METHOD OF INFANT FEEDING
AS A PREDICTOR OF MATERNAL RESPONSIVENESS

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University.

by

Emily Eiwen Drake
Master of Science in Nursing, University of Virginia, 1993
Bachelor of Science in Nursing, University of Virginia, 1985

Director: Sharron S. Humenick, Ph.D., R.N.
Professor, Department of Maternal Child Nursing
School of Nursing

Virginia Commonwealth University
Richmond, Virginia
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Abstract

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Infants need to develop effective, secure attachment to their primary caregivers in the

first year of life.   Researchers have not been able to identify all the factors that may

influence the development of infant attachment. Most of the studies in this area have been

done without regard to infant feeding as a potential factor. Maternal responsiveness

appears to be key in the child's development of secure attachment behaviors, yet even

after decades of research on infant attachment and maternal responsiveness, there is little

evidence available to assist with early identification of families at risk and few

interventions known to be effective in promoting maternal responsiveness.

The research questions for this study were: 1) Do mothers who exclusively breastfed their infants for at least 6 weeks report more maternal responsiveness behaviors 2-4 months after delivery compared to mothers who exclusively formula feed their infants? 2) How well does breastfeeding duration predict self-reported maternal responsiveness at 2-4 months once socio-demographics and maternal characteristics (i.e., self-esteem, satisfaction with life) are statistically controlled?

A cross-sectional survey design was used to assess the variables of maternal responsiveness, feeding patterns, and maternal characteristics in a convenience sample of 200 mothers in the first 2-4 months after delivery. The 60-item instrument included scales to measure maternal responsiveness (MIRI: Amankwaa et al., 2002), self-esteem (RSE: Rosenberg, 1965), and satisfaction with life (SWLS: Diener et al., 1985) as well as infant feeding and socio-demographic questions. A mixed mode data collection strategy was used combining Internet data collection with traditional paper-and-pencil survey methods.

Somewhat surprisingly, mothers who exclusively breastfed for at least 6 weeks did not report any more maternal responsiveness behaviors compared to mothers who formula fed their infants. Hierarchical multiple regression analysis revealed that satisfaction with life, self-esteem, and parity, but not breastfeeding, explained a significant portion of the variance in self-reported maternal responsiveness scores. Further research in this area is needed. It should be noted that this is one of few studies of maternal responsiveness using a self-report instrument and may also be the first study of maternal responsiveness using Internet data collection.

CHAPTER 1: INTRODUCTION

The purpose of this study was to compare self-reported maternal responsiveness in breastfeeding versus formula feeding mothers in the first 2-4 months after delivery. Infant feeding practices were evaluated as a potential predictor of maternal responsiveness. In chapter one, the problem statement, background, significance, research questions, and purpose of the study will be discussed. This chapter includes a summary of the theoretical framework and a discussion of the need for further research on maternal responsiveness.

Maternal responsiveness has been labeled as a critical factor in the cognitive and emotional development of children (Ainsworth, Blehar, Waters, & Wall, 1978; Raval et al., 2001). Derived from classic attachment theory (Ainsworth & Wittig, 1969; Bowlby, 1969), maternal responsiveness is a construct that describes sensitive interactions between mother and child. The early maternal-child relationship is critically important because it serves as the basis for the development of secure infant attachment and promotes healthy child development; thus, it was the focus for this study. It was hypothesized that the breastfeeding experience, along with other factors, may directly affect the mother's responsiveness to her infant's cues. Ultimately it was anticipated that

the findings of this research could increase our current understanding about the relationship of maternal responsiveness and feeding on infant development.

Statement of the Problem

The following discussion addresses the problem of insecure infant attachment and child development as it is related to maternal insensitivity and diminished responsiveness. Also discussed is the lack of adequate research on the role of infant feeding, in particular breastfeeding, in the development of maternal responsiveness. The importance and potential use of maternal responsiveness instruments for nurses and others working with mothers, children and families is highlighted throughout.

It is important for infants to develop effective, secure attachment to their primary caregivers in the first year of life; however, many infants are not able to develop this critical first attachment. It is estimated that approximately 40% of infants in the United States are not secure and display ineffective, disorganized, avoidant, resistant or ambivalent attachment patterns (van Ijzendoorn, 1995). In some high-risk populations the prevalence of insecure infant attachment may be as high as 60-80% (Barnard et al., 1988). The level of effectiveness of early attachment in infants has been documented to predict later attachment and mental health in school-aged children (Elicker, Englund, & Sroufe, 1992; Kestenbaum, Farber & Sroufe, 1989; Sroufe & Waters, 1982). Thus infant attachment has implications for childhood development, especially for children in high adversity environments. Recent studies suggest that ineffective attachment is emerging as a significant vulnerability factor for the growing child (Lyons-Ruth, 1996; Rutter,

1995). The World Health Organization has recently focused on caregiver-child interactions as a critical aspect of the care of young children and has called for further research and development of interventions to promote parental responsiveness (Richter, 2004).

The relationship between maternal responsiveness and the development of infant attachment has been the subject of many research endeavors. The assumption underlying this research is that infants of mothers who are responsive to their cues become more securely attached. Conversely, infants of less responsive caregivers are more likely to develop insecure and ineffective attachment. Determining the factors that facilitate maternal responsiveness is generally considered a way to promote the development of secure infants and prevent the type of ineffective attachment patterns that can ultimately contribute to behavioral and mental health problems in the child.

Although maternal responsiveness appears to be key in a child's development of secure attachment behaviors, even after decades of research on infant attachment and maternal responsiveness, there are few interventions to promote maternal responsiveness. Some research has suggested that family education, guided reflection, and intensive support may increase maternal responsiveness (Barnard, Morisset, & Spieker, 1993; Marvin, 1993); however, the long term effectiveness of these interventions has not been documented. In addition, there is little available to assist with early identification of families at high risk who may need this intervention. Researchers also have not been able to identify all of the factors that may influence the development of infant attachment. In

fact only about 23% of the variance has been explained thus far (Dewolff & van Ijzendoorn, 1997). Some of the factors that have been identified include sensitivity, mutuality, synchrony, emotional support, attitude, stimulation (Dewolff & van Ijzendoorn, 1997) and infant temperament (Goldsmith & Alansky, 1987). It is difficult to identify families at risk or design targeted interventions when many of the critical variables that are involved in the development of maternal responsiveness and later infant attachment are still unknown. Thus it seems that further exploration into the phenomenon of maternal responsiveness is warranted.

There is clearly a gap in the research literature regarding infant feeding method as a variable in the development of maternal responsiveness. Empirical studies of maternal responsiveness and attachment have been done largely without reference to feeding method, in particular breastfeeding. The breastfeeding experience is uniquely comprehensive in that it is a biological, social, and psychological phenomenon.

Preliminary evidence suggests that biologic mediators, such as the secretion of maternal hormones during breastfeeding may play a role in maternal responsiveness (Blass, 1994; Nelson & Panksepp, 1998; Prescott, 1997). The social act of breastfeeding with its frequent touching, holding, eye-to-eye contact and repetitive response to infant cues may also offer enhanced opportunities for the development of maternal responsiveness. The breastfeeding experience has potential psychological influence because it necessitates a constant give and take, a continuous cycle of signaling and responses usually led by the infant and responded to by the mother. Formula feeding can

be lead by the provider rather than the infant. Formula feeding is typically scheduled every four hours, while breastfeeding may occur every 2-3 hours, "on demand" by the infant. Breastfeeding is a frequent interaction with many components that could potentially influence the development of the early maternal-child relationship. Yet questions about feeding method are obviously missing from the data reported in the maternal responsiveness literature.

While the substantial physiologic benefits of breastmilk continue to be well researched (Ivarsson, Hernell, Stenlund, & Persson, 2002; Kramer et al., 2001; Mortensen, Michaelsen, Sanders, & Reinisch, 2002), the psychological benefits for the mother and infant are not as fully understood. There is anecdotal evidence that breastfeeding may enhance maternal responsiveness and attachment. Mothers often report that breastfeeding makes them feel closer to their infant and frequently a "bonding" or nurturing benefit is cited in the consumer literature (Huggins & Hartigan, 1999; Le Leche League International, 1997; Newman & Pitman, 2000); however, empirical testing of this phenomenon is not available.

<center>Background and Theory</center>

Researchers in the field of psychology, John Bowlby and Mary Ainsworth, pediatric physicians Klaus and Kennell, and nurse researchers Reva Rubin and Ramona Mercer have all produced classic work that has focused attention on the influence of early maternal-child interactions on infant development. Several models with many maternal and infant variables have been proposed and investigated in an effort to reveal the

relationship between maternal behavior and infant development. Each model has

contributed to our understanding; however, much of the variance in infant attachment and

maternal role development remains unexplained. Both the child and the mother's role

(including the internal emotional feelings of the parent toward their infant) and the

relationship of daily maternal-child interactions on infant development remain areas ripe

for study based on these foundational theories of attachment and maternal-infant

interaction.

John Bowlby (1951) began a long line of inquiry into the phenomenon of infant

attachment. Bowlby (1969) observed that infants naturally became attached to

individuals who consistently and appropriately responded to the infant's signals.

Bowlby, a clinical psychologist/psychoanalyst working in London in the post World War

II era, observed a predictable pattern in children's reaction to loss: first protest, then

despair, and finally detachment. Bowlby began to form the idea that infant attachment

was foundational for later attachment relationships in life. This first attachment provides

an internal working model or pattern of behavior that is played out again and again

throughout a person's life. Bowlby defined attachment as the infant's tie, which he

asserted, develops in the second half of the first year, to the mother as the primary

caregiver. Bowlby's intense focus on the characteristics of the primary caregiver has

angered some feminists and others who thought he placed undo emphasis on maternal

care giving. Bowlby also relied heavily on observation and anecdotal experience from

his own clinical practice: he lacked a quantitative measurement tool for these observed

behaviors. Bowlby's seminal work, however, provided a theoretical base for many studies of infant behavior.

Mary Ainsworth and her colleagues developed the first instruments to measure this interactive process of maternal responsiveness and sensitivity and infant attachment: the Maternal Care Scale and the Strange Situation Procedure. In her now classic "Baltimore study" Ainsworth and her team observed 26 mother-infant dyads in their homes throughout the first year of life (over 70 hours of intense observation per subject). They hypothesized that maternal behaviors could predict the security of attachment in the first year of life. They assessed many dimensions of maternal behaviors (e.g., sensitivity, acceptance, cooperation, and accessibility) using a newly developed observational instrument, the Maternal Care Scale. At the end of the first year they also measured infant attachment using a unique assessment procedure called the Strange Situation Procedure (SSP) which is now accepted as the "gold standard" for the measurement of infant attachment. Ainsworth et al. (Ainsworth, Blehar, Waters, & Wall, 1978) identified three specific patterns of infant attachment: Anxious-Avoidant (group A), Securely Attached (group B), Anxious-Ambivalent (group C); a fourth category, Disorganized-Disoriented (group D) was added later (Main & Solomon, 1986). As a result of this landmark study, and the instruments that she developed, attachment research and theory evolved to a new level. Ainsworth's theory suggests that a sensitive response to the infant's signals in the first year of life is paramount to the development of secure infant attachment. While this has become a hallmark study, the small sample size, the

introduction of an artificial laboratory situation, and potentially overstated results are weaknesses. Some replication studies have failed to reproduce the same degree of effect found in the initial Baltimore study (Goldsmith & Alansky, 1987; Rosen & Rothbaum, 1993; Seifer, Schiller, Sameroff, Resnick, & Riordan, 1996). Thus, although the SSP has been shown to effectively measure infant attachment, its predictors were not clearly shown.

Klaus and Kennell (1982) developed a theory based on animal behavior that suggested there was a critical period for attachment or bonding that occurred within the first few hours of days after birth; this early, critical time frame has since been refuted (Chess & Thomas, 1982). However, these physicians were extremely effective in prompting radical improvements in hospital birthing room care. At this same time, Reva Rubin (1984) described a predictable process of maternal attachment that begins in pregnancy and continues well into the post-partum period. Using a nursing perspective and observation, she described the developmental stages and tasks that are part of a complex and ongoing phenomenon of maternal role development and what she called, "binding-in." Unlike Klaus and Kennell, Rubin suggested that this development of maternal attachment or bonding occurs over a much longer period of time extending over the first weeks and months after the infant's birth. Unfortunately, it appears that Rubin's work is rarely cited outside the discipline of nursing.

Maternal responsiveness, particularly maternal-infant interactions such as daily feeding and social-behavioral interactions have been the focus for nurses who wrote

about responsiveness as an aspect of maternal role attainment. Mercer defines maternal role attainment as "the process in which the mother achieves competence in the role and integrates mothering behaviors into an established role set, so that she is comfortable with her identity as a mother" (Mercer, 1985, p. 198). Mothering that is responsive to the needs and cues of the infant is seen as evidence of successful maternal role attainment. Mercer and her colleagues contributed to the development of attachment theory through several large studies of both high and low risk families. In a large (N = 300), longitudinal study of parental attachment and maternal role development during the first 8 months after giving birth, these researchers found that maternal characteristics such as self-esteem (34%), depression (9.5%) and mastery/control of life events (3.4%) accounted for much of the variance in maternal competence. Self-esteem appeared to be a consistent major predictor in all groups (Mercer & Ferketich, 1994; Mercer & Ferketich, 1995). Unexpectedly, infant characteristics, environmental factors, family support, and life events appeared less significant in these study populations. While much of the variance remains unexplained, based on the review of literature above, it does appear that socio-demographics, maternal characteristics, and daily maternal-child interactions, such as breastfeeding, can influence maternal responsiveness.

In summary, much of the early research on infant attachment and maternal responsiveness has relied on observational methods. There is a need to continue this line of research with well-designed studies using new and valid measurement strategies.

Purpose

The aim of this study is to explore the relationship of infant feeding and maternal responsiveness. There is a possibility that breastfeeding has a unique role as a natural "intervention" to reduce the likelihood of developing ineffective attachment patterns and promote the development of maternal responsiveness.

Significance

Maternal responsiveness has been directly linked to the development of secure infant attachment, which in turn has implications for the long-term mental health of children. This section summarizes some of the longitudinal outcome studies of both secure and ineffective attachment patterns in childhood. Based on recent studies, it appears clear that both maternal responsiveness and infant attachment in the first year of life may have implications for the long-term development of children. In an extensive and critical review of the state of the science in attachment research, DeWolf and van Ijzendoorn (1997) concluded that dimensions of parenting such as sensitivity and responsiveness, as well as other factors yet unknown, play a key role in the development of infant attachment.

Secure infant attachment patterns have been associated with long-term outcomes in children. Infant attachment has been found to be a crucial determinant of later personality development in both normal and psychopathogical outcomes (Belsky & Nezworski, 1988). That secure infant attachment is an important factor in the development of psychological health has been documented in the following studies. In

1983, Sroufe and colleagues began a prospective study of a large cohort of 267 high risk children. In this Minneapolis longitudinal study of disadvantaged families, children with secure attachment in the first year of life had higher levels of self-esteem, empathy, compliance, and positive affect at 2-3 years of age. The securely attached children in the study also rated higher in emotional health, self-esteem, and self-confidence at age 10 (Elicker, Englund, & Sroufe, 1992; Kestenbaum, Farber & Sroufe, 1989; Sroufe, 1985). Thus, secure attachment appears to function as a protective factor even in the face of adversity.

Conversely, ineffective attachment in infancy has been linked with negative mental health outcomes. Attachment patterns from early infancy to pre-teen years have been shown to be remarkably consistent and stable over time (Main, 1996). Left untreated, ineffective attachment in infancy can lead to dysfunctional patters of behavior, lack of self-esteem, lack of basic trust, and problems in emotion regulation that can extend into adulthood. Recent studies focus on the link between disorganized attachment patterns in infancy and dissociative/psychopathic behavior in elementary and high school students (Carlson, 1998), disruptive and aggressive school behaviors (Lyons-Ruth, 1996), and adolescent drug use (Brook, Cohen, & Jaeger, 1998).

In a review of longitudinal studies of ineffective attachment behaviors, Lyons-Ruth (1996) concludes that disorganized attachment in infancy will predict aggression in school-age children even after controlling for family factors (stressors, discipline, child characteristics). Rutter (1995) states, "although insecure attachment cannot be equated

with psychopathology it must be regarded as an important vulnerability factor" (Rutter, p. 549).

Specific Aims

Using attachment theory as a conceptual framework, the following specific aims were generated for this study: (1) to compare maternal responsiveness in breast versus formula feeding mothers; and (2) to evaluate breastfeeding as a predictor of maternal responsiveness. The following conceptual-theoretical figure was used to guide this research (see Figure 1).

Research Questions

1. Do mothers who have exclusively breastfed their infants for at least 6 weeks report more maternal responsiveness behaviors 2-4 months after delivery compared to mothers who exclusively formula fed their infants?

2. How well does breastfeeding duration predict self-reported maternal responsiveness at 2-4 months once socio-demographics and maternal characteristics (i.e., self-esteem, satisfaction with life) are statistically controlled?

Definition of Study Variables

For the purposes of this study, the outcome variable, maternal responsiveness was understood as the mother's ability to recognize infant cues and act on those cues. Behaviors by the mother, which indicate maternal responsiveness, include comforting the infant, cuddling the infant, playing with the infant, talking to, feeding, and watching the infant respond to these actions. The underlying assumption in this definition of maternal

responsiveness is that mothers are able to recognize when they are successful in interpreting the infant's cues, provide appropriate response, and recognize when their infant is responsive to these efforts. Maternal responsiveness was measured with a 22-item self-report instrument, the Maternal Infant Responsiveness Instrument (MIRI; Amankwaa, Younger, Best, & Pickler, 2002).

For the purposes of this study, infant feeding was operationally defined as exclusive formula feeding, exclusive breastfeeding, or mixed feeding. For the purposes of some of the analysis in this study, only exclusively breastfed and exclusively formula fed groups were compared; the mixed feeding group was excluded in the analysis of the first research question. Exclusive breastfeeding was defined as at least six weeks of breastfeeding with on average one or less supplemental feedings and no more than two pumped breastmilk feedings per day. The definition of exclusive breastfeeding for this study was similar to the definition suggested by Labbock and Krasovec (1990) as full, almost exclusive breastfeeding or predominant breastfeeding. In this study, breastfeeding duration was defined as maternal self-report of weeks of any breastfeeding at the time of data collection or until weaning, whichever came first.

For the purposes of this study, salient maternal characteristics were identified as self-esteem and satisfaction with life. These were measured using the Rosenberg Self-Esteem Scale (RSE; Rosenberg, 1965) and the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). Socio-demographic covariates were age, race, number of children, education, marital status, employment and income, as reported by the

participants. For this study, salient infant characteristics were identified as the infant's age and health as reported by the mother.

Summary

Maternal responsiveness is an important phenomenon with implications for long-term psychological development of children. The breastfeeding experience may play a unique and yet untested role in the development of maternal responsiveness. Researchers purport that early attachment is at least in part the product of parent-child interactions and that promoting healthy parenting during the first years of life can help children develop a characteristic of resilience that may have a long term protective effect (Svanberg, 1998). Therefore, further investigation of the effects of infant feeding practices on maternal responsiveness is an important first step in developing interventions to promote the development of secure infant attachment.

CHAPTER 2: REVIEW OF THE LITERATURE

In this review of the literature, maternal responsiveness will be examined from the perspective/within the context of maternal role attainment and attachment theories as presented in chapter one. Chapter two provides a concept analysis of maternal responsiveness, outlines the proposed relationships among variables, and critically examines current research regarding infant feeding and maternal responsiveness.

Maternal Responsiveness

Maternal responsiveness is defined as the mother's ability to recognize infant cues consistently and act on those cues (Karl, 1995). Responsive and sensitive maternal interactions promote secure infant attachment (Ainsworth, Blehar, Waters, & Wall, 1978). These interactions are characterized by reciprocal and synchronous interchanges (sometimes called the parent-child "dance"). The continuous cycle of signaling and response over time builds security. That is, if parents are able to interpret their child's cues, then they can provide a safe and secure base for exploration and watch over and comfort or protect when needed (Barnard, Morisset, & Spieker, 1993; Marvin, 1993). Maternal responsiveness can be measured by behaviors elicited by the infant and can be observed by others. Behaviors by the mother, which indicate maternal responsiveness,

include comforting the infant, cuddling the infant, playing with the infant, talking to, feeding, and watching the infant respond to these actions.

Maternal responsiveness and its relationship with infant attachment has been studied for over three decades. First described by Ainsworth and colleagues (Ainsworth & Wittig, 1969), maternal sensitivity or responsiveness has been repeatedly linked to secure infant attachment in many studies (Belsky, Fish, & Isabella, 1991; Isabella, Belsky, & von Eye, 1989; Raval et al., 2001; Smith & Pederson, 1988) however these findings have not always been consistent (Coffman, Levitt, & Guacci-Franco, 1995; Rosen & Rothbaum, 1993; Ward & Carlson, 1995). Two independent meta analyses of over 60 studies demonstrated a significant but modest association (a combined effect size of r = .24) between maternal responsiveness and infant attachment (DeWolff & van Ijzendoorn, 1997; Goldsmith & Alansky, 1987). Generally researchers estimate that maternal responsiveness independently accounts for 24-32% of the variance. Still, much of the variance in infant attachment remains unexplained and the contribution of maternal responsiveness continues to hold interest for researchers in this field. Thus, further examining maternal responsiveness could play a role in helping to understand one piece of the larger infant attachment puzzle.

The concept of maternal responsiveness is similar but different than attraction, bonding, or affiliation. Responsiveness develops over time and is learned through repeated interactions between parent and infant. Certainly sensitivity and responsiveness develop in fathers as well as other caregivers, but mothers are the focus of this study because of the focus on breastfeeding.

Empirical Indicators of Maternal Responsiveness

The critical attributes of maternal responsiveness include parent-child interactions that are contingent on a cue from the child and which are appropriate in type, timing and intensity to the needs, and desires of the child (Raval et al., 2001). This includes the ability to see things from the infant's perspective, the willingness to allow for infant led interactions, and the active appraisal of the child's response. Characteristics associated with responsiveness have been described as sensitivity, emotional and physical availability, empathy, awareness, predictability, engagement, interest, non-intrusiveness, appropriateness, and kindness (Clark, 1999; Barnard & Kelly, 1990). Typically indicators of maternal sensitivity and responsiveness have been observed during everyday actions such as playing, teaching, feeding, comforting, holding, and communicating (both verbal and non-verbal).

To this point, researchers have primarily relied on observational methods to assess maternal responsiveness and sensitivity. Several of the instruments designed to measure parent-child interactions include subscales for parental responsiveness. Examples include the Nursing Child Assessment Teaching and Feeding Scales (NCATS/NCAFS; Barnard, 1978), the Parent-Child Early Relational Assessment (Clark, 1999), and the Emotional Availability Scale (Biringen, Robinson, & Emde, 1994). Munson and Odom (2001) provide a comprehensive and critical review of many of these published rating scales. Most of these instruments entail observations conducted either in the home, hospital, or laboratory setting. These instruments all involve semi-structured observations can last from a few minutes to an hour; sometimes video taped, the observations can be reviewed

and independently coded for reliability. Intensive training of the observer is frequently required before using most of these rating scales. While generally non-invasive, these observations can be somewhat burdensome for both the subjects and the researchers. The time, training, and expense associated with these instruments may cause researchers to limit sample size, introduce potential for bias, and ultimately limit the generalizabilty of findings.

The development of a reliable self-report paper-and-pencil instrument would be helpful for researchers in this field. The ease of administration would economically allow for longitudinal studies, larger sample size, and the exploration of new variables. Ultimately a combination of a rating scale and observation may generate more information than either type of instrument alone. The value of a self-report instrument in this case is the ability to tap into the mother's own perception and recognition of her infant's response to her actions. It is the essence of this awareness of cues and evaluation of response that defines maternal responsiveness. The advantage of using self-report is that it provides a direct measure of maternal feelings or perceptions that are otherwise unobservable, thus avoiding problems of interpreting behaviors. Certainly one potential source of bias with this type of self-report instrument is social desirability bias (SDB). Mothers may distort their responses or behaviors to appear to be "good parents." Fortunately several strategies can be used to minimize this bias. Providing clear instructions, appealing for honesty, and assuring confidentiality and anonymity reduce the risk of SDB (Edwards, 1957; Nunnally, 1978; Waltz, Strickland, & Lenz, 1991).

Infant Feeding and Maternal Responsiveness

There are several reasons to hypothesize a link between maternal responsiveness and infant feeding, in particular breastfeeding. The breastfeeding experience is a unique biological, social, and psychological phenomenon. Preliminary evidence suggests that biologic mediators, such as the secretion of maternal hormones during breastfeeding may play a role in maternal responsiveness (Blass, 1994; Nelson & Panksepp, 1998; Prescott, 1997). Breastfeeding with its frequent touching, holding, eye-to-eye contact and repetitive response to infant cues may also offer enhanced opportunities for the development of maternal responsiveness. Yet, empirical studies of maternal responsiveness and attachment have been done largely without reference to breastfeeding.

Maternal Responsiveness and Hormones Associated with Breastfeeding

Recent evidence suggests that breastfeeding may have a strong biological influence on maternal responsiveness. Oxytocin, a potent hormone released by the posterior pituitary gland, peaks during the end of pregnancy and during breastfeeding. This neuropeptide is sometimes described as the "love" hormone (Odent, 1999). Oxytocin promotes contractions in labor, stimulates milk ejection reflex in breastfeeding and is also released during lovemaking. Receptor sites for oxytocin are found in the breast and uterine tissue as well as specific areas of the brain. Neurobiologists and endocrinologists have recently begun studying the biology of attachment behaviors in relation to oxytocin and stress hormones in both animals and humans.

Several studies have demonstrated the effects of oxytocin on maternal behavior in animals. Oxytocin appears to facilitate parental behaviors and inhibit aggression in adult

female rodents such as prairies voles (Carter, Williams, Witt, & Insel, 1992). Oxytocin has also been associated with parenting behaviors in primates (Maestripieri, 1999). There have also been multiple studies of lactating rats demonstrating heightened maternal responsiveness and decreased aggression as well as diminished fear response (Hansen & Ferreira, 1986; Kellogg & Barrett, 1999; Toufexis et al., 1998). These studies are all preliminary in that they are based on animal models and involved small samples sizes (often only 8-10 animals per group). The findings are based on correlation and offer no causal explanation. It is unknown whether oxytocin influences human physiology and behavior in the same way that it does in animals. The animal data is suggestive of a link between oxytocin and maternal behavior but the role of oxytocin in human behavior remains speculative.

A few physiologic studies suggest that breastfeeding hormones may facilitate maternal responsiveness in humans. In particular, researchers have focused on the influence of oxytocin and its inverse relationship with the stress hormones, adrenocoritcotrophic hormone (ACTH) and cortisol. A study of 7 breastfeeding and 6 control group women demonstrated an increase in serum oxytocin levels and a corresponding decrease in ACTH and cortisol levels in response to suckling and breast stimulation (Chiodera & Coiro, 1987). Several comparative studies have suggested that lactation suppresses the physiologic response to stress in postpartum women. Other studies of breastfeeding women have demonstrated lower systolic BP and stronger cardiac vagal tone (Altemus, Redwine, Leong, Frye, Porges, & Carter, 2001), as well as significantly lower ACTH and cortisol in response to psychological and physiologic stress in a laboratory setting

(Altemus, Deuster, Galliven, Carter, & Gold, 1995). In a small study of 20 healthy

women, breastfeeding mothers had significantly lower stress hormone levels (ACTH,

cortisol and glucose; p <0.0001, p<0.05, and p > 0.001 respectively) during a treadmill

exercise stress situation compared to 10 women who were formula feeding their infants

(Altemus et al., 1995). Breastfeeding women also demonstrated lower stress responses

compared to formula feeding women as measured through norepinephrine levels, heart

rate, and skin conductance (Weisenfeld et al., 1985). All of these laboratory studies have

been cross-sectional in design thus it is unknown if these differences are long lasting or

clinically significant. It is also difficult to determine whether these differences in stress

response are mediated by environment, past experiences, or preexisting personality factors

that may predispose women to choose to formula feed rather than breastfeed. Therefore in

future studies, it will be important to control for maternal characteristics and environmental

factors that may influence maternal responsiveness. In summary, after reviewing the

literature on maternal hormones associated with breastfeeding, it seems logical to

hypothesize that breastfeeding may have some influence on maternal responsiveness either

directly or indirectly through the reduction of stress responses.

Maternal Responsiveness and Human Touch During Breastfeeding

Further evidence suggests that the skin-to-skin contact could help explain an increase

in maternal responsiveness among breastfeeding mothers. Many laboratory animal studies

have demonstrated an effect of maternal tactile stimulation on central nervous system

(CNS) development and response to stress in offspring. Researchers at McGill University

measuring stress in rats detected significantly lower hypothalamic, pituitary and adrenal

(HPA) hormones in the offspring of mothers who provided more licking and grooming and attentive nursing. Remarkably these rats produced significantly fewer hormones in response to stressful situations for the rest of their lives (Liu et al., 1997). These adult rats were less fearful and more maternal than the rats who received less licking and grooming in infancy. Other rat studies conducted at the University of Toronto show similar results (Fleming, Steiner, & Corter, 1997). This suggests that HPA development is mediated by mother-pup interaction, at least in these samples of laboratory animals.

Developmental psychologists have linked human touch to healthy brain development during the proliferation of synaptic connections in the cortex that occurs in the first 2 years of life. Well known studies of Kangaroo Care programs for premature infants have found many physiologic as well as psychological benefits associated with skin-to-skin contact for both the infant and the parent. Parents report decreased signs of depression, increased intimacy and a feeling of "knowing" their infant (Affonso, Wahlberg, & Persson, 1989; Gale & VandenBerg, 1998; Meyer & Anderson, 1999). Breastfeeding by its very nature promotes skin-to-skin contact every 2-3 hours and thus this may enhance maternal responsiveness through increased opportunities for human touch.

Maternal Responsiveness and Maternal-Infant Interactions during Breastfeeding

There are only a few small studies that have specifically examined maternal responsiveness/maternal-infant behavior and breastfeeding in humans. In Coffman's (Coffman,1992) review of the nursing research on parent-infant interactions, 26 studies are described yet none of them included infant feeding as a variable. In the studies reviewed by Coffman, maternal-infant interactions were typically measured during the first few

hours or days after birth (prior to discharge from the hospital). Many of these studies

appear to be plagued by power limitations imposed by sample size, bias, measurement and

conceptual problems.

Very few studies of breastfeeding and mother-infant interactions were found. In one

study of mother-infant interaction and breastfeeding, psychologists Kuzela, Stifter, and

Worobey (1990) conducted a single, 5 minute observation of 27 mother-infant dyads at age

7 months (11 were breastfeeding; 16 formula feeding) and found breastfeeding mothers in

this group displayed more maternal touch and their infants engaged in more spontaneous

vocalizations. Nurses Martone and Nash (1988) conducted a study of 15 formula feeding

and 15 breastfeeding mother-infant dyads using an observational measure of maternal-

infant interactions. Two days after delivery, no differences in maternal behavior were

reported between these two groups of mothers. This suggests that among their small

population of new mothers, initially there was no difference in maternal-infant interactions

based on their infant feeding choices. In a larger (N = 60), cross-sectional study of

maternal role adjustment and infant feeding method, significant differences in the level of

maternal-infant mutuality were found among breast and formula feeding mothers at 4-6

weeks postpartum (Virden, 1988). Thus there is the potential for a difference in mutuality

to develop over time, perhaps after several weeks of breastfeeding, although it would take

a longitudinal study to fully explore this potential.

Contradictory evidence has been reported in the literature. In a longitudinal study of

99 mothers and their infants, feeding practice did not show a significant affect on maternal

behavior at 8 and 12 months (Pridham, Schroeder, Brown, & Clark, 2001). In this study,

the Parent-Child Early Relational Assessment or PCERA (Clark, 1984; Clark, Paulson, & Conlin, 1993) was used to measure maternal sensitivity and responsiveness. Maternal attunement was also measured through the coding of video-taped feeding interactions. Some difference in maternal attunement scores were noted at the four-month data collection point; mothers of term infants who were still breastfeeding appeared to have higher attunement scores (m = 4.13, SD 0.96) than mothers who were formula feeding preterm infants (m = 3.92, SD 0.75). However a large proportion of the infants in this study were premature, very-low-birth-weight infants (n = 52) and very few infants (15/99) were actually breastfed beyond the first 4 months. Thus further research on maternal responsiveness is needed with mothers of term infants who are still actively breastfeeding several months after delivery.

Summary

In summary, maternal responsiveness is a concept of interest to developmental psychologists, physicians, nurses, social workers and others who work with children and families. In the past three decades research has accumulated regarding maternal sensitivity and responsiveness. However, after thorough review of that research literature, there appears to be a gap regarding breastfeeding as a potential variable in these studies. There is enough preliminary evidence to suggest that breastfeeding may play an important yet untested role in the development of maternal responsiveness. Some evidence based on laboratory and animal studies about the neuroendocrine changes that occur during lactation suggests that oxytocin influences maternal behavior. Other researchers have linked the skin-to-skin contact with changes in maternal behavior. It is also possible that the unique

interactions and learned behaviors that occur with breastfeeding could enhance responsiveness. Further investigation is needed to explore influence of breastfeeding on the development of maternal responsiveness.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

This chapter details the design and methods that were used to answer the following research questions:

1.   Do mothers who have exclusively breastfed their infants for at least 6 weeks report more maternal responsiveness behaviors 2-4 months after delivery compared to mothers who exclusively formula fed their infants?

2.   How well does breastfeeding duration predict self-reported maternal responsiveness at 2-4 months once socio-demographics and maternal characteristics (i.e., self-esteem, satisfaction with life) are statistically controlled?

Study Purpose

The purpose of this study was to compare the scores of self-reported maternal responsiveness in a group of mothers who have exclusively breastfed at least six weeks with a group of mothers who have exclusively formula fed. In addition, relationships among maternal socio-demographics, maternal characteristics (self-esteem and satisfaction with life), breastfeeding duration, and maternal responsiveness were examined.

Design

This study used a cross-sectional survey design to assess the variables of maternal responsiveness, feeding patterns, and maternal characteristics in a sample of 200 mothers in the first 2-4 months after delivery. A mixed-mode strategy was used to collect data through the Internet for some, and paper-and-pencil survey for other respondents.

The advantage of using a survey is that it can generate a quantitative data in a non-invasive manner with minimal participant burden. Survey methodologies are frequently used in everyday life and are considered non-threatening and acceptable to most people, thus participation should be high. Surveys can provide a practical method of collecting a relatively large amount of data that is needed to allow for the analysis of multiple variables (Dillman, 2000), in this case, 10 independent variables.

Sample

A convenience sample of 200 participants was used in this study. Participants were recruited from two distinct sites: a local pediatric clinic and from the Internet.

A paper-and-pencil version of survey was completed by 23 new mothers at a non-profit pediatric clinic in Charlottesville, Virginia. There are approximately 200 births per month in this geographical area. This clinic primarily serves rural, low-income families receiving federal or state health insurance (Medicaid or FAMIS). In fiscal year 2004, this clinic registered 12,000 pediatric visits. Of these registered visits, approximately 25 per month were potentially eligible to participate in this study (i.e., new mothers bringing their infants for well-child visits and scheduled immunizations at age 2-4 months). This site was chosen for several reasons: because it represented an ethnically diverse sample of low-income

mothers, and because this site was accessible to the investigator and was supportive of having research in the facility.

In order to achieve a larger and more geographically diverse sample, an Internet version of the same survey was self-administered to at least 170 participants recruited from the Internet. The recruitment strategies as well as the advantages and disadvantages of collecting data through the Internet are discussed below. A total sample size of 200 mothers in the first 2-4 months after delivery was achievable over a six month period of data collection.

Participants

The sample was divided into two subsets: exclusively breastfeeding (defined as breastfeeding at least through the first six weeks after delivery), and a subset of exclusively formula feeding mothers. Based on national and local breastfeeding rates, it was predicted that these two feeding groups would be approximately equivalent in size.

Feeding patterns were operationalized as either exclusively breastfeeding or formula feeding. Exclusive breastfeeding was defined as at least six weeks of breastfeeding with on average one or less supplemental feeding (either formula, water, glucose or other breast milk substitute) and no more than two pumped breast milk feedings per day.

Inclusion Criteria

All participants met the following inclusion criteria: (1) 18 years of age or older, (2) have given birth to a healthy, singleton, term infant who was 2-4 months of age at the time of data collection, and (3) be currently residing in the United States. All participants must be able to read English and understand the survey directions and questions.

Exclusion Criteria

Known mental illness or history of medically diagnosed depression in the mother excluded her participation. Major physical illness (chronic, acute, or congenital) in the infant excluded the infant. Also, infants who were exclusively fed pumped breast milk were excluded in order to avoid additionally confounding study results beyond those being statistically controlled. This was also because what is being studied here was not merely breast milk, but included the act of breastfeeding.

Screening Questions

All potential participants were asked three screening questions to determine eligibility. These were: (1) Do you have an infant between 2-4 months old? (2) Can you read and understand English? (3) Do you have any known mental illness? One additional screening question was included for the Internet participants: (4) Do you live in the United States?

Sample Size

A sample size of 200 participants should provide an adequate sample size based on power analysis, general guidelines, and practical considerations. Power analysis was used to estimate the number of participants necessary in order to detect any effects due to the independent variables of interest taking in consideration the type of statistical test, a medium effect size, and the alpha level of significance.

Power Analysis

For this study, computer-assisted power analysis (NQuery 4.0) suggests that a sample size of 122/group will provide a power of at least 80% to detect differences with a medium

effect size and the criteria for significance (alpha) set at 0.05 (2-tailed). The preliminary

results of a small pilot study (n = 16) were used as input for this power analysis and thus

this estimate of sample size may be conservative.

As a general guideline it is suggested that a minimum of 5-10 participants are needed

for every variable measured (Nunnally & Bernstein, 1994). When using multiple

regression, a ratio of 20 cases to each predictor is recommended for standard and

hierarchical regression (Tabachnick & Fidell, 2001). Using these rules as a guide, a

sample size of 200 would be appropriate for 10 predictor variables. Consideration must

also be given to the practical constraints related to cost and time, but the sample size must

be sufficient to detect significant differences and draw meaningful conclusions.

<center>Settings</center>

A mixed mode data collection strategy was used in this study. Both an Internet-based

and a more traditional paper-and-pencil version of the survey were used to collect data in

two different settings.

Using this mixed mode strategy had several advantages over using either method alone.

Offering the survey online helped reach a large population of mothers who were home-

bound with their new infants. Internet surveys are preferred by many participants and

described as more enjoyable, comfortable, and are often perceived as taking less time

(Rosenfeld, Booth-Kewley, & Edwards, 1993). The main drawbacks associated with

Internet survey methods are related to sampling coverage and validity. In order to reach

low-income mothers who may not have access to the Internet, a more traditional, paper-

and-pencil survey method was also used. The advantages and disadvantages of these

methods are discussed below as well as the potential variation introduced by the two different data collection methods.

Internet Data Collection

Because Internet data collection is a relatively new methodology, concerns may exist about the accuracy and feasibility of Internet data collection. However, multiple studies specifically examining the reliability and validity of Internet based data collection methods suggest that the results from Internet and paper-and-pencil instruments are essentially equivalent (Cronk & West, 2002; Stanton, 1998; Vispoel, Boo, & Bleiler, 2001). The main advantages of Internet survey methods are rapid access to numerous and geographically diverse participants, reduced research costs, and improved data accuracy. Data accuracy improves because missing data are less likely to occur and the risk of transcription and coding errors associated with manual data entry is reduced. Point and click surveys can incorporate radio buttons, selections lists, and pull down menus that facilitate data entry and minimize error (Rhodes, Bowie, & Hergenrather, 2003). Internet surveys can also be designed with skip patterns that are invisible to the participants so that they will only see the items that they need to complete. The Internet survey design can be purposefully kept simple so that participants with older, less sophisticated computers are able to complete the survey easily. A "help line" can be established so that participants can call for technical assistance or questions about the survey.

Not surprisingly, many of the criticisms associated with Internet data collection are common to other survey research methodologies as well. These primarily relate to sampling (selection bias, self-selection or the "volunteer effect"). Sampling from the

Internet alone can easily bias selection in favor of higher income households. Clearly a "digital divide" does exist. According to government figures from several years ago, slightly more than half (51%) of all households in the U.S. had computers and 41% had access to the Internet at home (National Telecommunication and Information Administration, 2000). Internet access appears to be increasing at an impressive rate, especially among rural populations and across all educational, income, and ethnic groups; however, the fact remains that not everyone has access, and even those who have computers in their home or office may not use them to their fullest extent. Dillman (2000) compared the current dilemmas associated with Internet data collection with many of the same challenges faced during the early use of telephone surveys. Therefore, in this study a mixed-mode strategy was used in order to enhance representativeness of the sample.

Clinic Setting

In addition to the Internet, data was also collected in a more traditional setting. The University of Virginia Primary Care Pediatric Clinic is conveniently located adjacent to a 500-bed tertiary care hospital. This clinic averages 12,000 out-patient visits per year (both sick and routine well-child visits); of these, approximately 250-300 are well-child/immunization visits for two and four month old infants. This state supported clinic primarily serves low-income families and has a large population of African American and an increasing population of Hispanic clients.

Subject Recruitment

Clinic Participant Recruitment

Data was collected only after IRB approval was received and permissions were obtained at the clinic to post advertisements/flyers, to recruit participants, and conduct surveys in the waiting room. The investigator requested a meeting with the staff at the clinic to provide information about the study. The data collector attended the clinic during peak times and set up attractive information displays to recruit participants who appear to meet the criteria by inviting them to participate through flyers and by word-of-mouth.

Face-to-face recruitment typically yields a 70%-80% survey response rate (Groves, 2002). It was expected that the response rate would be high since this is a salient issue of interest to new mothers. During pilot data collection (n = 16), a 94% response rate was achieved with face-to-face recruitment using token incentives. For the current study no incentives were provided for the participants.

Internet Recruitment

For Internet data collection, participants were recruited through newsgroups, discussion groups, bulletin boards, and chat rooms frequented by new mothers at BabyCenter.com. Permission to recruit was solicited from the webmaster prior to posting any recruitment e-mail advertisements (R. Tan, personal communication, November 8, 2004). Recruitment took place at BabyCenter.com on bulletin boards entitled, "Birth Clubs," "Development 3-6 months," "Breastfeeding," and "Parents of color."   Information about the study and a

hypertext link and uniform resource locator (URL) address for the survey was provided

(see Appendix A). After participants viewed an informed consent page and indicated

agreement, participants were then able to self-administer the Internet survey. It was

difficult to predict the number of responses that would come from the Internet. If

necessary, an appropriate sized sub-sample could have been randomly drawn from the pool

of Internet responses.

<div align="center">Data Collection Procedures</div>

Prior to any data collection, IRB approval was requested and received from both

agencies involved. These were the Human Investigations Committees at Virginia

Commonwealth University and the University of Virginia.

Mothers at the clinic who responded to the invitation to participate in the study were

screened to determine if they met inclusion criteria, and if they agreed to participate and

signed the consent form then they were then given a packet to complete. The investigator

collected data from the participants at conveniently located, private settings (either within

the clinic setting or at a mutually agreed upon location). Each packet contained a letter of

introduction, two copies of the consent form (one for the participant to keep), a self-sealing

envelope, and the 60-item survey to be completed.

Each participant at the clinic was given at least 20 minutes to complete the survey.

Based on pilot data collection with an educationally diverse sample, it was estimated that

the survey could be completed in approximately 15-20 minutes. The data collector was

available to answer questions, provide clarification, and to listen to any open ended

comments the participants may have about the research topic, the process, or the survey itself.

Internet participants self-administered the survey. Survey responses were directed into a secure database.

Protection of Human Subjects

Confidentiality of the participant's responses was stressed. The need for honest responses was also emphasized. All surveys were numbered, no names were used, and no identifying information was collected with the survey responses. For the Internet participants, informed consent was self-administered; contact information (e-mail, phone, and mailing address) was provided for questions or if further information was needed. For the clinic participants, signed consent forms were grouped and stored separate from the survey data in a locked storage cabinet. Privacy was provided during the actual completion of the survey and each participant was given a large manila envelope within which she could place the completed survey and seal it for confidentiality. All hard data collected was kept under lock and key and all electronic data was password protected.

For this study, several strategies were used to minimize specific risks associated with Internet data collection (including providing and substantiating informed consent, and assuring confidentiality, anonymity, and privacy). The Internet survey was posted at a pass-word protected Internet address and housed on a secure server in compliance with the Standards for Privacy of Individually Identifiable Health Information (U.S. Department of Health and Human Services, 2001). Survey responses were encrypted to protect confidentiality. Participants completed a consent form prior to advancing to the actual

survey questions. Internet participants were directed to click on the desired response and on a "submit" button at the end of the survey but they were also to pause, return, or exit the survey at any time. Because new mothers may be considered emotionally vulnerable, contact information for the researcher and a list of national resources were provided for participants in case of any unexpected emotional distress during the survey.

<p style="text-align:center">Instruments</p>

A 60-item survey was composed of three sub-scales. They were: the Maternal Infant Responsiveness Instrument (MIRI), used in research questions one and two; the Rosenberg Self-esteem Scale (RSE), and the Satisfaction with Life Scale (SWLS), used to measure maternal characteristics in research question two. Additionally the survey contained socio-demographic questions and infant feeding items. The following is a description and psychometric properties of each of the study instruments (see Appendix B).

<p style="text-align:center">Infant Characteristics and Feeding Method</p>

The first items on the survey assessed the infant's characteristics: infant's age, date of birth, birth weight, and current country and state of residence. These were designed to confirm study eligibility and determine the age of the infant.

Infant Feeding

There were also several maternal self-report items about infant feeding method: 1) "Are you currently feeding your baby formula/milk by bottle? If yes, how much per day?" 2) "Did you ever breastfeed your baby? If yes, how many weeks?" 3) "Did you breastfeeding for at least 6 weeks? If so, on average did you give one or less supplemental

formula feedings/day? And did you give two or less pumped breast milk feedings/day?"

4) "Are you currently breastfeeding your baby at all? If yes, how often per day?" Mothers

who were currently breastfeeding were also asked for a 24-hour feeding recall that includes

the number of times the infant breast fed in the last 24 hours and the number and category

of supplemental feedings if any (water, glucose, formula, or other). These feeding recall

questions were based on international indicators to assess breastfeeding practices accepted

by the World Health Organization (1991). The data on feeding patterns were used to

categorize participants into two extreme feeding groups: 1) exclusive formula feeding, 2)

exclusive breastfeeding at least six weeks. Data was collected from participants who have

breastfed less than six weeks but these cases were excluded from the analysis of the first

research question. All cases were included in the regression analysis for the second

research question.

<div align="center">Maternal Responsiveness Scale</div>

Maternal Infant Responsiveness Instrument

   The Maternal Infant Responsiveness Instrument (MIRI; Amankwaa, Younger, Best, &

Pickler, 2002) was used to measure the dependent variable, maternal responsiveness. The

MIRI was specifically designed to measure mothers' recognition of their own

responsiveness to their infant, mothers' recognition of their infant's responsiveness to

them, and difficulties in responsiveness. The underlying assumption is that mothers are

able to recognize when they are successful in interpreting their infant's cues, providing

appropriate responses, and when their infant is responsive to these efforts.

The MIRI is a cost effective self-report instrument that can be administered in a waiting area in a matter of minutes. The questions are short, easy to read, non-judgmental and not intimidating. There are 22 items on this scale (see Appendix B: items 9-30). Sample items include: "I believe I know when my baby wants to play," "I believe I can comfort my baby," and "I have watched my baby respond to my efforts to feed him/her." This self-report instrument uses a 5-point Likert scale for responses (strongly agree-strongly disagree). Some items are reverse-keyed to help reduce response set bias. Flesch-Kincaid readability criteria revealed a reading level of approximately 4th grade. One open-ended question, "any comments about this topic?" was included at the end of the survey for participants who may want to offer narrative comments. This qualitative data was saved for later analysis.

The MIRI was chosen because it was designed specifically for use in a similar population of economically and educationally diverse mothers and for use in clinic and child care settings. It has been used previously to measure bonding and attachment between mothers and infants during the process of maternal role attainment. Recent studies provide satisfactory validity and reliability data for this instrument with samples consisting of similar populations, specifically mothers of children age 1 to 6 months (Amankwaa et al., 2002).

The MIRI appears to be a valid and reliable instrument. In its initial testing, the MIRI scale had an alpha reliability coefficient of .86. During further pilot testing (n = 16) this scale produced an alpha of .82. To establish face validity and content validity, experts in

maternal child health reviewed the instrument and their input was used to further refine the items. Predictive and concurrent validity have not been studied.

Risk for social desirability bias (SDB) can be associated with this type of instrument. Mothers may distort their responses or behaviors to appear to be "good parents." To combat this, clear instructions were given, highlighting the fact that there are no "right" or "wrong" answers. The instructions also appealed for honesty. As much as possible, the participants were assured of confidentiality and anonymity.

The MIRI is an innovative measure of maternal responsiveness. There are other self-report instruments available such as the Parent to Infant Attachment instrument (Condon & Corkindale, 1998), the Postpartum Bonding Questionnaire (Brockington et al., 2001), the What Being the Parent of a New Baby is Like instrument (Pridham & Chang, 1989), the Maternal Attachment Inventory (Muller, 1994) and the Attachment to Child Subscale of the Parenting Stress Index (Abidin, 1995). These other instruments focus primarily on the parent's feelings about the infant and do not include an appraisal of the infant's responses. The MIRI appeared to be the best suited because it reflected the conceptualization chosen for this study; i.e., that the mother's own awareness of infant cues and evaluation of response is what defines maternal responsiveness.

<div align="center">Maternal Characteristics</div>

Self-esteem

Self-esteem was measured using the Rosenberg Self-Esteem Scale (RSE). This scale evaluates the self acceptance—liking or approval—component of self-esteem. Originally designed by Rosenberg (1965) for work with adolescents, this scale has now been tested

and used by psychologists, social scientists, and health care researchers with many diverse populations. Salient to this study, the RSE has been used with populations of new mothers (Fontaine & Jones, 1997; Hall, Kotch, Browne, & Rayens, 1996; Mercer & Ferketich, 1994), breastfeeding mothers (Damato, Dowling, Madigan, & Thanattherakul, 2005; Dennis, 2003), pregnant adolescents (Koniak-Griffin, Anderson, Verzemnieks & Brecht, 2000), parents (Loeb, Horst, & Horton, 1980), and older women (Taylor, 1997), in each instance demonstrating strong reliability and validity.

The RSE is a short, 10-item instrument (see Appendix B, items 43-52). Items are ranked on a 4-point Likert response scale (strongly disagree to strongly agree). Sample items include: "I have a positive attitude," and some reverse coded items such as, "I feel I do not have much to be proud of." Total scores can range from 10 to 40 with higher scores indicating higher levels of self-esteem. Population means are generally reported in the range of 12-30. Alpha reliabilities ranged from .84-.92 (Dennis, 2003; Hall et al., 1996). The RSE has been translated into many languages and tested cross-culturally. This scale is in the public domain.

The RSE was chosen because it has been used in several research studies of attachment and breastfeeding. In this study, self-esteem was a potentially confounding variable. Low self-esteem and depression, negative mood, and anxiety have been associated with diminished responsiveness in new mothers (Hart, Field, del Valle, & Pelaez-Nogueras, 1999; Tronick, Als, & Brazelton, 1977). In addition, high self-esteem and satisfaction with life have been associated with breastfeeding success (Dennis, 2003). Thus it was important to collect data on these variables.

Satisfaction with Life

Satisfaction was measured using the Satisfaction With Life Scale (SWLS). The SWLS is designed to measure a person's global self-assessment of life satisfaction (Diener et al., 1985). Low scores on the SWLS can be a proxy for depression. The SWLS has been used with a variety of clinical and non-clinical populations. In particular, this instrument has been tested with adolescents, pregnant women, and working mothers (Hammarberg, Astbury, & Baker, 2001; Ladwig & Napholz, 1996; Neto, 1993). The SWLS was chosen for this study because of its brevity and because it demonstrates strong reliability and validity.

The SWLS is a short, 5-item scale (see Appendix B, items 38-42). Each statement includes a 7-point Likert response (strongly agree – strongly disagree). Sample items include: "I am satisfied with my life," "In most ways my life is close to my ideal." Readability is estimated at 6th to 10th grade level. Total scores can range from 5 to 35; group means typically vary from 12-28 (Pavot & Diener, 1993). Low scores (< 20) are associated with depression and anxiety. Alpha reliability has been reported at .79 to .89 (Pavot & Diener, 1993). The unideminsionality of the scale has been supported by exploratory and confirmatory factor analyses (Shevlin, Brunsden, & Miles, 1997). Sensitivity and stability have also been tested. Test-retest coefficients of .83 and .82 have been reported at 2 weeks and 2 months respectively (Alfonso, Allison, & Rader, 96; Diener et al., 1985). The SWLS appears to detect changes over time as demonstrated by a test-retest coefficient of .54 after several years (Magnus, Diener, Fujita, & Pavot, 1992). It has

been translated into many languages and tested cross culturally. Normative data is available. This scale is in the public domain.

One additional 7-item scale, the Attachment to Child Subscale of the Parenting Stress Index (Abidin, 1995) was added to the survey (see Appendix B, items 31-37). The results from this subscale were retained for future analysis.

Demographic Information

At the end of the survey, seven socio-demographic items were included regarding age, racial identity, number of children at home, educational level, marital/partner status, employment, and income level (see Appendix B, items 53-59). Demographic attributes such as maternal age, marital status, educational level, and socioeconomic status are known predictors of breastfeeding behavior (Dennis, 2002). Thus these items are important to assess any demographic differences between the feeding groups. In addition, it was important to assess the influence of these demographic characteristics as potential confounding variables on the level of maternal responsiveness. Each demographic item was chosen carefully and placed at the end of the survey in order to minimize participant burden, preserve privacy, and to reduce risk of bias as much as possible.

Data Analysis

The final results of data analysis are reported in chapter four. An overview of that analysis is presented here. Statistical analysis was performed using SPSS, 12.0. All data were reviewed, examined for coding errors or missing data points (missing data were handled by mean substitution as appropriate), and then cleaned in preparation for data

analysis. Descriptive statistics were examined first, including frequencies, means, and distributions. Any out-of-range or unusual values were examined prior to analysis.

Descriptive data on maternal characteristics and socio-demographics were displayed in a table format. Any differences between feeding groups on maternal characteristics and socio-demographic variables were examined using paired t-tests for continuous data and Chi-square tests for dichotomous or categorical data. Differences in socio-demographics and survey results between data collection settings (Internet and clinic settings) were also compared. Mean scores, standard deviations, and ranges were reported for each of the instruments in the study. Analysis of internal consistency reliability using Cronbach's alpha was reported.

The following assumption testing was conducted for each of the statistical procedures. All continuous level data was analyzed for normality. Assumption testing for multiple regression was conducted prior to final analysis and included testing of linearity and homoscedasticity of the residuals for each variable. A scatter plot and histogram were generated in order to identify outliers. Outliers and residuals were investigated (standardized and studentized residuals > 2, Cooks distance > 4, VIF > 10) and any data points or cases displaying high leverage were considered for deletion. If collinearity diagnostics detected mulicollinarity, the data could be transformed using centering techniques (subtracting the mean from each data point).

Research Questions

First Research Question:

1. Do mothers who have exclusively breastfed their infants for at least 6 weeks report

   more maternal responsiveness behaviors 2-4 months after delivery compared to

   mothers who exclusively formula fed their infants?

Differences between feeding groups on maternal responsiveness scores were examined

using a t-test for continuous data.

Second Research Question:

2. How well does breastfeeding predict self-reported maternal responsiveness at 2-4

   months once socio-demographics, maternal characteristics (i.e., self-esteem,

   satisfaction with life) are statistically controlled?

Multiple regression techniques were used to determine the contribution of breastfeeding,

socio-demographics, and maternal characteristics (self-esteem and satisfaction with life) on

maternal responsiveness.

Exploratory Model

An exploratory model was built first by entering all the variables of interest in a

stepwise fashion. This was done to test and eliminate variables that did not contribute to

the equation; then a theoretical and more parsimonious model was developed.

Model Testing

Hierarchical multiple regression was used to examine the relationships between

variables. Breastfeeding duration was entered last into the model to determine whether it

significantly added to the prediction of maternal responsiveness after other variables had

been statistically controlled. Multiple regression was used to evaluate the overall model, provide a comparison of the observed and predicted values, and to evaluate the contribution of each independent variable in predicting the variance in maternal responsiveness scores.

The significance level for all statistical tests was set at 0.05. Preliminary data analysis involved graphic representation of all data. A code book and research journal were kept, documenting the decision-making process throughout data collection and analysis to enhance replication.

Limitations

Results were interpreted with caution due to the risk of bias and erroneous findings related to threats to external validity due to sampling methods. These sampling methods clearly limit the ability to generalize results to other populations.

This was a cross-sectional design with a sample of convenience. Because one cannot assign a group to breastfeed and given the overwhelming evidence of its benefits, randomized controlled trials are no longer ethical. While confounding variables associated with a woman's choice to breastfeed cannot be controlled by random assignment, one can attempt to control for these factors statistically. An additional limitation, which is inherent in cross-sectional design is that it does not measure changes in a given individual over time; however, the findings of this initial study may provide important information about time as a variable from which more effective prospective studies can be designed.

This method and design was chosen because it is consistent with the level of research needed to further explore the concept of maternal responsiveness and infant feeding. The

overall goal was for this to be the first in a series of multiple studies beginning a

productive line of research, assessing a variety of variables, using mixed modes of

sampling, recruiting, instruments, and analysis techniques.

Summary

This chapter has outlined the design and methods used to examine the proposed

research questions. The sample, rationale for sample size, mixed mode data collection, and

recruitment strategies were described and critiqued. The instruments and their

psychometric properties were summarized. The procedures for data collection and the plan

for statistical analysis have been explained. Rationale has been provided throughout and

the strengths and limitations of the design and methods have been discussed.

CHAPTER 4: RESULTS

This chapter presents a detailed description of the data collected as part of this research and the results of analysis including both significant and non-significant findings. The results of inferential statistical testing and multiple regression analysis related to the two research questions are highlighted.

Protection of Human Subjects

Prior to data collection, the protocol for this research was reviewed and approved by all agencies. These were the Institutional Review Boards at Virginia Commonwealth University (HIC #4211) and at the University of Virginia (#2005-0113-00).

Data Collection

The total sample included 177 Internet participants and 23 participants from the clinic setting, which constituted a total of 200 cases for data analysis. Among the initial 204 Internet respondents, 27 cases either did not meet the inclusion criteria or did not complete the survey. These partial cases were deleted from the data set, leaving 177 valid Internet participants.

Seven cases among the 30 clinic participants were not able to fully complete the survey for logistic reasons (e.g., infant distress, time constraints for the mother, lack of privacy), and these partial cases were deleted from the data set, leaving 23 clinic participants. There

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was a small percentage (10%, n = 3) who declined to participate at the clinic setting, thus a 90% response rate was achieved with face-to-face data collection. No data were collected on the non-responders.

<div align="center">Maternal Characteristics</div>

Women from 41 states across the United States completed the Internet survey. The percentages of the sample from different regions of the country are depicted in Table 1. The face-to-face participants were all from the Charlottesville, Virginia area.

The socio-demographics presented below reflect the total sample (see Table 2) and will be followed by explorations of differences between the subsample populations from the Internet and those from the clinic setting (see Table 3). The mean maternal age of the total sample was 28 years (SD = 4.8; range 18-41). The majority of the mothers were white (83%, n = 165), only 8% (n = 15) were African American, 5% (n = 9) were Hispanic, 3% (n = 5) were Asian American, and 2% (n = 4) identified themselves as other races: Biracial, West African, Euro/Maori, and "human" [sic]. The majority were married (80%, n = 159); 11 % (n = 21) were unmarried but in committed relationships; and the remaining 9% (n = 18) were single, separated, or divorced. A large portion of the sample (42 %, n = 80) had a family income over $60,000/year; 45% (n = 86) of the sample had a yearly income between $20,000 and $60,000; and 13% (n = 26) of the sample had a yearly income less than or equal to $20,000.

At the time of data collection, 46% (n = 90) of the mothers were stay-at-home-moms (SAHM) or not employed; 38% (n = 74) were working outside the home, either part time

or full time, and the remaining 16% (n = 31) were home on maternity leave. The majority of the women (78%, n = 154) were college educated; 17% (n = 34) had completed high school and/or trade school; 4% (n = 8) had completed grade school and some high school.

When differences in socio-demographics between the two data collection settings (Internet versus clinic) were examined, there were significant differences noted in every variable except working outside the home (see Table 2). The significant differences included: age (p<.000), race (p<.001), number of children (p<.05), education (p<.000), marital status (p<.000), income (p<.000), and feeding method (p<.000). The participants recruited at the clinic were younger, more likely to be non-Caucasian, more likely to be single, of lower education, of lower income, and more likely to be formula feeding their infants. Thus face-to-face recruitment in this setting serves to increase variation in the total sample and to add participants who are less likely to be accessing the Internet to the study. Yet no significant differences in instrument scores were noted between the Internet and clinic participants.

<div align="center">Infant Characteristics</div>

For 64% (n = 125) of the sample this was the first baby. At the time of the survey, the mean age of the infants was 3 months (SD .76; range 1-5 months); 52% (n = 103) of the infants were female.

<div align="center">Feeding Patterns</div>

Of the 200 mothers who completed the survey, 83% (n = 166) initiated breastfeeding. At the time of data collection, the mean duration of breastfeeding for the total sample was

8.76(6.58) weeks with a range of 0-24 weeks. In this sample of mothers 2-4 months after

delivery, it is unclear why some respondents indicated six months of breastfeeding. There

were eleven cases from the Internet group that reported 20-24 weeks of breastfeeding; with

these outlying cases removed from the analyis, the mean breastfeeding duration was 7.90

(SD 5.7) weeks with a range of 0-17 weeks of breastfeeding. In the subgroup, exclusive

breastfeeding (n = 109), the mean duration of breastfeeding was 13.13 (SD 4.39) with a

range of 7-24 weeks. At the time of data collection, 61% (n = 105) of the infants in this

study were currently breastfeeding. The majority of breastfeeding women (63%, n = 130)

breastfed exclusively for at least 6 weeks. Only 16% (n = 34) of the infants in this sample

were exclusively formula fed since birth.

A fairly large subset of the total sample (27%, n = 56), was labeled mixed feeders,

because these mothers reported that they initiated breastfeeding at birth but breastfed at the

breast less than 6 weeks, often supplementing feeding with two or more bottles of formula

per day, or relying on pumped breast milk for more than two feedings per day on average.

This mixed feeding subgroup was excluded from the analysis for research question one.

When differences in socio-demographics between the two extreme groups (exclusive

breastfeeding versus formula feeding) were examined, only age (p<.05), education level

(p<.002), and income level (p< .001) were significantly higher for the breastfeeding group.

In addition, there was a non-significant trend toward being married in the breastfeeding

group (see Table 3).

Instrument Results

Three instruments were used in this study. The mean, standard deviation, and alpha coefficient for each instrument are described below and shown in Table 4. Maternal responsiveness was measured using the 22-item MIRI scale. Each item was ranked by participants on a 1-5 scale. Negatively worded items were recoded for the purposes of scoring. Total scores ranged from 85-110. The overall mean score for this sample was 100.91 (SD 5.93). The alpha reliability coefficient for the total sample was .83.

Self-esteem was measured using the 10-item Rosenberg Self-esteem Scale (RSE). Each item was ranked on a 1-4 scale. Five negatively worded items were recoded. Scores ranged from 18-40. The group mean was 33.05 (SD 4.59). The alpha reliability (.89) of this instrument was strong.

Satisfaction with life was measured using the 5-item SWLS scale. Each item was ranked on a 1-7 scale. Scores ranged from 14-35 with a mean of 28.03 (SD 4.23). It should be noted that 4.5% (n = 9) of the sample scored less than 20 on the SWLS which is a score in the range indicating depression. When those nine cases were examined further, it was noted that four were breastfeeding, two were formula feeding, and the three remaining cases were mixed breast and formula feeding. When MIRI and RSE scores of these nine depressed cases were compared with the total sample, the nine cases with low SWLS scores appeared to have significantly lower RSE scores (mean = 28.44, SD 5.83, p = .002) but similar MIRI scores compared to the rest of the sample (p = .297). The alpha reliability coefficient with the total sample was .79.

Group differences in instrument scores were examined. There were no significant differences in MIRI, RSE, or SWLS scores by feeding groups (see Table 5) or by setting (Internet versus clinic) for data collection (see Table 6).

Data Handling:

Screening, Cleaning, and Assumption Testing

Prior to analysis, all variables were examined for accuracy of data entry, missing values, and the fit between their distributions and the assumptions for multivariate analysis. Upon examination of the minimum, maximum, mean, and range of scores, it appeared that there were no problems with data entry, or with out-of-range or unusual values. There were very few missing values (<1%) and these appeared to be random. Missing values were replaced by the mean for multiple regression analysis, a conservative technique to avoid loss of cases (Tabachnick & Fidell, 2001).

An uneven group size on several variables, particularly infant feeding group, was noted. These variables were retained for analysis but with caution because of the possibility of deflated correlations.

To improve linearity and to reduce the fairly severe skewness (Fisher's measure of skewness -3.93 and -3.793 for the MIRI and the SWLS respectively) and kurtosis (-.245, -.337), instrument scores were first reflected to correct negative skewness and then square root transformation was performed. After transformation, re-examination of distributions

and linearity scatter plots appeared satisfactory. Transformation yielded a Fisher's

measure of skewness less than one for the MIRI and SWLS (0.11 and 0.98 respectively).

One Internet case with an extremely low score on the SWLS, a score of 13 compared to

sample mean of 28(SD 4.2), was judged to be a univariate outlier; three other cases, all

from the Internet group, were identified through Mahalanobis distance as multivariate

outliers with p< .001. Mahalanobis distance (MAHAL) is the distance of a case from the

centroid of the remaining cases where the centroid is the point created by the means of all

the variables; these outliers may indicate an unintended subject in the sample population or

an extreme value with undue influence that can distort statistics (Tabachnick & Fidell,

2001). Therefore these outliers were deleted, leaving 200 cases for analysis.

Research Questions

First Research Question:

1. Do mothers who have exclusively breastfed their infants for at least 6 weeks report

more maternal responsiveness behaviors 2-4 months after delivery compared to

mothers who exclusively formula fed their infants?

There was no difference detected in self reported maternal responsiveness (MIRI)

scores (t = .133; p = .894) between women in this study who exclusively formula fed (n =

34) and those who exclusively breastfed (n =109).

Second Research Question:

2. How well does breastfeeding duration predict self-reported maternal responsiveness at 2-4 months once socio-demographics and maternal characteristics (i.e., self-esteem, satisfaction with life) are statistically controlled?

Exploratory Model

First an exploratory regression model was run to identify selected factors that were likely to predict which women would report high maternal responsiveness (MIRI) scores. The variables of maternal age, race, parity, education, marital status, employment, income, self-esteem (RSE), satisfaction with life (SWLS), and feeding category (as a rough indicator of duration) were entered together. The test of the full model with all 10 predictors was statistically significant ($F = 3.946$, $p < .000$), indicating that the predictors, as a set, distinguished those women scored higher on the measure of maternal responsiveness (MIRI).

Examination of the squared multiple correlation ($R2$) revealed that 17% of the variance was explained by the model. However, maternal age, race, education, marital status, employment, income, and feeding category were not significant contributors to the prediction of self reported maternal responsiveness. Self-esteem ($p<.01$), satisfaction with life ($p<.01$), and number of children ($p<.05$) were significant, positive predictors of self reported maternal responsiveness. Table 7 shows individual beta weights, and t and p values for each of the 10 predictors in the model.

Model Testing

A more parsimonious, hierarchical regression model, using only the significant variables, in the full model, was employed to determine whether breastfeeding duration was related to maternal responsiveness scores (see Table 8). Covariates included in the regression were self-esteem, satisfaction with life, and number of children, with weeks of breastfeeding entered last. These covariates were included in the analysis because we expected they would predict the variance in maternal responsiveness scores.

Breastfeeding category was not an initial significant predictor of maternal responsiveness in the exploratory model. We wanted however, to give breastfeeding an opportunity to show some predictive power once these other variables were held constant by the analysis. Thus, breastfeeding duration, as a continuous rather than categorical variable, was used here in order to include as many breastfeeding cases in the analysis as possible and to provide an opportunity for a linear relationship. Self-esteem ($p<.000$), satisfaction with life ($p<.05$), and number of children ($p<.05$) were significant (positive) predictors of maternal responsiveness. These three variables combined explained 14% of the variance in MIRI scores ($R = .381$; $F = 11.12$, $p < .000$) and breastfeeding duration was unable to explain any additional variance.

Post Hoc Analysis

To further explore any possible differences between the breastfeeding and formula feeding groups, the individual items of the MIRI were explored. No significant differences between the feeding groups were found on any of the items of the MIRI (see Table 9). The

p values of individual MIRI items ranged from $p = .14$ to $p = .94$. The two MIRI items that came closest to significance were: item 4, "I believe I can comfort my baby when he/she cries," and item 10, "I think I sometimes respond slowly to my baby." Breastfeeding mothers scored slightly lower on these items.

Power Analysis

After inferential statistical analysis was complete, a power analysis was performed using a standard computer program, NQuery 5.0. Results suggest that when the sample size is 134, the multiple linear regression test of $R2 = 0$ (alpha = .001) for 10 normally distributed covariates will have 80% power to detect an R2 of 0.200 with a medium effect size. Thus the sample size was adequate.

Additional Qualitative Data:

Comments from Participants

Many of the participants provided some interesting comments for the researcher (see Appendix C). Although these were not systematically analyzed, a select few are included below to give voice to the participants and to provide ideas for future research. Clearly this is a salient topic for many mothers:

> "I totally believe that exclusively breastfeeding my daughter has enabled me to better understand her non-verbal communications. She has different actions for hunger, sleepiness, etc., and because I pay attention to her frequently due to nursing every two hours I can 'read' her signals." (Internet participant)

> "Taking care of an infant is like boot camp only you can't understand the language the drill sergeant is speaking in." (Internet participant)

"This being my third baby, I believe it has become easier to understand my baby."
(clinic participant)

"I have to say the reality of motherhood is shockingly harder than I ever imagined,
and yet I cannot imagine my life without my daughter. I have never known such
sheer terror or sheer delight!" (Internet participant)

"I have been amazed at the depth of my attachment to my baby. . . Becoming a
mother has been a transformational experience." (Internet participant)

"I think that new parents (and pregnant women) have a HUGE variety of feelings
that they have to deal with, and that it's TOTALLY normal to feel this way."
(Internet participant)

"I liked that you had the question asking if it took time to develop feelings towards
my baby. I feel that is an area that people don't seem to talk about. But it does
take time!" (Internet participant)

"Sometimes I wish I could go out and find a job so I can get a break from the kids
for a little while. I'm with them 24/7 and only get a break if I have to go to the
store. I think you just need some me time." (clinic participant)

Summary

This chapter has described the data obtained and the results of data analysis. Both

significant and non-significant findings were presented. Of significance, the maternal

characteristics of self-esteem and satisfaction with life appeared to predict maternal

responsiveness scores in this sample. In this study, however, breastfeeding did not appear

to have a significant relationship with self-reported maternal responsiveness as measured

by the MIRI. Maternal age, race, number of children, education, marital status,

employment and income also appeared non significant in the prediction of maternal

responsiveness. These findings and their potential implications will be discussed in the

next chapter.

CHAPTER 5: DISCUSSION

This chapter includes a review of the purpose of this study and a discussion of the

characteristics of the sample and the significance of the findings. The strengths and

limitations of the study are discussed. This chapter also highlights the contributions of this

study to the development of nursing knowledge and to the body of research literature on

mother-infant attachment. Finally, implications for practice, theory, and future research

are discussed.

Purpose of the Study

This study was designed to explore the relationship of infant feeding method and

maternal responsiveness. The purpose of this study was twofold: to compare maternal

responsiveness in the first 2-4 months after delivery in breastfeeding versus formula

feeding mothers, and to evaluate breastfeeding as a potential predictor of maternal

responsiveness after statistically controlling for maternal characteristics and demographic

factors such as age, socioeconomic status, and educational level.

A cross-sectional survey design was used to assess the variables of maternal

responsiveness, feeding patterns, and maternal characteristics in a convenience sample of

200 new mothers. The 60-item instrument included scales to measure maternal

responsiveness (MIRI; Amankwaa et al., 2002), self-esteem (RSE; Rosenberg, 1965), and

satisfaction with life (SWLS; Diener et al., 1985), as well as infant feeding questions and socio-demographic items.

This study utilized a mixed mode data collection strategy. Data were collected first through the Internet using an Internet survey methodology; then additional subjects were recruited in a more traditional, face-to-face method using a paper-and-pencil survey at a non-profit, university based pediatric outpatient setting in a rural area of the southeastern United States.

Findings in this study indicated that infant feeding method was not related to maternal responsiveness as measured by the MIRI. There was a similar level of self-reported maternal responsiveness between mothers who chose to breastfeed and mothers who chose to formula feed. Hierarchical multiple regression analysis revealed that satisfaction with life, self-esteem, and the number of children, but not infant feeding, explained a significant portion of the variance in maternal responsiveness.

Characteristics of the Sample

The method of sampling used in this study was purposefully designed to achieve an ethnically, economically, and geographically diverse sample of mothers age 18-45 with young infants 2-4 months after delivery (N = 200). A mixed mode data collection strategy was used in order to obtain a representative sample. To enhance sample coverage, Dillman (2000) suggests a mixed-mode design whereby those without computer access are surveyed by traditional procedures. In this study, the goal of face-to-face recruitment at the clinic setting was to reach low-income participants. This goal was met. Participants from the two settings (Internet and clinic) were significantly different in terms of ethnicity,

education, martial status, number of children, household income and feeding method (see

Table 4). Participants recruited at the clinic (n = 23) included more African Americans,

younger mothers with more children, and mothers with less education, and lower income;

these participants were also more likely to be single and less likely to breastfeed than the

Internet participants (n = 177).

It should be noted that there were no significant differences in the results in terms of

maternal responsiveness, self-esteem, or satisfaction with life scores between the

participants from the two settings. This is consistent with previous studies of the reliability

and validity of Internet-based data collection methods that have also found equivalent

results using Internet versus paper-and-pencil instruments (Cronk & West, 2002; Stanton,

1998; Vispoel, Boo, & Bleiler, 2001).

The total sample (N = 200) included participants from 41 different states across the

United States (U.S.), and thus the sample was geographically diverse. The sample was

also diverse in terms of ethnicity and socio-economic status.

Demographic data for the study participants were compared to national census data.

The ethnic breakdown of the total study population included 83% Caucasian, 8% African

American, and 10% other (Asian American, Hispanic, and other ethnicities). According to

the latest national statistics from the U.S. Census Bureau (2000), 75% of the U.S.

population identify themselves as Caucasian, 12% as African American, and 13% as other

ethnicities. Thus, the study population was not fully representative of the minority

population in the U.S. While this sample was not entirely comparable to national

population statistics, it was diverse.

In terms of socio-economic status, the most recent U.S. Census reports that 12% of the families in the U.S live below poverty level (U.S. Census Bureau, 2005). In this study 13% of the families reported low income (defined as a family income <$20,000/year). In the U.S. approximately 40% of the population report an annual income over $60,000/year (U.S. Census Bureau, 2000) compared to 42% in the study sample. Thus the income of the total sample was likely an adequate reflection of the income levels of the general population in the U.S.

Estimations regarding marital status and educational level in the U.S. tend to vary. According to the most recent U.S. Census report, 43.7% of births in the U.S. are to single mothers (Martin et al., 2003). In this sample, 20% of the mothers identified themselves as unmarried. In addition the U.S. Census Bureau (2000) reports that 51% of the U.S. population have some college education compared to 78% in this sample. Thus the sample population over- represents married and college-educated mothers.

Demographic data were also compared to data from national birth certificate records and the U.S. Centers for Disease Control and Prevention (CDC) National Immunization Survey, a database that includes breastfeeding rates. According to the CDC, the mean age at childbirth is 25 (Martin et al., 2003); the mean age for the population in this study was 28 years. According to the latest national birth certificate data available, births to mothers under 20 years of age comprised 10.8 % of all births for 2002 (Martin et al., 2003). Of the mothers in this study, 6% were under 20 (note, mothers under 18 were excluded from the study). According to national birth certificate data, 13% of new mothers are over 35

(Martin et al., 2003). In this study only 7.5% were over 35. Thus, older mothers may have been slightly under-represented in this sample.

In this sample, 83% of the mothers initiated breastfeeding. According to the latest available national data on breastfeeding rates, the number of American mothers who choose to breastfeed climbed to about 71 percent in 2003 (Li, Zhao, Mokdad, Barker, & Grummer-Strawn, 2005). While more women in the U.S. are breastfeeding for the first few weeks, at 3 months this rate drops to 42% and fewer than one-third are still breastfeeding after six months (Li et al., 2005). It should be noted that in this study population, 61% of the participants were still breastfeeding at 2-4 months.

These comparisons suggest that the sample population in this study mirrors national samples in terms of income and marital status, but this sample may over-represent Caucasian (83% vs. 75%), educated (78% vs. 51% college educated) mothers, with a slightly higher breastfeeding initiation rate (83% vs. 71%) than is reflected in large U.S. population estimates. These differences may be partially explained by the use of Internet data collection methods and thus this sample may be more reflective of computer users than of all mothers. As with most convenience samples in social science research, the findings of this study pertain only to the participants of this study and cannot be generalized to the population as a whole.

<div align="center">Instruments</div>

All the instruments used in this study performed well, demonstrated good reliability and validity, and were easy-to-use for both the participants and the researcher. These scales are useful for research and may have the potential to be clinically useful as well.

The reliability estimates for the MIRI, the RSE, and the SWLS instruments were compared to reliability estimates obtained in other populations. Reliability estimates for the 22-item MIRI in the current study (α = .83) were consistent with reliability estimates observed in pilot studies and with the findings reported during instrument development (α = .86) by Amankwaa et al. (2002). Reliability of the 10-item RSE in the current study (α = .89) is consistent with previously reported reliability estimates (α = .84) with a similar population of postpartum mothers (Hall, Kotch, Browne, & Rayens, 1996). Reliability of the 5-item SWLS in the current study (α =.81) was also consistent with previously reported reliability estimates (Pavot & Diener, 1993). Ladwig and Napholz (1996) reported reliabilities for the SWLS (α = .86) using a sample of working mothers. The SWLS mean score in this study, 28.03 (SD 4.23), compares favorably with normative data obtained from a review of a group of published studies with means that fall in the range of 23 to 28 among clinical and non-clinical sample populations (Pavot & Diener, 1993).

The entire 60-item survey of all scales combined was easy to complete with minimal participant burden. The Internet version was completed within seven minutes on average (range of 4 to 19 minutes). The survey instrument was posted on the Internet at BabyCenter.com and completed by the first 79 respondents within 12 hours after posting. Participants in the clinic setting were able to complete the paper-and-pencil version of the survey within approximately 10 minutes. Topic salience likely influenced participation in this study. Comments from the mothers, both from the Internet and in person, suggested

that they enjoyed completing the survey and many expressed interest in the study and the results.

<div align="center">Discussion of the Findings</div>

First Research Question

1. Do mothers who have exclusively breastfed their infants for at least 6 weeks report more maternal responsiveness behaviors 2-4 months after delivery compared to mothers who exclusively formula fed their infants?

Somewhat surprisingly, mothers who exclusively breastfed for at least 6 weeks did not report any more maternal responsiveness behaviors compared to mothers who exclusively formula fed their infants. When comparing the two extreme groups (exclusive formula feeding versus exclusive breastfeeding) no difference was found in maternal responsiveness scores. Thus, in this study, infant feeding method did not appear to affect self reported maternal responsiveness.

The findings from the current study are consistent with at least two prior studies. In a small study of mothers who were breastfeeding (n = 15) and formula feeding (n = 15), no differences in maternal-infant interactions were observed in the first two days after delivery (Martone & Nash, 1988). In a larger (n = 99), longitudinal study comparing breast versus formula feeding mothers followed at several time points over the first year after delivery, no difference in maternal behavior was noted at 8 and 12 months (Pridham, Schroeder, Brown, & Clark, 2001). The Pridhan et al. study used the Parent-Child Early Relational Assessment or PCERA (Clark, 1984; Clark, Paulson, & Conlin, 1993) to measure maternal sensitivity and responsiveness coded from videotaped interactions.

Alternatively, there were several studies in which researchers reported findings that differed from the current study. In one very small study of mother-infant interaction and breastfeeding (11 were breastfeeding; 16 formula feeding) researchers observed that breastfeeding mothers in this group displayed more maternal touch and their infants engaged in more spontaneous vocalizations at 7 months (Kuzela, Stifter, & Worobey, 1990). In a larger (N = 60), cross-sectional study of maternal role adjustment and infant feeding method, significant differences in the level of maternal-infant mutuality were found among breast and formula feeding mothers at 4-6 weeks postpartum using a survey instrument (Virden, 1988). Therefore, despite the results of the current study, some studies do suggest that breastfeeding may have an effect on maternal responsiveness.

Because of the variety of instruments used and the differences in time frame, sample size and characteristics, it is not surprising that studies of infant feeding and maternal behavior have yielded conflicting results. For several reasons it is difficult to compare the findings of this study with the others cited. Most previous studies have used observational measures whereas in this study, the MIRI, a self-report instrument, was chosen to measure maternal responsiveness. Concurrent validity of the MIRI with observational measures of maternal responsiveness has not yet been documented. In this study, maternal responsiveness was studied at 2-4 months after delivery, a time that has been associated with high levels of maternal responsiveness (Mercer 1986, 2004; Pridham Schroeder, & Brown, 1999; Rubin, 1984; Sawyer, 1999). There may be a lack of variability in maternal responsiveness at this time as compared to expected variability at other times, thus producing different results.

Also, in this study the uneven group size (exclusive breastfeeding, n = 109; exclusive

formula feeding group, n = 34) and convenience sampling all have potential to confound

the findings related to study outcomes. Uneven group size is associated with violations of

the assumption of homogeneity of variance, issues related to overlapping variance, and

increased risk of a Type I error (i.e., concluding that a significant difference or relationship

exists when it does not). The use of multiple regression techniques is one of the strategies

for dealing with naturally occurring unequal group size in non-experimental research

(Tabachnick & Fidell, 2001). And while convenience sampling is practical but not ideal

because of non-representativeness, it is appropriate for exploratory research.

Second Research Question

2. How well does breastfeeding duration predict self-reported maternal responsiveness

at 2-4 months once socio-demographics and maternal characteristics (i.e., self-esteem,

satisfaction with life) are statistically controlled?

Three variables predicted much of the variance in maternal responsiveness in this

sample. Hierarchical multiple regression analysis revealed that satisfaction with life, self-

esteem, and the number of children, not breastfeeding, explained a small but significant

portion of the variance in maternal responsiveness scores (14%, R = .381).

Self-esteem, Satisfaction with Life, and

Maternal Responsiveness

There was a moderate, positive relationship between satisfaction with life, self-esteem,

and maternal responsiveness. That is, mothers who reported feeling increased satisfaction

with their lives and high self-esteem also reported increased responsiveness to their babies;

conversely, mothers who reported feeling less satisfied with their lives also reported feeling less responsive to their babies.

These findings are consistent with the findings of other researchers. Previous research has highlighted the role of self-esteem and successful adaptation to the maternal role. Self concept and perception of the infant are among many variables identified as influencing maternal responsiveness (Mercer, 1981, 1986). High self-esteem and mastery were found to be consistent predictors of parental competence (Mercer & Ferketich, 1994). Qualitative researchers have reported similar findings. From field notes and interactions with women, Rubin noted that self-image affects maternal role attainment (Rubin, 1967). In a qualitative study of women's experiences of early motherhood, Barclay et al. (1997) identified a relationship between the mother's perception of her baby and her perception of herself as a mother.

Low SWLS scores can be interpreted as a proxy for depression. Researchers report a strong negative correlation (r=-.72, p=.001) between the SWLS and the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 196; Ladwig & Napholz, 1996). Despite screening questions used in an attempt to exclude diagnosed depression, there were several mothers (n = 9) in this sample who may have been depressed, defined as a score <20 on the SWLS (Pavot & Diener, 1993). Mothers with low SWLS scores or symptoms of depression may need more attention. Anxiety and depression have been found to have negative effects on feelings of parental efficacy and infant attachment (Coyl, Roggman, & Neland, 2002; Hart, Field, del Valle, & Pelaez-Nogueras, 1998; Mercer & Ferketich, 1990; Fowles, 1998; Porter & Hsu, 2003). Mothers with depression tend to

reduce their investment in their new offspring; they are less responsive and less sensitive to infant cues, are less emotionally available, have a less successful maternal role attainment, and have infants that are less securely attached (Beck 1995, 1996; Cohn, Campbell, Matias, & Hopkins, 1990; Field, 1985, 2000; Fowles 1996; Hoffman & Drotar, 1991; Murray & Cooper, 1996; Murray & Stein, 1991). This is also consistent with Rubin's research that suggests there may be a relationship between low self-esteem and risk of role failure (Rubin, 1967). The paucity of research in this area, especially regarding the relationship between satisfaction with life and maternal responsiveness, precludes any generalizations regarding these findings. In addition, depression, which includes many components of psychological distress, is unique and conceptually different from satisfaction with life. Further research should be conducted before any generalization is made regarding the predictive value of life satisfaction to maternal responsiveness. Within these studies depression should also be studied with regard to satisfaction with life, self-esteem, and maternal responsiveness.

<div align="center">Number of Children and</div>

<div align="center">Maternal Responsiveness</div>

Analysis of the data also indicated a relationship between the number of children and maternal responsiveness. In this study, experienced mothers reported more maternal responsiveness. They felt better able to read their infant's cues to feed, to play, and to be held or comforted. This may be explained in some part by experiential learning (Kolb, 1984). Mothers may learn through the experiences with their first child how to be more responsive to their subsequent children. In this study, first-time mothers reported less

maternal responsiveness. In a qualitative study by Paris and Helson (2002), first-time mothers described a "conspiracy of silence" about the difficult realities of motherhood.

New parents may need more support and guidance on how to read the baby's cues in order to make them feel more confident as parents. The findings from this study may help support the need for programs for new parents like "Promoting First Relationships" and "Baby Cues" workshops and training for professionals such as the Parent Interaction Program, based on research by Barnard and colleagues at the University of Washington (Barnard, 1994).

<div align="center">Non-significant Findings</div>

Some non-significant findings were unexpected. In this study, most demographic variables were found to have little relationship to maternal responsiveness. In this study, low income mothers reported the same amount of maternal responsiveness as mothers with higher income; working mothers reported the same level of maternal responsiveness as not working outside the home or stay-at-home-mothers (SAHM); single mothers were not significantly different in their level of reported maternal responsiveness than married mothers; and there was no correlation between maternal age or educational level and maternal responsiveness.

These results contrast with the findings of other researchers who did find a relationship between some of these demographic variables and maternal behavior. Other studies have noted a relationship between maternal responsiveness and age (Mercer, 1981, 1986, Walker, Crain, & Thompson, 1986), educational level (Walker, Crain, & Thompson, 1986), and socio-economic status (DeWolff & van Ijzendoorn, 1997; Mercer, 1981, 1986;

Sroufe, 1985; Walker, Crain, & Thompson, 1986). The contrast between these studies and the current study could be accounted for by differences in sample characteristics and the conceptualization and measurement of maternal responsiveness (self-report versus observation).

Study Limitations

This study was limited by the research design and survey methodology used. The cross-sectional design only allows for data collection at a single point in time, and thus changes over time cannot be detected. This study was further limited by the sampling methods used. Using a convenience sample clearly limits the generalizability of the study's findings. Incorporating random selection would have been preferable to increase representativeness of the sample and to reduce bias. In this study, response bias was a potential threat, especially because those who volunteered for the Internet survey may have different characteristics than those who did not. Clearly, using subjects who self select for participation can bias results. Self selection presents a threat to internal validity and may also present a potential threat to external validity when there is an interaction effect of selection bias and the experimental variables (Cook & Campbell, 1979). Collecting data about the non-respondents and comparing that to the characteristics of the sample population could be reassuring, but collecting this information would not feasible for this particular Internet sample.

As with all survey studies, there are also potential flaws associated with self-report. The risk of social desirability bias (SDB) is certainly one potential source of bias with this type of self-report instrument. Mothers may distort their responses or behaviors to appear

to be "good parents." Fortunately several strategies can be used to minimize this bias. Providing clear instructions, appealing for honesty, and assuring confidentiality and anonymity reduce the risk of SDB (Edwards, 1957; Nunnally, 1970; Waltz, Strickland, & Lenz, 1991). The advantage of using self-report is that it provides a direct measure of maternal feelings or perceptions that are otherwise unobservable, thus avoiding problems of interpreting behaviors.

This study used a single measure of maternal responsiveness. Measurement error may affect sensitivity of design. Using different measures or combinations of self-report and observational measurements may be required to really tap into the phenomenon of maternal responsiveness and infant attachment. Using the MIRI along with an established observational measure of maternal responsiveness would also provide needed evidence of concurrent validity for the MIRI. This is the next step to further validate this instrument for use in research and clinical practice.

<div align="center">Implications for Practice</div>

Obstetric, women's health, pediatric, community health nurses and many others who have contact with new mothers are in a unique position to screen, educate, intervene, and refer. Clinical assessment of new parents, regardless of method of feeding could include maternal responsiveness scales such as the MIRI and satisfaction with life measures such as the SWLS. Parents may enjoy and even benefit from the opportunity to self-screen using these instruments.

Based on the comments from many of the participants in this study, mothers clearly identified parenting as a transformational experience. Nurses have a long history of

helping patients through life changing transitions. Just one example is the nurse's role in childbirth. For many years, nurses have been very involved in preparing new parents for childbirth. According to Harvey-Vallender (1998), "The emphasis on labour and delivery needs to be balanced with a focus on the magnitude of change which many women encounter in becoming new mothers." Using the same successful model used for childbirth classes, nurses could also provide parenting education and support, particularly for first-time parents.

Multidisciplinary groups concerned about parenting may want to test interventions that promote maternal responsiveness through clinical studies. Clinical researchers may find the MIRI a useful tool for pre- and post-test measurements to assess the success of new programs and interventions. Effective assessment and interventions are needed to promote growth as well as to prevent problems. Working with new mothers, helping them assess their strengths, supporting their parenting skills, and helping them feel better about themselves could increase long-term resilience for both the parents and the infant.

While formula feeding cannot provide the health benefits of breast milk, the mothers in this study were able to report a similar level of maternal responsiveness at 2-4 months regardless of feeding method and thus for the participants in this study, formula feeding did not appear to compromise the development of attachment behaviors. For parents, the findings of this study may be reassuring, particularly for mothers who are not able to or choose not to breastfeed.

Implications for Theory

The findings of this study support Rubin (1967) and Mercer's (1985) middle range theory of maternal role attainment. The theory about maternal role attainment continues to evolve. Mercer (2004) suggests that the term, "Maternal Role Attainment" be discontinued and replaced with the more encompassing term, "Becoming a Mother" (BAM). This new definition better reflects the dynamic nature of the concept and incorporates a more developmental approach to the study of maternal identity. It is hoped that the present study provides some added information about patterns of maternal behavior in the transition to motherhood and some of the variables (in particular, satisfaction with life) that may influence that transition.

Future Research

This study was the first to document that satisfaction with life predicted maternal responsiveness using the MIRI.   However, with only 14% of the variance explained by the predictors in this study, a large portion (86%) of the variance in maternal responsiveness remains unexplained. Becoming a mother is a complex, multifactorial, fluctuating, non-linear process that may vary across time. Clearly there are many other variables, maternal characteristics, infant characteristics, and outside factors that may influence the process of maternal responsiveness and infant attachment. The impact of postpartum or preexisting depression was not included in this study but should be included in future studies as a potential factor. In addition, social support and adult attachment patterns could be explored**.**   Social support has been identified as a factor in maternal role development in several other studies (Barclay, Everitt, Rogan, Schmied, & Wyllie, 1997; Goldstein,

Diener, & Mangelsdorf, 1996). Also memories of maternal and paternal acceptance, the mother's own adult attachment patterns, have been identified as a predictor of maternal responsiveness and sensitivity (Crockenberg & Leerkes, 2003, van Ijzendoorn, 1995).

For researchers exploring maternal responsiveness, the MIRI may become a useful instrument. This was the first large study of healthy mother-infant dyads using the MIRI, a self-report instrument developed to measure maternal responsiveness. Thus far there has been limited success in developing paper-and-pencil instruments in the area of maternal responsiveness and attachment research and so researchers have relied heavily on observational measures. The MIRI merits further development. This study yielded a rich data set that could be combined with other data for factor analysis, item refinement, and further validity testing of MIRI.

This was also one of the first studies using Internet recruitment and data collection to study new mothers. Internet data collection may become a useful tool for nurse researchers as well as others who are conducting research with new mothers and other hard-to-reach or potentially isolated populations.

Finally, despite the findings of the current study, it is important to continue to explore breastfeeding and its relationship with maternal responsiveness and infant attachment. We need to continue to document both the physiological and psychological benefits of breastfeeding. Researchers should collect data about infant feeding patterns routinely as a part of all maternal child health studies. This would be helpful in terms of tracking breastfeeding initiation and duration rates and may become more important as new research reveals benefits of breastfeeding yet unknown. Recent experimental studies

published in the journal *Nature* highlight the critical role of Oxytocin, one of the hormones associated with breastfeeding, in the development of trust in human relationships (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005); this is an area ripe for study.

Conclusion

In this chapter the purpose, findings, strengths and limitations of the study were discussed. Implications for practice, theory, and research were outlined. The unique contributions of the study were highlighted. It should be noted that this is one of few studies of maternal responsiveness using a self-report instrument and may also be the first study of maternal responsiveness using Internet data collection.

The goal of this study was to evaluate the method of infant feeding as a predictor of maternal responsiveness. Few studies have investigated the relationship between breastfeeding and maternal responsiveness. Surprisingly, in this study, infant feeding had no effect on self-reported maternal responsiveness; however, satisfaction with life, self-esteem, and the number of children did have a positive and significant relationship with maternal responsiveness. Further research is needed to continue to explore the concept of maternal responsiveness and the potential effect of breastfeeding and satisfaction with life on the maternal child relationship.

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<u>Appendices</u>

APPENDIX A

Internet Posting for Recruitment on BabyCenter.com

Thread: Invitation to participate in Mother-Baby Study

_____

Hi. I am a PhD student doing a study of Maternal Responsiveness.

I need 200 mothers who have healthy babies between 2 and 4 months old to

fill out a short survey. This online survey takes less than 10 to 20 minutes to complete.

If you would be willing to participate please click on the link below to

connect to the survey and further directions. Click right here < >

or go to http://www.surveymonkey.com/s.asp?u=46709926538

If you have any questions, you can contact me at : eje@virginia.edu or

(434) 924-0126. Thank you very much for considering this invitation,

Emily Drake

Virginia Commonwealth University, School of Nursing

Mother-Baby
Survey

Researcher: Emily Drake, VCU Nursing Doctoral Student

Please answer the following questions by writing in an answer or circling an answer. *Thank you*.

First some questions about your **new baby**:

1. How old is your baby now:
    1 month
    2 months
    3 months
    4 months
    5 months or older

2. Is your baby a boy? Or a girl? _____

3. How much did your baby weigh at birth? _____

4. Please rate your baby's overall health on this scale (please circle a number)

    Sick----1-------2-------3--------4--------5-----very healthy

5. What state do you live in? _____

Please answer some questions about **feeding** your new baby:

6. Did you ever breastfeed your baby?   **Yes   No**

     If **no**, please **skip to question # 9 in the next section**

     If yes, how many weeks did you breastfeed _____?

7. Did you breastfeed for at least 6 weeks?   **Yes   No**

     If yes, during that time did you give your baby on average
     one or less supplemental formula feedings/day?   Yes   No

     And did you give 2 or less pumped breast milk feedings/day? **Yes   No**

8. Are you currently breastfeeding your baby at all? **Yes   No**

     If **no**, please **skip to question # 9**

     If yes, how many times did you breastfeed in the past 24 hours? _____
     In the past 24 hours, did you give the baby any supplemental feedings other than
     breast milk?

Water	How much _____
Glucose	How much _____
Formula	How much _____
Juice	How much _____
Pumped breast milk	How much _____
Other _____	How much _____

Please answer the following statements as honestly as you can.
There are no "right or wrong" answers.
Circle the answer that best fits your level of agreement.

These first statements are about **responding to your new baby:**

9. I have made faces and smiled at my baby and watched for my baby's response to me.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

10. I believe my baby wants me to touch him/her too often.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

11. I have seen my baby respond to my playing with him/her.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

12. I believe that I can comfort my baby when he/she cries.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

13. I have seen my baby respond to my talking to him/her.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

14. I believe I know when my baby wants to play.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

15. I have seen my baby respond to my comforting him/her.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

16. I believe I know when my baby wants me to feed him/her.

Strongly agree *Agree* *Somewhat agree* *Disagree* *Strongly disagree*

17. I have watched my baby respond to my feeding him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

18. I think I sometimes respond slowly to my baby.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

19. I believe my baby responds well to my holding him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

20. I have watched my baby respond to my touching him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

21. I believe my baby wants me to play with him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

22. I am sometimes afraid of my baby's appearance.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

23. I believe my baby wants me to comfort him/her too often.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

24. I believe my baby wants me to talk to him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

25. I feel good about how I respond to my baby.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

26. I feel good about how my baby responds to me.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

27. I believe I know when my baby needs me to feed him/her.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

28. I sometimes feel afraid to care for my baby.

Strongly agree   *Agree*   *Somewhat agree*   *Disagree*   *Strongly disagree*

29. I like the way my baby responds to me when I play with him/her.

Strongly agree   Agree   Somewhat agree   Disagree   Strongly disagree

30. I believe my baby wants me to hold him/her too often.

Strongly agree   Agree   Somewhat agree   Disagree   Strongly disagree

---

Please respond to these statements about **your new baby:**

31. How easy is it for you to understand what your baby wants or needs?

   a. Very easy,
   b. Easy,
   c. Somewhat difficult,
   d. It is very hard,
   e. I usually can't figure out what the problem is.

32. It takes a long time for parents to develop close, warm feelings for their baby.

Strongly agree   Agree   Not Sure Disagree   Strongly disagree

33. I expected to have closer and warmer feelings for my baby than I do and this bothers me.

Strongly agree   Agree   Not Sure Disagree   Strongly disagree

34. Sometimes my baby does things that bother me.

Strongly agree   Agree   Not Sure Disagree   Strongly disagree

35. When I was young, I never felt comfortable holding or taking care of babies.

Strongly agree   Agree   Not Sure Disagree   Strongly disagree

36. My baby knows I am his or her parent and wants me more than other people.

Strongly agree   *Agree*   *Not Sure* *Disagree*   *Strongly disagree*

37. The number of children that I have now is too many.

Strongly agree   *Agree*   *Not Sure* *Disagree*   *Strongly disagree*

Please respond to these statements about **your feelings about your life:**

38. In most ways my life is close to my ideal.

Strongly agree   *Agree*   *Slightly agree*   *Neither agree or disagree*   *Slightly disagree*   *Disagree*   *Strongly disagree*

39. The conditions of my life are excellent.

Strongly agree   *Agree*   *Slightly agree*   *Neither agree or disagree*   *Slightly disagree*   *Disagree*   *Strongly disagree*

40. I am satisfied with my life.

Strongly agree   *Agree*   *Slightly agree*   *Neither agree or disagree*   *Slightly disagree*   *Disagree*   *Strongly disagree*

41. So far I have gotten the important things I want in life.

Strongly agree   *Agree*   *Slightly agree*   *Neither agree or disagree*   *Slightly disagree*   *Disagree*   *Strongly disagree*

42. If I could live my life over, I would change almost nothing.

Strongly agree   *Agree*   *Slightly agree*   *Neither agree or disagree*   *Slightly disagree*   *Disagree*   *Strongly disagree*

The next set of statements is about your **sense of self**:

43. On the whole, I am satisfied with myself.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

44. At times I think I am no good at all.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

45. I feel that I have a number of good qualities.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

46. I am able to do things as well as most other people.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

47. I feel I do not have much to be proud of.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

48. I certainly feel useless at times.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

49. I feel that I'm a person of worth, at least on an equal plane with others.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

50. I wish I could have more respect for myself.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

51. All in all, I am inclined to feel that I am a failure.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

52. I take a positive attitude toward myself.

Strongly agree   *Agree*   *Disagree*   *Strongly disagree*

These last questions are about **you:**

53. Your Age: _____

54. Racial Identity

1. African American
2. Asian American
3. Caucasian/White
4. Hispanic
5. Other _____

55. How many children do you have at home now? _____

56. What is the highest grade you completed in school?

1. Some Grade School or High School
2. Completed High School
3. Some college/AA
4. College degree
5. Graduate degree

57. Marital Status

1. Married
2. Divorced
3. Separated
4. Single
5. Unmarried, but in a committed relationship
6. Widowed

58. Current Employment Status

1. Stay at home mom/ not employed
2. Working full-time now
3. Working part-time now
4. On leave

59. Annual Family Income

    1. less than $10,000 per year
    2. between 10,000-20,000
    3. between 20,001-30,000
    4. between 30,001-40.000
    5. between 40,001-50,000
    6. between 50,001-60,000
    7. above 60,001/year

60. Comments: Please write any comments that you want to share with the researcher:

_____

_____
_____

_____

__Thank you very much for completing this survey.__

VCU HIC # 4211
UVA HIC # 2005-0113-00

APPENDIX C

Comments from Participants

1. i totally believe that exclusively breastfeeding my daughter has enabled me to better understand her non verbal communications. she has different actions for hunger, sleepiness, etc, and because i pay attention to her frequently due to nursing every 2 hours (altho i'd pay attention to her anyway, but you see what i'm saying) i can 'read' her signals. her dad, while involved to a great degree, doesn't seem as in tune with her signals, so sometimes she has to get all the way up to crying with him, before he 'gets it'.

2. There are some holes in the responses to the beginning questions. My daughter was 6 lbs 3 oz at birth. The choices were 4-6 lbs or 7+ lbs. I chose 4-6 but this is not entirely accurate. Also, There should be an option of "still breastfeeding." The question that asks how long baby was breastfed implies that breastfeeding should be finished by now.

3. I have dreamed of becoming a mother for many years. I have to say the reality of motherhood is shockingly harder than I ever imagined, and yet I cannot imagine my life without my daughter. I have never known such sheer terror or sheer delight!

4. I started my "adult" life I was only 16 but feel I've done a wonderful job. I have 3 happy healthy daughters and am lucky enough to be able to stay home with them. I also believe that breastfeeding my girls has strenghtened the bond between us. After all I am the one who can feed her!

5. I've responded to these questions to how I'm feeling now. I had post-partem depression, and for the first month would have answered these questions quite differently than I have now.

6. I pump breastmilk - so the baby gets breastmilk, just not directly. also, I travel for a living - sometimes this makes me feel as if i am going to miss a lot.

7. I love being a mother. I started babysitting when i was 10 years old and always wanted LOTS of my own kids. I think i also want lots of kids because i am an only child.

8. The question about how long I breastfed seems poorly written and I was not sure how to answer. My baby is 3.5 months old. Therefore I answered that I breastfed my baby for 3 months because I could not yet say I have breastfed her for 4. However I plan to breastfeed her for several years and will not introduce solids or anything but breastmilk until she is at least 6 months old. The way I answered the question made me feel like I breastfed for 3 months and then weaned her which is not the case.

9. I am not unemployed! I have a much harder job than my husband who has a number of degrees and job responsibilities...he would agree with me. Taking care of an infant is like boot camp only you can't understand the language the drill sergent is speaking in. It is also the most rewarding wonderful thing I have ever done. My baby is important enough for me to give up my dream of getting my degree so as to give the best life to my child...(at least for now).

10. Regarding question 67, I marked Unemployed, but I am a SAHM, and if you don't think that qualifies as a catagory, you are wrong. Most days I work much harder than I did when I was "employed". I think your survey should reflect stay at home mom's or parents into a separate catagory.

11. just some general comments/questions: q41: not sure what you're looking for here -- my experience (bonded immediately) or my opinion of others' bonding experiences q51: who wouldn't change something about their life?! Do you mean major change or any change? Generally I'll keep the life I have but I'd love to have naturally curly hair instead of the stick straight fine mess I've been given. again, not sure what aim of this question is. . . Question re feeding habits over last 24 hours, my answer here would vary depending on the day and the last 24 hours may not be how my child is fed the majority of the time (eg Sunday feeding habits vs. weekday habits) Interesting survey, would like to see the results. thanks!

12 I have a difficult baby meaning that he is high needs (definition by Dr. Sears). I feel that I would be more content with my life had my baby been less demanding.

13. I am a stay at home mom, not unemployed.

14. We are planning on having one more child in 2 or 3 years, and are happy about it. I am a stay at home mom, and love it most of the time. It's funny, the days I am getting barfed on and running kids to the doctor I feel at my best because my kids need me and I am there. I am also content to take them to the park, or on a walk. The last thing is, new babies are a lot of work and require alot of time. But, the smiles, coos, and milk bubble blowing are my payment!!

15. I love being a mom. Before my daughter was born, I didn't have those warm loving feelings I had heard about mom's having towards their newborns - but the minute she was born those feelings turned into pure love.

16. I have been amazed at the depth of my attachment to my baby. I expected to look forward to going back to work, but in fact it feels wrong to leave my baby. I'm cutting back on my work schedule (and disposable income) so I can be home with him more. Becoming a mother has been a transformational experience.

17. I believe that when you are at a point mentally, physically and financially ready for a baby, that is the time to do it. Otherwise, stress may overwhelm the mother/child relationship.

18. Re: question #67 Will you consider adding a Full Time At Home (stay at home mom) choice? "Unemployed" sounds like it's not by choice that we don't work. There are increasing number of women nowadays choose to stay home after the baby is born and give up the career they had prior to the baby.

19. for the employment status, i think you should include being a stay at home mother...i am not employed outside the home, but taking care of my children is a full time job, andif i was taking care of someone else's children, i would be considered employed.

20. On question 67, a nice addition to "unemployed" would be "stay-at-home mom". I feel that I am certainly employed in the most rewarding job of all...being a mom! Good luck with your study. I hope you get lots of participants.

21. My children are adopted. That is why I answered that I didn't consider breastfeeding. It's possible that my responsiveness to them is affected by how long I waited to get them.

22. The only big regrets that I have is not finishing college before having a child.

23. I liked that you had the question asking if it took time to develop feelings towards my baby. I feel that is an area that people don't seem to talk about. But it does take time!

24. Being a mother is very hard work, but I love it and wouldn't trade it for anything. The first few weeks are the toughest, but once you make it through those, everything gets much easier.

25. I work full time because of benefits and need but have a strong desire to be a stay at home mom. It is very difficult to go to work some days and to leave the baby at day care. Many days I feel guilty because I am away from the baby all day.

26. My husband went to VCU! Good luck with your research!

27. I think that new parents (and pregnant women) have a HUGE variety of feelings that they have to deal with, and that its TOTALLY normal to feel this way.

28. Becoming a mother has definitely been the most wonderful experience of my life

29. My Husband is in the army thats why I don't work

30. I am a graduate student currently attempting to finish my thesis. i will be finished in three more weeks. The baby is 3 months 4 weeks now.. on april 7 he will be 4 months. But i used 4 months to mark his age.

31. Being a mother is greatest thing in the world. I love it. I wouldn't take anything for my sweet baby girl. Her and my husband are the most important things in my life and I am honored to be a part of theirs. Good luck with your research!

32. I wasn't sure how to respond to the question are you breast feeding. I am exclusively pumping breast milk and my baby gets no supplements, only breast milk. He had a weak suckle so at first he had to be supplemented with formula but within the first week of his life he was getting all breast milk. Never got the hang of breast feeding, but pumping actually is working out great. I only have to pump 3-4 times a day and I get more than I need and have the freedom to go places. As of right now I have more than 800oz of milk in the freezer!!!

33. This being my third baby, I believe it has become easier to understand my baby.

34. The only thing in my life that I wish I had is a college degree, which I am proud to say I am working to achieve! Thanks!!

35. I waited a long time before having her. I'm very glad I needed the extra time to truly enjoy this sweet baby.

36. taking care of kids is not easy but if you love them you will do almost anything for them like I do mine.

37. sometimes I wish I could go out and find a job, so I can get a break from the kids for a little while. I am with them 24/7 and only get a break if I have to go to the store. I think you just need some me time.

38. I'd like to see the results of the survey on the weekly Women's Place email.

39. Baby is social. She likes people.

40. Me having kids plays a major part in my life. They make me want to better myself and education.

Tables

TABLES

Table 1

Percentages of the Sample from Different Regions of the United States (N = 200)

Region	Number (percentage)
East Coast	82 (42%)
Central	43 (22%)
Midwest	32 (16%)
West Coast	35 (18%)
Other (Alaska, Hawaii)	3 (2%)

Note. Five participants did not respond to this question.

Table 2

Comparison of Socio-demographic Characteristics by Recruitment Site

(Internet versus Clinic)

	Internet (n = 177)	Clinic (n = 23)		
Socio-demographic Characteristic	Mean (SD) Number (percent)	Mean (SD) Number (percent)	Test Statistic	p Value
1. Age (years)	28.13 (4.6)	24.17 (5.1)	3.79^a	.000***
2. Race, white	152 (87%)	13 (56%)	13.46^b	.001**
3. First child	115 (66%)	10 (43%)	4.64^b	.029*
4. Some college	147 (85%)	7 (30%)	35.86^b	.000***
5. Married	151 (86%)	8 (35%)	34.09^b	.000***
6. Employed	94 (55%)	11 (48%)	0.38^b	.366
7. Low Income	11 (6%)	15 (68%)	63.36^b	.000***
8. Infant feeding, Formula	21 (16%)	13 (81%)	33.15^b	.000***

^{a} t-test. ^{b} chi square.
*p<.05.
**p<.01.
***p<.001.

Table 3

Comparison of Socio-demographic Characteristics by Infant Feeding Group (Exclusive
Breastfeeding versus Formula Feeding) (N =143)

Variable	Exclusive Breastfeeding (n = 109) Mean (SD) Number (percent)	Formula Feeding (n = 34) Mean (SD) Number (percent)	Test Statistic	p Value
1. Age (yrs)	28 (4.5)	26 (4.4)	2.08 [a]	.039*
2. Race, white	91 (83%)	26 (76%)	0.85 [b]	.246
3. First child	71 (66%)	17 (50%)	2.71 [b]	.075
4. Some college	92 (85%)	20 (59%)	10.78 [b]	.002**
5. Married	90 (83%)	23 (68%)	3.48 [b]	.055
6. Stay-at-Home-Mom (SAHM)	50 (47%)	14 (42%)	0.01 [b]	.409
7. Low income	8 (8%)	11 (32%)	13.12 [b]	.001**

[a] t-test. [b] chi square.
*p<.05.
**p<.01.

Table 4

Summary of Instrument Scores and Alpha Reliability (N = 200)

Instrument	Mean (SD)	Range	Alpha Coefficient
MIRI	100.91 (5.93)	85-110	.83
RSE	33.05 (4.59)	18-40	.89
SWLS	28.03 (4.23)	14-35	.81

Note. Instruments: Maternal Infant Responsiveness Instrument (MIRI), Self-esteem (RSE), Satisfaction with Life Scale (SWLS).

Table 5

Comparison of Instrument Scores by Feeding Group (N = 143)

Instrument	Exclusive Breastfeeding (n = 109) Mean (SD)	Formula Feeding (n = 34) Mean (SD)	t-test	*p* value
MIRI	100.92 (5.9)	101.56(5.6)	-.557	.578
RSE	33.34(4.6)	33.53(4.6)	.252	.832
SWLS	28.18(4.0)	27.97(4.9)	-.213	.802

Note. Maternal Responsiveness (MIRI), Self-esteem (RSE), and Satisfaction
with Life (SWLS).

Table 6

Comparison of Instrument Scores by Data Collection Setting

(Internet versus Clinic)

	Internet (n = 177)	Clinic (n = 23)		
Instrument	Mean (SD)	Mean (SD)	t-test	*p* value
MIRI	100.81 (5.9)	101.65 (6.0)	- .637	.525
RSE	32.94 (4.6)	33.83 (4.0)	-0.86	.387
SWLS	28.24 (4.0)	26.43 (5.4)	1.52	.139

Note. Instruments: Maternal Infant Responsiveness Instrument (MIRI), Self-esteem (RSE), Satisfaction with Life (SWLS).

Table 7

Exploratory Multiple Regression Analysis for Maternal Responsiveness (N = 200)

Variable	Standardized β	t	p value
Maternal Age	.032	.382	.703
Race	-.036	-.523	.602
Number of Children	.160	2.09	.037 *
Education level	-.011	-.118	.906
Marital Status	.116	1.50	.135
Employment level	.124	1.73	.085
Income level	-.067	-.730	.466
Self-esteem (RSE)	.198	2.67	.008**
Satisfaction (SWLS)	.233	3.03	.003 **
Feeding Group	.006	.098	.927

**p<.01.
*p<.05.

Table 8

Summary of Hierarchical Multiple Regression Analysis for Variables Predicting Maternal

Responsiveness (N = 200)

Model Variables	F	R^2	R^2change
1. RSE, SWLS, Number of Children	11.12*	.14	.145*
2. RSE, SWLS, Number of Children, Breastfeeding	8.30	.14	0.0

Note. Outcome variable: Maternal Responsiveness (MIRI). Predictors: Self-esteem (RSE), Satisfaction with Life (SWLS), Number of Children, and Breastfeeding Duration (weeks).

*$p < .001$.

Table 9

Post Hoc Analysis of Differences between Breast and Formula Feeding Groups on

Individual Items on the Maternal Infant Responsiveness Instrument (MIRI)

MIRI Item	Exclusive Breastfeeding (n = 109) Mean(SD)	Formula Feeding (n = 34) Mean(SD)	t-test	*p* value
1. MR1	4.91(.551)	4.82(.716)	.735	.464
2. MR2	3.09(1.70)	3.41(1.50)	-1.05	.296
3. MR3	4.92(.431)	4.91(.288)	.081	.935
4. MR4	4.82(.410)	4.91(.288)	-1.48	.141
5. MR5	4.95(.228)	4.97(.171)	-.592	.555
6. MR6	4.61(.525)	4.56(.705)	.427	.672
7. MR7	4.92(.277)	4.94(.242)	-.411	.682
8. MR8	4.68(.508)	4.71(.579)	-.257	.798
9. MR9	4.90(.303)	4.82(.387)	1.04	.302
10. MR10	3.65(.894)	3.85(.784)	-1.30	.197
11. MR11	4.84(.364)	4.82(.387)	.282	.778
12. MR12	4.89(.313)	4.79(.538)	.998	.324

Table 9 (continued)

Post Hoc Analysis of Differences between Breast and Formula Feeding Groups on

Individual Items on the MIRI

MIRI Item	Exclusive Breastfeeding (n = 109) Mean(SD)	Formula Feeding (n = 34) Mean(SD)	t-test	*p* value
13. MR13	4.80(.427)	4.82(.459)	-.319	.751
14. MR14	4.75(.492)	4.71(.579)	.483	.630
15. MR15	4.13(.987)	4.15(1.132)	-.099	.922
16. MR16	4.82(.410)	4.74(.448)	1.00	.316
17. MR17	4.75(.434)	4.76(.435)	-.061	.951
18. MR18	4.80(.403)	4.82(.387)	-.323	.747
19. MR19	4.65(.551)	4.74(.511)	-.789	.432
20. MR20	4.64(.646)	4.71(.579)	-.514	.608
21. MR21	4.85(.354)	4.91(.292)	-.806	.422
22. MR22	4.15(.921)	4.12(1.066)	.197	.844

Note. All *p* values non-significant.

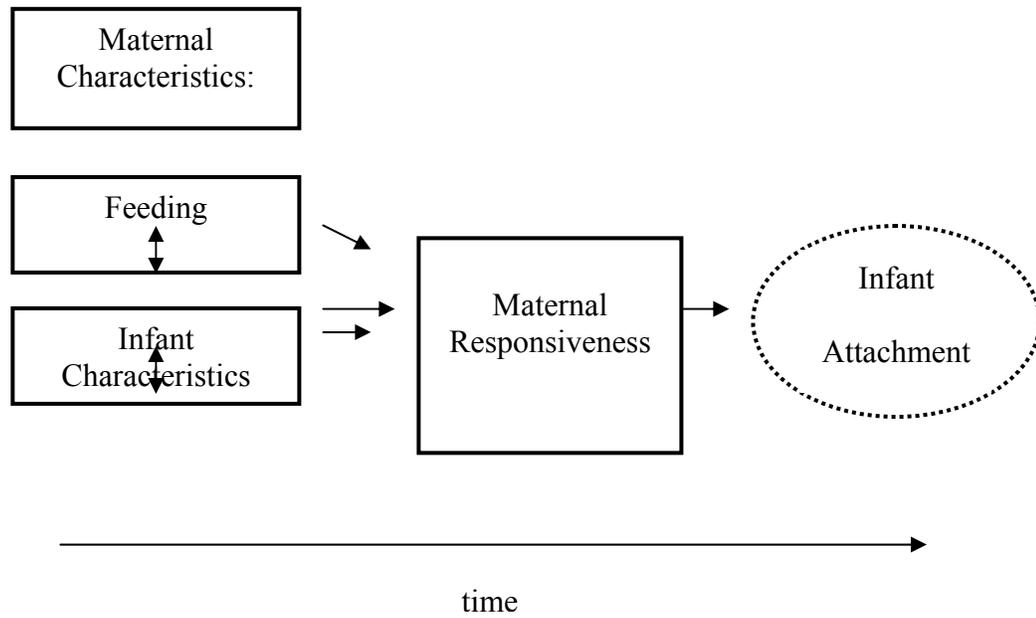Figure 1. Conceptual Theoretical Framework for this Study.

Figure1. Conceptual Theoretical Framework for this Study.

VITA

Emily Drake was born November 21, 1962 in Washington, D.C. She is a citizen of the United States of America. She graduated from Woodlawn High School, Arlington, Virginia in 1980. She earned her Bachelor of Science in Nursing from the University of Virginia, Charlottesville, Virginia in May 1985. In 1985, she joined the nursing staff in the Obstetrics Department at the University of Virginia Medical Center. She earned her Masters of Science in Nursing from the University of Virginia in August 1993. In 1994 she joined the faculty of the University of Virginia School of Nursing. She is currently an Assistant Professor with teaching responsibilities in undergraduate maternal-child health nursing and information technology. Ms. Drake is a member of the Association of Women's Health, Obstetric and Neonatal Nurses and Sigma Theta Tau International. She currently resides in Palmyra, Virginia.