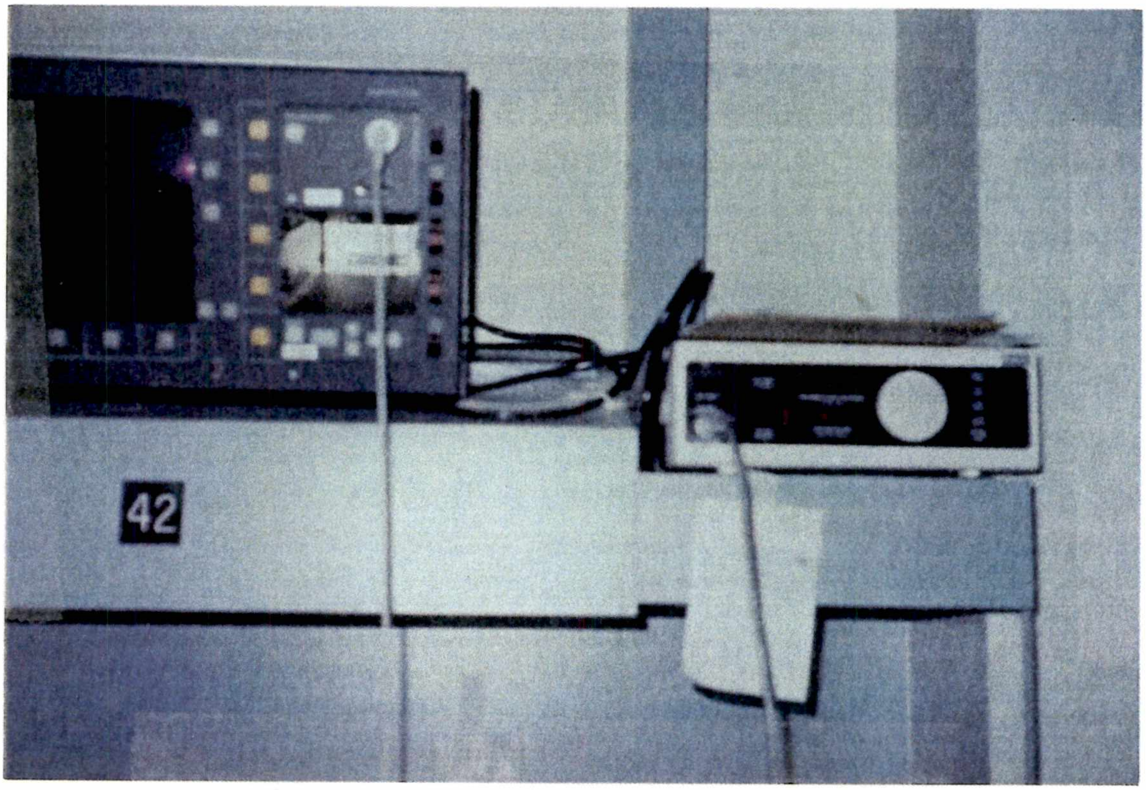

Figure 3. The Kontron Supermon Heart Rate Monitor (left) and Nellcor Pulse Oximeter (right) (used with permission).

was left in place at the bedside for the duration of the study period (see Figure 2).

The reliability of the Nellcor pulse oximeter monitor was determined by several methods:

1. Calibration of the equipment was ascertained by the respiratory therapist upon initial attachment of the monitor to the infant.
2. Periodic (frequency varied) blood analysis samples measuring 0_2 saturation were correlated with the 0_2 saturation reading displayed on the Nellcor monitor (at the time the blood sample was obtained). Reliability was accepted when the blood analyses and monitor were within 2 to 3% of the other. These two instruments never differed when randomly compared.
3. Reliability was also accepted if the Nellcor HR was correlating with the Kontron Supermon's displayed HR, and the Nellcor displayed a pulse bar of 4 or more in rhythm with the Kontron Supermon's pulse display (these correlations are used by UT staff to determine the Nellcor's reliability) (see Figure 3). On the infrequent occasions when the monitors didn't concur, no data were charted for that time interval.

D. <u>Nellcor Pulse Oximetry</u>. A noninvasive procedure that uses an instrument for determination of "the relative amount of oxyhemoglobin and deoxyhemoglobin in the blood, expressing the result in terms of oxygen saturation" (Fuhrman & Zimmerman, 1992, p. 100). Fuhrman and Zimmermon (1992) also reported that the reliability and validity of the pulse oximeter, when compared to actual oxygen saturation levels, is well documented (for the percentage of 0_2 saturation levels examined in this study). The instrument gives a numerical digital readout for both HR and 0_2 saturation. (Reliability for the Nellcor pulse oximeter was previously discussed under HR and 0_2 saturation) (see Figure 2).

E. Sleep States. High and Gorski (1985) defined and categorized the preterm infants' states of consciousness, "based on the 6-state scale described by Brazelton (1973) for term infants" (High & Gorski, 1985, p. 134). The six-states as defined by High and Gorski (1985) were used in this study and are listed below (High & Gorski, 1985, p. 135).

Quiet Sleep (State 1) -- eyes closed, no movement except startles, and regular respirations for the whole 15 second observation interval.

Active Sleep (State 2) -- may have rapid eye movement, some motor activity and may see occassional mouthing, grimacing and irregular respirations.

Drowsy (State 3) -- transitional waking with eyes open and close, irregular respirations, increasing activity level, and mild fussiness.

Awake Alert (State 4) -- eyes half to fully open for the whole 15 second observation interval, no movement and regular respirations.

Active Awake (State 5) -- eyes open, much spontaneous activity, irregular respirations, and irritability, with crying less than 15 seconds in duration.

Crying (State 6) -- sustained crying for the whole 15 second observation interval.

The infant's sleep state was coded once every 30 seconds by the PI on the NACS based upon the presence or absense of the above behaviors. Reliability was determined by interrater reliability measured every 7 to 10 days for two, 10-minute time periods of data collection. The RA that performed the interrater reliability was a R.N. currently enrolled in the Master's program at UT. Overall reliability for the study was 92% (see Table 1 for state classification mean scores).

F. Motor Activity Categories -- These categories were taken from Harrison (1990) and defined as follows.

Single Limb Movement - Infant moves only one arm or one leg during the coding interval.

Multiple Limb Movement - Infant moves more than one limb (e.g. two arms, or arm and leg) during the coding interval. (If multiple limb movement is coded, single limb movement will not be coded for the same interval.)

Gross Body Movement - Infant moves trunk (may also move one or more limbs during the same interval).

Table 1. Reliability Scores for State Classifications and Motor Activity Categories.

Variables			Mean Scores
I.	State Classification (Sleep States)		
	1.	Quiet Sleep	0.90
	2.	Active Sleep	0.87
	3.	Drowsy	0.94
	4.	Awake Alert	0.99
	5.	Active Awake	0.97
	6.	Crying	1.00
II.	Motor Activity Categories		
	1.	Single Limb Movement	0.89
	2.	Multiple Limb Movement	0.92
	3.	Gross Body Movement	0.90
	4.	Head Turning	0.91
	5.	Facial Grimace	0.90
	6.	Startle	0.95
	7.	Mouthing	0.90
	8.	Smiles	0.93
	9.	Clenched Hands and/or Feet	0.90
	10.	No Movement	0.92
		Overall Mean Score =	0.9243 or 92%

Head Movement - Infant moves head in any direction.

Facial Grimace - "A frown, eye tightening, and/or upper lip raising" (Barnard, 1978, p. 55, modified).

Startle - Rapid extension, and then flexion of arms or legs involving whole body movement.

Mouthing - Infant makes visible movements with mouth, such as sucking, tongue protrusion, or lip grimace ["with lips retracted to the side...straight across" (Barnard, 1978, p. 55)].

Smiles - Infant's lips are raised and retracted to the side. Mouth may be open or closed.

Finger or Toe Movement - Involves compression or extension of fingers or toes.

No Movement - Score if none of the other nine motor activity categories are observed during a time interval. [Taken from Harrison (1990)]

The infant's motor activity was measured and coded every 30 seconds by the PI on the NACS. Reliability was determined by interrater reliability as described under sleep states (see Table 1 for motor activity category mean scores).

Previous interrater reliabilities from the Harrison (1991a) pilot study for state classifications and motor activity categories were high. The range for the mean scores were 0.87 (for single limb movement) to 1.0 (for sleep states and smile category).

G. Motor Activity Index -- This index was scored by combining five of the motor activites described in the above Motor Activity Categories: single limb movement, multiple limb movement, body movement, head movement, and startles. Reliability was determined as previously discussed under motor activity categories.

H. Behavioral Distress Cues -- Three signs of behavioral distress (mouthing/yawning, facial grimacing, and clenched fingers/toes), comprised this category as determined from coding of these activities on the NACS. Validity of this grouping needs further exploration. Reliability was determined as previously discussed under motor activity categories.

I. Caloric Intake. The number of calories consumed or delivered per day. Caloric intake was calculated from chart data per day for each infant during the 10-day study period (days 7 through and including day 16) and totaled for the 10 days. All calories from both intravenous (IV) and oral/gavage (PO) intake were recorded based on the protein, fat, and glucose concentrations of the intake sources, and total caloric intake was calculated accordingly. The calories per milliliter (ml) were determined based on the manufacturer's or physician's specifications for formula and intravenous fluids (e.g. intralipids, dextrose in water, and hyperalimentation). Reliability was determined by random comparison of the P.I.'s calculated (daily) caloric intake to the registered dietician's calculated (daily) caloric intake written frequently in the progress notes.

DATA COLLECTION

Random Assignment

The parents of preterm infants who met the previously stated criteria were invited to participate in the study. After informed consent was obtained, the infants were assigned randomly to either the experimental or control group. Random assignment was accomplished with the use of a random numbers table (Ott, 1988). Twenty two-digit numbers ranging from 01 through 20 were located on the table. The first 10 numbers, that were located on the table, were assigned to the control group; the remaining 10 numbers comprised the experimental group.

Informed Consent and Confidentiality

The following procedure was implemented to obtain informed consent. The researcher contacted the NICU daily to identify preterm infants who met the study criteria. After ascertaining from the NICU physician or charge nurse that there were no reasons for the preterm infant to be excluded from the study, the parent(s)/legal guardian were approached initially by the nursing staff to invite them to participate in the study. If the parent(s)/legal guardian were interested in their infant's participation in this study, the researcher or primary care nurse approached the parent(s)/legal guardian and described both the purpose of the study and the methods to be utilized. The parent(s)/legal guardian were also informed of the slight risk of a brief, transitory decrease in the preterm infants' oxygen levels during the touch. It was conveyed to the parent(s)/legal guardian that if this occurred ($< 88\%$ 0_2 saturation for 15 seconds), the touch intervention would be stopped and staff notified if needed. Parents were asked for written consent only after all explanations had been given and all questions had been answered (see Appendix B for consent form).

All information collected for this project was treated confidentially and all records were kept in a locked file cabinet by the researcher in the researcher's home. Only the principal investigator had direct access to data in the file cabinets; data were shared only with the dissertation committee when needed.

Parents were (1) assured confidentiality, (2) advised that they were not obligated to allow their baby to participate in the study and may withdraw at any time, (3) assured that their decision about participation would not affect their baby's hospital care, (4) told that there were no provisions for financial payment related to participation in the study, and (5) advised that they may receive a summary of the results of the study when completed.

Assumptions

The following assumptions have been accepted about this study:

1. The NICU environmental stimuli affecting the preterm infants in this study will equally affect all preterm infants in this study.
2. Touch given to these preterm babies by others, including nursery personnel and parents/visitors, will equally affect all preterm infants in this study.

Procedures for Data Collection

The following method for gentle touch has been utilized by Dr. Lynda Harrison (1990; modifying Jay, 1982) and with her consent, was adapted for this project. The duration of touch (20 minutes versus 15 minutes), the timing of the touch (once every morning versus 3 times a day), and the data collection method (direct observation versus videotaping) was changed for this study. This decision reflected the PI's clinical expertise and literature support for investigation of other gentle touch intervention protocols.

Twenty preterm infants were assigned randomly to either the control or experimental group. Infants in the control group received the routine NICU nursing care. Infants in the experimental group received the routine NICU care as well as 20 minutes of "touch intervention" (supplemental stimulation) once every morning from the seventh to the sixteenth day of life. Twenty minutes for the length of the touch intervention was chosen because the PI wanted to simulate a length of time typically observed in mother-infant interactions. In addition, 20 minutes was longer than the duration of touch implemented in most studies. Touch was started on day seven because staff wanted to allow time for physiological stabilization and to decrease the chance for untoward sequelae. One touch intervention was given per day because of time and economic constraints, as well as a desired variation of the timing of touch.

The principal investigator's (PI) role was that of observer and coder, based upon prior training and experience with coding of behavioral data from Harrison et al.'s (1992) pilot study. The touch intervention was provided primarily by two research assistants (RA) who were registered nurses with NICU experience. (Due to emergency surgery, one of the RAs was out for 3 weeks in June. Two experienced NICU nurses were taught the touch intervention protocol and took her place in the study during that time period.) Nurses, rather than parents, administered the touch intervention in order to insure consistency in deliverance of the touch intervention, and because of limited availability of parents.

The touch intervention was provided according to the following protocol used by Jay (1982), and modified according to recommendations by Harrison (1991b, personal communication). Placement of the R.A.'s hands during gentle human touch was modified from Jay (1982), because during the Harrison (1991a) pilot study, the neonatologist was concerned that placement of a hand on the chest/thorax and abdomen during gentle touch could impair respiratory status. Thus, one of the R.A.'s hands was placed on the baby's head and the other hand was placed on the shoulder and arm. Additionally, the PI refined the protocol to address and control visual and auditory stimuli, factors that were not previously controlled by Jay (1982) or Harrison (1991a). The PI also kept constant four other variables: during actual data collection times all infants were placed on their left sides; none were given pacifiers; none were restrained; and none wore eye patches. Also, if the infants were being fed intermittently by gavage, the touch intervention was given after the feeding (not within the hour prior to being fed).

A. Touch Intervention Protocol

1. After donning scrub attire, the RA scrubbed her hands and arms for 3 minutes with an antiseptic scrub brush per UT's NICU policy.
2. The RA warmed her hands prior to touching the baby by allowing her hands to warm under the radiant warmer/isolette.
3. All infants were placed in the same position, on their left side, to enable the RA to touch the infant's right side. A diaper roll (of 1 diaper) was placed next to the infant's back for support. Turkewitz (1977) reported that the right side was one of the neonates' more sensitive areas to touch, and thus, the touch was provided on the right side. If the infant was not in this position, the PI asked the nurse to place the baby in this position. Data collection began no sooner than

10 minutes after the position change to allow for adaptation to a new position.

4. The RA approached the infant from behind, and remained behind the infant, to control for eye contact and visual stimulation. The RA did not talk to the infant, and whispered softly to others if absolutely necessary, to control for supplemental auditory stimulation. In addition, a folded blanket was placed halfway over the top of the isolette to prevent light from shining directly in the infant's eyes. (The radiant warmer provided its own protection from the direct bright light.) The RA placed one hand on the infant's head and the other on the infant's shoulder and arm, being careful of any supplemental support equipment attached to the infant (see Figure 4). The RA sat on a height-adjusted stool during the touch intervention. The RA initially placed her hands in position above the infant and slowly lowered them onto the infant with full touch applied within 30 seconds. Specifically, the RA's left hand was placed on the infants' head with her fingertips at rest immediately above the eyebrow line and the rest of the hand touching the crown of the head. The RA's right hand was placed on the infants' right shoulder and arm. Specifically, the RA's right thumb was on the infants' right shoulder (at midline position) with the rest on

Figure 4. The Gentle Human Touch Nursing Intervention (used with permission).

her fingers and hand touching the infants' arm (stopping right above the elbow), and not placed on the infants' chest. Both of the RA's forearms rested on the edge of the radiant warmer or isolette for support and to ensure continuous, full-contact touch with the infant without force. This touch intervention was successfully used even when the infant was receiving oxygen via flexihood (see Figure 5). This gentle human touch was continued for 20 minutes.

5. If the infant's oxygen saturation reading on the Nellcor Pulse Oximeter fell below 88% and remained below 88% for a full 15 seconds, the intervention was stopped and not done that day. In addition, the RA observed for any signs of distress (e.g. color change, increased agitation) which would also indicate discontinuation of the touch intervention.

The touch intervention was stopped only one day, for one baby (see discussion, Chapter V). This was handled statistically by the computerized statistical program.

After coding videotapes from the Harrison et al. (1992) pilot study, it was believed that direct, rather than videotaped observation, by a trained observer (PI) could be a very accurate approach to coding data. Direct observation eliminated the

Figure 5. The Gentle Human Touch Nursing Intervention During Oxygen Administration via Flexihood (used with permission).

expense of videotapes, camera, recording/playback equipment, and time required to code data collected on the videotapes. Additionally, direct observation precludedequipment problems, possible visual constraints, and delayed recognition of videotaping problems that result in "missing data." However, because the PI could not observe and give the touch intervention at the same time, qualified research assistants were employed to do all the intervention.

B. Direct Observation and Recording Protocol

1. The PI implemented UT's NICU protocol for visitors regarding scrubbing hands and wearing of gowns.

2. The PI had a pencil, a clipboard of blank assessment sheets for observation and recording purposes, earphones and a cassette player (see Figure 6).

3. The PI signaled to the RA with her hands to "start" (gave OK sign) and "stop" (moved hand horizontally back and forth) the touch intervention.

4. The PI wore earphones connected to a small cassette-player in her pocket. The tape had previously been recorded to play at 15 second time intervals saying "observe" (a pause for 15 seconds during which observation was done), and "record" (a pause for 15 seconds during which recording was done).

Figure 6. Supplies Used for Direct Observation and Recording by the Principal Investigator.

The touch intervention protocol was implemented when the infant was 7 days old and was provided once every morning (between 4 AM and 7 AM) for 10 consecutive days. Data were collected daily (during the 10 days of touch intervention), as well as on the day before (day 6) and the day after (day 17) the touch intervention was discontinued.

The following data were collected:

1. On the sixth day of life for the control and experimental group infants, the investigator directly observed and recorded, for 45 minutes in the morning, sleep state classifications and behavioral activity employing the Neonatal Assessment Coding Sheet (NACS) as modified with Harrison (1991b, personal communication) (see Appendix A). This procedure was repeated on the 17th day of life.
2. Infants in the experimental group had heart rate, oxygen saturation, sleep-state classifications and behavioral activity observed and recorded by the PI on the NACS (per protocol) as follows:
   a. <u>before</u> the touch intervention for 10 minutes,
   b. <u>during</u> the touch intervention for 20 minutes, and
   c. <u>after</u> the touch intervention for 10 minutes.

   Thus, infants in the experimental group had a total of 40 minutes of data recorded each morning for the 10 days of touch.

3. A variety of demographic and other information (see Appendix C) was recorded throughout the study period per chart review.

4. The NICU nurses were asked to mark a checklist indicating parental/other visits, parental/other touch, and the length of time that parents touched the baby during each visit (see Appendix D). Unfortunately, the nurses rarely completed the checklists, and this data was not analyzed. This checklist was possibly not completed because of time constraints and the many responsibilities the nurses had in the NICU that were of higher priority. (Also, many parents visited infrequently because they lived out of town.)

5. Interrater reliability checks on coding accuracy of the NACS was done every 7-10 days for two random 10 minute periods by the PI with a trained assistant (a pediatric nurse, currently enrolled in UT's MSN program). The research assistant was trained by the PI and assessed for data coding reliability (greater than 80%) prior to reliability data collection. The percentage agreement method was used. Different infants were used; some reliability checks were done before/after touch and some were done during touch. The percentage agreement method

used in Harrison et al. (1992) pilot study was also implemented in this study. That formula is:

$$\frac{\text{agreements}}{\text{agreements + disagreements}}.$$

Treatment of the Data

The raw data from the Summary of Data Form was entered onto the University of Tennessee, Knoxville's mainframe computer, and the Statistical Analysis System (SAS) was used to analyze the data. Before data from the NACS could be entered and formatted by SAS, HR and 0_2 saturation means (per sheet for each time period or phase) were determined by a hand calculator. Also, the percentage of time spent in each sleep state and each movement category (for each time period or phase) was determined by a hand calculator. All percents were then entered into the computer program. Commands were written for SAS to combine single limb movements, multiple limb movements, gross body movement, head turning, and startle into a dependent variable named "motor activity." A dependent variable named "behavioral distress cues" was created by combining the scores for facial grimacing, mouthing, and clenched hands and/or feet. "No movement" and "smiles" were left as individual dependent variables. The states classifications (e.g. quiet sleep, active sleep) were also examined as dependent variables. The remaining two dependent variables on the NACS were physiological--HR and 0_2 saturation levels.

Thus, there was one independent variable ("touch") and eight primary dependent variables (HR, 0_2 saturation, quiet sleep, active sleep, motor activity, behavioral distress cues, smiles, and no movement). Seven additional dependent variables were examined in relationship to the "touch" intervention: weight gain, caloric intake, number of days on supplemental oxygen, number of blood transfusions, number of days on phototherapy, length of hospitalization and discharge weight. Morbidity status was a variable originally proposed to be examined, but due to problems in identifying an instrument that was appropriate for the data collected, this variable was dropped from the study.

All data for infants in the experimental group were entered and identified by code (subject number), day (1 to 10) and phase (before, during and after touch). Data for days 6 and 17 (for the control and experimental groups) were entered by code and identified as pre-baseline (day 6) or post-baseline (day 17) for group comparisons.

Descriptive statistics were used to describe subjects and present demographic data. The two-sample t-test was performed to test Hypothesis #1 and to answer the research questions (comparing the control versus the experimental groups on the identified variables).

Repeated-measures analyses of variance was chosen for Hypotheses #2 and #3 because this was a design using the subjects as their own controls for these two hypotheses. Specifically a univariate, two within-subject, zero between-subject repeated-measures analysis was used; the two within-subject factors were day (1 to 10) and phase (before, during, and after touch). For all significant repeated-measures analyses of variance, post hoc comparisons (pairwise comparison procedures) were made using Fisher's Least Significant Difference test (LSD). This test controlled the pairwise comparison error rate at alpha level=0.05 (equal to the chance of making an error for each comparison) versus the experiment-wise error rate. In addition, interaction effects of the factors, day and phase, were tested with plots examined.

SUMMARY

This study examined the effects of a program of gentle human touch on fragile, preterm infants (27 to 32 weeks gestational age). Infants were assigned randomly to either a non-touch control group, or an experimental touch group. Infants in the experimental group received a daily program of gentle human touch (for 20 minutes) for 10 consecutive days (days 7 to 16). All touch was administered by the same, trained individuals (Registered Nurses with NICU experience). The principal investigator directly observed and coded all of the daily touch interventions, and group data (collected on days 6 and 17). Interrater reliability checks were assessed regularly.

SAS was used for data analyses. Descriptive statistics were used to analyze demographic data and repeated-measures ANOVA, Fisher's LSD test, and $\underline{t}$-tests were performed to test the hypotheses and answer the research questions.

CHAPTER IV

RESULTS

Demographics

There were 10 caucasian preterm infants randomly assigned to each group (total N=20). The control group had 3 females and 7 males; the experimental group had 6 females and 4 males. The mean gestational age was 30.4 for the control group infants, and 30.0 for the experimental group infants. The mean birthweight was 1457 grams (range 970 to 1880 grams) for the control group infants and 1373.6 grams (range 695 to 1740 grams) for the experimental group infants (see Table 2). Mean Apgar scores for the control group infants were 7 at 1-minute (range 3 to 8) and 8.4 at 5-minutes (range 7 to 9). Mean Apgar scores for the experimental group infants were 5.8 at 1-minute (range 1 to 9) and 8.1 at 5-minutes (range 5 to 9). Fifty percent (N=5) of the infants in the control group, and 40 percent (N=4) of the experimental group infants were born by cesarean-section to mothers with a mean age of 24 years (for the control group) and 25.6 years (for the experimental group).

Two-sample t-tests and a Chi-square analysis were conducted between the two groups on demographic variables to determine group differences (see Table 3). There

Table 2. Characteristics of Preterm Infants in the Control and Experimental Groups.

	CONTROL GROUP (N=10)		EXPERIMENTAL GROUP (N=10)	
VARIABLE	MEAN (SD)	RANGE	MEAN (SD)	RANGE
Gestational Age	30.4 (1.58)	28-32	30.0 (1.76)	27-32
Birthweight	1457 (280)	970-1880	1373.6 (319.3)	695-1740
Apgar at 1 minute	7 (1.63)	3-8	5.8 (2.74)	1-9
Apgar at 5 minutes	8.4 (0.84)	7-9	8.1 (1.29)	5-9
Mother's age	24 (4.35)	19-30	25.6 (6.38)	18-35
Gravida	2 (1.25)	1-4	2.1 (0.99)	1-4
Para	1 (1.25)	0-3	0.9 (0.99)	0-3
Weight on Day 6	1363 (268.5)	1010-1950	1248 (264)	720-1510

Table 3. Comparison of Control and Experimental Groups on Selected Demographic Variables.

VARIABLE	*t*	*p*
Gestational Age	0.53	0.60
Birthweight	0.62	0.54
Mothers' Age	-0.66	0.52
Apgar at 1 Minute	1.19	0.25
Apgar at 5 Minutes	0.62	0.55
Weight on Day 6	0.97	0.35
Sex	Chi-square=1.82, df=1	not significant

were **no** statistical differences found between the control and experimental group infants for gestational age, birthweight, mothers' age, Apgar scores at both 1 and 5 minutes, number of days on the ventilator and in the oxyhood, and weight on day 6 (the day prior to the touch intervention period).

Sixteen preterm infants, 8 in the control group (mean # of days=3.3) and 8 in the experimental group (mean # of days=3.2), received supplemental oxygen therapy during the study period. Although the mean number of days that the control group infants were on ventilators (mean=2.8) was greater than the mean number of days for the experimental group infants (mean=1.3), the experimental group babies had a greater number of days receiving oxygen via oxyhood (mean=1.9) when compared to the control group (mean=0.5). In addition, two infants in each group were diagnosed with Patent Ductus Arteriosus (PDA) which was treated and resolved with drug therapy during the first week of life. There were also two preterm infants in the study (one in each group) who had abnormal cranial ultrasounds revealing mild intraventricular hemorrhages.

Hypothesis #1

> Compared to infants in a randomly assigned control group, preterm infants who receive 20 minutes of gentle human touch daily (from days 7 to 16 post birth) will display:

a) a greater increase in periods of inactivity (no movement) from day 6 to day 17;

b) a greater decrease in motor activity from day 6 to day 17;

c) a greater decrease in the frequency of behavioral distress cues from day 6 to day 17;

d) a greater increase in weight gain from day 6 to day 17;

e) a greater increase in the percent of time in quiet sleep from day 6 to day 17;

f) a greater decrease in the percent of time in active sleep from day 6 to day 17.

One-tailed t-tests on mean differences (score on day 17 minus score on day 6) were conducted to compare infants in the control and experimental groups. Although some of these dependent variables may be correlated and pose potential concern with using multiple t-tests, MANOVA could not be used because of the small sample size.

Statistical significance at the 0.05 significance level was found between groups for percent of time in **active sleep** ($t = 1.7$, $p = 0.05$) and **near significance** was seen between groups for frequency of **motor activity** ($t = 1.59$, $p = 0.065$) (see Table 4). No statistically significant differences were found between groups for the remaining dependent variables of interest: percent of time in no movement, frequency of behavioral distress cues, amount of weight gained, and percent of time in quiet sleep (see Table 4). (The direction of the group mean difference is identified by the positive (+) or negative (-) sign. A positive value indicated an increase in the value of the variable upon completion of the 10-day study period; a negative sign indicated a decrease in the stated variable upon completion of the 10-day study period.) Therefore, hypothesis #1 was partially supported. Even though only two of the six comparisons were statistically significant, the group differences were all in the expected direction.

Hypothesis #2

> Preterm infants who receive 20 minutes of gentle human touch daily (from days 7 to 16 post birth) will display no change in heart rate or oxygen saturation levels before, during, and after touch.

Univariate repeated-measures ANOVAs were conducted to assess the effects of day and phase on the dependent variables (DV) mean heart rate and oxygen saturation. There were **no** significant main effects for phase or day for either heart rate or oxygen saturation (see Table 5). Mean heart rates for before, during, and after touch phases were 156, 154, and 155, respectively. Mean oxygen saturations during the 3 phases were as follows: **before** touch-94.5, **during** touch-94.4, and **after** touch-94.3.

Table 4. Comparison of Differences Between Control and Experimental Groups.

Variable	Control Group	Experimental Group	*t*	*p* (one-tailed)
No Movement	1.4	4.4	-0.25	0.40
Motor Activity	3.06	-2.7	1.59	0.065**
Behavioral Distress Cues	1.07	-5.13	1.0	0.16
Weight Gain	184.5	232.5	-0.96	0.18
Quiet Sleep	-4.2	3.4	-0.65	0.26
Active Sleep	13.4	-9.6	1.7	0.05*

* = significance

** = near significance

Table 5. Repeated-Measures Analyses of Variance for Physiological Variables.

VARIABLE	SUM OF SQUARES	F VALUE	p
DV: Heart Rate			
Day	1880.4185	0.94	0.4945
Phase	115.6802	1.21	0.3214
Phase*Day	863.3432	1.82	0.0267
DV: Oxygen Saturation			
Day	61.6666	0.46	0.8940
Phase	1.7448	0.35	0.7125
Phase*Day	21.7172	0.53	0.9390

There was significant phase X day interaction for HR but not for oxygen saturation. Plots of mean HR by day according to phase indicated **no** easily interpretable difference in day-to-day variability by phase (see Figure 7). The significant interaction appears to be solely a function of differential rates according to phase on only Day 7 of the intervention. Figure 8 shows consistent day-to-day variation in oxygen saturation for the 3 phases. Therefore, the null hypothesis for Hypothesis #2 was accepted; there were **no changes** in HR or oxygen saturation levels before, during, and after touch.

Hypothesis #3

> Preterm infants who receive 20 minutes of gentle human touch daily (from days 7 to 16 post birth) will display increased inactivity (or no movement), decreased motor activity, decreased behavioral distress cues, and an increased percent of time spent in quiet sleep during touch as compared to before and after touch.

Repeated-measures ANOVAs were performed to assess the effects of day and phase on the dependent variables mean percent (of time) for motor activity, no movement, behavioral distress cues, and sleep-states by code (subject), day, and phase. There were **highly significant** main effects as a function of phase for motor activity ($F=21.02$, $p=0.0001$), no movement ($F=12.44$, $p=0.0004$), behavioral

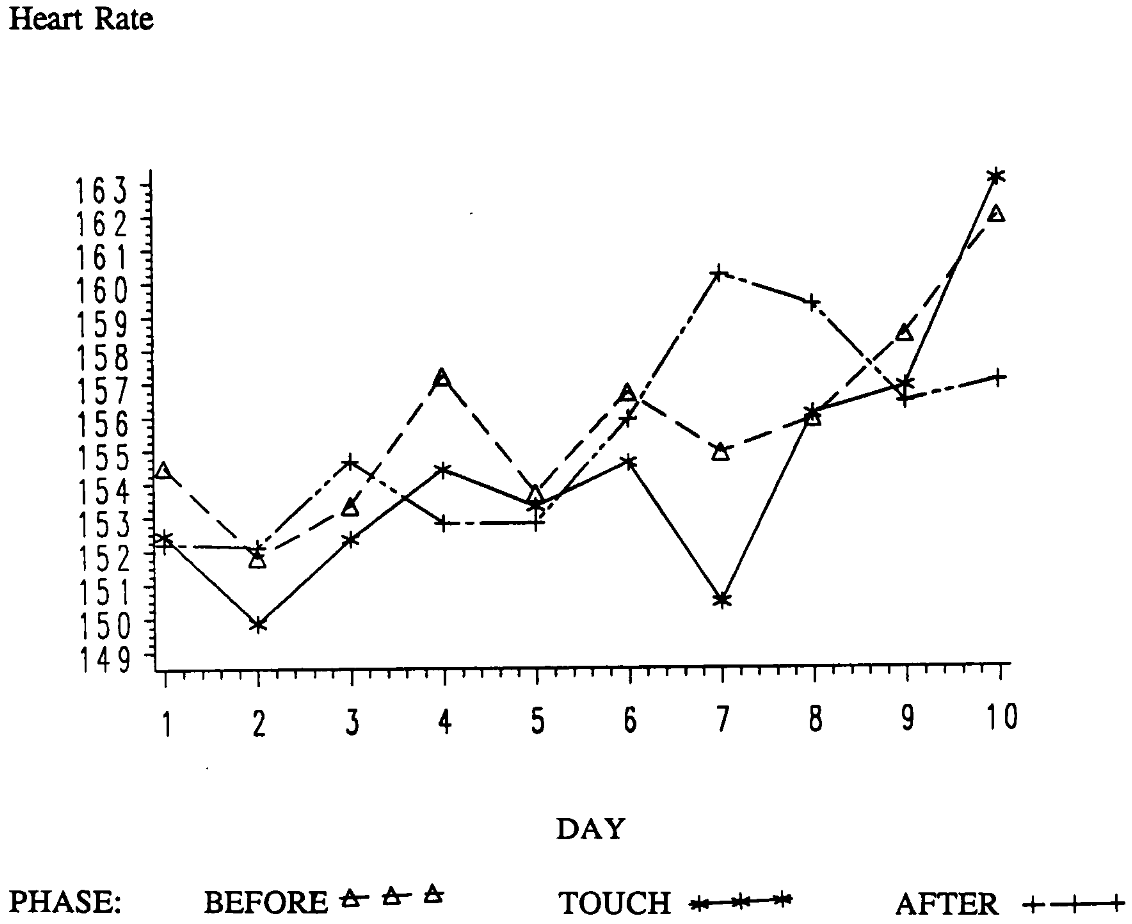

Figure 7. Mean Heart Rates by Phase and Day of Touch Intervention.

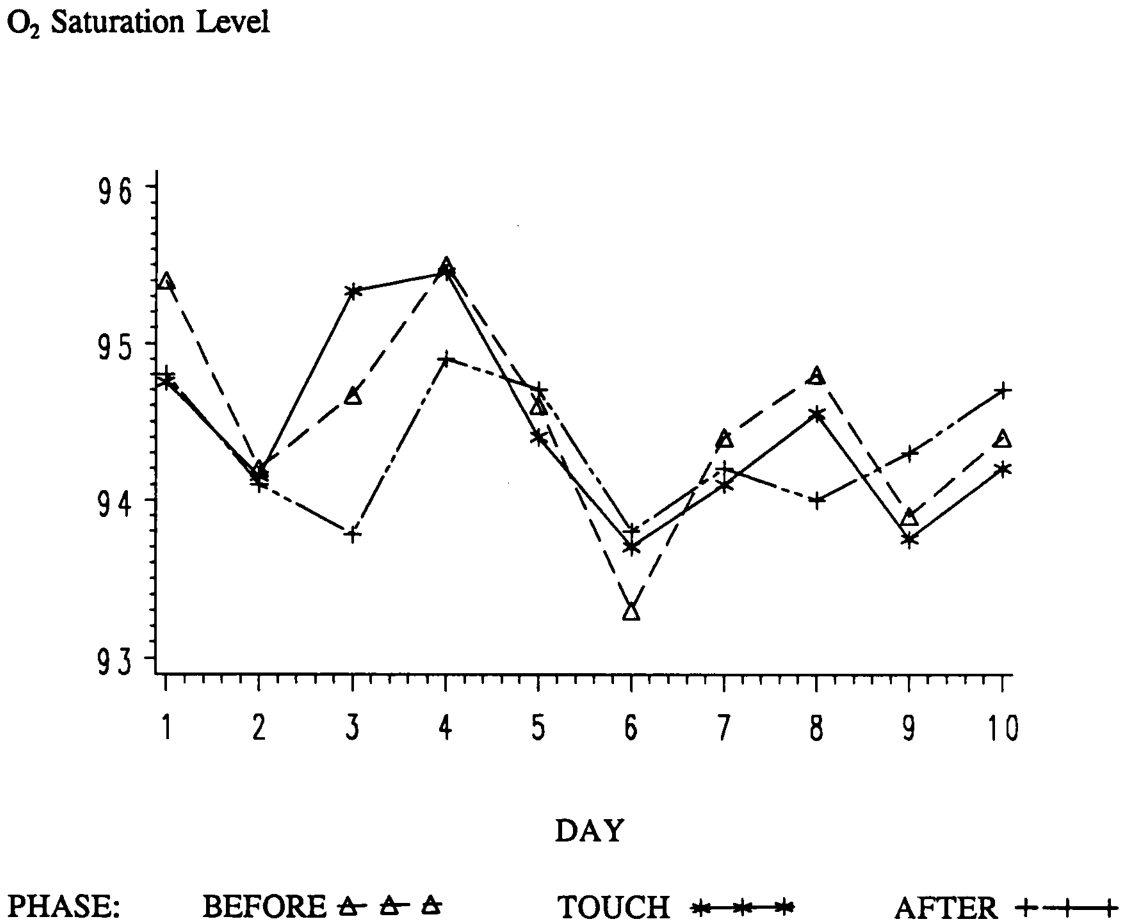

Figure 8. Mean 0_2 Saturations by Phase and Day of Touch Intervention.

distress cues ($F=14.53$, $p=0.0002$), quiet sleep ($F=14.54$, $p=0.0002$), and the drowsy state ($F=20.12$, $p=0.0001$) (see Table 6). There were no significant day effects or interaction effects. Graphs of mean responses across days by phase are shown in Figures 9, 10, 11 and 12.

Pairwise comparisons of mean responses by phase were made using Fisher's LSD tests for each of the five dependent variables in which significant phase effects were found. The LSD tests for motor activity supported the hypothesis that the amount of time for motor activity **during** touch (mean=8.87%) was significantly **lower** than the time for motor activity both before (mean=17.07%) and after (mean=14.91%) touch (see Figure 9). The LSD tests for the no movement category showed that the amount of time preterm infants spent **not** moving **during** touch (mean=33.29%) and **after** touch (mean=31.57%) was significantly **higher** than the before touch period (mean=17.53%) (see Figure 10). In addition, the frequency of behavioral distress cues exhibited by the infants before touch (mean=35.9%) was found to be significantly **higher** than the frequency of behavioral distress cues displayed by the infants both **during** (mean=27%) and **after** (mean=28%) touch (see Figure 11).

There were two sleep-states that warranted the LSD pairwise comparison procedure. The amount of time preterm infants spent in quiet sleep both **during**

Table 6. Repeated Measures Analyses of Variance for Significant Behavioral Variables.

Variable	Sum of Squares	F Value	p
DV: Motor Activity			
Day	936.2988	0.68	0.7267
Phase	3505.8537	21.02	0.0001*
Phase*Day	388.9693	0.55	0.9317
DV: No Movement			
Day	6123.3655	0.97	0.4742
Phase	14728.6026	12.44	0.0004*
Phase*Day	2444.9409	0.49	0.9612
DV: Behavioral Distress			
Day	2421.3058	0.74	0.6755
Phase	4549.5621	14.53	0.0002*
Phase*Day	1022.9026	0.64	0.8639

Table 6. (continued)

Variable	Sum of Squares	F Value	p
DV: Quiet Sleep			
Day	7817.8472	1.17	0.3236
Phase	15969.1132	14.54	0.0002*
Phase*Day	2688.0710	0.51	0.9517
DV: Drowsy			
Day	6662.1322	1.85	0.0727
Phase	9268.0618	20.12	0.0001*
Phase*Day	7646.3014	1.46	0.1120

* = significance

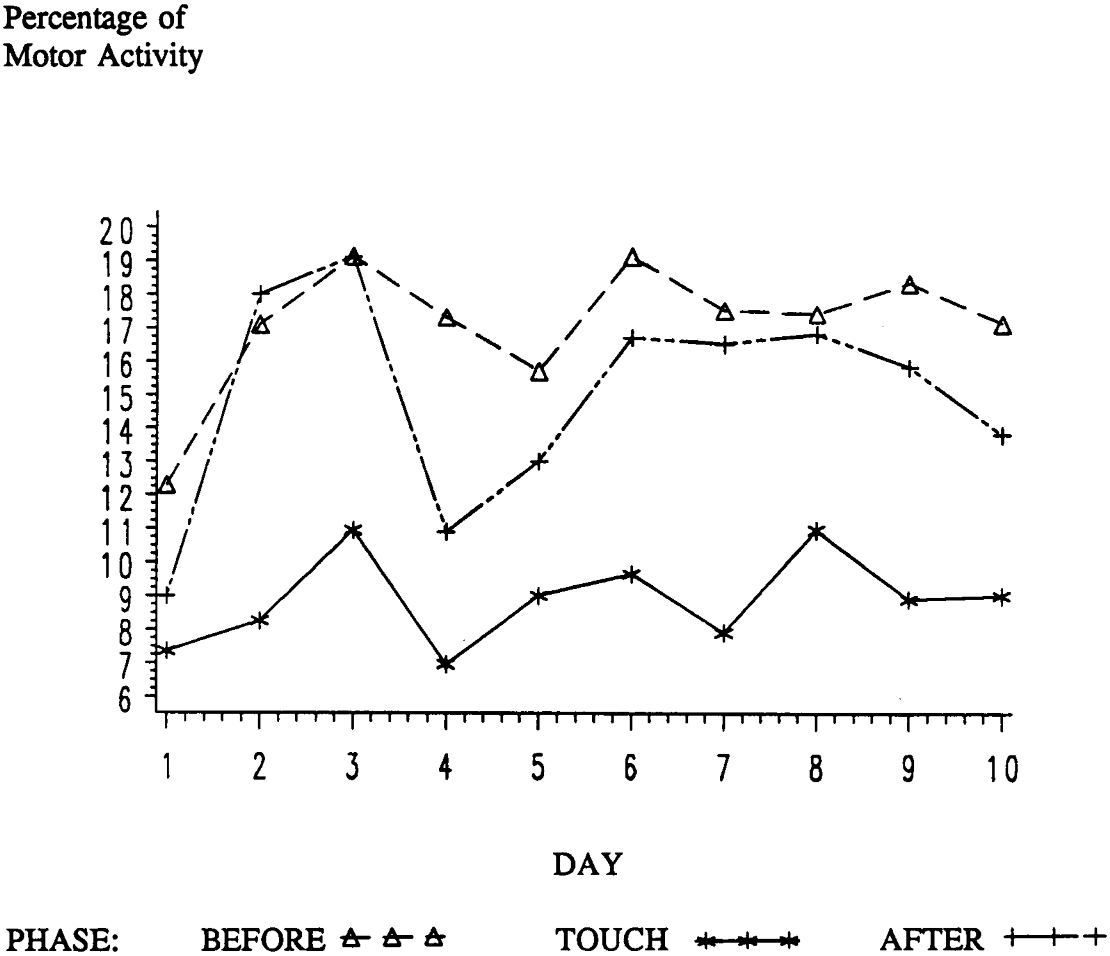

Figure 9. Mean Percentage (of time) for Motor Activity by Phase and Day of Touch Intervention.

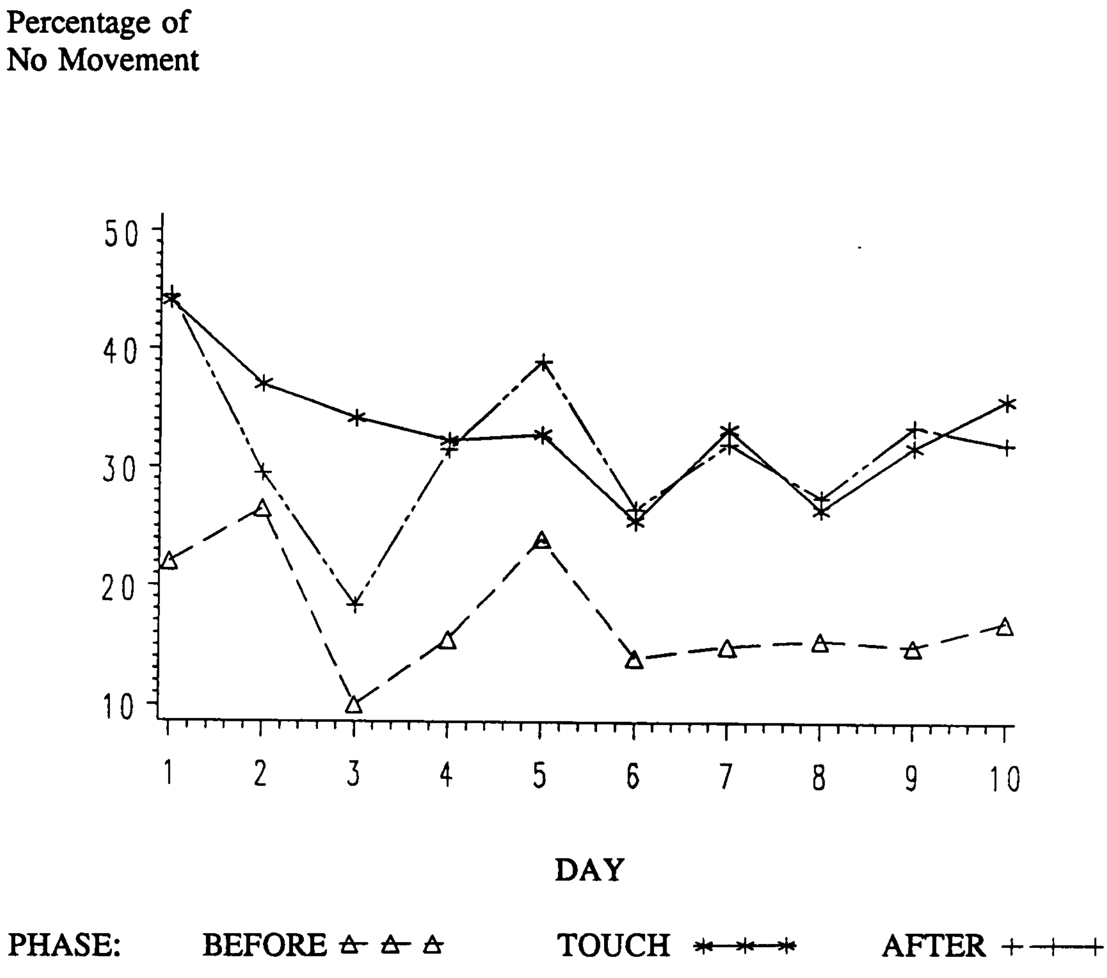

Figure 10. Mean Percentage (of time) Inactive (no movement) by Phase and Day of Touch Intervention.

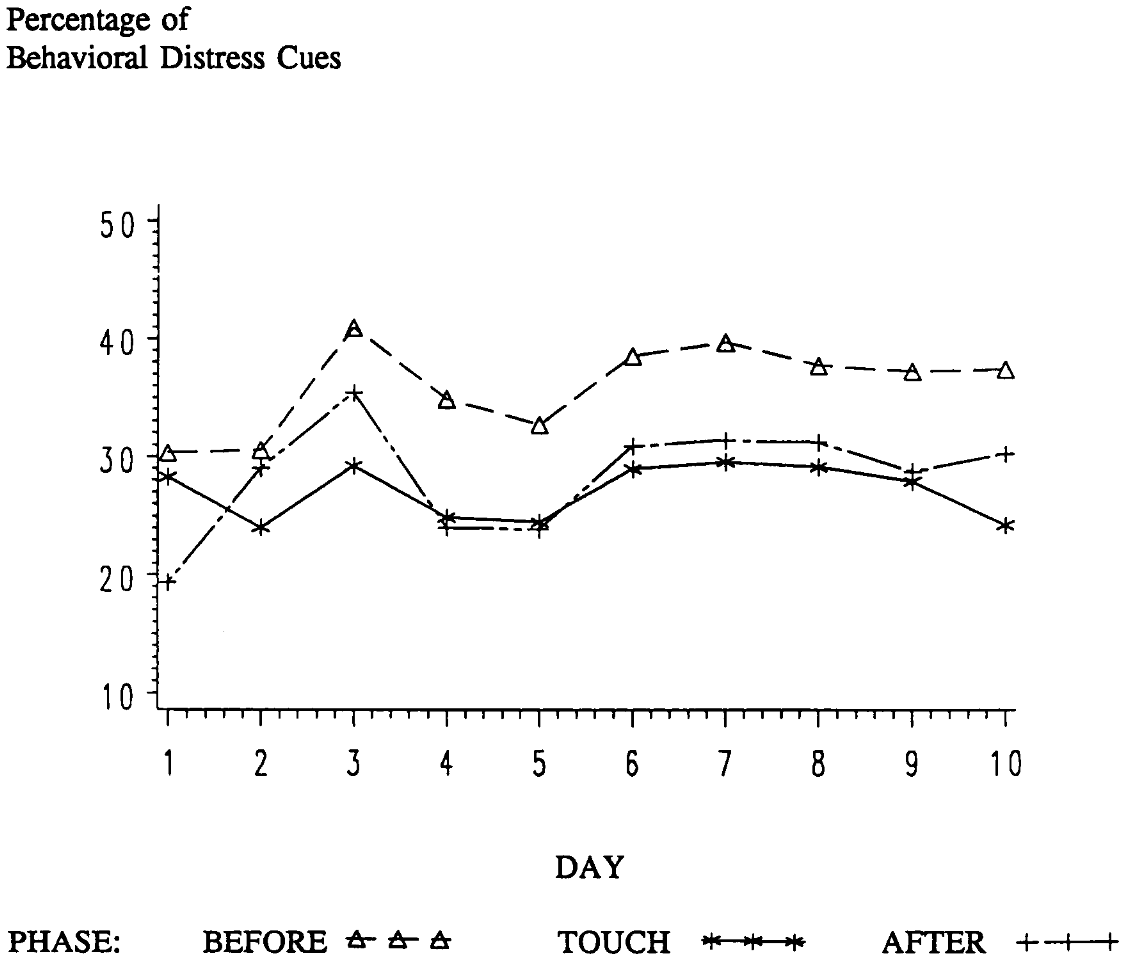

Figure 11. Mean Percentage (of time) for Behavioral Distress Cues By Phase and Day of Touch Intervention.

(mean=34%) and **after** (mean=32%) touch was significantly **higher** than the amount of time spent in quiet sleep before touch (mean=17.6%) (see Figure 12). Finally, significantly **more** time was spent in the drowsy state by preterm infants before touch (mean=21%) than both during (mean=10.46%) and after (mean=8.43%) touch. Thus, the null hypothesis for Hypothesis #3 was rejected; there **were** differences on the stated dependent variables before, during, and/or after touch.

Research Questions

1. Are there differences between infants in the control and experimental groups on the following variables measured during the 10-day study period: caloric intake, number of days on supplemental oxygen, number of blood transfusions, and number of days on phototherapy?
2. Are there differences between infants in the control and experimental groups on length of hospitalization and discharge weight?

Descriptive statistics were examined for the variables stated in the two research questions. The mean weight on day 6 (before the touch intervention period) was 1363 grams for the control group and 1248 grams for the experimental group. The mean weight on day 17 (after the touch intervention period) was 1547.5 grams for the control group and 1480.5 grams for the experimental group. The mean caloric intake for the total 10-days (of the study period) was 1456.2 calories for the control group and 1407.4 calories for the experimental group. Also, both groups had

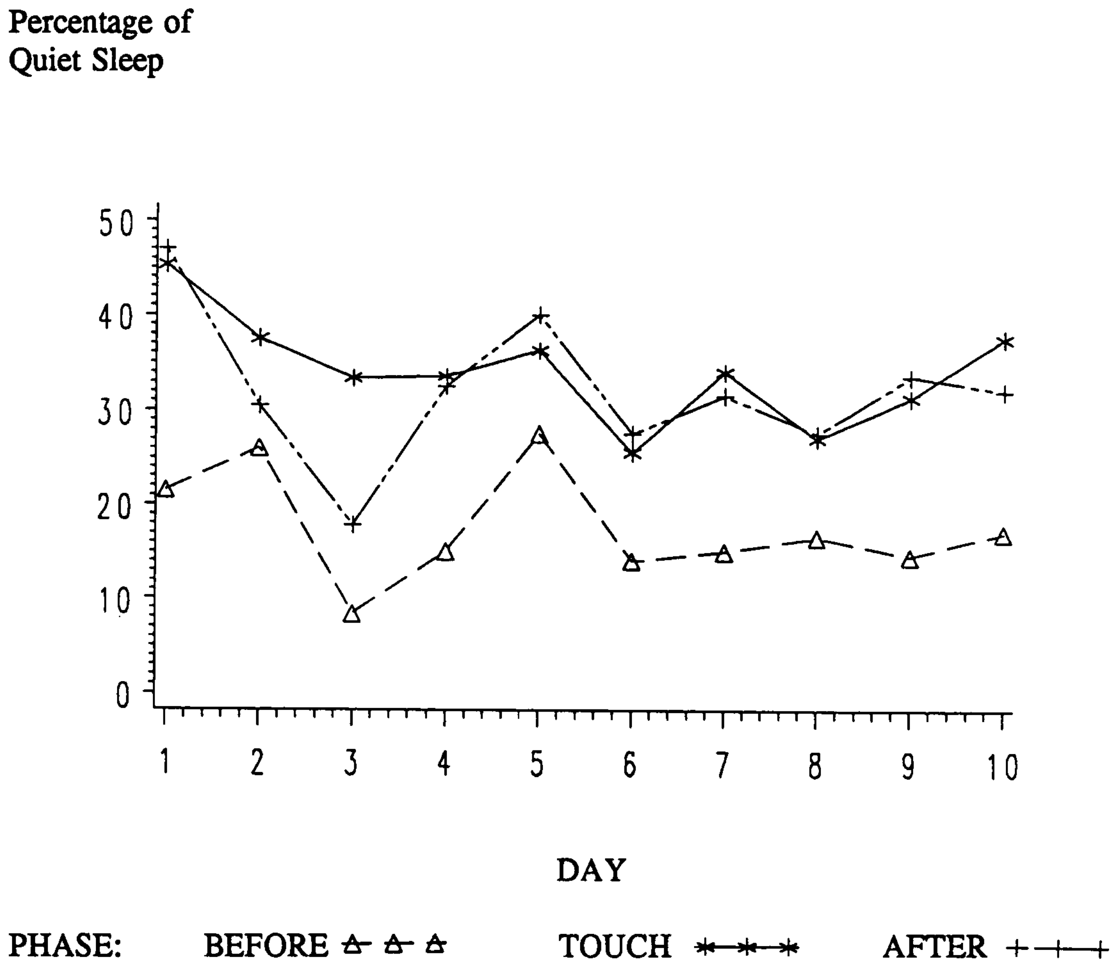

Figure 12. Mean Percentage (of time) for Quiet Sleep by Phase and Day of Touch Intervention.

the same number of days during the study period (N=2.1) receiving nothing by mouth (NPO), only intravenous fluids. Additionally during the study period, the control group received a mean of 0.8 days of phototherapy and one-half of a blood transfusion compared to a mean of 1.8 days of phototherapy and 1 blood transfusion received by the experimental group.

Upon discharge from the hospital, the preterm infants in the control group had a mean weight of 2269.5 grams as compared to a mean weight of 2295.6 grams for the preterm infants in the experimental group. The mean length of hospitalization for the control group was 46.6 days and 49 days for the experimental group.

Independent sample t-tests were conducted to answer these questions. There were no statistically significant differences found between groups on any of these variables (see Table 7).

Summary

In summary, 20 preterm infants participated in this study (control group N=10, experimental group N=10) of a gentle human touch nursing intervention on preterm infants of 27 to 32 weeks gestation. Experimental group infants had a significantly greater decrease in the percentage of time spent in active sleep over the 10-day study period compared to control group infants. Near significance was seen between groups for the variable of motor activity. Preterm infants in the

Table 7. Comparison of Control and Experimental Groups on Research Question Variables.

Variable	Mean For Control Group	Mean For Experimental Group	t	p
Caloric Intake	1456.2	1407.4	0.24	0.82
Number of Days on Supplemental 0_2	3.3	3.2	0.05	0.96
Number of Blood Transfusions	0.5	1.0	-0.96	0.35
Number of Days on Phototherapy	0.8	1.8	-1.82	0.09
Length of Hospitalization	46.6	49.0	-0.26	0.80
Discharge Weight	2269.5	2295.6	-0.22	0.83

experimental group demonstrated a greater decrease in motor activity from day 6 to day 17 than did control group infants. There were no other statistically significant differences between the two groups.

Repeated-measures analyses on data from the experimental group infants showed no significant differences for the physiological variables (HR and 0_2 sat) before, during, and/or after the touch intervention. However, there was highly significant variation in five behavioral variables (motor activity, no movement, behavioral distress cues, quiet sleep state, and drowsy state) before, during, and/or after the touch intervention. The following mean differences for the behavioral variables were significant:

1. less motor activity during touch (compared to before and after touch),
2. more inactivity (no movement) during and after touch (compared to before touch),
3. less behavioral distress cues during and after touch (compared to before touch),
4. more quiet sleep during and after touch (compared to before touch), and
5. less drowsiness during and after touch (compared to before touch).

CHAPTER V

DISCUSSION AND CONCLUSIONS

This chapter discusses the meaning and relevance of the results of this study, through the lens of the theoretical framework, in light of previous research. Conclusions are drawn, limitations are discussed, and implications for further study are posited.

Discussion

It was proposed in the theoretical framework, based upon the Roy Adaptation Model of nursing, that touch is fundamental for adaptation to extrauterine life. Furthermore, it was posited that touch may enable the preterm infant to cope with extrauterine life in the NICU as demonstrated through adaptation in the physiological and interdependence modes.

Through examination of physiological and interdependence mode behaviors, **the results of this study suggest that gentle human touch does not adversely affect preterm infants and may be beneficial** to these infants. These findings support those of other researchers (Field et al., 1986; Harrison et al., 1992; Jay, 1982;

Rausch, 1990; Rose, 1984; Tribotti, 1990a; White-Traut & Tubeszewski, 1986) who have proposed the benefits of tactile stimulation for preterm infants.

Discussion of Findings Within the Experimental Group

Specific signs of immediate, effective physiological adaptation, **demonstrated in the responses of the experimental group to the touch intervention**, included heart rate and oxygen saturation stability (for infants who were receiving supplemental oxygen, the concentration of inspired oxygen was not different or adjusted before, during, or after each touch intervention). In congruence with the article by Catlett and Holditch-Davis (1990), these results suggested that the preterm infant was not physiologically stressed by this stimulation. Specifically, there were no increases in HR or decreases in oxygen saturation levels during or after the touch intervention of this study. These results also support the similar findings reported by Harrison et al. (1992). Tribotti (1990a) reported an initial, temporary drop in the infants' oxygen saturation level during the first session; oxygen remained the same during the second session, and increased slightly by the third session.

Comments by RN's working in the NICU indicated that they perceived the touch intervention as a non-stressful, positive experience for the infants. One nurse related that "this seems to be something the babies like," while another nurse reflected "this baby seems to rest better after you touch him." Yet, another nurse enthused (upon our arrival to implement the touch intervention) she was glad "her" baby was going to be touched--he had been so irritable and she felt the "touch" helped him calm down.

Additionally, five behaviors were observed in the experimental group that communicated adaptation via the physiological and interdependence modes. These responses included: **decreased motor activity** during touch (compared to before and after touch) and **less movement, decreased behavioral distress cues, more quiet sleep, and less drowsiness** during and after touch (than before touch). With the exception of the finding for less drowsiness, these results were consistent with findings reported by other researchers (Field et al., 1986; Harrison et al., 1992; Jay, 1982; Scafidi et al., 1990). These behaviors are also indicative of both regulator and cognator effectiveness, and thus, suggest the preterm infant's ability to cope. In addition, these behaviors are associated with lower oxygen and energy demands, and therefore, they can be expected to promote the infant's growth and development. The finding of less drowsiness during and after touch (than before touch) can be explained by the fact that these infants spent more time in quiet sleep (thus diminishing the percent of time spent in the other sleep states).

Of particular interest, and warranting further discussion, is the preterm infant's responses **after** the touch intervention. There appeared to be a carryover effect, occurring approximately by day 4 and remaining throughout the touch period, for several significant behaviors: behavioral distress cues, no movement, quiet sleep, and drowsiness. Examination of the plots of these variables (by day and phase) revealed a probable novelty effect for day 1 (similar percentages during and after touch) but a return to baseline (after touch) on days 2 and 3. On day 4 and thereafter, however, mean percentages on these four behaviors remained comparable both during and after the touch intervention. These findings support similar results by Harrison et al. (1992), Jay (1982), and Tribotti (1990a). However, the research findings reported here reflect a greater quantification of the dependent variables and a greater control of extraneous variables than in other studies.

According to RAM, these results are indicative of effective cognator activity through the coping process channels of perceptual/information processing, learning, and judgment. Thus, coping was apparent through adaptive physiological mode responses (continued HR and 0_2 saturation stability; decreased movement, behavioral distress cues and drowsiness; and increased quiet sleep) and adaptive interdependence mode responses (receptive of nurturance as demonstrated by the adaptive physiological behaviors) observed over the course of the study period.

Additionally, these findings statistically document previous observations acknowledged by several NICU nurses during the course of the study. An NICU nurse reflected "there seems to be a carryover effect on the baby after being 'touched'--he's more quiet." One of the RA's commented that "after a few days, the babies seem to like being touched." Also, another RA stated (regarding one preterm infant) "she's like a 'wild woman', so irritable and moving all the time, but she quiets down during touch."

In conclusion, the gentle human touch nursing intervention was believed beneficial to these preterm infants (as measured by a variety of parameters), with **no adverse effects** being demonstrated. The touch intervention was stopped for only one infant, on one day. This particular infant was the youngest (27 weeks gestation) and the smallest (birthweight of 695 grams) of both the control and experimental groups. The infant was also one of the most physiologically unstable in the study, and was the only infant requiring 100% FiO_2 (fraction of inspired oxygen concentration) per mechanical ventilation. On day 3 of the touch intervention study period, this baby was placed on 100% FiO_2 (up from 85% FiO_2 on day 2). Discussion was held, with the primary nurse and charge nurse, whether this baby should be "touched" at all that day. Because the primary care nurse saw improvement during touch the previous two days, it was determined to attempt the touch intervention. The preterm infant's O_2 saturation fell below and remained below 88%, and thus, the touch intervention was discontinued as per protocol. The P.I. later decided not to "touch" any preterm infant on 100% FiO_2 because of limited recourse if there were untoward sequelae. The neonatologist agreed with this decision; the head nurse stated she would support the researcher's judgment in individual situations.

Discussion of Findings Between-Groups

Infants in the control and experimental groups were also compared on previously stated dependent variables that are indicative of extrauterine adaptation. Comparisons revealed significantly less time spent in active sleep, and near significance for decreased motor activity, among infants in the experimental group as compared to infants in the control group. These findings reflect effective regulator and cognator activity. Specifically, these two findings support the results reported by Harrison et al. (1992). Neither Jay (1982) nor Tribotti (1990a) had collected data on the short-term behavioral effects of gentle human touch between groups. Most between-group data reported on tactile stimulation, alone, or in combination with other sensory modalities, examined long-term effects such as weight gain, length of hospitalization, and performance on various infant developmental scales at or after discharge from the hospital. There has been little research documenting the short-term effects of tactile stimulation.

Although there were no other statistically significant differences between groups, the experimental group means were greatly different, in the hypothesized direction, for four variables: no movement, behavioral distress cues, quiet sleep, and weight gain (refer to Chapter IV, Table 4). This difference suggests more effective coping by the experimental group infants. Although these results were not statistically significant, decreased movement, decreased behavioral distress, increased quiet sleep, and greater weight gain have been documented in other tactile studies of preterm infants (Field et al., 1986; Harrison et al., 1992; Jay, 1982; Scafidi et al., 1990). Lack of significance seen in this study may be due to the small sample size, the frequency of touch (once a day), the length of the study period (10 days), or the timing of the initiation of touch (touch was started at 7 days of age).

The results of the pilot study by Harrison et al. (1992) suggested that there might be differences between the experimental and control groups for weight gain, number of days on supplemental oxygen and phototherapy, and number of blood transfusions (which would be indicative of continued adaptation). Jay (1982) also reported that the experimental group required less oxygen over time, had higher hematocrit levels and required fewer transfusions. This study found no statistical differences between groups on these variables during the study period. Again, this may be due to the small sample size and frequency, length, and relative timing of the touch intervention. However, it is of interest to note that the experimental group infants gained more weight than did the control group infants, by the end of the 10-day study period, on fewer calories (indicative of effective regulatory activity, and possibly, cognator activity).

Additionally, researchers have reported shorter lengths of hospitalization and greater discharge weights for preterm infants who were provided with supplemental tactile stimulation (Field et al., 1986; Harrison et al., 1992; Scafidi et al., 1990).

Although this study focused on the immediate and short-term effects of a gentle human touch intervention, no differences were seen between the groups on these variables. It is interesting that although the experimental group infants had a smaller mean birthweight than did the control group infants, the experimental infants' mean discharge weights were higher (possibly indicative of effective regulator and cognator activity).

This study also examined the frequency of smiles between the control and experimental groups and within the experimental group. There were no significant findings regarding the occurrence of smiling or non-occurrence of smiling between groups or within the experimental group. Smiling at this age is "reflexive," it is not socially related (or learned) (Hodapp & Mueller, 1982; Piaget, 1952). The question remains: should there be any difference between groups? And if there is a difference, what does it mean? The significance of smiling behaviors in preterm infants warrants further investigation.

Lastly, although this study only examined two physiological variables (HR and 0_2 saturation), other physiological parameters, if measured, could provide valuable information. Measurements of cortisol, growth hormone, and catecholamines (e.g. norepinephrine, epinephrine) may be insightful in determination of stress responses and growth responses, between preterm infants assigned to a control or experimental group. Three researchers (Harrison et al., 1992; Kramer et al., 1975; Scafidi et al.,

1990) reported on stress and growth response levels in preterm infants (in control versus experimental groups) after tactile stimulation. Kramer et al. (1975) reported no differences in plasma cortisol levels between groups in response to a stroking intervention. Scafidi et al. (1990) found an increase in norepinephrine, but no changes in cortisol or growth hormone levels for the experimental group of preterm infants that received massage and kinesthetic stimulation. They suggested this may indicate that the intervention itself was non-stressful and may be helpful in stimulating maturational increases of catecholamines. Lastly, Harrison et al. (1992) reported a greater decrease in serum corisol levels among infants who received 10 days of a gentle human touch intervention compared to infants in a control group. Further research is needed to explore physiological responses to tactile stimulation. This research may prove critical in determination of the benefits, or adverse effects, of tactile stimulation on preterm infants.

Summary of Conclusions

In conclusion, gentle human touch was provided as a focal stimulus to facilitate the infant's coping and adaptation to extrauterine life. This intervention was deemed appropriate and beneficial in assisting the preterm infant in this transition as evidenced by adaptive physiological mode and interdependence mode behaviors observed in the study. These adaptive responses included: heart rate and oxygen saturation stability, increased quiet sleep and less active sleep and drowsiness, decreased motor activity, increased no movement, and decreased behavioral distress cues.

IMPLICATIONS

There are many implications for nursing and other health professionals that may be suggested as a result of this study. Of primary interest, is the matter of "minimal stimulation" policies. The results of this study suggest that general use of "minimal stimulation" signs scattered indiscriminately throughout the NICU may be inappropriate. Selected use of minimal stimulation, based upon the individual preterm infants' responses to stimuli, would better serve the needs of these infants. Preterm infants demonstrating continued, pronounced regulator activity and ineffective cognator activity, even after incoming stimuli were modulated, would be candidates for minimal stimulation. However, minimal stimulation status should be re-evaluated on a continuing basis.

Parents may benefit from education regarding the different types of touch. Harrison and Woods (1991) reported that stroking was the most frequent type of touch used by parents during NICU visits to their preterm infants. However, there is support in the literature that stroking is arousing and may be perceived as aversive by the preterm infant (Brazelton & Field, 1990; Oehler, 1985). Because most parents are eager for interaction with their infants and usually want to "touch" their babies, it is appropriate to encourage gentle human touch as an alternative method of touching fragile, preterm infants.

Nurses, physicians, and other health professionals would benefit from knowledge about tactile stimulation. Nursery personnel often stroke or pat preterm infants, when perhaps, another type of touch will be more appropriate. Education regarding signs of ineffective regulator and cognator activity (coping mechanisms used by the preterm infant) would be useful to staff for determination of the infants stimulation boundaries. In addition, knowledge of the potential benefits of gentle touch may encourage a new conceptualization of the role of touch in the NICU. The global issue of "touch" may be re-directed, and nursing care re-centered, upon loving, interactional touch versus the procedural, reactional touch that is the standard-operating-procedure of most NICU's.

Roy's Adaptation Model and Theory of Person as an Adaptive System successfully guided the middle-range theory of touch for this study and should be used in further research efforts in this area of preterm touch. Additional research based on this model would promote necessary development and refinement of the theory, especially as it relates to infants and children.

Recommendations

Although no generalizations should be drawn from this small study, many suggestions for further study may be posited. Studies of gentle human touch with larger sample sizes, including differing races, are needed. Studies with more preterm infants of varying gestational ages, and of different genders are warranted. More research needs to be directed toward determination of the optimal time to initiate a touch intervention, and the length of time and frequency of different types of tactile interventions for both physiologically stable, and unstable, preterm infants. It would be worthy to investigate the effects of different types of tactile stimulation on preterm infant populations with selected medical problems (e.g. congenital anomalies, Grade III and IV intraventricular hemorrhages). Case studies, and studies of twins, may also prove invaluable. Furthermore, more research is necessary for all combinations of multimodal sensory stimulation on medically-fragile, preterm infants in the NICU.

There is great need for development of instruments that could be used to evaluate the effects of tactile stimulation on preterm infants. It would be helpful if there was general consensus on defined state classifications, and if these classifications were used more consistently between researchers. More research is also necessary to determine what a preterm infants' behavior signifies (e.g. non-stressed versus stressed behavior). Indices or instruments could then be created to measure these defined behaviors and then be assessed for validity and reliability. Lack of generally accepted instruments in the area of preterm touch posed problems for this study, and thus, contributed to limitations for this particular study and other studies reviewed in the literature.

More attention also needs to be directed toward the provider of touch--do preterm infants demonstrate the same effects of touch when the touch is provided by nurses versus parents? In addition, control of extraneous variables and standardization of the touch protocol are ongoing concerns. Documentation of the cost effectiveness of a touch intervention program, highlighting the benefits to the preterm infant, is needed. Lastly, there is a need for follow-up studies to document the long-term effects of tactile stimulation, in addition to the immediate and short-term effects.

In conclusion, Korner (1987) said it most succinctly when she queried "Stimulation for whom, what kind, how much, at what intervals, at what postconceptional age, and for what purposes?" (p. 12).

REFERENCES

REFERENCES

Ainsworth, M.D. (1982). Early caregiving and later patterns of attachment. In M.H. Klaus & M.O. Robertson (Eds.), Birth, interaction and attachment (pp. 35-43), Skillman, NJ: Johnson & Johnson.

Als, H. (1986). A synactive model of neonatal behavioral organization: Framework for the assessment of neurobehavioral development in the premature infant and for support of infants and parents in the neonatal intensive care environment. Physical and Occupation Therapy in Pediatrics, 6, 3-53.

Andrews, H. A. & Roy, C. (1986). Essentials of the Roy Adaptation model. New York: Appleton-Century-Crofts.

Barb, S.A. & Lemons, P.K. (1989). The premature infant: Toward improving neurodevelopmental outcome. Neonatal Network, 7(6), 7-15.

Barnard, K. (1978). Nursing child assessment training resource manual. Seattle, WA.

Barnard, K. (1987). Paradigms for intervention: Infant state modulation. In N. Gunzenhauser (Ed.), Infant stimulation: For whom, what kind, and how much? (pp. 129-135). Biscayne Bay, FL: Johnson and Johnson.

Barnett, K. (1972). A theoretical construct of the concepts of touch as they relate to nursing. Nursing Research, 21, 102-110.

Bottorff, J. L. (1991). A methdological review and evaluation of research on nurse-patient touch. In P. L. Chinn (Ed.), Anthology on caring. New York: NLN.

Bowlby, J. (1953). Some pathological processes by early mother-child separation. Journal of Mental Science, 99, 265-272.

Bowlby, J. (1960). Grief and mourning in infancy and early childhood. The psychoanalytic study of the child, (pp 9-52). New York: International Universities Press.

Bowlby, J. (1969). Attachment and loss (Vol. 1). New York: Basic Books.

Brazelton, T.B. (1990). Touch as a touchstone. In K.E. Barnard & T.B. Brazelton (Eds.), Touch: The foundation of experience, (pp. 561-566). Connecticut: International Universities Press, Inc.

Brazelton, T.B., Tronick, E., Adamson, L., Als, H., & Wise, S. (1975). Early mother-infant reciprocity. In M.A. Hofer (Ed.) Parent-infant interaction. Amsterdam: Elsevier.

Brazelton, T. B. & Field, T. M. (1990). Introduction. In N. Gunzenhauser (Ed.), Advances in touch: New implications in human development (pp. xiii-xvii). Skillman, NJ: Johnson & Johnson.

Catlett, A.T., & Holditch-Davis, D. (1990). Environmental stimulation of the acutely ill premature infant: Physiological effects and nursing implications. Neonatal Network, 8(6), 19-26.

Cole, J.G. (1985). Infant stimulation reexamined: An environmental and behavioral-based approach. Neonatal Network, 3(5), 24-36.

Cornell, E.H. & Gottfried, A.W. (1976). Intervention with premature human infants. Child Development, 47, 32-39.

Diamond, M.C. (1984). Cortical change in response to environmental enrichment and impoverishment. In C. Brown & T. Brazelton (Eds.), The many facets of touch, (pp. 22-29). Johnson & Johnson Baby Products Company.

Dubowitz, L.M.S., Dubowitz, V., & Goldberg, C. (1970). Clinical assessment of gestational age in the newborn infant. Journal of Pediatrics, 77, 1-10.

Duldt, B. & Giffin, K. (1985). Theoretical perspectives for nursing. Boston: Little, Brown, & Company.

Fawcett, J. (1989). Analysis and evaluation of conceptual models of nursing (2nd ed.). Philadelphia: F. A. Davis Company.

Field, T. (1986). Interventions for premature infants. Journal of Pediatrics, 109(1), 183-191.

Field, T., Schanberg, S., Scafidi, F., Bauer, C., Vega-Lahr, N., Garcia, R., Nystrom, J. & Kuhn, C. (1986). Tactile/kinesthetic stimulation effects on preterm neonates. Pediatrics, 77(5), 654-658.

Fitzpatrick, J. & Whall, A. (1989). Guidelines for analysis of nursing conceptual models. In J. Fitzpatrick & A. Whall. Conceptual models of nursing: Analysis and application (2nd ed.). Norwalk, CT: Appleton & Lange.

Frank, L.K. (1957). Tactile communication, Genetics Psychological Monographs, 56, 211-251.

Fuhrman, B.P. & Zimmerman, J. J. (1992). Pediatric critical care. St. Louis, MO: Mosby-Year Book, Inc.

Glass, P., Avery, G.B., Subramanian, K.N.S., Keys, M.P., Sostek, A.M. & Friendly, D.S. (1985). Effect of bright light in the hospital nursery on the incidence of retinopathy of prematurity. The New England Journal of Medicine, 33, 401-404.

Gorski, P.A. (1985). Behavioral and environmental care: New frontiers in neonatal nursing. Neonatal Network: Journal of Neonatal Nursing, 3(5), 8-11.

Gottfried, A. & Gaiter, J. (1985). Infant stress under intensive care. Baltimore, MD: University Park Press.

Gottfried, A.W. & Hodgman, J.E. (1984). How intensive is newborn intensive care? An environmental analysis. Pediatrics, 74(2), 292-294.

Gottfried, A.W., Wallace-Lande, P., Sherman-Brown, S., King, J., Coen, C., & Hodgman, J.E. (1981). Physical and social environment of newborn infants in special care units. Science, 214, 673-675.

Gunderson, L.P. & Kenner (1987). Neonatal stress: Physiologic adaptation and nursing implications. Neonatal Network, 5, 37-42.

Hack, M., Horbar, J., Mallory, M., Tyson, J., Wright, E., & Wright, L. (1991). Very low birth weight outcomes of the National Institute of Child Health and Human Development Neonatal Network. Pediatrics, 87(5), 587-597.

Harlow, H.F. (1958). The nature of love. American Psychologist, 13, 673-685.

Harrison, L. (1985). Effects of early supplemental stimulation programs for premature infants: Review of the literature. Maternal-Child Nursing Journal, 14(2), 69-90.

Harrison, L. (1990). Effects of gentle human touch on preterm infants. Unpublished grant proposal.

Harrison, L. (1991a). Effects of gentle contingent touch on preterm infants. Proposal submitted to the National Center for Nursing Research (grant # 1201 NR 03147-01).

Harrison, L. (1991b). Personal communication, April 29.

Harrison, L. & Woods, S. (1991). Early parental touch and preterm infants. Journal of Obstetric, Gynecologic, & Neonatal Nursing, 20, 299-306.

Harrison, L., Groër, M., Modrcin-McCarthy, M., & Wilkinson, J. (1992). Effects of gentle human touch on preterm infants: Results from a pilot study. Infant-Behavior & Development, 15, 12.

Hartup, W.W. (1989). Social relationships and their social significance. American Psychologist, 44(2), 120-126.

Hasselmeyer, E.G. (1964). Handling and premature infant behavior. Dissertation Abstracts, 1964, 24B, 2874B-2875-B.

High, P. & Gorski, P. (1985). Recording environmental influences on infant development in the intensive care nursery. In A. Gottfried & J. Gaiter (Eds.), Infant stress under intensive care (pp. 131-155). Baltimore, MD: University Park Press.

Hodapp, R.M. & Mueller, E. (1982). Early social development. In. B. Wolman (Ed.), Handbook of developmental psychology (pp. 284-300). Englewood Cliffs, NJ: Prentice Hall.

Horowitz, F.D. (1987). Targeting infant stimulation efforts: Theoretical challenges for research and intervention. In N. Gunzenhauser (Ed.), Infant stimulation: For whom, what kind, when, and how much? (pp. 97-108). Biscayne Bay, FL: Johnson and Johnson Baby Products, Co.

Jay, S.S. (1982). The effects of gentle human touch on mechanically ventilated very-short gestation infants. Maternal Child Nursing Journal, 11, 199-256.

Klaus, M.H., & Kennell, J.H. (1976). Maternal infant bonding. St. Louis, MO: The C.V. Mosby Company.

Klaus, M.H., & Kennell, J.H. (1982). Parent-infant bonding (2nd ed.). St. Louis: C.V. Mosby Co.

Korner, A.F. (1987). Infant stimulation: Issues of theory and research. In N. Gunzenhauser (Ed.), Infant stimulation: For whom, what kind, when, and how much? (pp. 88-97). Biscayne Bay, FL: Johnson & Johnson, Inc.

Korner, A.F., Schneider, P., & Forrest, T. (1983). Effects of vestibular-proprioceptive stimulation on the neurobehavioral development of preterm infants: A pilot study. Neuropediatrics, 14(3), 170-175.

Korones, S.B. (1981). High risk newborn infants. St. Louis, MO: The C.V. Mosby Company.

Kramer, M., Chamorro, I., Green, D., & Knudtson, F. (1975). Extratactile stimulation of the premature infant. Nursing Research, 24, 324-334.

Leib, S., Benfield, G., & Guidubaldi, J. (1980). Effects of early intervention and stimulation on the preterm infant. Pediatrics, 66, 83-89.

Levine, S. & Stanton, M. (1984). The hormonal consequences of mother-infant contact in primates and rodents. In C.C. Brown (Ed.), The many facets of touch. Johnson & Johnson Pediatric Round Table 10.

Lott, J. W. (1989). Developmental care of the preterm infant. Neonatal Network, 7(4), 21-28.

Lucey, J. F. (1984). The sleeping, dreaming fetus meets the intensive care nursery. In C.C. Brown (Ed.), The many facets of touch (pp. 75-83). Biscayne Bay, FL: Johnson & Johnson, Inc.

Marriner-Tomey, A. (1989). Nursing theorists and their work. St. Louis, MO: The C.V. Mosby Company.

Meleis, A.I. (1985). Theoretical nursing: Development and progress. Philadelphia: J. B. Lippincott.

Merenstein, G. B. & Gardner, S. L. (1985). Handbook of neonatal intensive care. St. Louis, MO: The C.V. Mosby Company.

Montagu, A. (1986). Touching: The human significance of the skin (3rd ed.). NY: Harper & Row.

O'Donnell, J. (1990). The development of a climate for caring: A historical review of premature care in the United States from 1900 to 1979. Neonatal Network, 8(6), 7-17.

Oehler, J. M. (1985). Examining the issue of tactile stimulation for preterm infants. Neonatal Network, (December), 25-33.

Ott, L. (1988). An introduction to statistical methods. Boston, MA: PWS-Kent Publishing Company.

Piaget, J. (1952). The original intelligence in children. New York: Routledge & Kegan Paul.

Rausch, P. B. (1981). Effects of tactile and kinesthetic stimulation on premature infants. Journal of Obstetrical and Gynecological Nursing, 10, 34-37.

Rausch, P. B. (1990). Effect of tactile and kinesthetic stimulation on weight gain of premature infants. In K.E. Barnard & T.B. Brazelton (Eds.), Touch: The foundation of experience (pp. 253-268). Madison, WI: International Universities Press, Inc.

Reite, M. (1990). Touch, attachment, and health: Is there a relationship? In K.E. Barnard & T.B. Brazelton, (Eds.), Touch: The foundation of experience (pp. 195-225). Madison, WI: International Universities Press, Inc.

Rice, R. (1976). Neurophysiological development in premature infants following stimulation. Developmental Psychology, 13, 69-76.

Rice, R. (1985). Infant stress and the relationship to violent behavior. Neonatal Network, 3(5), 39-44.

Robertson, J. (1953). Some responses of young children to loss of maternal care. Nursing Times, 49, 382-386.

Rose, S.A. (1984). Preterm responses to passive, active, and social touch. In C.C. Brown (Ed.), The many facets of touch (pp. 91-100). Biscayne Bay, FL: Johnson & Johnson, Inc.

Rosenweig, M., Bennett, E., & Diamond, M. (1972). Brain changes in response to experience. Scientific American, 226(2), 22-29.

Roy, C. (1980). The Roy Adaptation Model. In J. P. Riehl & Roy, Conceptual models for nursing practice (2nd., pp. 179-188). New York: Appleton-Century-Crofts.

Roy, C. (1984). Introduction to nursing: An adaptation model (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Roy, C. & Andrews, H. A. (1991). The Roy Adaptation Model: The definitive statement. Norwalk, CT: Appleton & Lange.

Rubin, R. (1963). Maternal touch. Nursing Outlook, 11, 828-831.

Scafidi, F.A., Field, T., Schanberg, S., Bauer, C., Tucci, K., Roberts, J., Morrow, C., & Kuhn, C. (1990). Massage stimulates growth in preterm infants: A replication. Infant Behavior & Development, 13(2), 167-189.

Scarr-Salapatek, S. & Williams, M.L. (1973). The effects of early stimulation on low birth weight infants. Child Development, 44, 94-101.

Schanberg, S., Kuhn, C., Field, T., & Bartolome, J. (1990). Maternal deprivation and growth suppression. In N. Gungenhauser (Ed.), Advances in touch. Skillman, NJ: Johnson & Johnson, Inc.

Schorr, T., & Zimmerman, A. (1988). Making choices, taking chances: Nurse leaders tell their stories. St. Louis: C.V. Mosby Co.

Seay, B.M. & Harlow, H.F. (1965). Maternal separation in the rhesus monkey. Journal of Nervous and Mental Diseases, 140, 434-441.

Siegel, E. (1982). A critical examination of studies of parent-infant bonding. In M.H. Klaus & M.O. Robertson (Eds.), Birth, interaction and attachment, (pp. 51-61). Johnson & Johnson Baby Products Company.

Solkoff, N., Yaffee, S., Weintraub, D., & Blase, B. (1969). Effects of handling on the subsequent development of premature infants. Developmental Psychology, 1, 765-768.

Speidel, B.D. (1978). Adverse effects of routine procedures on preterm infants. Lancet, April, 864-866.

Spitz, R. (1945). Hospitalism: An inquiry into the genesis of psychiatric conditions in early childhood. In O. Feinichel et al., (Eds.), The psychoanalytic study of the child (Vol. 1). New York: International Universities Press.

Suomi, S.J. (1984). The role of touch in rhesus monkey social development. In C.C. Brown (Ed.), The many facets of touch. Johnson & Johnson Pediatric Round Table 10.

Tedrow, M. P. (1991). Overview of the interdependence mode. In C. Roy & H. A. Andrews (Eds.), The Roy Adaptation Model: The definitive statement (pp. 385-403). Norwalk, CT: Appleton & Lange.

Tribotti, S. (1990a). Effects of gentle touch on the premature infant. In N. Gungenhauser, (Ed.), Advances in touch. Skillman, NJ: Johnson & Johnson, Inc.

Tribotti, S. (1990b). Admission to the neonatal intensive care unit: Reducing the risks. Neonatal Network, 8(4), 17-22.

Turkewitz, G. (1977). The development of lateral differentiation of head posture in the human neonate. Annals of the New York Academy of Science, 299, 309-318.

Webster's Third New International Dictionary, Unabridged (1986). Springfield, MA: Merriam-Webster, Inc., Publishers.

Wegman, M. E. (1988). Annual summary of vital statistics--1987. Pediatrics, 82, 817-827.

Wegman, M. E. (1989). Annual summary of vital statistics--1988. Pediatrics, 84(6), 943-956.

Wegman, M. E. (1991). Annual summary of vital statistics--1990. Pediatrics, 88(6), 1081-1092.

Weininger, O. (1954). Physiological damage under emotional stress as a function of early experience. Science, 119, 285-286.

Weiss, S. J. (1979). The language of touch. Nursing Research, 28(2), 76-80.

Weiss, S. (1992). Psychophysiologic and behavioral effects of tactile stimulation on infants with congenital heart disease. Research in Nursing & Health, 15(2), 93-101.

White, J. L. & Labarba, R. C. (1976). The effect of tactile and kinesthetic stimulation on neonatal development in the premature infant. Developmental Psychology, 9(6), 569-577.

White-Traut, R., & Tubeszewski, K. A. (1986). Multimodal stimulation of the premature infant. Journal of Pediatric Nursing, 1(2), 90-94.

APPENDICES

APPENDIX A

NEONATAL ASSESSMENT CODING SHEET*

Code# _____ Visit _____ Time (check one) Pre __ Touch __ Post __

PHYSIOLOGICAL MEASURES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Heart Rate																				
2. O_2 Saturation																				

SLEEP STATES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Quiet Sleep																				
2. Active Sleep																				
3. Drowsy																				
4. Awake Alert																				
5. Active Awake																				
6. Crying																				

MOVEMENT (check all)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Single limb movement OR																				
2. Multiple limb movement																				
3. Gross body movement																				
4. Head turning																				
5. Facial grimace																				
6. Startle																				
7. Mouthing																				
8. Smiles																				
9. Clenched hands and/or feet																				
10. No movement																				

x = can't see

*Modified from L. Harrison's (1990) coding sheet

APPENDIX B

TITLE: Physiological and Behavioral Effects of a Gentle Human Touch Nursing Intervention on Preterm Infants

INSTITUTION: University of Tennessee Medical Center at Knoxville

My baby has been invited to participate in a study to evaluate the effects of "gentle human touch" on preterm babies in the neonatal intensive care unit (NICU). Gentle human touch involves the placement of one hand on the baby's head and the other hand on the baby's shoulder and arm. Several other studies have shown that this type of touch may benefit premature babies.

This study and my baby's role as a participant have been explained to me. It is my understanding that if my baby participates in the project, my baby will be randomly assigned to one of two groups. If my baby is placed in one group, he or she will receive the usual NICU nursing care. If my baby is placed in the other group, he or she will receive 20 minutes of gentle touch every day for 10 consecutive days, in addition to the usual NICU nursing care. This gentle touch will begin 7 days after birth and end after the gentle touch is given on the sixteenth day after birth.

If my baby seems to become upset by the gentle touch, the session will stop for at least 30 minutes before beginning another touch session.

Risk and Benefits

Several studies have shown that premature babies who received gentle human touch had greater weight gain, more quiet sleep and a shorter length of hospitalization. Gentle human touch may cause my baby to have a temporary, slight drop in his or her oxygen level. If this occurs, the touch will be stopped, the oxygen adjusted, and the staff notified if needed.

Cost and Payment

I understand there is no cost, either to me or my baby, associated with this gentle touch intervention. I understand that there are no provisions for any financial payment to me or my baby for participation in this study.

____

Parent/Legal Guardian's Initials

TITLE: Physiological and Behavioral Effects of a Gentle Human Touch Nursing Intervention on Preterm Infants

INSTITUTION: University of Tennessee Medical Center at Knoxville

Confidentiality

I understand that any information about my baby obtained from this research will be kept strictly confidential. I consent to the publication of the study results so long as my baby's information is anonymous and/or disguised so that identification cannot be made.

Right to Withdraw

I understand that my baby's participation in the study will start at 6 days of age and continue until 17 days old. I have the option to withdraw my baby from the study at any time without incurring any penalty or loss of benefits otherwise available to me and my baby, including medical care at this institution.

Consent

I understand that I am not waiving any of my baby's legal rights or releasing the hospital or its agents from liability for negligence. I understand that The University of Tennessee Memorial Hospital does not provide for reimbursements in the event of injury resulting from the research procedure.

I have read the preceding information or it has been read to me. I have discussed this study with the nurse. Any additional questions I may have will be answered by
Mary Anne Modrcin-McCarthy, Doctoral Candidate, RN, (phone #)

____

Parent/Legal Guardian's Initials

TITLE: Physiological and Behavioral Effects of a Gentle Human Touch Nursing Intervention on Preterm Infants

INSTITUTION: University of Tennessee Medical Center at Knoxville

My signature means that I have freely agreed for my baby to participate in this study. I understand a copy of this signed consent form will be given to me.

Parent/Legal Guardian (circle one)

Signature: ____

Relationship to baby: ____________________________________

Date: ______________________________

Witness:

____

Date: ______________________________

Please write your address below if you would like a summary of the findings upon completion of the study.

I have explained to the above individual the purpose, possible benefits, possible risks, and the baby's role associated with participating in this study.
I have answered questions raised and will respond to questions that might be asked in the future.

Date: ____________ Signature:

____

Principal Investigator
Mary Anne Modrcin-McCarthy, Doctoral Candidate, RN
Phone:
College of Nursing
University of Tennessee Medical Center
Knoxville, TN

____
Parent/Legal Guardian's Initials

APPENDIX C
DATA SUMMARY SHEET

I. Admission Demographics

Code ________ Birthdate __________ Dates in Study _____________

Gender ___________ Race __________

Gestational Age __________ Birthweight ____________

Apgar 1 _________ Apgar 5 ____________

Maternal Age ___________ C-section: No ☐ Yes ☐

Gravida (with this pregnancy) ___________ Para (before this infant)______
Cranial Ultrasound 0 (not done) __ 1 (done, normal) __ 2 (done, abnormal) __

PDA ☐ No ☐ Yes; Indocin ☐ No ☐ Yes

RDS Survanta ☐ No ☐ Yes

Exosurf ☐ No ☐ Yes

II. Treatment (during study period)

1. Supplemental Oxygen ☐ No ☐ Yes
   Dates & Methods:

2. Phototherapy ☐ No ☐ Yes
   Dates:

3. Transfusions ☐ No ☐ Yes
   Dates:

4. 10-Day Caloric Intake _______________________

5. Drugs (name & # of days)
   a.
   b.
   c.

6. Weights Day 6 ____________________ Day 17 ____________

III. Discharge

Weight _______________ Date (# days in hospital) ___________
(over)

DATA SUMMARY SHEET (CONTINUED)

DATE	INTAKE (type & amount)	CALCULATED: CAL/DAY

10- DAY TOTAL =

APPENDIX D

PARENT VISIT RECORD*

Date	Who Visited? (M=Mom, D=Dad; G=Grandparent; or Other)	(Check if yes; approximate number of minutes) Touched	Held Baby

*Modified from L. Harrison's (1990) record sheet

VITA

Mary Anne J. Modrcin-McCarthy was born in Kansas City, Kansas, to Matthew J. and Ann Modrcin and was the second of four children. She received her elementary education at St. John the Baptist School, and her high school education from Bishop Ward High School, both located in Kansas City, Kansas. She attended The University of Kansas, Lawrence, Kansas, where she graduated with the degree of Bachelor of Science in Nursing in August, 1974. She also attended Boston University, Boston, Massachusetts, where she graduated in August, 1977, with the degree of Master of Science in Nursing. She has been registered to practice professional nursing in several states, but is currently registered in the State of Tennessee.

She has always practiced and specialized in nursing of infants and children. Most of her clinical practice and teaching experience has been in the neonatal intensive care unit, the pediatric intensive care unit, and in the hospital setting for nursing care of the chronically-ill child and acutely-ill child. She has held many positions in her professional career of nursing. She has been a staff nurse, a clinical nurse specialist and nurse educator in the neonatal intensive care unit, educator of licensed practical nurses, and educator of both undergraduate and graduate nursing students. She held the faculty position of Instructor of Nursing at both The University of Kansas, Kansas City, Kansas, and The University of Hawaii, Honolulu, Hawaii. She held the faculty position of Assistant Professor of

Nursing at both Catholic University of America, Washington, D.C., and The University of Nevada, Las Vegas, Nevada.

She has been the recipient of scholarships and awards; she has published and presented papers, both at the national and international level. She is a member of Sigma Theta Tau and other nursing organizations.

Her family and friends are integral to her life. She married Vincent P. McCarthy, MD in March, 1979, and had a son, Logan Spencer Modrcin McCarthy in February, 1987. Reading, playing the piano, cooking, and dance are activities she enjoys.

In August, 1989, she began her pursuit of the Doctor of Philosophy degree in Nursing at The University of Tennessee, Knoxville, Tennessee. In December, 1992, requirements for the Ph.D. in Nursing degree were completed.