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Mothers behaviors, infant behaviors, heart rate, and rocking within the early mother-infant relationship

Huff, Marlene, Ph.D.

Case Western Reserve University (Health Sciences), 1991

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MOTHER BEHAVIORS, INFANT BEHAVIORS, HEART RATE, AND ROCKING WITHIN THE EARLY MOTHER-INFANT RELATIONSHIP

by

MARLENE HUFF

Submitted in partial fulfillment of the requirements
to the Degree of Doctor of Philosophy

Thesis Advisor: Ellen Rudy, Ph.D., R.N.

The Frances Payne Bolton School of Nursing
CASE WESTERN RESERVE UNIVERSITY
August, 1991
CASE WESTERN RESERVE UNIVERSITY

GRADUATE STUDIES

We hereby approve the thesis of

Marlene Sue Huff

candidate for the Ph.D.
degree.*

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Marlene S. Huffman
MOTHER BEHAVIORS, INFANT BEHAVIORS, HEART RATE, AND ROCKING WITHIN THE EARLY MOTHER-INFANT RELATIONSHIP

Abstract

by

MARLENE HUFF

The purpose of this study was to describe and determine the relationships between the elements of mother behaviors, infant behaviors, heart rate, and rocking within the early mother-infant relationship. Using a descriptive research design 30 mother-infant dyads, within 72 hours after delivery, were videotaped for 15 minutes of uninterrupted time together. The mother sat in a rocking chair and held her infant. Rocking was initiated and controlled by the mother. No specific directions for interaction were given.

Heart rates of mothers and infants were monitored using electronic monitoring. Mother and infant behaviors were coded from the videotape using an adapted Face-to-Face Interaction Guide (Kay & Fogel, 1980). Rocking cycles were coded from an electronic monitor and the videotape. Behaviors were recorded as discrete events, whether the
behavior was present or absent in each 10 second time epoch. The total
number of epochs in which the behavior occurred for each 5 minutes was
used for initial analysis. The data was then categorized according to the
number of epochs the behavior was present within the total 5 minutes.
The Pearson product-moment statistical test was used to determine
relationships among the elements using the data for each 10 seconds and
after it was categorized. There were significant relationships among the
mother and infant behaviors, heart rates, and rocking. Significant
relationships were also found between the mother’s heart rate and infant
crying, the infant’s heart rate and posture change, bouncing and rocking,
and the infant state and rocking.

The elements were described using descriptive statistics. Behaviors identified in previous research as attachment behaviors were
present within the early mother-infant relationship. The intensity and
frequency of these behaviors, however, diminished over the 15 minutes.
The heart rate of both mother and infant remained relatively consistent.
Mothers rocked their infants at a rate of 37 cycles per minute.

Results of this study suggest that attachment assessment be
performed when the mother and infant reunite because of the diminish-
ing nature of attachment behaviors. Since rocking was performed by all
of the mothers in this study, it is implied that rocking is a natural
activity between healthy mothers and infants. The association among
the elements in this study support the proposition that there is some
link between mother-infant attachment behaviors, heart rates, and
rocking within 72 hours after birth.
DEDICATION

This work is dedicated to my husband, Darryl, and my two sons, Kevin and Keith, who have sustained me throughout this period of study with encouragement, understanding, patience, and love.
ACKNOWLEDGEMENTS

The writer acknowledges support from many persons throughout this endeavor. A special thanks is given to Ellen Rudy of the Frances Payne Bolton School of Nursing, Case Western Reserve University for chairing my dissertation committee and for her inspiration, encouragement, and guidance. The other members of my committee, J. Youngblut, D. Modly, and J. Kennell, shared expert knowledge in their field of interest, kept me focused, and helped me refine the study.

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CHAPTER I

THE PROBLEM

Formation of a healthy maternal-infant relationship provides the foundation for physical and psychological growth of the infant, and the development of social relationships in later life (Bowlby, 1958, 1969, 1977; Erickson, Sroufe, & Egeland, 1985; Pastor, 1981). Within this dyadic relationship, infant behaviors, mother behaviors and their subsequent responses contribute to the development of attachment (Ainsworth, 1979; Bowlby, 1977; Kennell & Klaus, 1984). Behaviors generally viewed as observable attachment behaviors include the mother smiling and talking to the infant and the infant making sounds or reaching toward the mother (Belsky, Rovine, & Taylor, 1984). Beal (1991) operationally defines attachment as a mutual reciprocal interchange characterized by maternal responsiveness to infant cues and the infant’s discrimination of the parent. Physiologic behaviors, or responses, may also be indicators of attachment (Jones & Thomas, 1989). For example, by observing heart rate, the assessment of an objective attribute or a condition conducive to attachment may be possible. This physiologic measurement may be an indicator of the emotional state as well as a physiologic state. This notion is based on the knowledge that emotions are reflected in physiologic responses (Skerrett, Hardin, & Puskar, 1983) and that the emotional state contributes to the quality of dyadic interaction (Brazelton, 1983). Heart rate may assist in defining an emotional state
called attention in the newborn that is conducive to the development of attachment.

In addition to the behaviors that are generally linked with the attachment process, rocking has been observed to be an activity initiated by many mothers. This activity, although not currently and consistently assessed as an indicator of the attachment process, may be as important as any other. The relationships among the elements of infant behaviors, mother behaviors, heart rates, and rocking may provide another piece of information about the early mother-infant dyad that will assist nurses to recognize attributes of positive infant-mother attachment or the lack of attachment behaviors soon after birth.

Recognition of potential attachment problems is a concern for maternity nurses. With shortened hospital stays, the mother’s personal needs (Rubin, 1981) may suppress the behaviors that are associated with attachment, making assessment within the first few days following birth more difficult. Most early attachment studies (Ainsworth, 1979; Bowlby, 1969) looked at infants and mothers a few months post delivery. Even though information is available for defining mother-infant behaviors after birth (Barnard, 1978; Klaus & Kennell, 1976; Stainton, 1990), the attachment behaviors from studies of older infants have dominated the assessment of dyads during the puerperium. The presence of the behaviors customarily used to assess attachment, however, may not be as prevalent during the first few days after birth as health providers have expected. Therefore, the purpose of this study was to describe and analyze relationships between infant and mother behaviors, the
physiological variable of heart rate, and rocking within the first few days following birth.

**Background of the Problem**

The mother-infant relationship is complex and has been studied by many researchers (e.g., Ainsworth, 1979; Bowlby, 1969; Klaus & Kennell, 1982). Such research has supported the belief that the relationship between the mother and infant is the foundation of subsequent child development. Bowlby (1969) proposed that even though the responses that the infant uses in the early years of development might change during further development, the underlying technique learned in infancy to form an emotional tie with another person remains stable. When a strong bond is established in infancy, and is nourished throughout development, children are more likely to grow up to be secure, self-reliant, trusting, and cooperative. In contrast, children who do not develop this strong bond tend to be insecure and anxious. These children may be more likely to develop neurotic symptoms, depression, anger and later maladapted social behavior (Erickson, Sroufe, & Egeland, 1985).

Lack of a strong bond is likely to arouse maternal anger and subsequent social problems in the child (Bowlby, 1973). In a review of previous research, Miller and Brooten (1983) concluded that parenting skills may develop inadequately in the absence of a strong emotional tie during the child’s infancy, and that there may be greater risk for the mother to abuse or neglect her child. The authors also suggested that
mothering skills may be lacking when a strong emotional tie is not formed with the infant.

The process of strong emotional tie development between a mother and her infant has been described using different labels. For example, the label "attachment" was used by Ainsworth (1979) and Bowlby (1969). For these authors, attachment was defined primarily as a unidirectional process from the child to the main caretaker. Because the mother is generally the main caretaker, early studies focused on how the child forms an attachment to the mother. Ainsworth (1979) identified several conditions that affect the development of attachment. These include the amount of time the dyad spends together, the level of maturity of the mother, and the ability of the mother to capture the infant's attention. These precursors of attachment assume a bidirectional process as each member of the dyad responds to the other.

Another label used for the process of developing an emotional tie was "bonding" (Klaus & Kennell, 1982). In their early research on bonding, Klaus and Kennell (1976) defined the process of bonding as primarily unidirectional from mother to infant. Behaviors exhibited by mothers shortly after birth were studied and described. The contributions of both members of the dyad in the interaction process were apparent, thus assuming that bonding is also a bidirectional process. Awareness of the importance of early and extended time for dyads to be together after birth was an important contributing outcome of the research (Kennell, 1989).
Four elements of the mother-infant dyadic relationship were addressed in this research study. The first and second elements are infant behaviors and mother behaviors. The third element is the physiological variable of heart rate, and the fourth element is rocking.

**Infant and Mother Behaviors**

The process of attachment has generally been indirectly assessed through observable dyadic behaviors. These behaviors have been delineated and aligned with attachment through previous research. In this study the focus was on behaviors that are observable in the mother-infant relationship such as en face positioning and touching.

The process of developing an emotional bond, or attachment has been assessed by an instrument designed by Stainton (1990). Stainton used observable behaviors to describe the mother-infant relationship during the first few days following birth. In this study the behaviors are referred to as attachment behaviors. The characteristic behaviors are specific for the mother and for the infant.

Infant behaviors, including the cry, visual exploration, and active hand contact are exhibited through individualized responses (Bates, Mastlin, & Frankel, 1985; Bernstein & T'Amis-LeMonda, 1990). Mother behaviors of vocalizing, kissing, and touching have been well defined (Field, 1987; Rubin, 1981). In addition to individual behaviors, reciprocal interaction such as cuddling, prolonged gazing, and other reciprocal responses have been identified (Reiser, 1981). These behaviors, which
may be observed in day-to-day interaction between healthy mothers and infants, indicate the attachment process and the progressive development of a close emotional tie within the maternal-infant dyad (Zanden, 1989). Thus, the first two elements of the dyadic relationship studied in this research are infant behavior and mother behavior.

**Heart Rate**

The next element studied in this research was the physiological variable of heart rate. Brazelton (1983) states that the "responses of the infant’s neurological and physical systems are at the core of any development of emotion" (p. 37). The maturation of these systems forms the base for future emotional experience. The autonomic nervous system is the most basic control system of the newborn. The nervous system determines the infant’s response in a given situation, such as crying or a change of emotional state. Heart rate has been used by health professionals as an indicator of both physical and emotional well-being. This research explored relationships between heart rates and attachment behaviors.

Porges (1984) studied physiologic correlates of attention. Attention is a state when the infant is demonstrating selective sustained interest. Pulse rates are physiologic responses to stimuli or lack of stimuli and have been linked to emotion. In cognitive terms, emotions may be conceived as schemas that guide the organization of behavior. The source of these emotional schemas is the nervous system. In
behavioral terms emotions are made up of sets of responses that include physiological changes and expressive reactions.

Science has not developed to the level of being able to validate interpretations of expressive reactions to emotions in infants. In the mother, questions may be asked or behaviors observed to interpret specific emotions. However, for the infant, this level of interpretation is not developed. Physiologic emotional responses have been documented but not delineated for the specific emotions that are associated with the development of attachment.

The importance of the mother-infant dyad in emotional development and subsequent expression of emotions by the child was described by Miller and Sperry (1987). Anger is one emotion that the infant learns to handle. The socialization of emotion is taught by the caregiver at an early age. For example, the infant has some control over emotional development by initiating behaviors to elicit the mother’s attention; crying may gain the mother’s attention. The mother defines and puts limits on the infant’s behaviors by interpreting them, and responding to them. In this manner, the mother helps the infant to put the behaviors into a meaningful framework. This early interpretation may be expressed in physiologic change and provide a beginning, objective indicator of conditions that influence the attachment process.

**Rocking**

The fourth element of the dyadic relationship studied was rocking. Rocking within the mother-infant dyad relates to the infant’s
need for whole body movement. Rocking simulates the motions that the infant and mother experience together prenatally. In the uterus, stimulation of the fetus is provided by the mother’s walking, turning during sleep and other daily activities. Therefore, at birth the infant is accustomed to multidimensional body movement and natural rocking motions of the mother (Montague, 1971).

Brazelton (1983) has indicated that rocking is a natural maternal response, often spontaneously initiated by a mother when she is holding her infant. A mother may spontaneously rock her infant even when her mind is focused on something else or if the infant is asleep. While spontaneous rocking is likely for term infants who are frequently held and rocked by their mothers, premature infants are less likely to be held and rocked by their mothers because of equipment and modern nursery routines. Barnard (1973) found that when premature infants were rocked, the rates of neurological and physical growth in prematures were significantly increased. Subsequent research indicates that it may not be the rocking per se but the response to multiple stimuli that accelerated the growth (Barnard, 1986; Lee, 1990). It seems logical that if rocking is a positive stimulus to immature infants that it may well be an equally positive one for mature infants. While we have some data to support the importance of rocking, rocking chairs are not standard equipment in many maternity rooms.

Interest for this study was derived through many observations of mother-infant dyads. Mothers who bounced their infants or used rhythmic whole body movement to change position seemed to be more
in tune to their infant’s needs than the mothers who did not rhythmically move their infant. If this activity is an indicator of the attachment process, perhaps it should be added to the list of behaviors that are assessed in new mothers. The realization that dyadic, rhythmic movement is one of a set of actions (as in touching, transference of body heat, sounds) may give more importance to the investigation of this behavior as a component of attachment. Although each of the elements of infant and mother behaviors, heart rates, and rocking have been examined singularly in previous research, no studies have been located which examined the association among the five elements during the first 3 days after birth.

**Research Questions**

This study examined infant and mother behaviors, the physiological variable of heart rate, and rocking within the early mother-infant dyadic relationship. The following research questions were addressed:

1. What are the observable attachment behaviors of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together?

2. What are the observable attachment behaviors of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together?
3. What is the heart rate of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together?

4. What is the heart rate of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together?

5. What are the rate and intensity of rocking behavior in the mother-infant dyad?

6. What is the relationship between attachment behaviors of mothers and infants, heart rate, and rocking behavior in the mother-infant dyad?

Description and analysis of the elements of infant behaviors, mother behaviors, heart rate, and rocking expanded the base of knowledge related to mother-infant dyads. Although these elements have been investigated singularly, the relationships among them had not been examined previously. Description of the variables and the determination of relationships was the purpose of the study.
CHAPTER II
LITERATURE REVIEW

This chapter first presents the review of literature on attachment theory and attachment behaviors. Secondly, a review of the literature that supports the study of heart rate and rocking in relation to attachment is presented. A section of literature review that addresses combinations of the elements of infant behaviors, mother behaviors, heart rate, and rocking follows.

Attachment Theory

Attachment theory, based primarily on the early works of Bowlby (1969, 1973, 1977), and Ainsworth (1964, 1967, 1973), has in recent years provided the framework for understanding the development of infants. This theory holds the view that infants are born with a behavioral control system, or a biologic propensity to behave in ways which promote contact with a caregiving figure, usually the mother. The internal being, or control system, then develops in response to caregiving behaviors. From this, an affective bond between the infant and caregiver develops. The set goal of the establishment of an affective
bond is felt security. This is not the same type of relationship as is a social bond. In fact, although not mutually exclusive of, the social bond is different from playful interaction (Bretherton, 1985). At least two types of bonds develop. Even though they are likely to be to the same person, the attachment process may be with one person and the social process with another. This sequence is considered a normal part of development (Ainsworth, 1973).

The early mother-infant relationship, or the security of an infant's attachment, is postulated to be the foundation on which to build future social behaviors (Bowlby, 1969). Even though the way in which the child responds socially may change, each developmental period sets the stage for how the child adapts to the next period, beginning with attachment in infancy (Sroufe, 1979).

Sroufe, Fox, and Pancake (1983) examined the relationship between infant-caregiver relations and later overdependency. The study sample (N = 40) was preschool children with varying attachment histories. The children had been classified in a previous study according to attachment levels. A series of rankings, ratings, and descriptions by the teacher and behavior observations of free play and group settings clearly showed that children who were securely attached as infants showed less emotional dependence on their preschool teachers than did those students who were insecurely attached. This study along with others (Petit & Bates, 1984; Schaefer, 1989) supports the developmental organizational perspectives of development that a secure attachment in infancy provides a foundation for later autonomous functioning.
One study that supports the predictive nature of attachment behavior found that early mother-infant interaction was significantly correlated with academic competence during kindergarten (Schaefer, 1989). Low-income women (N = 321) and their infants were observed in the home at 4 and 12 months of age. The dyad was observed during caregiving activities and play. The mother’s behavior was coded regarding her acceptance, interaction, and responsiveness to the infant. Infant behaviors such as responsiveness to the mother were also observed. When in kindergarten, teachers were asked to complete questionnaires about the child’s behavior. Each of the 4 and 12 month rating factors as well as kindergarten teacher ratings determined the predictive validity of behaviors. Infants who were more securely attached did better in kindergarten than those who were not.

A longitudinal study that gave some support to the predictive power of early attachment assessment (12 and 18 months of age) was done by Erickson et al. (1985). Mothers at risk for later caretaking problems (N = 267) were recruited during pregnancy. All dyads were videotaped at 12 and 18 months and classified as anxious/avoidant, securely attached, or anxious/resistant. The dyads were videotaped again at 24 months in a series of problem-solving tasks and observed at 42 months when they were asked to complete tasks that required some assistance from the mother. The videotape data as well as interviews and test results showed that "children who were anxiously attached as infants functioned more poorly in preschool than did children who were securely attached" (p. 162). Anxious/avoidant children were more
noncompliant and interacted poorly with their peers. It was concluded from these results, that the quality of attachment is a strong predictor of future behavior.

Another study that looked at predictive characteristics for behavioral or emotional problems in later life was done by Bates, Maslin, and Frankel (1985). Mother-child interaction (N = 160) was assessed in the home and laboratory, and with questionnaires. Mother behaviors that were assessed included affectionate contact, responsiveness to the infant’s distress, and verbal responsiveness. These behaviors positively correlated with attachment. The infants were assessed for temperament, including fussing and crying. Temperament ratings predicted maintenance of contact but attachment at 12 months was not shown to be predictive of behavior problems at 3 years. Although this study is inconsistent with Erickson et al. (1985), it does demonstrate that mother and infant behaviors are indicators of attachment.

Social, emotional, cognitive, and language development of the child has been related to the quality of the child’s early attachment to the mother. Main (1983) conducted a short-term longitudinal study to support these beliefs. Forty mother-infant dyads were observed in a laboratory when the child was 12 months old. They were separated briefly two times during the session. Infants who greeted the mother positively following the sessions were classified as securely attached. Infants who avoided the mother were considered insecurely attached. At 20.5 months of age, the infants were tested using the Bayley Scale of Mental Development. At 21 months, the infants were videotaped during
a play session. During this session, the mother was asked to respond as necessary but not to initiate or direct the play. Results showed that 25 of the infants were securely attached and 15 were insecurely attached to the mother. During the Bayley testing session, the securely attached infants were more likely to cooperate with the tester and treated the tasks as a game. They also used more words, more frequently approached the playmate, and were more attentive to the toys than were the insecurely attached infants.

The studies just reviewed support attachment theory. Bowlby’s theory of attachment (1969, 1977) postulates that the infant’s relationship to the mother is an essential precursor to later social relationships. Since Bowlby’s original work, however, research has provided data to support the notion that infants develop an attachment to a specific person, or persons, who may or may not be the mother (Rutter, 1979). Attachment is likely to form with the person who brings comfort in times of stress (Maccoby & Masters, 1970). A child may form multiple attachments. Another factor, that is likely to foster development of attachment includes the way a parent responds to the infant; attachment is most likely to develop to the person who actively interacts with the infant and is responsive to the infant’s cues (Ainsworth, 1973). Thus, attachment presupposes that there is a reciprocal relationship (interaction) which changes in balance as the child grows. Attachment is not a unitary concept and is complex in nature. Although attachment is complex and influenced by many factors, it is generally believed that the quality of attachment provides the foundation for future social relationships and behavior (Crockenberg, 1981; Freiberg, 1987).
Bonding

The theory of bonding is included in this review of literature because it is a component piece of attachment. Most of the research about bonding investigated mother-infant dyads during a limited time span after delivery. Because of the timing the focus on bonding adds an important dimension to this study.

Bonding, a term made popular by Klaus and Kennell, is the process of establishing a close emotional tie (or bond) with another human being (Klaus & Kennell, 1982). This definition sounds very much like attachment; the difference lies in the early research findings, primarily surrounding the importance of a time for the mother and infant to get to know each other shortly after birth and during the puerperium. This time is believed to be important for bond development. The behaviors that were described by Klaus and Kennell are similar to those that were described by attachment theorists and support the notion of early attachment. The terms are frequently used together or interchanged in clinical settings.

The studies done by Klaus, Kennell, and associates in the early 1970s gave rise to the belief that there is a period after birth when interaction within the dyad is important for optimal development of affectional ties. Klaus and associates (1972) observed that the time period they later called the sensitive period occurs shortly after birth and lasts for a varying amount of time, usually 20 minutes to 2 hours. This time is accompanied by a heightened awareness of the senses; early
contact may facilitate a more rapid and stronger initial mother to infant attachment than when no such contact occurs. Twenty-eight dyads participated in the research. Fourteen mothers had the traditional contact with their infants (a glimpse of the baby at birth and brief contact at 12 hours, then visits every 4 hours.) In the experimental group (N = 14) mothers were given their nude infants for 1 hour within the first 3 hours after birth and 5 extra hours of contact for 3 days after delivery. The experimental group evidenced more behaviors related to "bonding" than the control group. The results of these studies precipitated changes, such as allowing mother and infant to stay together immediately after delivery, in the method of maternity nursing care delivery in the United States. A trend ensued to keep mother-infant units together instead of separating them.

The work of Klaus and Kennell stimulated health care providers to acknowledge that the imposed separation of a healthy mother and her infant immediately after birth was not necessary and may even interfere with the attachment process. Using their work as a springboard, health care providers began to allow mothers time to be with their infants immediately after birth; this evolved into the current practice of allowing the mother and infant to be together as much as the mother desires (Goldberg, 1983). A necessary separation of the mother and infant following birth disrupts the usual sequence of interactions between the mother and infant and may be a reason for future disruptive relationships (Seifert, Thompson, Ten-Bensel, & Hunt, 1983).
In Klaus and Kennell’s (1976) early work, the term bonding was used primarily to describe the unidirectional process that a mother goes through as she forms an affectional tie with the infant during the time shortly after birth. Although the reciprocal nature of the interaction was acknowledged, the early work focused primarily on the mother’s behaviors toward her infant.

Klaus and Kennell (1982) have altered their definition of bonding to expand to the long term process of the development of an emotional tie between a parent and their offspring. Although defined differently in practice and in the literature, clinically, bonding is used interchangeably with attachment, and the verbiage form of the two words are also used interchangeably (Huckabay, 1987; Klaus & Kennell, 1982; Leiderman, 1981).

Klaus, Jerauld et al. (1972) studied mothers’ behavior toward their full term infants during the first few hours after birth. The purpose of the study was to determine whether the hospital practice of separating a mother and her infant affected later maternal behavior. Fourteen mothers (control group) had the usual amount of contact with their infant and 14 mothers had an additional 16 hours of contact with their infant. Mothers were asked to return to the hospital a month after delivery for three separate observations. Twenty-five specific activities were measured, including the mother’s interest in the infant (determined by en face positioning), stroking, kissing, bouncing, and cuddling (labeled fondling behaviors). The average of the interrater reliability coefficients was 0.83 for en face and 0.99 for fondling. Results
of the study showed that the extended-contact mothers had significantly
greater en face and fondling (11.6% and 6.1% compared to 3.5% and 1.6%
in the control group). Results suggested that early and extended contact
can have a powerful effect on the mother's interaction with her infant
and consequently, the infant's future development.

Another tenet of bonding is the notion that the systematic
driving forces that occur in the mother's responses to the infant during this
time after birth, have lasting effects on subsequent maternal behavior
(Goldberg, 1983). Anisfeld and Lipper (1983) studied the effects on
infant placement on the mother's abdomen for 1 hour following birth
(29 mothers experienced extra contact; 30 mothers received routine care).
The dyads were observed at 2 days and at 3 months after birth. The
mothers in the contact group showed more affectionate behaviors than
in the non-contact group. Conversely, mother-infant dyads (N = 60)
were studied by Craig, Tyson, Samson and Lasky (1982) for the effects
of 1 hour skin-to-skin contact of the mother and infant after birth. The
comparison group had less than 10 minutes of contact with the infant
wrapped. At 1 month of age, no differences were found between groups
on any measure of the Neonatal Perception Inventory.

In summary, the notion of bonding is important because of the
major changes in the health care system that were elicited from Klaus
and Kennell's work. Although clearly the initial contact is but one phase
in the attachment process, and contact beyond the immediate postnatal
period is equally important, health care providers must recognize the
importance of the initial contact and supply time, if possible, for dyads to be together.

The purpose of this review of the literature was to give credence to the observation of infant and mother behaviors as indicators of the quality of mother-infant interaction. Given that this early phase of dyadic development is but one of the phases of infant and parental development, early assessment of behavior may allow for early intervention. The researcher accepts that early, quality, mother-infant interaction, although not essential to social development, does give the child an early start toward a firm foundation.

Mother-Infant Interaction

Mother-infant interaction is presented as a subheading to attachment to provide a stronger focus on dyadic responses. It is now generally accepted that the infant and the mother are both active participants in a reciprocal system of interaction. The presence or absence of attachment has generally been evaluated indirectly using observable behaviors. Validation of attachment can only be done through affirmation of the person experiencing it. The interaction between the mother and her infant has been used to assess the attachment process (Barnard, 1986). The affective bond of attachment is manifested through specific behaviors toward the other member of the dyad. Barnard (1986) developed the Child Health Assessment Interaction Model portraying the reciprocalness of the mother-infant relationship. Barnard’s work focused on the interactive behavior between the parent and child from 1 month
to 12 months of age. Her work supports the belief that the dyadic interactions should be described and considered in relation to each other.

**Mother-Infant Behaviors**

Research has supported behavioral indicators of the process of bonding such as kissing, cuddling, and prolonged gazing (Brazelton, 1983). These indicators are behaviors that exist when a bond is developing and yield some information about the quality of the mother-infant relationship; they are not necessarily indicators of the existence of a firm bond (Zanden, 1989). It is generally accepted that mother-infant interaction is a shared experience, influenced by both members of the dyad. Even though the behaviors are separated for ease in discussion, the mutuality of the behaviors must be kept in awareness. The complexity of interaction has been reduced somewhat by looking at behaviors separately.

**Infant Behaviors**

The beginnings of interaction behavior may be present at birth for the infant. Brazelton (1983) has demonstrated that infants have been able to recognize their mother’s voice within hours after birth. The knowledge that the infant is already familiar with the mother is important for the support of early assessment of infant behaviors.

The interactive behaviors displayed by the newborn shortly after birth are important to the way the mother responds. Infants are capable of responding to more environmental cues than was previously believed. The degree of infant responsiveness to eating, consolability, and cuddling
will evoke and maintain caregiving behaviors by the mother. The infant rewards the mother through these behaviors. If an infant responds to the mother in some positive way such as looking at her, moving in her arms, making noises, or even burping, the mother will respond positively. Cuddliness is very important because the mother generally interprets this behavior as acceptance and the desire to be with her (Brazelton, 1983).

The cooing sounds, gurgles, and cries of the infant also affect the interaction process between a mother and her infant. Even though new mothers may not be able to interpret their infant’s cry immediately, different types of crying have been identified very early after birth. All of these types of early crying indicate a need for attention (Korner, Hutchinson, Koperski, Kraemer, & Schneider, 1981; Lounsbury & Bates, 1982).

The behavior state of the infant affects the interaction between the mother and infant. Crying tells the mother that the infant’s limits have been reached. In this state, the quality of the interaction is not as good as it is when the infant is in the quiet-alert state. In the quiet-alert state the infant is able to attend to the environment and focus attention on the stimuli that are present. In this state, the infant provides the most pleasure and positive feedback for the mother (Thoman, Davis, Denenberg, 1987; Thoman & Whitney, 1989). The state of the infant is, therefore, an important factor in the study of the maternal-infant relationship.
With their relatively sophisticated sensory systems, infants respond preferentially to stimuli that occur in human social interaction. For example, infants have the ability to habituate: An infant will orient and attend visually to a stimulus and then the attention wane. This is one way an infant processes information and may be predictive of later cognitive functioning (Bornstein, 1989).

The infant has an individual level of activity response in general and in specific situations. For example, the infant may always be quiet or active. The emotional intensity (calmness or being feisty) is a characteristic of the infant. The infant’s mood or temperament (fussy, happy), sociability or responsiveness, curiosity, and visual alertness are a few of the descriptors that have been used to describe the infant’s contribution to the mother-infant relationship (Korner et al., 1985; Watt, 1987; Zeanah, Zeanah, & Stewart, 1990).

**Mother Behaviors**

Just as the infant’s personality affects the relationship, so does the mother’s. The mother’s contributions to the relationship are also multidimensional. In a review of the literature, Mercer (1981) concluded that the maternal role is learned through all past experiences; mothering behaviors are not believed to be intuitive. While most women seem to achieve the role of mother successfully, some may not. Some of the maternal characteristics which may affect the acquisition of the maternal role and thus the mother-infant interaction process include culturally defined behaviors such as how mothers are expected to interact with the infant, age, and self-confidence (Rubin, 1981).
The maternal role is culturally defined with some normative structure and specified behaviors. Cultural expectations of the maternal role are learned throughout one's lifetime. Early in a young girl's life attitudes and behaviors expected of a mother are practiced by play activity. Values are transferred to a young girl as comments are made and behaviors are encouraged within this role playing (Lidz, 1976). The culturally defined behaviors may affect the interaction that occurs within the mother-infant dyad.

Nover, Shore, Timberlake, and Greenspan (1984) studied the relationship of maternal perception and maternal behavior. A major dimension of maternal interactive behavior is responsiveness to the infant's signals. Nover et al. studied mothers and healthy 9-month-old infants. Forty-three mothers, age range of 19 to 39 years, and their infants participated in the study. The dyads were videotaped in a session where the mothers were to spend time with their infant like they would at home. Observation of the free play situation was the main method of data collection. Mothers who did not have accurate perceptions of the infant's behavior were significantly less socially interactive with their babies. This study supports assessment of mother-infant interaction as an indicator of the mother's perception of her infant.

Maternal behavior of warm, responsive interaction with her infant was found to be the most important finding in a study by Bates, Olson, Petit, and Bayles (1982). Subjects (N = 168) were visited at home when the infant was 6 months of age. Later the dyad visited the
laboratory twice. Mothers were assessed for affectionate contact (touch, bouncing, jiggling, rocking), approach to the infant, stimulation of the infant with a toy, and nonaffectionate behaviors. The contribution used most by the mother was responsiveness to the infant.

The age of the mother also contributes to the quality of dyadic interaction. Studies comparing women in their 20s with younger women suggest that women in their 20s have a greater psychosocial readiness for mothering (Reeder et al., 1980). The teenage mother must adapt to the mothering role while she still needs to be mothered (Field, Widmayer, Stringer, & Ignatoff, 1980; Smith, Goodman, Ramsey, & Pasternak, 1982). An observation of primiparous mothers found that the older the mother is, the more she interacts with her infant in a positively affectionate, sensitive, and stimulating manner (Ragozin, Basham, Crnic, Greenberg, & Robinson 1982). Mothers ranging in age from 16-38 comprised the study sample (N = 53 full-term dyads and 52 pre-term dyads). Perceptions of the parenting role were assessed at 1 month post discharge from the hospital and interactive behaviors were assessed 4 months after discharge. Increased maternal age was significantly related to greater satisfaction with parenting and to more optimal observed behavior. Results indicate that maternal age should be accounted for in studies of mother-infant interaction. Thus in this study, the sample inclusion criteria limited participants to 18 years of age or older.

Another characteristic that may affect the dyadic relationship is role expectation. Croft (1982) studied the effects of prenatal preparation classes on interaction behaviors (N = 61 primiparous women). Results
of the study suggested that expectations set by the mother as a result of the class content may be unachievable and a letdown may be experienced after the delivery because so much effort had been expanded in preparation. The mother's self-confidence was altered, affecting the interaction process. In contrast, knowledge about delivery and newborn characteristics have been related to more maternal self-confidence and increased interactions with the newborn (Kennell & Klaus, 1984). The importance of Croft's findings to this study is that if knowledge affects the attachment process it should be addressed in some manner in studies during the puerperium. One piece of demographic data collected was attendance in childbirth education classes.

**Dyadic Behaviors**

The interaction between a mother and her infant has traditionally been studied within psychology utilizing a face-to-face paradigm (Field, 1987). This study will follow this tradition; therefore, a review of some of the literature using this technique follows.

The Face-To-Face Interaction Guide was designed to be used with videotapings of mothers and infants in face-to-face play. Using the face-to-face paradigm, some simplification and standardization of maternal-infant behaviors can be made without reducing the complexity of behavioral organization and interaction (Kaye & Fogel, 1980).

Kaye and Fogel (1980) used the Face-To-Face Interaction Guide to analyze the reciprocity of mother-infant behaviors at 6, 13, and 26 weeks of age. The sample consisted of 52 mother-infant dyads who had
no major birthing complications. Videotaping sessions lasted 4-7 minutes during which the mother sat in a straight chair and held her infant in her lap. The mother was asked to "see if you can get his/her attention and play with him/her as you normally do." Three levels of the mother-infant relationship were discussed: (a) mothers' expressive or stimulating behavior and infants' attention, (b) infants' rates of facial expressions as a function of their attention to the mothers and of the mothers' facial activity, and (c) the most common sequences of discrete events. Analysis of these levels of behavior showed that mothers of younger infants used vestibular stimulation to attract the infant's attention but as the infant got older, the use of vestibular stimulation decreased. The infant's behavior was at first mainly responsive to the mother and later became more autonomous. Mere responsiveness, seen in early mother-infant dyadic behavior, shifted as the infant became older to more spontaneous, reciprocal interaction. Even at 6 weeks, however, there was some reciprocity between the mother's and infant's responses.

Other studies also support reciprocal interactions between a mother and her infant using instruments similar to Kaye and Fogel's face-to-face guide (1980). Belsky, Taylor, and Rovine (1984) studied 74 mother-infant dyads where the infant was one month of age at the onset of the study. Findings in the study led to the conclusion that reciprocal interactions within the mother-infant dyad look more similar than different across the first 9 months of life.

Reciprocal interactions within the mother-infant dyad beginning at 2 months of age were studied by Tronick, Als, and Brazelton (1980).
Dyadic phases, similar to the face-to-face categories used by Kaye and Fogel (1980) were used to break down and code the interactions. The phases used were disengagement, initiation, mutual orientation, greetings, and play dialogues. Results suggest that infants tend to keep their behaviors within a more narrow range than is available to them and their rate of change within the phases is slow. The mother is able to move more quickly within the states and thus match the infant’s state. The interaction within the mother-infant dyad can be characterized as a smooth and modulated movement which allows the dyad to simultaneously change their state of relatedness.

Cohn and Tronick (1987) used a face-to-face interaction scale to describe the sequence of dyadic states at 3, 6, and 9 months of age, and to evaluate the validity of the dyadic states. Fifty-four dyads participated in this study. Videotapes of the dyadic interactions were coded using Monadic Phases. For each of the 54 dyads, the mother-infant states were highly related and not independent (for all but 2 dyads, chi-square tests, df = 3, were significant at p < .001). The results of the study support the belief that each partner changes in response to the other’s changes in state.

The establishment of a mother-infant relationship is a task of motherhood (Rubin, 1981). Accomplishment of this task is important because the infant who experiences this relationship benefits physiologically, psychologically, and socially. If such a relationship is not established, there is greater risk for child abuse and inadequate development of psychosocial skills. The amount of interaction received by the infant
is an important stimulus in the development of intelligence and language as well as in the development of innate personality characteristics (Castiglia, 1987). Barnard (1986) has described key factors as important to the interaction process between a mother and her infant. These areas, for the mother, are sensitivity to the infant’s cues, ability to alleviate the infant’s distress, and the ability to create an environment that fosters cognitive and social development. The infant behaviors are the ability to produce clear cues and the ability to respond to the caregiver. Using the factors listed above, Barnard (1978) developed the Nursing Child Assessment Feeding Scales. These scales consist of 76 behavioral items to be observed during a feeding time. Feeding time is used because feeding places the interactive process in a natural context. The scales provide a guide for assessing the quality of the mother-infant relationship. Barnard’s work is presented here to emphasize the importance of reciprocal interaction, that the infant gives cues and the mother responds to them. Her work supports the fact that behaviors associated with a positive mother-infant interaction can be observed in dyadic interaction.

Some mothers are able to accomplish the task of developing an emotional tie with their infant prior to birth. Carter-Jessop (1981) divided 10 healthy primiparas into two groups to determine the effect of a prenatal attachment intervention. The experimental group was taught to feel for the babies’ parts through the abdomen and were encouraged to be aware of the fetal activity and how they could affect the activity. The mothers were also taught and encouraged to rub,
stroke, and massage their abdomen over their baby on a daily basis. During the second to the fourth day after delivery, the mother's level of attachment was measured noting specific maternal behaviors. There was a significant difference between the control and experimental group scores. The researchers surmised that the experimental mothers were consistently more happy, verbal, and comfortable with their infants. This sample, however, was too small for any level of sensitivity.

Assuming that each partner in the maternal-infant dyad is interacting with the other in a unique manner, the reciprocal interaction between the mother and infant has been explored. Belsky, Taylor, and Rovine (1984) studied the stability and change of the reciprocal interaction in 74 mother-infant dyads. Interactions were observed when the infants were 1, 3, and 9 months of age. Four summary constructs were found to underlie 15 behavioral categories. The four constructs were reciprocal interaction, noninvolvement, distress, and basic care. Authors concluded that, despite the similarity of interaction techniques that were observed early in life among the dyads, changes occurred over the first 9 months of life, diversifying the interaction techniques. This study supports previous knowledge that interaction is a dynamic process and the dyad is resilient to change.

Other studies that looked at interactions within the dyad also have supported the reciprocality of interaction behaviors. Tronick, Als, and Brazelton (1980) described infant-mother face-to-face interaction. These authors observed expressive behaviors, called Monadic Phases. The Monadic Phases provided a framework for a descriptive analysis of the
dyadic interactions. This work on face-to-face interactions suggested that interaction is a system of mutually and reciprocally regulated units of behavior. Five infant-mother dyads, with infants ranging in age from 80 to 92 days of age were included in the study. The 3 minute interaction was videotaped and later analyzed for each partner's contribution to the interaction. Results supported the uniqueness and reciprocity of the dyadic interactions. Again, the small sample is a limitation of the study.

The mother's responsiveness to her infant has been widely accepted as important to good developmental outcome. Similarly, infants respond to the mother as well. Linn and Horowitz's (1983) study of infants and mothers began to describe the process of describing developmental outcome. Twenty-eight newborns were observed twice while being fed by their mothers. The infant was also tested using the Neonatal Behavioral Assessment Scale with Kansas Supplements (Brazelton, 1973). The infants were given visual, auditory, and tactile stimulation. Reflexes and consolability as well as other behaviors were assessed. This study suggested that the infants exhibited an adaptive function of behavioral variability that is important to mother-infant interaction.

Another study that suggests the interrelationship effect of mother and infant was done by Fish and Crockenberg (1981). The study looked at infant irritability, motor activity, and sociability from the newborn period through the first 9 months of life. Sixteen dyads were assessed at birth, and at 1, 3, and 9 months of age. Motor activity was
least affected by mother behavior. Sociability of the infant was positively related to maternal contact and responsiveness. Fussing and crying were consistent throughout the study time. The results suggest the relative importance of both mother and infant contributions to the desired outcome.

Attachment behaviors were studied by Bornstein and Tamis-LeMonda (1990). Twenty-eight dyads were observed during two home visits, at 2 and 5 months after birth. Mothers were asked to behave in their usual manner. Coded behaviors of mother included the mother’s engagement of the infant and eliciting the infant’s attention to herself and to something in the environment. This included behaviors such as touch, positioning the infant, speech, or gestures. The infant activities included visual exploration and hand contact. Results indicated that mothers and infants correspond mutually and they adapt to changes in each other over time. The instability of individual behaviors suggest that mothers and infants are flexible and adaptable. A multi-model view of specificity in mutual dyadic interactions during 6 months after birth was supported in this study.

A study by Field, Healy, and LeBlanc (1989) was designed to determine whether behavior states of mothers and infants are shared. The sample was 16 primiparous women (seven depressed and nine nondepressed) with their 3-month-old infants. The mothers were filmed in 3-minute face-to-face interaction when they were to play with their infant. The mothers’ behaviors were coded as anger/poke, disengage, elicit, and play. Infant behaviors were coded as protest, look away,
object, attend, and play. Heart rate of the mother and infant were analyzed for coherence with the behaviors. Coherence was found between mother and infant and between behaviors and heart rates. There was greater coherence between the dyadic behavior and heart rate in the nondepressed mothers, perhaps because nondepressed mothers were more responsive to the infant’s behavior.

Infant and mother behavior frequencies were studied by Whitt and Casey (1982) to determine interactional correlates of infant cognitive development ($N = 47$). The control group received the physical exam and discussions of physical and preventive care. The study group were involved in discussions designed to enhance the interaction in the dyad. These discussions were aimed at increasing the mother’s awareness of the infant’s behaviors, encouraging response to the infant’s cues, and helping the mother feel more confident. Crying and vocalizing were presented as communication efforts. Mothers were encouraged to respond to infant’s cries using visual, vocal, and touch contact. The enface position was modeled by the physician. Nine maternal behaviors used for the study were vocalize, look, smile/laugh, hold, touch, game play, give/show toy, caretaking, reads alone (p. 950). The infant behaviors were vocalize, look, fret/cry, nonvocal noise, laugh, smile, touch, extra movement, quiet play, play with toy with mother, eyes closed (p. 950). The mother behaviors of vocalizing, looking, and smiling correlated strongly with effective relationship suggesting that this type assessment may be correlated with infant development. The results
support the use of frequencies of maternal behaviors for assessing the quality of mother-infant interaction.

Stainton (1990) developed instruments to measure the progress of the mother-infant relationship in the first 8 weeks postpartum. The instruments provide a score on five behavioral categories of maternal care. These categories include sensitivity to the infant, touching/holding, eye-to-eye and face-to-face contact, caretaking competence, and expression of feelings. This work recognizes that certain interactions that are indicators of a positive mother-infant relationship can be assessed by nurses during the first days after birth. The tools are to assess need for nursing care, not the quality of parenting.

From the studies previously presented, there is support for measuring infant behaviors and mother behaviors in dyadic interaction. Although studies are limited that have focused on interaction during the first 3 days after birth, the assumption is made that specific mother-infant dyadic behaviors such as mutual eye gazing are indicators of a healthy mother-infant relationship.

Heart Rate

The somatic physiologic response that was examined in this study was the heart rate of a mother and her infant. Postulating that this response varies with different emotions, and that emotions affect mother-infant interaction, a review of the literature surrounding an emotional state that is conducive to attachment is presented. This review is followed by studies that address heart rates in the dyad.
Physiology

Contentment, one emotion that may affect attachment, is defined by the researcher as an emotional state of peacefulness. Contentment is a calm emotion, one that is in contrast to the stressful emotions of anger and fear. Emotions can be broken down into component responses which include expressive actions, reactions and physiologic change (Malatesta & Izard, 1984).

"Emotion is a relatively short-term evaluative response essentially positive or negative in nature involving distinct somatic (and often cognitive) components" (Kemper, 1978, p. 47). Emotions are virtually transitory, depending upon the circumstances that influence them. Somatic components are the measurable and observable changes in the body that accompany the emotion such as change in heart and respiratory rate, perspiration, flushing, or motor activity. The cognitive components are the words that describe the emotion the person uses to describe their feeling about the situation.

The opposite strong emotional reactions to contentment is stress or anxiety. When the hypothalamus senses stress, it initiates a chain of reactions that produce the general adaptation syndrome. Among the stress responses are increased heart and respiratory rates. Hypothalamus sensors detect changes in the chemistry, temperature, and pressure of the blood. The hypothalamus is informed of emotions through tracts that connect it with the emotional centers of the cerebral cortex. When a stressor appears, the hypothalamus stimulates the sympathetic nervous system (Tortora & Anagnostakos, 1984).
In contrast to the sympathetic nervous system, the parasympathetic system is concerned with activities that restore and conserve body energy. Whereas the sympathetic system increases heart and respiratory rates, the parasympathetic system works to decrease them. Under normal conditions, the two systems work together to maintain balance. The main function of the sympathetic system is to counteract the parasympathetic effects just enough to carry out the normal processes requiring energy. Contentment, or a calm state, derives its existence from the parasympathetic nervous system, and may be expressed in heart rate and respiratory rates (Thibodeau & Anthony, 1988). This information gives support for the measurement of these parameters.

A common theme in psychological theory involves the belief that there is some pattern of neurological activity that is the core aspect of emotion. This aspect would then remain invariant through time despite other influences. There is also a common theme of continuity between the emotional life in childhood and adulthood. Even though the expression of emotion may not be the same, the emotional syndrome of childhood is the same as that in adulthood (Averill, 1984).

One theory about emotional development contends that all the basic emotions are in place at birth; they are immature and need nurturing (Brazelton, 1983). Even though the emotions are in place, many of them do not become apparent to observers until later. Although the infant cannot express emotions in words, other indicators such as heart and respiratory rates may add support to this theory (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). This information suggests that
indirect measurements of heart rate can be used as an indicator of emotional state.

Heart Rate Studies

Infant heart rate response as a function of the psychological state was studied by Berg, Berg, and Graham (1971). Infants (N = 24) were tested for their reaction to sound intensity which was related to the infant’s general state of awareness and to pulse rates. According to the study, response depends on state and on the intensity and rise of stimuli. In general, the sound stimulus used in the research produced deceleration of pulse rates in both waking and sleep states of the infant. Deceleration of heart rate has been associated with an infant state which facilitates stimulus intake and learning while acceleration may be a part of a protective system but inhibits intake (Graham & Clifton, 1966).

Porges (1984) studied physiologic correlates of attention as a way of looking for underlying learning disorders. Common behavior disorders in children are characterized by deficits in attention. Thus, the possibility of finding measurable physiologic differences in the child was pursued in an effort to predict the attention ability of the child. In response to a stimulus, the heart rate of healthy infants initially slowed and was then often followed by an increase. The heart rate changes were observable in neonates before the motor responses were developed. The response to stimulus onset was primarily by heart rate acceleration and deceleration to stimulus offset. The infant heart rates decreased in
variability during the stimulus. Porges called this an attentional state of the newborn. Porges’ study provided the foundation for studying the infant’s heart rate in dyadic interaction.

In one of Porges’ studies (Fox, Nathan, & Porges, 1985), cardiac vagal tone was evaluated as a way of predicting developmental outcome of infants. At 40 weeks gestation, a 3-minute EKG was recorded on 80 infants. The healthy term infants had a slower heart rate than preterm infants. Neurologic assessment was performed and analyzed with the heart rate. The analyses of data from 8 and 12 months of age indicated that infants with high vagal tone at 4 weeks have more positive developmental outcomes than infants with low vagal tone. Thus, this type of measurement may be a means of identifying infants at risk.

Infants between 2 and 8 weeks of age (N = 11) were tested under two state conditions, awake and asleep. Tactile stimulation was produced by nylon filaments being run from the corner of the infant’s mouth to the ear. The data demonstrated that there are important differences in infant’s cardiac response to tactile stimulation which are dependent on the state of the infant (Lewis, Bartek, & Goldberg, 1967).

Although performed on father-infant dyads, Jones and Thomas’s (1989) study gives background data for physiologic measurement within the infant-mother dyad. The purposes of their study were to describe the cardiovascular effects of first-time fathers holding and interacting with their infant and to investigate the relationships between the father’s verbal and nonverbal behavior and infant state. First time fathers (N = 157) were videotaped with their infants at 2 or 3 days
following birth. Blood pressure and heart rates were measured before and after a 6 minute interaction time. Cardiovascular changes of the father were found to be related to the state of their infants and to their own verbal behavior. In this study, the father’s blood pressure was higher when the infants cried and remained high after the session. This finding suggests that the infant’s cry was stressful to the father. Fathers who talked more to their infant during the session had a lower blood pressure and a higher pulse than fathers who talked less. This study suggests that along with other measures, monitoring of physiologic parameters during infant-parent interaction may reveal predictable parental responses.

A study that incorporated a relaxation technique was one by Booth, Johnson-Crowley, and Barnard (1985). The purpose of the study was to determine if various massage and exercise procedures would enhance the development of the infant and the maternal-infant relationship. Thirty-four primiparas and their infants participated in the study. Mothers were assigned to one of three groups. One group was to use powder-massage and exercise, one group non-powder massage and exercise, and the other control group was not encouraged to use massage or exercise. The mothers in the massage groups were encouraged to use infant massage techniques twice a day for 15 minutes for 12 weeks. At 14 weeks postpartum observations were made of a mother-infant free play session and a mother-infant massage and exercise session. Although there were no statistically significant differences between the groups, the subjective results suggested that when parents learn more about and
become sensitive to their infant, they develop a closer relationship with their infant. The qualitative aspect of this research addresses the value of a specific interactive technique, one that may be related to relaxation, contentment, or attention.

The normal physiologic changes that occur during pregnancy include nonpathological changes in the circulatory system. Knuttgen and Emerson (1974) investigated physiological response in normal pregnancy at rest and during exercise. Thirteen healthy pregnant women and three nonpregnant women were studied. The pregnant women were tested at 4 week intervals during pregnancy and at 6 weeks after birth. Nonpregnant women were tested on five occasions at intervals of 3-4 weeks. After resting for 30 minutes, blood pressure, heart, and respiratory rates were determined. Exercise was performed by walking on an included treadmill and cycling for 10 minutes each. At rest, mean values for heart rate were 81 prepartum and 66 postpartum. During exercise the mean heart rate was 133 (treadmill) and 140 (cycling) prepartum and 123 (treadmill) and 137 (cycling) postpartum.

In summary, literature supports using physiological variables to determine an awareness state. This researcher proposes that the state which has been identified as the one when quality interaction occurs may be considered contentment, a state when irritability is at a minimum and the person is able to concentrate. Contentment is conceptualized as an emotion that is reflected in one's physiological and psychologic state. The impact of this state may be important in mother-infant interaction. Somatic components of contentment are the measurable and observable
changes in the body such as change in heart and respiratory rates (Kemper, 1978). The parasympathetic nervous system controls the body's responses to stressful events by counteracting the effects of the sympathetic nervous system (Tortora & Agnostakos, 1984). Descriptors used for the cognitive component of contentment have been used for relaxation response. Contentment is a calm emotion, contrasting with stressful emotions such as anger and fear (Malatesta & Izard, 1984). A common theme in psychological theory involves the belief that there is some pattern of neurological activity that is the core aspect of emotion (Averill, 1984). The contented infant is not well described in the literature. A general idea of descriptors of contentment in a healthy infant may be attained by describing the infant who is not content. For example, the infant in drug withdrawal who is difficult to console gives one a mental picture of what contentment is not (Flandermeyer, 1987). There is, however, little information in the literature describing aspects of contentment, especially in the full term infant or the mother during the first few days following birth. The preceding literature review offers support for the assessment of heart and respiratory rates as indicators of mother-infant interaction and as a reflection of dyadic contentment.

**Rocking**

Rocking is a rhythmic movement that can be observed in daily activities. Webster's Third New International Dictionary (1976) defines rocking as a behavior having a swaying, rolling, or back and forth movement. From this definition, different types of rhythmic movements may
be called rocking. Various types of rocking are incorporated in the activity of human beings. The rocking that a mother produces when she sits in a rocking chair holding her infant is the focus of this study.

Rocking is soothing as well as stimulating to the infant and mother. Through the vestibular stimulation from rocking, it is thought that coordination and control of voluntary movement are facilitated (Corner, Kraemer, Haffner, & Casper, 1975). When growth patterns of premature infants were studied, weight gain was significantly accelerated when the infants were rocked regularly. Rocking stimulation may elicit a global effect on the mother-infant dyad that is hardly comparable to the effect of a simple stimulus affecting one sensory pathway; it is the integration of all the stimuli received during rocking that gives the effect (Leib, Gary, & Gurdubaldi, 1980; Pomerleau & Malcut, 1981).

Ambrose (1969) hypothesized that rocking would terminate crying in newborns. Research interest arose from observations of crying infants; when a mother rocked her infant, the infant frequently stopped crying. Ambrose built a vestibulator to provide rhythmic vertical up and down movement to infants. At a rate of 60 to 70 oscillations per minute, infants ceased their crying and a decrease in heart and respiratory rates were noted. Ambrose also attempted to stimulate crying with increased body movement but was unable to achieve this result. Even though the specific statistics of this research were not reported in the literature, the results of this early study on rocking provided a knowledge base for further research.
Barnard (1973) found that rocking premature infants in a horizontal rocking bed and coupled with auditory stimulation significantly increased the amount and length of quiet sleep. In addition, the infants showed more weight gain and greater maturational scoring. The stimulation program, consisting of 15 minutes an hour for two weeks, was provided for seven infants during the 33rd and 34th week gestation. A control group consisted of eight prematures. Auditory stimulation was a low frequency heartbeat recording; rocking was completed with a maximum displacement of 3" and a movement of 29-30 strokes per minute (Barnard, 1973).

The use of rocking as a nursing intervention was supported in a study by Burns, Deddish, Burns, and Hatcher (1983). Twenty-two infants were randomly assigned to experimental or control groups. The infants were 28-32 weeks gestation. Control infants were maintained in traditional incubators while the incubators of the infants in the experimental group had oscillating waterbeds and rhythmic sounds. No significant differences between groups were found in the physical parameters of weight or head measurements. However, the experimental group spent less time in active sleep than the control infants. The results suggest that the use of the rocking bed and rhythmic sounds may enhance the development of preterm infants.

Although done on Korean low birth weight infants, an experimental study by Lee (1990) supports using sensory stimulation for the enhancement of development. Control group infants (N = 34) received routine hospital care. The experimental group (N = 34) received routine
care plus stimulation. At the first sensory level the experimental group received 2-3 minutes of tactile (massage) stimulation and visual stimulation (ball placed in the infant's visual line 3-5 times). In the second level, auditory (music box) stimulation was added. Growth and development were measured using weight gain and a neurobehavioral assessment. Results showed that sensory stimulation improved the infant's weight gain, sensory functioning, and the nervous system organization. Results support the investigation of other methods of stimulation such as rocking for enhancement of development. Rocking includes tactile stimulation even though it is provided by a technique that differs from Lee's study.

Although rocking was not performed in a rocking chair, similar motion was studied by Anisfeld, Casper, Nozyce, and Cunningham (1990). Subjects (N = 49) were randomly assigned to an experimental or control group. The experimental group received soft baby carriers and the control group received infant seats. The difference in carriers was to allow for more physical contact in the experimental group. At 13 months of age, the Ainsworth Strange Situation was administered. More of the infants who were carried in the soft baby carriers were securely attached to their mothers than those who were handled in the hard carrier.

Studies that investigated rocking in the elderly population may assist in understanding rocking in the mother-infant dyad. Houston (1989) studied rocking and relaxation in persons, age 65 or older, who were living in the community (N = 65). The persons were seated in a rocking chair and measurements of heart rate, blood pressure, and skin
temperature were checked before, during, and after rocking. A statistically significant decrease in heart rate \(p < .01\) and skin temperature \(p < .001\) was found after the rocking.

A recent study by Thomas, Ptak, Giddings, Moore, and Opperman (1990) investigated the effects of rocking on the mother who is post cesarean section. Although this is not the population that is studied by this researcher, it does add to the knowledge base about rocking in the puerperium and supports the combination of mother-infant interaction, rocking and physiologic measurements in this study. Mother-infant dyads \(N = 290\) were studied by Thomas et al. The sample was randomly assigned to a rocking or a non-rocking group. Mothers who rocked at least 60 minutes per day had less gas and were discharged home earlier. The study had a qualitative component of looking at attachment behaviors within the rocking dyads. There was a positive influence of rocking on the mother-infant relationship as identified through observable attachment behaviors.

Censullo, Lester, and Hoffman (1985) studied mother-infant dyads \(N = 15\) term and 15 preterm) during face-to-face interaction. Dyads were videotaped for 3 minutes during which the mother was asked to keep the infant's attention. Rhythmic patterning was assessed according to dyadic phases (initiation, mutual orientation, greeting, play, and disengagement). Findings showed that early mother-infant interaction was rhythmic. The mother and infant development of turn taking, as seen in this study, is basic to verbal dialogue between two human beings (Lester, Hoffman, & Brazelton, 1985). Censullo et al.
(1985) study gave incentive to look more closely at the rhythm of rocking in the mother-infant dyad as well as the measurement of dyadic behaviors.

In summary, the literature on rocking supports the belief that rocking has an influence on well-being. Ambrose (1969) found that rocking is an effective soothing technique for infants. Rocking was found to significantly improve the condition of premature infants (Barnard, 1973; Burns, Deddish, Burns, & Thatcher, 1983). Significant desired physiologic effects in the elderly were found by Houston (1989), and during the puerperium by Thomas et al. (1990). These studies give evidence of the need for further research about rocking. While studies supported the effectiveness of rocking in the elderly and premature infants to improve their physical condition, there is minimal literature that describes rocking in full term newborns.

**Studies Combining the Research Elements**

The relationship between physical-psychological activity and growth and development of infants is illustrated in kangaroo care for premature infants. At the Hospital Materno Infantil in Colombia (Anderson, Marks, & Wahlberg, 1986) infants in satisfactory condition, no matter how small, go directly to the mother as early as 2 to 3 hours after birth. The mothers are instructed to breastfeed whenever the infant wants to be fed and to carry them skin-to-skin in an upright position between their breasts. Although documentation of follow-up was not found in the literature, founders of the Kangaroo Program report
dramatic reductions in mortality, morbidity, and parental abandonment when the program is used. The techniques used in the program provide a maternal milieu of physical closeness and rhythmic movement. Although these results are questionable due to poor follow-up studies, the approach incorporated some of the ideas of this study and warrants noting for this research.

Raush (1981) studied the effects of tactile and kinesthetic stimulation on premature infants. Forty premature infants, age 1 to 10 days were included in the study; 20 of the infants were in the treatment group. Treatment consisted of a specified pattern of gentle rubbing different areas of the skin followed by rhythmic flexing and extending motions of the extremities. The treatment was given 15 minutes a day for 10 days. Significant differences were found in feeding intake and stooling frequency, inferring growth differences in the prematures. The results suggest that single daily stimulation in the first 10 days post-partum enhanced the clinical course of premature infants.

Field et al. (1986) also studied the effects of tactile/kinesthetic stimulation of preterm neonates. The tactile/kinesthetic stimulation consisted of three 15 minute periods of rhythmic body stroking and passive movements of the limbs three times a day for 10 days. Weight gain and an increase in mature habituation were significant. The data suggested that the tactile/kinesthetic stimulation facilitates growth and behavioral organization in preterm neonates.

The review of the literature on mother-infant interaction supports the importance of developing a strong emotional tie between a
mother and her infant (Kennell & Klaus, 1984). This emotional tie may be present for the mother prior to the birth of her infant. (Carter-Jessop, 1981). The process of developing a close emotional tie is exhibited through interactional behaviors such as eye gazing and reciprocal verbalizations (Barnard, 1978; Kaye & Fogel, 1980; Klaus et al., 1972; Siegel et al., 1980). Tactile/kinesthetic stimulation may facilitate behavioral organization and habituation in the preterm infant (Field et al., 1986; Raush, 1981).

A study by White-Traut and Nelson (1988) looked at the effect of maternally administered tactile, auditory, and vestibular stimulation in the interaction between a mother and her premature infant. Thirty-three mother-infant pairs were assigned to one of three groups: (a) a control group, (b) a talking group, and (c) an interactive group. The interactive group treatment included massage, talking, eye contact and rocking. Rocking for 5 minutes provided vestibular stimulation to the infant. The Nursing Child Assessment Feeding Scale (Barnard, 1978) was used to measure the mother’s interaction with her infant. Significant differences were identified among the three groups for maternal ($p < .03$) and infant ($p < .05$) behaviors. The findings suggest that mothers benefitted most from active interaction with their premature. Rocking is one method of providing this interaction.

Rocking is thought to be soothing because of the quiet stimulation of the baby’s skin and muscles (Montague, 1971). Rocking may be an activity that promotes meeting many needs of the dyad, both physical and psychological and includes many stimuli (Kulka, Fry, & Goldstein,
Early theorists proposed that satisfaction of the infant’s needs for stroking, rocking, and handling enhanced the growth and development of the central nervous system, especially the cerebrum (Hebb, 1949; Kulka, Fry, & Goldstein, 1960). Rocking and caressing stimulate the pleasure pathways of the infant brain. Restak (1979) postulated, from a review of previous studies, that if the infant’s needs for vestibular and tactile stimuli are not met, difficulties with social adjustment may occur later in life. The postulations of early theorists have been supported by subsequent research.

Chaze and Ludington-Hoe (1984) included rocking in a rocking chair at 16 rocks per minute in an infant stimulation care plan for premature infants. The protocol was as follows: when the infant was quiet and alert, visual stimulation would be given first; if the infant was active alert, tactile stimulation would be given first; drowsy infants would first receive auditory stimulation. This is one of the few published care plans for infants that includes rocking as a method of stimulation. The rationale for this plan is validated by studies which suggest that rocking is important for prematures (Burns, Deddish, Burns, Hatcher, 1983; Lee, 1990).

White-Traut and Nelson’s (1988) study supports rocking as one method of providing interaction within the dyad. Continuous rhythmic stimulation was found to have a pacifying effect for 1-month-old infants (Brackbill, 1971). Passive cycling exercise for 1 to 10 month old infants increased growth and development (Porter, 1972). Supported by previous research, rocking has been included in a care plan for premature infants
(Chaze & Ludington-Hoe, 1984). Similar studies to support the need for rocking are not available for full term infants; the effect of including rocking and rhythmic stimulation in the care of full term infants is not clear in the literature.

**Summary**

Research describing the relationships between mother-infant behaviors, heart rates, and rocking is lacking in the literature. There is, however, data to support further investigation of the relationships between these elements. Attachment behaviors of mothers and their infants have been identified. Description of heart rates during mother-infant interaction is presented in the literature, primarily in relation to attention. Literature subtly suggests that emotional state is reflected through heart rates, and may be an indicator of quality mother-infant behaviors. Indirectly, descriptors of contentment are used in the literature. For example, when an infant is crying, he is not considered to be content. Likewise, when the infant is in the quiet-alert state and looking around, he is considered to be content. This may also be attention to a stimulus.

The effects of rocking behavior have been studied for the premature infant and the older adult. Rocking as a soothing technique for fussy and crying infants and as a stimulating mechanism for premature infants has been studied. Chaze and Ludington-Hoe (1984) have documented the importance of rocking in the care of preterm infants. However, the importance of rocking for full term infants or for
new mothers has received little attention. Ambrose (1969) built the vestibulator and found that infants can be soothed using vertical rhythmic activity cycles. This movement, however, was up and down movement; the arcing movement obtained through rocking in a rocking chair needs further description. There is currently little description in the literature of the description of rocking behaviors that are used by the mother during the first few days following birth of a full term, healthy infant.

The gaps in the literature for the relationships between infant behaviors, mother behaviors, heart rates, and rocking supply the impetus for this research study. Even though the average hospital length of stay for healthy mother-infant dyads is 2 days, nursing research describing these first days is limited. This study is designed to add to the knowledge about mothers and infants by describing infant behaviors, mother behaviors, heart rates, and rocking within the mother-infant dyad during the first 3 days following birth.
CHAPTER III
METHODS

This chapter presents the research design for the study. The setting and sample selection, data collection protocol, and the instruments used for data collection are all described. The pilot study is discussed and the protection of human subjects is presented. Lastly, the statistical analysis of data and a summary statement concludes this chapter.

Design

A descriptive, nonexperimental research design was used to collect data to study the most frequently observed infant behaviors, mother behaviors, heart rates, and rocking, within the first 3 days after birth. Continuous real-time recordings of heart rates and videotapes of mothers and their infants were used to collect data for the elements of infant behaviors, mother behaviors, heart rates, and rocking. Description and analysis of these elements provided information to answer the research questions.

Setting

The setting for this research was a maternity unit in a voluntary, nonprofit hospital located in a midwestern state. The hospital was
a Level III, high-risk center for maternity clients from 15 counties and a variety of cultural backgrounds. The hospital was located in a large urban area and provided care to the childbearing family during pregnancy, labor, birth and recovery. Most births occurred in a traditional delivery room. Infants were taken to a central nursery where they remained for approximately two hours, or until the infants successfully adapted to extrauterine life. After this transition infants were cared for by their mother in the mother’s room during the day and returned to the central nursery at night. Most of the mother-infant dyads were discharged home on the second day after birth.

The maternity unit used for this study delivered 3893 babies during 1988. Thirty percent of these infants were delivered by cesarean section. Twelve percent of the infants were premature (Statistical Report Form, City Hospital, 1988).

**Target Population and Sample**

Mother-infant dyads who were within the first 3 days following birth were the target population for this research. The convenience sample consisted of 30 healthy, not high-risk, mother-infant dyads who met the following selection criteria for participation in the study:

1. The mother and infant were patients on the maternity unit.

2. The dyad exhibited no major deviations from the expected course of labor, birth, and recovery. No cesarean section births were
included. No dyad who needed special medical or nursing care was included.

3. The mother was primiparous.

4. The mother was the biological mother of the infant. No adoptive mothers or infants were included.

5. The mother was 18 years of age or older.

6. The infant was full term at birth (i.e., between 38 and 42 weeks gestation by Dubowitz score).

7. The mother did not have a positive history of drug abuse.

All dyads who met the criteria on days when data were collected were approached for participation in the study. In this manner, the bias of selective sampling was removed. Dyads were from a variety of social backgrounds. All patients were from a 15 county area. The mother sample consisted of 30 women ages 19 to 36. All mothers were primiparous.

**Sampling Procedure**

The sample was recruited by personal visits from the researcher. Initially, the researcher went to the hospital unit and reviewed the census record for potential subjects. Background data were obtained from the patient’s chart and a decision made about eligibility based on the participation criteria. Collaboration with the nurse assigned to the dyad gave further information about the patients. If the primary nurse felt that the patient should not participate, (i.e., a recent physical or
emotional upset), the dyad was dropped from the list of potential subjects. This occurred on two occasions.

When it was clear that the dyad met the study criteria, the mother was approached by the researcher, given verbal and written information about the study, and asked to participate. All mothers were approached in a similar manner. A total of 52 mothers were approached and 36 dyads were videotaped. Due to missing data, six dyads were not included in the sample. Recruitment stopped when the data were complete for 30 mother-infant dyads.

Procedure

Research Room Layout and Preparation

A private room on the maternity unit was made available by the hospital for this study. The room had no windows or furniture other than that used for data collection. Two mirrors, 2 feet by 4 feet, were hung on adjacent walls 1 foot from the corner where the videotaping occurred. The mirrors provided a means to observe the infant’s face when the infant was held over the mother’s shoulder. The code number of the observed dyad was placed beside one of the mirrors. This number coincided with the number on the computer program.

The room was located in an adjoining corridor to the maternity unit. Minimal traffic went past the room, providing a quiet atmosphere for the dyads. The use of a room that was prepared and used only for the study also provided consistency. The room was organized and
prepared with equipment prior to the arrival of the dyad, thus minimizing confusion or stimulation prior to data collection.

Equipment

A traditional wooden rocking chair was placed in one corner of the room, facing the opposite corner. The chair was 18 inches from the corner providing adequate space for rocking yet providing the needed space for videotaping. To allow for consistency in placement, the desired location for the chair was marked with tape placed on the floor. A pillow was put on the chair for the comfort of the mother.

A Panasonic PV-645 portable video camera was secured on a tripod and positioned 4 feet from the mother and 1 foot to the right of the mother's center, 5 to 15 degrees above the horizontal plane of the mother’s face. This angle and position yielded the best view of both faces. When the dyad was in face-to-face contact, more of the infant’s profile was obtained than the mother’s.

Two Hewlett-Packard monitors were placed on a cart against the wall to the right of the rocking chair. An adult monitor, model 78354A and a neonatal monitor, model 78834C were used to collect physiologic and rocking data. In addition to measuring heart rate, the neonatal monitor had the capacity to measure pressure. Both monitors were specially adapted to allow the electrical heart signals to be interpreted digitally.

Rocking activity was recorded as a pressure wave pattern change connected directly to the monitor. The pressure receptor on the monitor
was attached to a quartz pressure transducer which was connected to a 1000 cc plastic intravenous solution bag via intravenous tubing. The IV bag was filled with air and placed under the left rocker of the chair, 12 inches from the back of the rocker. As the mother rocked the chair backward, air pressure increased in the tubing and transducer; a signal was sent to the monitor, through a Keithly unit (575 Measurement and Control System) and to the computer. Rocking was displayed in a wave pattern on the monitor.

Heart rates were obtained using skin electrodes. The electrodes were Solid gel safety socket Ag/AgCl 13953CA for the infant and adult electrodes for the mother. The monitors and the electrodes were donated by the Hewlett-Packard Company.

The Keithly unit, connected to the monitors via an electrical cable, changed the signals received from the monitors to signals that were transferred to a computer. The Hewlett-Packard computer, supplied with a program written specifically for this research study, recorded the heart, and rocking data. Frequency of rocking was displayed as waves of activity on the computer screen. Heart rate was displayed digitally. The computer was loaned to the researcher by the hospital.

A clock with a second hand, initialized by the computer program, was on the wall beside one mirror. Starting the clock with the computer program allowed synchronization of data; when the clock started, so did the computer recording of heart rates and rocking. The movement of the clock’s second hand signaled the time for coding variables.
Data Collection Process

Orientation of Nursing Staff to Study

A member of the hospital research committee was a liaison between the researcher and the hospital for the study. The liaison was completely informed of the study and was readily available to answer questions from the nursing staff. The nursing staff was initially informed of the research study by their supervisor. Further information was given on a personal basis by the researcher. When the primary nurse was approached about the patient’s participation, the basics of the research study were shared with the nurse. The decision to inform nurses individually was made by the nursing supervisory staff.

Background Information and Permit

The first step in data collection was to obtain information from the charts. Chart review affirmed that the dyad met the inclusion criteria and supplied other information to be used in analysis (see Appendix A.)

The mother was approached by the researcher and was told briefly about the study; she was then asked to participate. If she agreed to participate, a letter of introduction (Appendix B) and a permit (Appendix C) were given to her. Any questions about the study were answered. The mother signed the permit and a copy of the permit was given to her. The mother was asked to notify her primary nurse when the infant
was awake and between feedings and when she was ready for the observation session.

**Baseline for Physiological Variables**

The mother’s and the infant’s heart rates were checked within 2 hours of the participation. This provided baseline rates to use for data analysis.

**Videotaping and Monitoring**

When the mother notified the primary nurse that she was ready for the study to begin, the researcher went to the mother’s room and escorted the dyad to the research room. The primary nurse was told that the dyad would be out of the mother’s room for about 1/2 hour. Because the research room was about a 5-7 minute walk from the patient’s room, all mothers were offered a wheel chair but none accepted. The infant was placed in a crib and the crib was pushed, usually by the researcher, to the research room.

Upon entering the research room, the equipment was explained to the mother. The mother was asked to sit in the rocking chair; the electrodes were shown to her and applied to her chest. To obtain the electrocardiogram wave patterns, maternal electrodes were placed below the right and left clavicle, at the mid-clavicular line, and 2 inches below the left breast on the axillary line. Infant electrodes were placed below the clavicles at the mid-clavicular line but the third electrode was placed on the abdomen in the left epigastric area. The infant was handed to
the mother and the electrodes were applied to the infant’s chest. For five of the dyads an additional heart rate was obtained from both members of the dyad and compared to the monitor output to assure reliability of the monitors. The monitor pattern was observed by the researcher to verify the functioning of the equipment.

Directions were given to the mother regarding how to call for help (call bell or call out vocally). She was asked to keep the infant’s head uncovered if possible and was told that the study would last 15 minutes and that the computer would sound four musical notes at the end of the program. No other specific directions were given to her. The rocking she did was spontaneous and self directed.

The computer program and the videocamera were started. The 15-minute session was recorded at standard play speed. The electrical wave pattern was viewed on the computer screen and compared to the monitor to assure that the program was functioning properly. The researcher left the room. When the 15-minute session was over, signified by the four musical notes from the computer, the researcher entered the room, turned off the video camera, and asked the mother about the session. The electrodes were removed from the infant and the infant was placed in the crib. The electrodes were removed from the mother and the skin under the electrodes was cleansed with water. (The mother’s electrodes contained a conductive gel that became liquid when warm; the infant electrodes were a solid gel conductor.) Respiratory rates were collected along with heart rates. Even though careful attention was given to the validity of measuring respiratory rate, there were
questionable results. Therefore, this variable was not included in the study.

The researcher accompanied the dyad back to their hospital room. During this walk, the mother was thanked for participating in the study. The researcher told the primary nurse about completion of the session. The researcher returned to the research room, copied data from the computer to a floppy disk and prepared the room for the next participating dyad.

Participation Gift

A week’s supply of formula (worth $10.00) was given to the mother for participation in the study. This gift was made available through a donation from Ross Laboratories. A copy of the videotape was sent to the mother after discharge.

Measurement

Measurement of the elements of infant behaviors, mother behaviors, heart rates, and rocking provided numerical data to use in answering the research questions. The purpose was to describe and identify relationships among each of the elements.

Theoretical Definitions

Infant behaviors: Actions or responses of an infant to the stimulation of the mother.

Mother behaviors: Actions or responses of a mother to the stimulation from the infant.
Heart rate: The average number of times the subject’s heart beats per minute.

Rocking: Counteractive, rhythmic body movement.

Operational Definitions of Elements

Infant Behaviors: Actions exhibited by an infant during 15 minutes of uninterrupted time with the mother. These actions include head orientation, eye quality, facial expression, movement, and state.

Mother Behaviors: Action exhibited by a mother during 15 minutes of uninterrupted time with her infant. These actions include head movements, facial expressions, vocalization, touching, and changing the infant’s position.

Heart rate: The average number of times the subject’s heart beats per minute for 5 minutes as expressed in beats per minute and measured with an electronic monitor.

Rocking: Counteractive rhythmic body movement, produced by the mother while sitting in a rocking chair holding her infant, as indicated by the rate in cycles per minute.

Instruments

Infant and Mother Behaviors

The instrument used to measure the infant and mother behaviors was an adaptation of the Face-To-Face Interaction guide used by Kaye and Fogel (1980).
The Adapted Face-To-Face Interaction Guide (AFTFIG) (see Appendix D) categorized infant's behaviors according to head orientation, eye quality, facial expression, vocalizations, movements, and state of wakefulness. The mother's behaviors were categorized according to head movements, facial expressions, vocalizations, touching, and changing baby's position. The adapted Face-To-Face Interaction guide added the categories of infant state, maternal vocalization, and gross infant movement. The behaviors were coded as discrete activities, whether they were present or absent during a 10-second segment of time.

Reliability and validity of interaction guides. Reliability of the Face-To-Face Interaction Guide was reported by Kaye and Fogel (1980) at an 85% level or better, based on the mean agreement between two codings of two coders. Intercoder and intracoder reliability was obtained by randomly dividing codable videotapes among team members who independently coded them at the beginning and end of a series of tapings.

In this study interrater reliability ranged from 92% to 100%. Three areas, infant facial expression, infant vocalization, and maternal touch had an average of 92% reliability rate. The highest areas were head orientation and infant eye quality. Two masters prepared, maternity nurses coded pilot data until 90% agreement was reached in all categories. Every fifth dyad throughout the study was then coded independently according to the AFTFIG by the same two researchers. A 93% agreement was maintained.

Intrarater reliability in this study was obtained by the researcher coding every fifth dyadic session a second time. A range of
93% to 100% agreement was maintained for each category. The lowest area was infant facial expression.

Validity of this instrument is content validity; the behaviors have been supported through previous research as attributes of the interaction between a mother and her infant (Ainsworth, 1979; Bowlby, 1969; Klaus & Kennell, 1976). Validity for use of the adapted instruments was obtained through an expert panel. Four members were in agreement that the behaviors identified on the AFTFIG were appropriate and measurable for an infant and mother within the first 3 days following birth.

Heart Rate

Heart rates were recorded using Hewlett-Packard monitors. Validity of the measurement was obtained by directly observing the monitor screen for the ECG wave and respiratory wave patterns which indicate whether the monitor signal is accurate and not artifact, or not an appropriate signal. For five dyads, the heart rate was counted by the researcher by auscultation using a stethoscope. These results were then compared to the monitor pattern.

Rocking

Rocking was limited to the whole body arcing motion the dyad experienced simultaneously in a rocking chair. Rocking was controlled by the mother and imposed on her newborn. Reliability of the measurement of rocking was obtained by two raters counting rocks from the
videotape. An average agreement of 98% was obtained. The computer recording of rocking was compared to the videotape. Only hard rocking was recorded by the computer. Two coders counted rocks from the computer program and a 94% agreement was obtained.

**Pilot Study**

The purpose of the pilot study was to refine the mechanics and organization of the research procedure. The pilot study was done 3 months before the primary study, in the same hospital and on the same unit. Five mother-infant dyads were videotaped. The changes made after the pilot study included: securing potential participant names from the hospital census roster rather than from the charge nurse, shortening the initial introduction to the mother (because the researcher was able to determine interest, or a lack of interest, early in the introduction); adding an electrical clock that was initialized by the computer; and changing the videocamera to a more recent model. After the pilot study was completed, the decision was made to use the entire 15-minute videotaping session for analysis rather than discard any of the beginning or ending time. Initially a portion of time was to be discarded to allow for the time the mother took to get used to the camera and equipment. After viewing the pilot videotapes, it was apparent that the mothers were not noticeably uncomfortable and that important data may be discarded. The rest of the research procedure remained unaltered in the primary study.
Protection of Human Rights and Privacy

Approval to conduct this study was be obtained from the Research Review Committee of the Frances Payne Bolton School of Nursing, Case Western Reserve University, and the Research Review Committee for Human Services both at Case Western Reserve University and from the agency where the study was conducted (Appendices E and F). Two documents, a Letter of Introduction (Appendix B) and the Permit for Participation (Appendix C) were utilized. The Letter of Introduction was augmented with a verbal description of the study. A written consent was obtained from the mother for both her and her infant to be included in the study before data collection was initiated. Both written documents as well as the verbal commentary explained that participation in the study was voluntary and that lack of participation would not jeopardize the care that they received while in the hospital. Participants were informed of their right to withdraw from the study at anytime.

Subject names were noted on the consent only, and code numbers were assigned for identification purposes. Code numbers were used on the Background Information Sheets, the videotapes, and the computer programs. Information obtained was reported as group data so subject anonymity was maintained.

Data collection tools, background information, and identifying consent forms were kept in separate, locked files. Only the researcher had access to these files. Subject's identifying data will be destroyed
when the study has been completed. Signed permission forms were retained by the researcher.

**Statistical Analysis of Data**

Coding of the research data was done for each 10-second interval throughout the 15 minutes of videotaping. For the statistical analysis, the data were collapsed into 5-minute intervals.

Descriptive statistics were used to describe the characteristics of the sample and the variables. Using correlation coefficients the relationships among the study variables were obtained. A correlation matrix was obtained using infant behaviors, mother behaviors, heart rates, and rocking as variables.

**Summary**

Infant behaviors, mother behaviors, heart rates, and rocking within the early mother-infant relationship were described and analyzed using a descriptive research design. For the study, mothers sat in a rocking chair and held their infants for a 15-minute time period. During this time, data pertaining to infant behaviors, mother behaviors, heart rates, and rocking were collected by observation and electrical monitoring. Analysis included identification of relationships among infant behaviors, mother behaviors, heart rates, and rocking within the early mother-infant relationship using Pearson product-moment correlation. Descriptive statistics including mean, frequency distributions, and standard deviations were used to describe the sample and the research variables.
CHAPTER IV
RESULTS

This chapter presents a description of the sample and the findings relevant to the research questions about the early mother-infant relationship. A discussion of the findings and implications for nursing practice follow.

The research questions addressed were:

1. What are the observable attachment behaviors of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together?
2. What are the observable attachment behaviors of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together?
3. What are the heart rates of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together?
4. What are the heart rates of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together?
5. What are the rate and intensity of rocking behavior in the mother-infant dyad?
6. What is the relationship between attachment behaviors of mothers and infants, infant state, respiratory and heart rates, and rocking behavior in the mother-infant dyad?
Sample Description

The sample consisted of 30 mother-infant dyads who were recruited from the population of one hospital. All dyads resided within a 15 county area and were within 72 hours after birth. All mothers saw their infants from 1/2 to 1 hour following birth. After this acquaintance time, the infants were taken to the central nursery for 2 to 3 hours. After stabilization, infants were cared for by their mothers in the mothers’ rooms during the day and returned to the central nursery during the night except for feedings.

The time of the research observation occurred between 18 and 72 hours after birth. Forty percent of the research observations occurred approximately 40 hours after birth. The minimum amount of time following birth was 17 hours (1 dyad) and the maximum was 62 hours (1 dyad). The mean was 19.04 hours and the SD was 24.77 hours. The sample came from varied religious, cultural, and economic backgrounds. As shown in Table 1, 76.7% of the sample were married, and 83.3% lived with their partner. The majority of the sample was caucasian (86.7%), and had group insurance (76.7%). All mothers in the sample were between the ages of 18 and 37. The mean age was 26.7 years (SD = 5.16).

Mothers were in the hospital between 4 and 32.5 hours before giving birth. The amount of time the mother pushed prior to delivery ranged between 0 minutes and 180 minutes.
Table 1

Demographic Data of Mothers (Total N = 30)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-21</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>22-25</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>26-29</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>30-33</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>34-37</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Black</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Caucasian</td>
<td>26</td>
<td>86.7</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catholic</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>Protestant</td>
<td>14</td>
<td>46.7</td>
</tr>
<tr>
<td>Jewish</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>No choice</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>County of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summit</td>
<td>20</td>
<td>69</td>
</tr>
<tr>
<td>Surrounding counties</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>23</td>
<td>76.7</td>
</tr>
<tr>
<td>Separated</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Single</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td><strong>Living arrangements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With spouse/mate</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>With own mother/father</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>Alone</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Payment method</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group insurance</td>
<td>23</td>
<td>76.7</td>
</tr>
<tr>
<td>Indigent</td>
<td>7</td>
<td>23.3</td>
</tr>
</tbody>
</table>
All mothers in the sample were primiparous. Three of the mothers had an abortion, one had a previous still born. Eighty-three percent of the mothers had an episiotomy. During labor 28 mothers received epidural anesthesia, one mother received local analgesia, and one mother received no analgesia (see Table 2).

Table 2

Obstetrical Data and History of Mothers (Total N = 30)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abortion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>Stillborn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>29</td>
<td>96.7</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Episiotomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>26.6</td>
</tr>
<tr>
<td>Analgesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidural</td>
<td>28</td>
<td>93.3</td>
</tr>
<tr>
<td>Local</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>None</td>
<td>1</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Prenatal maternal employment outside the home varied from no outside employment to full time employment. Birthing classes were attended by 80% of the mothers. Maternal formal education ranged from
those who had not completed high school to those who had completed Ph.D. education (see Table 3).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>High school</td>
<td>10</td>
<td>33.3</td>
</tr>
<tr>
<td>Technical</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>College: 1-4 years</td>
<td>8</td>
<td>26.7</td>
</tr>
<tr>
<td>More than college</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No outside employment</td>
<td>12</td>
<td>40.0</td>
</tr>
<tr>
<td>Unskilled</td>
<td>7</td>
<td>23.3</td>
</tr>
<tr>
<td>Technical</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>Professional</td>
<td>6</td>
<td>26.7</td>
</tr>
<tr>
<td>Prenatal Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24</td>
<td>80.0</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Infant Sample

All 30 infants (N = 12 male and 18 female) were healthy as evidenced by the initial newborn exam, no deviation from the usual hospital routine was made in the care the infants received. The Apgar scores were between 4 and 9 at 1 minute and 5 minutes of age. The mean was 7.59 (SD = 1.35) at 1 minute and 8.31 (SD = 1.79) at 5
minutes. All infants were observed for this study between feedings. They had all been fed within 4 hours of the research observation. The infants weighed between 2438 grams and 4564 grams with a mean weight of 3289 grams (SD = 595 grams). Infants were between 38 and 41 weeks gestation as evidenced on the Dubowitz Newborn Evaluation (M = 39.34 weeks; SD = .81 weeks). Table 4 summarizes the demographic data of the infant sample.

The baseline heart rates were checked prior to the observation session. The mothers’ base heart rate ranged from 64 to 105 beats per minute (M = 78.4; SD = 10.41). The infants’ base heart rate ranged from 100 to 154 beats per minute with an average of 134 beats per minute (SD = 12.05).

The data show that the criteria for sample inclusion and/or exclusion in the study were met. The sample was one of convenience and nonprobability and there was variability in sample characteristics such as age, education, and socioeconomics. Sample characteristics that have previously been identified as factors which influence attachment behaviors were included in the sample description.

Research Questions

The study results will be reported according to the research questions.

Research Question 1 (RQ1)

RQ1: What are the behaviors of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together?
The observable behaviors exhibited by the mothers were categorized using the Adapted Face-To-Face-Interaction-Guide. All of the maternal attachment behaviors in the AFTFIG were exhibited by mothers in the sample. The categories and definitions are summarized in Appendix G.

Observable behaviors were coded as discrete events, presence or absence, for each 10-second segment of time. The epochs of time that
the behavior was exhibited were totaled for each 5 minutes of observation time. The 5-minute total was used for analysis of data. Table 5 lists the behaviors of the mother in descending order of occurrence.

During the first 5 minutes the mother spent most of the time looking at her infant. Touching the infant was the second most prevalent behavior. Although mothers' facial expressions were normal 65% of the time, exaggerated expressions were used by 29 mothers as a means of responding to their infant.

Table 5

Observable Behaviors of the Mother Over First 5 Minute Segment of Time

<table>
<thead>
<tr>
<th>First 5 Minutes Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Looking at infant</td>
<td>13-30</td>
<td>26.40</td>
</tr>
<tr>
<td>Touching infant</td>
<td>7-30</td>
<td>20.43</td>
</tr>
<tr>
<td>Normal facial expression</td>
<td>0-30</td>
<td>19.66</td>
</tr>
<tr>
<td>Talking or singing</td>
<td>0-29</td>
<td>13.00</td>
</tr>
<tr>
<td>Exaggerated expression</td>
<td>0-29</td>
<td>7.13</td>
</tr>
<tr>
<td>Looking away</td>
<td>0-16</td>
<td>3.40</td>
</tr>
<tr>
<td>Bouncing infant</td>
<td>0-12</td>
<td>2.70</td>
</tr>
<tr>
<td>Change of infant's position</td>
<td>0-9</td>
<td>0.90</td>
</tr>
</tbody>
</table>
Using raw data with no significance testing, a trend was observed for attachment behaviors to decrease. Although the most prevalent behavior continued to be the mother looking at the infant during the second 5 minutes of observation, the mean was lower than the first 5-minute mean. Touching behavior diminished as did talking/singing, and exaggerated facial expressions. The amount of time the mother spent looking away increased as did normal facial expression (see Table 6).

During the third 5 minutes of holding their infant, the mother used attachment behaviors during fewer epochs of time. She spent less time looking at the infant and more time looking away. Talking/singing, exaggerated expressions, and touching all decreased in frequency (see Table 7).

The significant differences between the means of epochs of time a behavior presented during the first 5 minutes and the last 5 minutes were determined by a paired t-test. A probability value of $\leq .05$ was used to determine significance. The amount of time the mother looked toward the infant decreased ($p = .0038$), she made fewer facial exaggerations and smiled less ($p = .0176$), talked less ($p = .0003$), and touched the infant less ($p = .0001$) from the first 5 minutes to the last 5 minutes. To complement the decrease in mother looking toward the infant, there was an increase in the number of epochs mother was looking away ($p = .0065$) from the infant. No other changes between the first 5 minutes and the last 5 minutes were significant ($p \leq .05$) using the paired t-test.
### Table 6
Observable Behaviors of the Mother Over Second 5 Minute Segment of Time

<table>
<thead>
<tr>
<th>Second 5 Minutes Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Looking at infant</td>
<td>12-30</td>
<td>23.20</td>
</tr>
<tr>
<td>Normal facial expression</td>
<td>0-30</td>
<td>21.00</td>
</tr>
<tr>
<td>Touching infant</td>
<td>1-30</td>
<td>16.53</td>
</tr>
<tr>
<td>Talking or singing</td>
<td>0-25</td>
<td>10.23</td>
</tr>
<tr>
<td>Exaggerated expression</td>
<td>0-6</td>
<td>6.623</td>
</tr>
<tr>
<td>Looking away</td>
<td>0-25</td>
<td>6.1</td>
</tr>
<tr>
<td>Bouncing infant</td>
<td>0-6</td>
<td>1.57</td>
</tr>
<tr>
<td>Change of infant's position</td>
<td>0-5</td>
<td>1.07</td>
</tr>
</tbody>
</table>

### Table 7
Observable Behaviors of the Mother Over Third 5 Minute Segment of Time

<table>
<thead>
<tr>
<th>Third 5 Minutes Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Looking at infant</td>
<td>6-30</td>
<td>22.37</td>
</tr>
<tr>
<td>Touching infant</td>
<td>3-30</td>
<td>14.23</td>
</tr>
<tr>
<td>Normal facial expression</td>
<td>0-30</td>
<td>20.80</td>
</tr>
<tr>
<td>Talking or singing</td>
<td>3-30</td>
<td>7.43</td>
</tr>
<tr>
<td>Exaggerated expression</td>
<td>0-18</td>
<td>4.60</td>
</tr>
<tr>
<td>Looking away</td>
<td>6-24</td>
<td>7.5</td>
</tr>
<tr>
<td>Bouncing infant</td>
<td>0-11</td>
<td>1.80</td>
</tr>
<tr>
<td>Change of infant’s position</td>
<td>0-8</td>
<td>1.30</td>
</tr>
</tbody>
</table>
Summary of Results

Mothers did exhibit observable behaviors that are said to be related to attachment during the 15-minute uninterrupted time they spent with their infant. In general, behaviors used to elicit the infant’s attention became less frequent in each of the three, 5 minute segments (see Figure 1). Observable behaviors decreased except bouncing and changing the infant’s position. This decrease was not statistically significant, however. Mothers did look directly at their infants, touched them, talked or sang to them, bounced them, changed their position, and made exaggerated facial expressions to them. Although all of the decreases in behavior were not significant, (p ≤ .05) the trend was for observable attachment behaviors to decrease over the 15 minutes.

Figure 1. Behaviors of the mother over 15 minutes.

<table>
<thead>
<tr>
<th>number of epochs behavior occurred</th>
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</thead>
<tbody>
<tr>
<td>30</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Looking at infant  Touching  Talking  Exaggeration

n=30
Research Question 2 (RQ2)

RQ2: What are the observable behaviors of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together?

The observable behaviors that were exhibited by the infants were categorized using the Adapted Face-To-Face Interaction Guide. The observable behaviors were coded as discrete events, presence or absence, every 10 seconds for 15 minutes. The data were collapsed into 5-minute time periods. The 5-minute total was used for analysis of data (see Table 8).

Table 8
Observable Behaviors of the Infant Over First 5 Minute Period

<table>
<thead>
<tr>
<th>First 5 Minutes Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Looking toward mother</td>
<td>0-30</td>
<td>20.07</td>
</tr>
<tr>
<td>Quiet/Sleep state</td>
<td>0-30</td>
<td>20.73</td>
</tr>
<tr>
<td>Active</td>
<td>0-30</td>
<td>11.3</td>
</tr>
<tr>
<td>Eyes closed</td>
<td>0-30</td>
<td>10.33</td>
</tr>
<tr>
<td>Looking away</td>
<td>0-30</td>
<td>9.83</td>
</tr>
<tr>
<td>Normal face</td>
<td>0-30</td>
<td>6.33</td>
</tr>
<tr>
<td>Awake</td>
<td>0-30</td>
<td>6.26</td>
</tr>
<tr>
<td>Eyes open</td>
<td>0-29</td>
<td>5.57</td>
</tr>
<tr>
<td>Alert</td>
<td>0-26</td>
<td>3.83</td>
</tr>
<tr>
<td>Open mouth</td>
<td>0-20</td>
<td>3.70</td>
</tr>
<tr>
<td>Made sounds</td>
<td>0-8</td>
<td>1.33</td>
</tr>
<tr>
<td>Crying</td>
<td>0-15</td>
<td>1.1</td>
</tr>
</tbody>
</table>
During the first 5 minutes, the most common behavior was the infant looking toward the mother (20.07 epochs of time). Even though the infant was quiet or asleep, mother held the infant in a position where the infant’s head was directed toward the mother. The infant was active 11.3 epochs of time. The eyes being open was the most common behavior where the infant was an active participant in interaction. Crying behavior was demonstrated the least.

During the second 5 minutes, the mean quiet/sleep state increased from 20.73 to 21.70 and mean activity rate decreased from 11.3 to 9.80. The amount of time the eyes were open decreased from 10.33 to 3.87. Conversely, infant sounds and crying increased during the second 5 minutes. Crying increased from 1.1 to 1.33 and sounds increased from 1.33 to 1.43. The infant looking toward the mother decreased from 20.07 to 19.80 and open mouth decreased from 3.70 to 2.20 (see Table 9).

During the third 5 minutes, the infants had increased quiet/sleep time from 21.7 to 23.2, the eyes were closed more (6.5 to 7.36), and the awake state time decreased from 4.27 to 3.73. Dialectically, crying increased from 1.33 to 2.63 (see Table 10).

For infant behaviors, the significant differences between the means of epochs of time a behavior presented during the first 5 minutes and the last 5 minutes were determined by a paired $t$-test. A probability value of $< .05$ was used to determine significance. The amount of time infant’s eyes were open decreased ($p = .03$), the mouth was open less ($p = .019$), and the infant moved less ($p = .01$) during the last 5
Table 9

**Observable Behaviors of the Infant Over Second 5 Minute Period**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Quiet/Sleep state</td>
<td>0-30</td>
<td>21.70</td>
</tr>
<tr>
<td>Looking toward mother</td>
<td>0-30</td>
<td>19.80</td>
</tr>
<tr>
<td>Looking away</td>
<td>0-30</td>
<td>10.10</td>
</tr>
<tr>
<td>Active</td>
<td>0-30</td>
<td>9.80</td>
</tr>
<tr>
<td>Eyes closed</td>
<td>0-30</td>
<td>6.5</td>
</tr>
<tr>
<td>Normal face</td>
<td>0-29</td>
<td>5.3</td>
</tr>
<tr>
<td>Awake</td>
<td>0-22</td>
<td>4.27</td>
</tr>
<tr>
<td>Eyes open</td>
<td>0-29</td>
<td>3.87</td>
</tr>
<tr>
<td>Alert</td>
<td>0-29</td>
<td>2.33</td>
</tr>
<tr>
<td>Open mouth</td>
<td>0-15</td>
<td>2.20</td>
</tr>
<tr>
<td>Made sounds</td>
<td>0-5</td>
<td>1.43</td>
</tr>
<tr>
<td>Crying</td>
<td>0-16</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Table 10

**Observable Behaviors of the Infant Over Third 5 Minute Period**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Number of Epochs Behavior Exhibited</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>Quiet/Sleep state</td>
<td>0-30</td>
<td>20.33</td>
</tr>
<tr>
<td>Looking toward mother</td>
<td>0-30</td>
<td>23.20</td>
</tr>
<tr>
<td>Looking away</td>
<td>0-30</td>
<td>9.87</td>
</tr>
<tr>
<td>Active</td>
<td>0-27</td>
<td>7.80</td>
</tr>
<tr>
<td>Eyes closed</td>
<td>0-30</td>
<td>7.36</td>
</tr>
<tr>
<td>Normal face</td>
<td>0-30</td>
<td>5.00</td>
</tr>
<tr>
<td>Awake</td>
<td>0-30</td>
<td>3.73</td>
</tr>
<tr>
<td>Crying</td>
<td>0-28</td>
<td>2.63</td>
</tr>
<tr>
<td>Eyes open</td>
<td>0-25</td>
<td>2.13</td>
</tr>
<tr>
<td>Open mouth</td>
<td>0-19</td>
<td>1.43</td>
</tr>
<tr>
<td>Alert</td>
<td>0-30</td>
<td>1.17</td>
</tr>
<tr>
<td>Made sounds</td>
<td>0-7</td>
<td>1.13</td>
</tr>
</tbody>
</table>
minutes. No other differences were significant ($p \leq .05$) using the paired $t$-test.

Summary of Results

The observable behaviors described in the review of literature that influence the attachment process were present during an uninterrupted time of being held by the mother. Although the infants were asleep the majority of time, activity, sounds, and expression were apparent. The infants were alert fewer epochs of time ($p .0359$), their mouths were closed more epochs of time ($p .0197$), and they demonstrated motor activity (were active) during fewer epochs of time ($p .0107$) (see Figure 2).

Figure 2. Behaviors of the infant over 15 minutes.
Research Question 3 (RQ3)

RQ3: What are the heart rates of the mother in a mother-infant dyad during 15 minutes of uninterrupted time together? (See Table 11.)

Table 11

Mother Heart Rates* (N = 30)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 5 Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>87.35</td>
<td>12.72</td>
<td>86.06</td>
<td>64.86</td>
<td>120.86</td>
</tr>
<tr>
<td>Second 5 Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>87.48</td>
<td>12.54</td>
<td>87.60</td>
<td>65.00</td>
<td>119.33</td>
</tr>
<tr>
<td>Third 5 Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>87.37</td>
<td>13.62</td>
<td>87.36</td>
<td>59.86</td>
<td>122.60</td>
</tr>
</tbody>
</table>

Note. *Heart Rates are expressed as an average per minute over each 5 minutes.

Heart rates were initially recorded every 20 seconds in average rates per minute. The data were collapsed into 5 minute segments of time and recorded as average rate per minute for the 5 minute segment of time. The mother’s mean heart rate remained fairly constant during the 15 minutes, ranging from 87.35 (SD = 12.7) to 87.48 (SD = 12.5). A paired t-test showed no significant difference between time 1 and time 3.
Research Question 4 (RQ4)

RQ4: What are the heart rates of the infant in a mother-infant dyad during 15 minutes of uninterrupted time together? (See Table 12.)

During the first 5 minutes, the infants' heart rates averaged 118 average beats per minute (range = 95-146; SD = 13.56). During the second 5 minutes the infant's heart rate was 118.54 average beats per minute (range = 86-160; SD = 15.9). During the third 5 minutes, the infant's heart rate was 119.84 average beats per minute (range = 85-194; SD = 20.4).

Table 12

Infant Heart Rates* (N = 30)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First 5 Minutes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>118.00</td>
<td>13.56</td>
<td>116.63</td>
<td>94.60</td>
<td>146.33</td>
</tr>
<tr>
<td><strong>Second 5 Minutes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>118.54</td>
<td>15.91</td>
<td>120.03</td>
<td>85.86</td>
<td>159.60</td>
</tr>
<tr>
<td><strong>Third 5 Minutes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse</td>
<td>119.84</td>
<td>20.41</td>
<td>117.50</td>
<td>85.00</td>
<td>194.40</td>
</tr>
</tbody>
</table>

*Note. *Pulse Rates are expressed as an average per minute over each 5 minutes.

The mean heart rate increased slightly as did the standard deviation. The range of heart rate widened over the 15 minutes and the median was highest in the middle 5 minute time segment. A paired t-test showed no significant difference between time 1 and time 3. A
more precise and sensitive way of measuring heart rate would be necessary to recognize the potential subtle change or condition that may be a component of attachment.

Research Question 5 (RQ5)

RQ5: What are the rate and intensity of rocking behavior in the mother-infant dyad?

Rocking activity within the dyad was initiated and controlled by the mother. No directions were given to the mother prior to the observation session. All mothers rocked during the session although the rate and intensity varied. The average overall rate was 42.57 cycles per minute (SD = 13) The range was 19 cycles per minute to 60 cycles per minute. The intensity varied from minimal to high (hard rock). Mothers rocked an average of 13.29 (SD = 13) minimum cycles per minute and 5.84 (SD = 10) hard cycles per minute.

During the first 5 minutes of observation, moderate intensity rocking was performed at an average of 31 (SD = 17) cycles per minute. Thirty percent of the cycles were of minimal intensity, meaning that the chair was displaced backward approximately 2 inches. Seventy percent of the time was spent in moderate rocking, meaning the chair was displaced backward on the rocker about 4 inches. Moderate rocking plus minimal rocking was the total cycles per minute rocked. Hard rocking was the rocking that was forceful enough to increase the pressure on the monitor and was backward movement of 4 to 6 inches. Moderate and hard rocking are recorded together for descriptive purposes. The mean cycles per minute of hard rocks was 9.6 (SD = 13.59) or 21% of the time (see Table 13). The percent of hard rocking time is reported as a part of the moderate rocking time.
Table 13

Rocking In Cycles Per Minute

First 5 Minutes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum rocking</td>
<td>0-78</td>
<td>13.63</td>
<td>23.45</td>
<td>30</td>
</tr>
<tr>
<td>Moderate rocking</td>
<td>0-59</td>
<td>31.20</td>
<td>17.78</td>
<td>70</td>
</tr>
<tr>
<td>Hard rocking</td>
<td>0-52</td>
<td>9.6</td>
<td>13.59</td>
<td>21</td>
</tr>
</tbody>
</table>

During the second 5 minutes of observation, the mother rocked at a moderate intensity an average of 30.8 (SD = 16) cycles per minute. Thirteen cycles were of minimum quality. Moderate rocking plus minimal rocking was the total cycles per minute rocked. Hard rocking was used by the mother 13% of the time (see Table 14).

Table 14

Rocking In Cycles Per Minute

Second 5 Minutes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum rocking</td>
<td>0-67</td>
<td>13.13</td>
<td>22.21</td>
<td>30</td>
</tr>
<tr>
<td>Moderate rocking</td>
<td>0-57</td>
<td>30.83</td>
<td>16.72</td>
<td>70</td>
</tr>
<tr>
<td>Hard rocking</td>
<td>0-53</td>
<td>5.8</td>
<td>11.98</td>
<td>13</td>
</tr>
</tbody>
</table>
During the third 5 minutes of observation time, the mean moderate rocking cycles per minute were 25.82 (SD = 16). Thirteen cycles were of minimum quality and 2 of them were of hard quality (see Table 15).

Table 15
Rocking in Cycles Per Minute

<table>
<thead>
<tr>
<th>Third 5 Minutes Variable</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
<th>% Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum rocking</td>
<td>0-64</td>
<td>13.10</td>
<td>21.71</td>
<td>34</td>
</tr>
<tr>
<td>Moderate rocking</td>
<td>0-49</td>
<td>25.82</td>
<td>16.10</td>
<td>66</td>
</tr>
<tr>
<td>Hard rocking</td>
<td>0-19</td>
<td>2.13</td>
<td>5.00</td>
<td>05</td>
</tr>
</tbody>
</table>

The average rocking cycles per minute decreased over each 5-minute segment of observation time. The average cycles per minute decreased from 44.83 to 43.96 to 38.92. The decrease was in hard rocking and moderate rocking. Hard rocking went from 9.6 cycles per minute to 5.8 to 2.13. Average rocking started at 31.20, went to 30.83, and then 25.82. Minimum rocking was very consistent (13.63; 13.123; 13.10) even though the average cycles per minute decreased slightly (see
Figure 3). Using a paired t-test, the only significant difference between the first 5 minutes and the last 5 minutes was in hard rocking (p = .004). Hard rock decreased over the 15 minutes.

Figure 3. Percent of mean rocking rates in intensities for the 15-minute observation time.

[Diagram showing percentages: Hard Rock 9, Minimum 31, Moderate 60]

This information suggests that mothers rock their infants at a rate of 38.0 to 44.8 cycles per minute if given the opportunity. Figure 3 illustrates the percent of minimum rocking, moderate rocking, and hard rocking used across the 15 minutes of observation time.
Research Question 6 (RQ6)

RQ6: What is the relationship between the behaviors of mothers and infants, heart rates, and rocking behavior in the mother-infant dyad?

The Pearson product-moment correlation test was used to examine relationships among the elements of infant and mother behaviors, heart rates, infant state, and rocking. The data were first analyzed using the values for the number of epochs of time a behavior occurred during a 5 minute time segment. Because this research examined three 5 minute time segments, the data are presented separately for each of the 5 minute segments. In the first analysis, the Pearson product-moment test was done on the data as it was originally coded. Tables 16, 17, and 18 display a correlation matrix that includes the correlation coefficient for relationships between the attachment behaviors, infant state, heart rates, and rocking for data in the original state. Secondly, the variables were categorized into dichotomous groups (i.e., based on how long the behavior occurred) to correct for skewed distributions (see Appendix H). The Pearson product-moment correlation test was then used for the categorized variables. Tables 19, 20, and 21 display a correlation matrix for each 5 minute time segment using the categorized variables. The results of this second analysis, since it accounts for skewedness, may more accurately describe the relationships between the variables. A probability of ≤ .05 was considered significant.

Relationships between the variables are discussed by presenting the mother behaviors and describing significant relationships between that behavior and the infant behaviors. Only the statistically significant
Table 16
Matrix of Pearson Product-Moment Coefficients ($r$) for Infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Original State Data*

Time 1: First 5 Minutes ($N = 60$)

<table>
<thead>
<tr>
<th>Mother</th>
<th>Infant</th>
<th>Looking toward</th>
<th>Looking away</th>
<th>Eyes open</th>
<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Cry</th>
<th>Activity</th>
<th>Alert state</th>
<th>Awake state</th>
<th>Quiet/Sleep state</th>
<th>Pulse average</th>
<th>Minimal rocking</th>
<th>Moderate rocking</th>
<th>Hard rocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking toward</td>
<td>-0.590$^3$</td>
<td>-0.5857$^3$</td>
<td>-0.3659$^1$</td>
<td>-0.5343$^2$</td>
<td>-0.5188$^2$</td>
<td>0.4675$^2$</td>
<td>0.4790$^2$</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Looking away</td>
<td>-0.5343$^2$</td>
<td>0.5317$^2$</td>
<td>0.4181$^1$</td>
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</tr>
<tr>
<td>Smile/Exaggeration</td>
<td>0.5050$^2$</td>
<td>-0.5188$^2$</td>
<td></td>
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</tr>
<tr>
<td>Normal expression</td>
<td>-0.4675$^2$</td>
<td>0.4790$^2$</td>
<td>0.4284$^1$</td>
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</tr>
<tr>
<td>Talking/Singing</td>
<td>0.4764$^2$</td>
<td>-0.4874$^2$</td>
<td>-0.3721$^1$</td>
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<tr>
<td>Touching</td>
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<td></td>
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<td></td>
<td>0.410$^2$</td>
</tr>
<tr>
<td>Bouncing</td>
<td>0.3973$^1$</td>
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<td>0.5129$^2$</td>
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<td>0.480$^2$</td>
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<tr>
<td>Pulse, average</td>
<td>0.3777$^1$</td>
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<td>0.6142$^3$</td>
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<tr>
<td>Minimal rocking</td>
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</tr>
<tr>
<td>Moderate rocking</td>
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<td></td>
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<tr>
<td>Hard rocking</td>
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</tr>
</tbody>
</table>

Note: $^1p < .05$. $^2p < .025$. $^3p < .001$. *For clarity in reading the table, only significant correlations ($p < .05$) have been reported.*
Table 17

Matrix of Pearson Product-Moment Coefficients (r) for Infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Original State Data*

Time 2—Second 5 Minutes (N = 60)

<table>
<thead>
<tr>
<th>Second 5 Minutes</th>
<th>Infant</th>
<th>Looking toward</th>
<th>Looking away</th>
<th>Eyes open</th>
<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Cry</th>
<th>Activity</th>
<th>Alert state</th>
<th>Awake state</th>
<th>Quiet/sleep state</th>
<th>Pulse, average</th>
<th>Minimal rocking</th>
<th>Moderate rocking</th>
<th>Hard rocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking toward</td>
<td>.4421 (^2)</td>
<td>.4394 (^2)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Looking away</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smile/Exaggeration</td>
<td>.4342 (^2)</td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Normal expression</td>
<td>.4892 (^2)</td>
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Note: \(^1\)p ≤ .05. \(^2\)p ≤ .025. \(^3\)p ≤ .001. *For clarity in reading the table, only significant correlations (p ≤ .05) have been reported.
Table 18
Matrix of Pearson Product-Moment Coefficients (r) for Infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Original State Data
Time 3--Third 5 Minutes (N = 60)

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<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Cry</th>
<th>Activity</th>
<th>Alert state</th>
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<th>Minimal rocking</th>
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Note: 1\(p \leq .05\), 2\(p \leq .025\), 3\(p \leq .001\). *For clarity in reading the table, only significant correlations (\(p \leq .05\)) have been reported.
Table 19
Matrix of Pearson Product-Moment Coefficients (r) for infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Categorized Data

Time 1 -- First 5 Minutes (N = 60)

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<th>Mother Behavior</th>
<th>Infant</th>
<th>Looking toward</th>
<th>Looking away</th>
<th>Eyes open</th>
<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Cry</th>
<th>Activity</th>
<th>Alert state</th>
<th>Awake state</th>
<th>Quiet/Sleep state</th>
<th>Pulse, average</th>
<th>Minimal rocking</th>
<th>Moderate rocking</th>
<th>Hard rocking</th>
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<tbody>
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<td>Looking toward</td>
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<td>-.5806&lt;sup&gt;3&lt;/sup&gt;</td>
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<td>Looking away</td>
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Note: <sup>1</sup>p = < .05. <sup>2</sup>p = < .025. <sup>3</sup>p = < .001. *For clarity in reading the table, only significant correlations (p < .05) have been reported.
Table 20
Matrix of Pearson Product-Moment Coefficients (r) for Infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Categorized Data*

Time 2--Second 5 Minutes (N = 60)

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<th>Looking away</th>
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<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Cry</th>
<th>Activity</th>
<th>Alert state</th>
<th>Awake state</th>
<th>Quiet/ Sleep state</th>
<th>Pulse, average</th>
<th>Minimal rocking</th>
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<td>Mother</td>
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Note: $^1 p = .05$. $^2 p = .025$. $^3 p = .001$. *For clarity in reading the table, only significant correlations (p ≤ .05) have been reported.
Table 21

Matrix of Pearson Product-Moment Coefficients (r) for Infant Behaviors, Mother Behaviors, Heart Rates, and Rocking Using Categorized Data

Time 3--Third 5 Minutes (N = 60)

<table>
<thead>
<tr>
<th>Third 5 Minutes</th>
<th>Infant</th>
<th>Looking toward</th>
<th>Looking away</th>
<th>Eyes open</th>
<th>Eyes closed</th>
<th>Open mouth</th>
<th>Normal expression</th>
<th>Sounds</th>
<th>Activity</th>
<th>Alert state</th>
<th>Awake state</th>
<th>Quiet/Sleep state</th>
<th>Pulse, average</th>
<th>Minimal rocking</th>
<th>Moderate rocking</th>
<th>Hard rocking</th>
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<tbody>
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<td>Mother</td>
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Note: \( p \leq .05 \). \( p \leq .025 \). \( p \leq .001 \). *For clarity in reading the table, only significant correlations (\( p \leq .05 \)) have been reported."
relationships are presented. The results of testing the data before categorization and the results of testing the data after categorization to fix the distribution is presented. The data before it was categorized is presented as first analysis and after categorization is called categorized data. The first 5 minute time segment is time 1, the second is time 2 and the third is time 3. The results then are summarized to give a more comprehensive analysis of the relationships.

Head orientation. The mother generally held the infant in an en face position. This is illustrated in the results of the correlation tests between the direction the mother is looking and the direction the infant’s face is held.

With the first analysis, there was a positive correlation with the infant looking toward the mother in all three time segments. The categorized data gave the same results of positive correlations in each of the three time segments. The correlation coefficients ranged from demonstrating a slight relationship (.3730) to a marked relationship (.7521). Significance was demonstrated in all three time segments.

With the first analysis and the categorized data there was a negative correlation between the mother looking toward the infant and the infant looking away. This behavior occurred in each of the 5 minute time segments and indicates the mother’s ability to engage their babies.

When the mother was looking away from the infant and the infant was looking toward her, the correlation was negative. When the mother was looking away from the infant and the infant was also looking away, there was a positive correlation during the first 5 minutes with
both data calculations. In the third 5 minutes a positive correlation existed only with the categorized data. This is an anticipated correlation because the two behaviors are opposing each other.

In summary, the head positioning was usually directed toward the other partner. The negative relationships reflected the brief time periods when the two were not in a face-to-face position. En face positioning is characteristic of attachment behavior. At this early age, the mother controlled the position of the infant’s head. The importance of the behavior lies in the knowledge that the mother held the infant so that when the infant’s eyes opened, they could be directed to the mother.

Facial expression. There was a positive correlation between the infant looking toward the mother and the mother smiling at the infant and/or making exaggerated facial expressions. This positive correlation occurred in the first analysis during the first 5 minutes. During the last 5 minutes, a positive correlation occurred with the categorized data only. When the infant was looking away from the mother, there was an inverse relationship with the first analysis for the first and third 5 minute time segments. There was a positive correlation with mother smiling or using exaggerated facial expressions when the infant’s eyes were open (both data groupings at time 2), when the infant’s mouth was open (with categorized data in all three 5 minute segments), when the infant was crying (with both groupings at time 2), when the infant was active (both groupings, time 2), and when the infant was in an alert state (categorized data, time 2).
Negative correlations existed between the mother smiling or using exaggerated facial expressions and the infant looking away (with first analysis, time 1 and time 3), when the infant’s eyes were closed (with first analysis, time 1 and categorized data, time 3), and when the infant was in a quiet/sleep state (categorized data, time 1).

There was a positive correlation between mother having a normal facial expression and the infant looking away from the mother (both data groupings, time 1 and with first analysis, time 3), when the infant’s eyes were open (first analysis, time 2), when the infant also had a normal expression (both groupings, time 1), and when the infant was in a quiet/sleep state (categorized data, time 3). A negative correlation existed between the mother having a normal facial expression and the infant looking toward the mother (both groupings, time 1 and with the first analysis, time 2), with the infant’s mouth open (both groupings, time 1), with the infant in an alert state (categorized data, time 1 and 3), and when the infant was in an awake state (both groupings, time 3).

In summary, the correlations between mother smiling or using exaggerated facial expressions with the infants behavior showed that the mother used more of these behaviors when the infant was looking at her and was active in some way. When the infant was looking away or was asleep, the mother used less of these behaviors. The inverse relationships when demonstrated more in the first analysis than in the categorized data.

The mother had a normal facial expression when the infant was looking away, when the infant also had a normal expression, and when
the infant was asleep. When the infant was awake and active, the number of epochs in which the mother had a normal expression was less. In other words, the data indicates that the mother generally had a normal facial expression when the infant was also quiet and nonresponsive. More negative correlations were found using the categorized data than using the first analysis.

**Mother’s vocalizations.** The vocalizations of the mother included any vocalization or singing that was done during the observation. The mother did not need to make complete sentences for the sounds to be coded. There were positive correlations with mother’s vocalizations and the infant looking toward the mother (both data groupings, time 1), when the infant’s mouth was open (first analysis, time 2), when the infant cried (first analysis, time 2), and when the infant was active (both groupings, time 2)

There were negative correlations with mother’s vocalizations and the infant looking away (both groupings, time 1), with the infant’s eyes closed (both groupings, time 1), with the infant also having a normal expression (first analysis, time 1), with the infant in an alert state (categorized data, time 2) and with rocking (categorized data, time 3).

To summarize, the mother talked or sang more when the infant was looking toward her and was active or crying than when the infant was looking away or was not responding. This was an expected finding because of the reciprocal nature of communication. When the mother talked, she was more likely to rock at a slower rate than when she was not talking. This relationship was evident only in the categorized data.
Mother's tactile stimulation of infant. The amount of time the mother spent touching, changing the infant's position, or bouncing the infant was correlated with the infant's behaviors. A positive relationship existed with the mother touching the infant and the activity of the infant (both groupings, time 1). A negative relationship existed when the mother was touching the infant and the infant was in an alert state (categorized data, time 1).

There was a positive relationship between the mother changing the infant's position and the infant's eyes being open (first analysis, time 2), the infant making sounds (first analysis, time 1), the infant being active (both groupings, time 3), the infant in an alert state (categorized data, time 1 and original analysis, time 2), and the infant's pulse rate (both groupings, time 3). A negative relationship existed only between the mother changing the infant's position and the infant being in a quiet/sleep state (both groupings, time 3).

There were positive correlations between the mother bouncing the infant and the infant looking toward the mother (first analysis, time 1), the infant looking away (categorized data, time 3), the infant having an open mouth (first analysis, time 3), the infant making sounds (first analysis, time 1), the infant's heart rate (both groupings, time 1) and hard rocking (categorized data, time 3). The only negative correlation existed with bouncing and the infant looking toward the mother (both groupings, time 3).

In summary, the mother touched her infant more, changed the infant’s position more, and bounced her infant more when the infant was
awake and responding. Categorization yielded more significant relationships than were found in the first analysis. Infant heart rate increased with bouncing and changing the infant's position suggesting a physiologic response to the movement, even though it was passive movement. Hard rocking increased with change of position and bouncing, suggesting that the mother was attempting to change the activity pattern either for herself or her infant. The findings were anticipated based on previous research studies. The stimulation a mother gives to her infant through tactile/vestibular stimulation is an expected mothering behavior, especially when the infant is awake and responding.

**Mother's heart rate.** Only one significant correlation existed with the mother's heart rate. There was a fair degree of relationship ($r = .5623$) in time 1 with the infant having an open mouth or crying using categorized data. This finding suggests that the mother was anxious about the infant crying and was responding physiologically to the stimuli.

**Rocking.** Minimal rocking was positively correlated with the infant looking at the mother (both groupings, time 1) and with the infant sleeping (categorized data, time 1 and first analysis, time 3). Minimal rocking was negatively correlated with the infant looking away (both groups, time 3), with the infant crying (categorized data, time 1), and with infant activity (categorized data, time 2). Moderate rocking was positively correlated with the infant looking away (both groupings, time 3) and with the infant crying (categorized data, time 1). There was a negative correlation with moderate rocking and the infant looking toward
the mother (both groupings, time 3), the infant making sounds (categorized data, time 2), and the infant crying (first analysis, time 2). Hard rocking correlated positively with the infant’s eyes and mouth being open and the alert state (all with categorized data, time 3).

In summary, the data suggests that the mothers used minimal rocking more when the infant was asleep, used moderate rocking during most of the time, and used hard rocking when the infant was very alert. These findings were anticipated from observations made in the clinical setting. The data results suggest less stimulation while the infant is asleep and more when the infant is awake.

**Answer to Research Question 6.** Significant relationships were found between the behaviors of mothers and infants, infant state, heart rates, and rocking. The data suggests that the relationship between the mother and infant behaviors is greater than between the other variables of heart rate and rocking. The mother showed more responsive and stimulating behavior when the infant showed more responsive behavior and was awake indicating reciprocal interaction within the dyad. The heart rate was only correlated with the infant crying indicating the mother’s physiologic response to the infant’s need. Changes in rocking behavior suggest that mothers use varying rocking intensities according to the infant’s behavior.

The significant correlations found between mother and infant behaviors were anticipated because the behaviors studied in this research have been used in previous research to assess the attachment process. A stronger correlation between the infant crying and the mother's
vocalization was expected. Only in the second 5 minutes was there a significant correlation between these two variables. A strong correlation was expected between rocking and crying. A positive correlation was found ($r = .41$) only in the first 5 minutes of the first analysis.

The anticipation was that heart rates would correlate with mother and infant behaviors, vocalizations, and with rocking. The heart rate for mother and infant remained relatively consistent. Validity of the measurement of heart rate was demonstrated by checking the apical heart rates of five mothers and infants with a stethoscope and comparing that rate with the one on the monitor.

With the first analysis, the highest overall coefficients were .75 between the variables of mother looking at baby and baby looking at mother and combinations of looking at each other (.73, -.77, .72). This number means that there is a marked relationship between the two variables, as expected from the literature review.

The relationship was moderate to marked between mother's pulse and infant's cry (.61), posture change and infant cry (.72), posture change and awake state (.68), and posture change and quiet sleep (.60). Weak relationships (.20 to .39) were shown in at least one time segment for the relationships between bouncing and looking toward, mother's normal expression and infant awake state, minimal rocking and quiet sleep, talking/singing and an infant's open mouth or normal expression, bouncing and baby looking toward, the mother's pulse and looking toward, exaggeration and the infant's eyes closed. The remaining
statistically significant relationships fell between .4 and .59 indicating a fair degree of relationship exists.

Using categorized data, no marked relationships were shown. The highest correlation coefficient showing a fair degree of relationship was between the mother looking toward the infant and the infant looking toward her (.58) or the infant looking away (-.58). The next highest was between the mother's pulse and cry (.56), rocking and cry (-.55), and rocking and baby's head position (.52, -.52, -.59, .59). The remaining correlation coefficients fell below these values.

Looking at the analysis from both the first analysis and with categorized data, the statistical results were similar when analyzing the data in different ways. The data with the first analysis yielded higher coefficients and suggests a stronger relationship than may be present.

In summary, significant correlations existed between the elements of infant behaviors, mother behaviors, heart rates, and rocking. A significant relationship between more of the behaviors had been anticipated from clinical observations and literature review. The results, however, give credibility to the notion that the research elements influence each other in some way.

Chapter Summary

In this chapter, the research questions were answered using descriptive statistics. Relationships between the behaviors, heart rates, and rocking, as evidenced by the results of the Pearson product-moment statistical test, were presented. The results support previous research surrounding these elements.
CHAPTER V
DISCUSSION AND CONCLUSION

Infant behaviors, mother behaviors, heart rates, and rocking were studied using a descriptive research design to describe the elements and identify relationships among the elements. Thirty mother-infant dyads within 72 hours after birth were videotaped while the mother held her infant in a rocking chair for 15 minutes of uninterrupted time. Heart rates of both mother and infant were measured using an electronic monitor. Rocking was measured with the use of the monitor and through observation of the videotape.

Results of this study are consistent with previous research studies and support the notion that infant and mother behaviors, heart rates, and rocking are associated with each other in some way. The presence of infant and mother behaviors, generally associated with attachment, supports nursing assessment of these behaviors during 72 hours post birth. Results suggest, however, that these behaviors are not as prevalent as one might expect, that they are more evident during the first few minutes of acquaintance (i.e., arousal from sleep or meeting after a separation time), and that the intensity of behaviors diminishes over a relatively short period of time (15 minutes).
Discussion of Outcomes

Four major outcomes evolved from this research study. First, the behaviors that have previously been identified as attachment behaviors were observed in mother-infant dyads during the first 72 hours after birth. Second, attachment behaviors diminished within a relatively short period of time. Third, when a rocking chair was available, mothers did rock their infants, and fourth, mother and infant heart rates remained stable throughout the observation time.

Presence of mother-infant behaviors. The presence or absence of observable attachment behaviors has been the basis of nursing assessment of a mother's feelings toward her infant (Barnard, 1978; Stainton, 1990). The behaviors used to assess attachment during the puerperium were present during 72 hours after birth in the dyads in this study. The infant behaviors include crying, reaching out movements, making cooing sounds, and looking at the mother. Mother behaviors include gazing or looking at the infant, touching, and talking. These same behaviors were shown in previous research to be present at birth and as the child grows older (Ainsworth, 1979; Censullo, 1987; Cohen & Tronick, 1987). Some researchers have used these behaviors to develop instruments for assessment of attachment beginning in the first days after birth in the hospital and later at home (Barnard, 1978; Stainton, 1990). These instruments utilize observation of attachment behaviors during a certain amount of time. Frequently these observations are made when the nurse enters the mother's room. Since nurses try to identify dyads at risk for poor
attachment during the first 72 hours after delivery, it is important to know which attachment behaviors exist, and which do not during this time period after birth. This research was timely because of the changes in hospital care that have encouraged infants to remain with the mother during most of the hospital stay but to be discharged in a short period of time thus limiting the time for any intervention by the nurses.

**Diminishing behaviors.** Even though attachment behaviors were present in the dyads in this study, the intensity of positive attachment behaviors (i.e., talking/singing) diminished over a relatively short time. Previous newborn attachment studies have generally looked at behaviors in relation to a specific intervention or stimulus (Kaye & Fogel, 1980; Lee, 1991; Main, 1983), and the aspect of diminishing intensity of behaviors has not been reported and has not received priority attention. This knowledge is very important to nurses, however, because timing of the attachment assessment, according to this study, may influence the outcome or score. If observations are done when interest in each other has waned, the assessment most likely would suggest the need for a nursing intervention to facilitate attachment and this may, in fact, not be a correct assessment.

This diminishing over time may reflect the fatigue a mother experiences following birth and the sleep cycles of the infant (Rubin, 1981; Thoman & Whitney, 1989). Since the mother is the partner who initiates most interactions, intense attachment behaviors may not be apparent when the mother is fatigued. When nurses walk in the room and see the mother watching television or talking on the telephone while the infant is fussing, they may be quick to criticize the mother for
a lack of attachment behaviors. The results of this study imply, however, that it is probably normal for a mother to tire quickly of intense interaction with her infant. Nurses must be careful not to make false judgments or to criticize mothers during a brief encounter. Nurses must also be careful to make attachment assessments at times when mother and infant are reuniting rather than during a time when the mother’s interest has turned to something else.

**Heart rates.** Heart rates have been used by nurses primarily to assess physical well-being. There was a significant correlation between mother’s heart rate and infant crying during one 5 minute interval. This finding suggests that when checking the heart rate of the mother, awareness of the infant’s condition must also be taken into account. There was a significant correlation between the infant’s heart rate and mother bouncing the infant. This result is consistent with the knowledge that increased activity and/or attention increases the heart rate (Fox & Porges, 1985; Tortora & Anagnostakos, 1984). Even though the infant is passively being moved, internal body adaptations are being made.

It was thought that heart rates may supply objective data to facilitate assessment of attachment. However, even though other researchers have found a change in heart rate when infants are paying attention to a stimulus (Fox & Porges, 1985; Porges, 1984) and this may be a state when the infant is most attentive, this change was not apparent in this research. The heart rates remained remarkably stable throughout the observation time. Perhaps in healthy mothers and infants, a change cannot be identified within 15 minutes. Perhaps
because there were no intense stimuli, and the mother and infant were comfortable, the heart rates remained stable. If heart rates were to be investigated further in relation to attachment, it is suggested that they be studied during intense interaction or with a definite stimulus, and compared to sleep or quiet state heart rates.

In this study, an attempt was made to study the relationship between respiratory rates and mother-infant behaviors and rocking. Although the data were collected, the average rate per minute was recorded 5 breaths per minute above normal for the mother. Analysis of the variable was dropped from the study due to questionable validity of the data.

**Rocking.** Rocking is the variable that stimulated this research study. Rocking chairs were present in central nurseries and birthing rooms, but they were not made available for all mothers to use. Management personnel gave reasons such as there is not enough space in patient rooms, mothers wouldn’t rock anyway because they are so sore, and the rocker on the bottom of the chair may cause accidents. In contrast to these objections, mothers and nurses used the rocking chairs in the central nursery and mothers were observed rhythmically moving their infants while holding them. In this study, mothers did rock their infants when the chair was made available to them. Even when the mother became tired and the infant was asleep, the mother continued to rock.

While this study did not look at outcomes of rocking, or show positive effects of rocking, certainly one can say that rocking did not hurt
the dyadic relationship. Based on studies of premature infants (Barnard, 1973; Burns et al., 1983; Lee, 1990) rocking may have potential benefits not yet identified. The dyadic rocking motion incorporates many interaction components such as touch, rhythmic movement, smell, and sound. Rocking may facilitate meeting the kinesthetic needs of infants as well as interaction needs.

From the correlations found with rocking (infant crying, awake state, quiet/sleep state, and infant sounds), a closer look at the nursing practice of providing/not providing rocking chairs for mothers after birth is warranted. Nurses should know if rocking is healthy for the dyad and if so, under what conditions and when. The knowledge of rocking would potentially have ramifications for nursing related to assessment, intervention, and outcomes. As hospitals are being renovated, nurses should have scientific rationale for inclusion/exclusion of rocking chairs in the patient rooms. The data from this study does not give direction for this decision and further research is warranted. This consideration impacts on monetary cost as well as the potential outcome of mother-infant attachment.

**Nursing Implications**

Studies on the benefits of a secure attachment imply that nurses must be astute in assessing attachment behaviors or the lack of them, as early as possible. Nurses who care for the dyad shortly after delivery have the opportunity and responsibility to identify dyads at risk for poor attachment. The results of this study suggest that nurses must be careful to make observations during a time when the mother and/or
infant are physically and mentally alert and validate the absence of behaviors through several observations.

Based on the findings of other studies, it was anticipated that rocking would highly correlate with attachment behaviors. Even though this was not found in this study, rocking seemed to be a naturally occurring behavior within a mother-infant dyad. Consideration should be given to the assumption that rocking may provide a situation that would enhance attachment behaviors. Implications for nursing intervention, however, remain in question. The optimal type and amount of rocking as well as outcome need further investigation.

Suggestions for Future Research

Several indications for additional research have been identified from the results of this study centering around the need for studying the elements of infant and mother behaviors, heart rates, and rocking using a more controlled research design. To tease out the significance of the elements calls for an experimental design.

Some suggestions for future research are:

1. The effect of specified amounts of rocking on attachment behaviors using a sample that includes dyads at risk as well as healthy dyads should be studied. To date, research supports some positive effects of rhythmic movement (Anisfeld et al., 1990; Barnard, 1973; Thomas et al., 1990) and it is known that rocking is an activity engaged in by many mother-infant dyads. The effect of rocking at different rates, and intensities, is a topic of interest. Does rocking positively influence the attachment process?
2. The effect of rocking on dyadic behaviors using a longitudinal design should be analyzed. The development of attachment in dyads who rock versus those who do not rock should yield some long-term effects of rocking. It is predicted that infants who are rocked develop into more self-confident children. One problem with this type of study is the multidimensional nature of the environment. The confounding variables would be numerous.

3. Study the effect of rocking on the infant’s state using a quasi-experimental or experimental design. Can the infant be aroused or quieted by certain types of rocking?

4. Study the usual behaviors of mothers and infants at a time when they are not intensely interacting for the first 72 hours after birth to obtain a better description of “down time” behaviors. How much time do mothers initiate interaction when they are not expected to do so?

5. Study the variations in mother and infant heart rates over a given period of time during a variety of interaction behaviors. For example, look at heart rates before and after an interaction protocol is introduced. Look at the results over time.

6. Use a quasi-experimental design with rocking as an intervention to determine the effects of rocking on dyads identified by nurses to be at risk for poor attachment and with substance abuse mothers.

Limitations of the Study

The descriptive research design limited the results to a description of the elements of interest and determination of correlations among
the elements. The convenience sample (N = 30 dyads) from which these data were taken limits generalization to other populations. Therefore, the conclusions of the study apply only to this sample of mother-infant dyads. The sample did not lend itself to randomization due to the time limitations surrounding data collection. The small sample size was also a limiting factor when generalizing to larger populations. The size of the sample, however, was large enough to provide data to support additional research. Participants were selected from only one acute care facility in one midwestern state. Therefore, responses were limited to this sample.

Another limitation was the placement of the videocamera. Ideally, it would have been placed out of the mother’s sight to minimize the influence of filming on her behavior. Likewise, all of the infant’s behaviors were not visualized because all angles were not filmed. A Hawthorne effect may have also influenced the mother’s behaviors since they knew they were being studied.

**Conclusion**

Although description and analysis of the relationships among mother behaviors, infant behaviors, heart rates, and rocking did not provide definitive results, it seems that rocking has potential importance for the practice of nursing. The goal of nursing is to enhance the mother-infant relationship in the pursuit of maximum social and physical development of the mother and infant. The precise nature of rocking and its therapeutic effectiveness continues to require examination.
Because attachment has become such an important focus in nursing practice, systematic investigation of infant and mother behavior and the phenomena that influence these behaviors must continue within the discipline of nursing. As nurses and other health professionals continue to develop a broader understanding of mother-infant attachment, the ability to more accurately pick up cues that indicate a disruption in the process during puerperium is enhanced. The eventual goal in describing mother-infant behaviors was to understand factors which enhance or retard developmental competence. The most important outcome of this study was that behaviors currently used to indicate attachment may not be as prevalent in the newborn period and in a hospital setting as believed. This suggests that nurses must be very cautious making early judgments about attachment. The goal of nursing practice to make accurate assessments is made possible through nursing research and theory. This research was consistent with previous studies, but added a dimension of concern for the validity of the current assessment practice. A broader understanding of the early mother-infant relationship was added to nursing knowledge, thus enhancing the ability to make accurate assessments.
REFERENCES
REFERENCES


APPENDIX A

BACKGROUND INFORMATION AND DEMOGRAPHIC DATA
Demographic Data

Code Number

County and Zip Code

Date and time of first contact

Date and time of observation

Date and time of birth

Length of labor

Unusual circumstances of labor

Age of mother

Gravida   Pariety: Term   Preemies

Abortion   Living

Marital status:

Married   Separated   Single

Living with: Partner   Family   Alone

Ethnic heritage   Race

Religion

Highest level of education obtained

Prenatal education classes: Yes   No

Method of infant feeding: Bottle   Breast

Occupation

Medications received during labor

Infant Data: Age at the time of observation

Sex   Apgar   Birthweight

Gestational age
Payment method for services:

- Private insurance
- Group insurance
- Self pay
- Indigent

Baseline Data:

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Mother:

Infant:

Do you have a rocking chair at home? Yes No

If yes, how often do you rock yourself? ___________________________

Do you plan to rock your baby at home? Yes No

If yes, tell me more about when you plan to rock your baby.

_________________________________________________________________

_________________________________________________________________

If no, tell me more about why you are not going to rock your baby.

_________________________________________________________________

_________________________________________________________________
APPENDIX B

LETTER OF INTRODUCTION
Patterns in the Mother-Infant Dyad

The purpose of this study is to describe patterns of mothers and their infants during the first few days after birth.

The study will include a 15 minute time segment when you will hold and rock your baby in a rocking chair in a manner that is comfortable for you. The 15 minute session will be videotaped. During the videotaping, monitors will record the rate that you rock in the rocking chair as well as your heart and respiratory rates and your baby's heart and respiratory rates. You will be asked some questions that relate to the research study.

You are being asked to voluntarily participate in this study. Your confidentiality will be protected; your name will be known only to the investigator. All of the information obtained from this study will be kept confidential and will be used for research and educational purposes. You may choose not to answer any or all of the questions asked and you may withdraw from the study at any time. Whatever you decide, your care will not be affected in any way. You may ask questions at any time and the investigator will answer them as accurately as possible. There are no known risks to this study. For your participation, you will receive a supply of formula worth approximately $10.00.

Thank you for your time and participation in the study.

Marlene Huff, R.N., M.S.N.
Principal Investigator
Doctoral Candidate
School of Nursing
Case Western Reserve University
Cleveland, Ohio 44106
(216) 375-7551
APPENDIX C

PERMIT FOR PARTICIPATION
Permit for Participation in Study

I give permission for my participation and my infant's participation in this research study. The information obtained from this study may be used for research and education. I have been informed that my participation in the study is voluntary and that I may withdraw from the study at any time. My care in the hospital will not be affected by my participation or lack of participation in the study. My identity will be kept confidential, and will be known only to the investigator. There are no known adverse effects from participation in this study. I understand that participation in the study involves holding my baby while sitting in a rocking chair, rocking as I desire, being videotaped, and being monitored for pulse and respiratory rates. My baby's participation includes being rocked by me, being videotaped, and being monitored for pulse and respiratory rates. I may also be asked questions relevant to the research study. My participation and permission for my baby to be included in the study are purely voluntary.

____________________________________
Name and date
APPENDIX D

ADAPTED FACE-TO-FACE INTERACTION GUIDE
Adapted Face-to-Face Interaction Guide

Infant

1. Head Orientation
   Toward -- the infant’s nose is in a straight line toward the mother’s head.
   Away -- the infant’s nose is pointed away from the mother’s head.

2. Eye Quality
   Closed -- the eyes are closed.
   Alert/Dull -- the eyes are open.

3. Facial Expression
   Open mouth -- the mouth is open or some movement of the mouth.
   Normal -- the face is in a resting state with mouth closed.

4. Vocalization
   Sounds -- any vocal sounds from the infant except crying.
   Cry -- fussy sounds.

5. Activity -- any movement of self, i.e., gross motor movements, reaching out, turning head, stiffening of arms or flexing them.

6. State
   Alert -- eyes open; movement of eyes; movement of limbs; includes crying.
   Awake -- eyes open; no activity of limbs.
   Quiet/Sleep -- eyes closed; limbs relaxed; used if eyes were not visible and there was no movement.

Mother

1. Head Orientation
   Toward -- a straight line from mother’s nose would hit the baby.
   Away -- a straight line from mother’s nose was directed away from baby.

2. Facial Expression
   Smile/Exaggeration -- any expression of the mother, usually to capture attention; kissing, raised eyebrows, frown.
   Normal -- the face is in a resting position, or talking without altered expression.
3. Vocalization
   Talking/Singing -- any vocal sounds the mother makes.

4. Touching -- any use of hands or fingers to touch baby, other than holding; includes patting.

5. Handling Infant
   Posture Change -- movement of the baby from one position to another.
   Bouncing -- rhythmical movement in a vertical or horizontal plane.
APPENDIX E

APPROVAL FROM

FRANCES PAYNE BOLTON SCHOOL OF NURSING
CASE WESTERN RESERVE UNIVERSITY
FRANCES PAYNE BOLTON SCHOOL OF NURSING

INVESTIGATOR:       Marlene Huff
FROM:               The School of Nursing Research Review Committee

The proposed project entitled Patterns of Bonding, Rocking, and Contentment within the Mother-Infant Relationship has been reviewed by the Committee and approved.

X A copy of the proposal and approval has been forwarded to the CWRU Office of Research Administration Committee on Human Studies. You will hear from them shortly.

Please forward to University Hospitals for review.

Date:          5/13/90
Committee Chairperson: Beverly L. Roberts

cc: Dean
     Investigator

APPRVL_FRM
18 MAY 1989
CG
APPENDIX F

APPROVAL FROM

CASE WESTERN RESERVE UNIVERSITY
TO:

SUBJECT: Notice of: [X] Review and Approval

The Committee has reviewed your proposal entitled: Patterns of Bonding, Rocking, and Contentment Within the Mother-Infant Relationship

Please be advised that with respect to (1) the rights and welfare of the individual(s) involved; (2) the appropriateness of the methods to be used to secure informed consent; and (3) the risks and potential benefits of the investigation, the Committee considers your project:

[ ] Exempt

[ ] Acceptable with reservations noted

[ ] Not acceptable for reasons noted

Follow-up: The Committee wishes to have a status report on this project on ______________ (date)

Remarks:

Date       June 6, 1990

Signed

For ORA Use

Type Project: [ ] New [ ] Renewal: Human Risk [ ] Yes [ ] No

Source of Support: [ ] Outside Funding [ ] Departmental or Other

Agency (Potential) Agency No.

Are any of the following involved: [ ] Yes [ ] No

[ ] Minors, [ ] Fetus(es), [ ] Abortuses, [ ] Pregnant Women, [ ] Prisoners,

[ ] Mentally Retarded, [ ] Mentally Disabled Subjects

If "yes" please mark the appropriate category.

cc: Faculty Advisor

Dean

Department Chairman (or Investigator)
APPENDIX G

APPROVAL FROM

ACUTE CARE FACILITY
April 12, 1990

Ms. Marlene Huff  
2035 Alabama, S.W.  
Dalton, Ohio  44618  

Dear Marlene:  

Your research project, *Patterns of Rocking, Bonding and Contentment Within the Mother-Infant Dyad*, has been approved by the Nursing Research Committee. This letter signifies your approval to begin data collection. If your project is incomplete six months from the above date, you will be required to submit a progress report which will be mailed to you. Progress reports are required at six month intervals until the research is completed.

I remind you that data results are to be shared with all nursing staff involved, and a copy of these results is to be submitted to my office.

If you need further assistance, please do not hesitate to contact me at (216) 375-3824.

Sincerely,

[Signature]

Tonda Verdejo, R.N., M.S.N.  
Chairperson  
Nursing Research Committee

TV/jv
APPENDIX H

RULES FOR CATEGORIZING DATA
Rules for Categorizing Data

The original 10 second data was categorized into dichotomous groups according to the number of epochs of time the behavior existed over 5 minutes for the variables that were skewed. The variables that were not skewed were not categorized.

<table>
<thead>
<tr>
<th>Infant Variables</th>
<th>Epochs of Time</th>
<th>Category</th>
<th>Value for Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking toward mother</td>
<td>1-29 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Looking away</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Alert eyes</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Eyes closed</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Open mouth</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Normal expression</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Making sounds</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Crying</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Alert</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Awake</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Quiet sleep</td>
<td>0-20 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 YES</td>
<td>1</td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Mother Variables</th>
<th>Epochs of Time</th>
<th>Category</th>
<th>Value for Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looking away</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Posture change</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bouncing</td>
<td>0 NO</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-30 YES</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The behaviors that were not placed into dichotomous categories are not included in the rules list.