PARENTAL DEMOGRAPHIC AND PSYCHOSOCIAL FACTORS, NEONATAL BEHAVIORS, AND INFANT TEMPERAMENT AS CORRELATES OF INFANTILE COLIC

By

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by

Marilyn Wiegand McAuliffe

This work is dedicated to

my parents, Ligia and Joseph,
who provided me with the
opportunity and support;

my husband, John,
who provided me with the
impetus and desire;

my son, Christopher,
who provided me with the
inspiration and motivation;

and

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who provided me with the
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with my love and gratitude.

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Infantile colic is a behavioral phenomenon of unknown origin, occurring during the first 3 months of life, characterized by fussing, crying, or screaming for which there is no uniformly successful method of therapy. This study investigated the relationship between colic and several demographic variables, parents' prenatal and postpartum state and trait anxiety, mother's fatigue and support, neonatal irritability, and later temperament. A sample of 163 couples, recruited from prepared childbirth classes, completed a battery of questionnaires during the 3rd trimester of pregnancy and the 1st, 6th, 12th, and 32nd postpartum weeks.

Colic was not found to be significantly related to birth order, feeding method, race, parents' ages, infant's gender, mother's drug use in labor and delivery, father's work hours, birthweight, gestational age, infant allergy, or family history of allergy. Although most infants demonstrated increased crying, mostly during the evening hours, from 2 to 12 weeks of age, the variability of these age parameters was

less for more colicky infants, whose crying invaded any hour of the day. A differentiation, therefore, should be made between colic and the developmental phase, characterized by increased crying, that most infants are thought to experience.

Correlations between temperamental characteristics and colic indicated that more colicky infants were less rhythmic, less distractible, more variable in mood, had shorter durations of orienting, and greater frustration to limitations at 3 months of age than less colicky infants. The relationship between colic and mood and frustration to limitations remained significant at 8 months of age.

The best regression model for predicting colic demonstrated a weak but significant positive relationship between colic and father's education, mother's first postpartum week fatigue, and neonatal irritability. Although several factors related to colic were identified, the small amount of variance explained in colic scores suggests that the most crucial variables have yet to be recognized. Or, perhaps, more valid measures of these suggested associated factors, or of colic itself, could result in a better understanding of this pediatric problem. The variables identified by this research should, therefore, not be dismissed as insignificant, but considered in terms of why they bear any relationship to colic at all.

CHAPTER I
INTRODUCTION

Background of the Problem

Parental complaints of unsoothable crying in their young infants are not uncommon to the pediatrician. After ruling out medical problems as the cause of crying, the physician frequently affixes the label "colicky" to the wailing infant and reassures the parents that the condition is self-limiting and will be outgrown by 3 or 4 months of age. Such reassurance may be of some value in calming the fears of the parents, but it does little to reduce the tension aroused by persistent and unsoothable infant crying.

There is little consensus regarding the definition, treatment, and etiology of infantile colic. Colic is more of a symptom than it is a disease in that one can easily describe the classic profile of the colicky baby, but the cause of the symptoms has not been determined. This lack of knowledge has resulted in a conglomeration of descriptions of characteristics of the colicky baby rather than a single, agreed-upon, definition. Taylor's (1957) description of a colicky baby is similar to most others found in the literature.

> Infantile colic is a symptom complex characterized by recurrent attacks of crying or screaming, occurring in infants under the age of three months, in whom there is no obvious cause for these attacks, such as improper feeding or gross physical defects. The crying is characteristically worse in the evening, but in some cases may occur at any time of the day or night.

> The crying is usually rhythmic in nature, recurring every 5 to 10 minutes, but it may be continuous over a period of a few hours. During severe attacks the infant draws his knees up, tenses his whole body, sweats profusely, and appears to be in pain. There are gradations in the severity of the condition from the "fussy" baby to the infant who drives his parents to distraction. The symptoms usually disappear by the age of three months, and for this reason the condition has sometimes been referred to as "three-month colic." (p. 458)

In attempts to adhere to stringent criteria of colic, many researchers (Carey, 1968; Cobb, 1956; Licamele, Palumbo, Quinn, & Zuckerman, n.d.) have defined the colicky baby as "one who, otherwise healthy and well fed, [had] paroxysms of irritability, fussing or crying lasting for a total of more than three hours a day and occurring on more than three days in any one week" (Wessel, Cobb, Jackson, Harris, & Detwiler, 1954, pp. 425-426). Other researchers (Paradise, 1966; Stewart, Weiland, Leider, Mangham, Holmes, & Ripley, 1954) have preferred to view colic on a continuum from none to severe with infants displaying varying degrees of soothability. Regardless of the exact definition employed, the one aspect of colic that is uniformly agreed upon is that it involves infant crying for which no immediate explanation or means of relief can be found.

Statement of the Problem

Numerous theories exist that attempt to identify the etiology of infantile colic. Allergy, gastro-intestinal disturbances, infant temperament, and maternal anxiety are only a few of the suggested causes. Although time has seen many theories fall in and out of favor, one theory that continues to appear in the literature implicates maternal anxiety and family tension as causes or contributing factors in the etiology of colic. Several authors (Brazelton, 1962; Carey,

1968; Cobb, 1956; Wessel et al., 1954) have suggested that the salience of environmental tension may be influenced by constitutional or temperamental characteristics of the infant.

One explanation for the confusion surrounding the causes of colic has been the inadequacy of the measures that have been used to identify potential etiological factors. The problems to be addressed by the present study are, therefore, both methodological and theoretical.

Methodological Problems

Much of the research investigating the role of maternal anxiety in infantile colic has been plagued with methodological problems. In addition to the procedural shortcomings of retrospective evaluation of anxiety and colic, there has been a lack of valid, reliable, and objective instrumentation for measuring both variables. Many authors (Bonar, 1935; Breslow, 1956; Brody, 1979; Meyer, 1958; Stewart et al., 1954; Taylor, 1957) have concluded that postnatal maternal emotions are important, but the assessment of these emotions has frequently been based on subjective clinical impression or crudely constructed instruments lacking evidence of reliability or validity.

A major procedural limitation of several studies (Breslow, 1956; Stewart et al., 1954; Taylor, 1957; Wessel et al., 1954) relating postnatal maternal anxiety to infantile colic has been the timing of data collection. These researchers obtained measures of anxiety after the onset of colic. It is not surprising to find elevated anxiety scores for mothers living with colicky babies. It would be more informative to correlate colic with anxiety scores obtained prior to the onset of colic. Paradise (1966) suggested that future research should

investigate maternal emotional factors early in pregnancy "or, preferably, before conception" (p. 130). A few researchers (Lakin, 1957; Paradise, 1966) have collected prenatal anxiety data immediately after birth; however, these studies have been retrospective in that mothers were asked to report on the anxiety they experienced during pregnancy. It is questionable whether one can adequately recall the level of anxiety experienced at an earlier point in time, especially if the anxiety was not severe.

Researchers focusing on prenatal maternal anxiety have usually offered a more organized assessment of anxiety. However, many of these studies have failed to deal with the suggestion that anxiety can be conceptualized as both a trait and a state (Spielberger, Gorsuch, & Lushene, 1970) and that the less stable state anxiety might be the more appropriate variable in a study focusing on anxiety in pregnancy (Beck, Siegel, Davidson, Kormeier, Breitenstein, & Hall, 1980). State anxiety would also be a more sensitive indicator of maternal emotional fluctuations through the early postpartum months when colic has been found to occur.

Many studies of maternal psychological factors during pregnancy and the early postpartum period have been univariate in nature focusing on the single variable of anxiety. Some researchers (Carey, 1968; Pleshette, Asch, & Chase, 1956) have suggested that the support received by the pregnant woman and new mother is among the best predictors of maternal anxiety during pregnancy and the postpartum period. Because anxiety is a global construct, it provides little information as to its source. It should be profitable to examine anxiety in conjunction with more specific and informative measures of maternal psychosocial experiences.

Methodological deficiencies have not been restricted to the measurement of maternal anxiety. The diagnosis of colic has usually been made by clinical impression. While such impressions may be adequate for the purposes of the pediatrician, they pose difficulties for the researcher interested in quantitative and qualitative analysis of colic. An instrument capable of placing infants on a continuum of "colic-soothability," as well as identifying qualitative differences in colicky behaviors, would be valuable in the investigation of individual differences in soothability of young infants.

Theoretical Problems

One hypothesized etiological factor in infantile colic that has received attention in the literature has been maternal anxiety. Colicky infants are thought to be healthy babies who develop into normal, healthy children. Meyer (1958) explained that "until adequate controls can determine a pathological condition of the anatomy or a physiological dysfunction in these infants, it is justifiable for us to assume they are physically normal" (p. 629). Because it has been difficult to attribute the symptoms of colic to any type of physical problem, many researchers have looked to environmental factors to explain colic. These researchers would agree with Levine's (1956) statement that colic "originates in emotional rather than physiological factors" (p. 837). Bakwin (1956) and Stewart et al. (1954) proposed that maternal anxiety leads to inconsistent handling of the baby such that the baby is frequently and alternately exposed to understimulation and overstimulation. This inappropriate caregiving results in excessive infant crying. Authors who have concurred with this line of

thought have cited the results of studies suggesting an absence of colic in hospital dispensaries and institutions (Meyer, 1958; Levin, 1950; Spitz, 1951) to support their reasoning.

Other authors (Carey, 1968; Meyer, 1958; Wessel et al., 1954) have suggested that colic is related to constitutional or temperamental factors in the baby. Meyer (1958) stated that colicky babies "deviate from expected or conventional behavior because they vary (as do adults) in temperament, reaction to sensory stimuli, and in motor skills" (p. 629). From this perspective, if postnatal maternal anxiety plays a role in the etiology of colic, it is likely to be a secondary one. Colicky babies are believed to have a low threshold for sensory stimulation (Benjamin, 1961; Carey, 1972; Korner, 1971; Levine, 1956; Meyer, 1958) and, therefore, would be highly responsive to environmental tension. Postnatal anxiety, therefore, could tend to intensify, but not cause, colicky behavior. To date, no study has examined the interacting effects of environmental tension and temperament on infantile colic.

Most of the earlier studies focused on postnatal maternal anxiety, but a few researchers (Lakin, 1957; Paradise, 1966) have found a relationship between prenatal maternal anxiety and infantile colic. However, these results must be interpreted with caution in that sample sizes were small and methodology was of questionable validity.

Although the results of the above-mentioned studies must be considered tentative, animal studies (Thompson, Watson, & Charlesworth, 1962; Ottinger, Denenberg, & Stephens, 1963) have demonstrated a relationship between prenatal maternal anxiety and emotionality and behavior of animal offspring. Prenatal anxiety has also been related

to pregnancy, labor, and delivery complications in humans (see McDonald, 1968). Several studies (Chisholm, Woodson, & Da Costa Woodson, 1978; Farber, Vaughn, & Egeland, 1981; Korner, Gabby, & Kraemer, 1980; Ottinger & Simmons, 1964; Sontag, 1944; Woodson, Blurton Jones, Da Costa Woodson, Pollock, & Evans, 1979) have carried the investigation beyond the pregnancy and birth experiences to the physical status of the neonate. A few studies have examined the effects of anxiety on infant behavior.

Although Lakin and Paradise were the only researchers to associate prenatal anxiety with the specific infant behaviors involved in infantile colic, other researchers (Ottinger & Simmons, 1964) have found a relationship between prenatal maternal anxiety and the crying behavior of the neonate. More recently, Farber et al. (1981) found prenatal maternal anxiety to be related to neonatal behaviors, including infant irritability, and mother-infant interaction. Other researchers (Chisholm et al., 1978; Korner et al., 1980; Woodson et al., 1979) have found a relationship between physiological measures of maternal stress and neonatal irritability. Chisholm et al. (1978) reported a significant correlation of .71 between blood pressure during the second trimester of pregnancy and neonatal irritability.

The fact that studies have found relationships between prenatal maternal anxiety or blood pressure and neonatal irritability lends credibility to Sontag, Steele, and Lewis's (1969) statement:

> Although emotional stages in postnatal life are recognized as affecting physiological-endocrinological states, as for example the effects of anxiety on the thyroid function and blood sugar levels, there has been in the past little general recognition of the fact that such psychosomatic relationships and others might,

> through placental interchange, constitute powerful changes in fetal physiology . . . and perhaps behavior. (p. 1)

Thus far, most of the "behavior" being investigated has been limited to irritability of the newborn. It is reasonable to question whether the same factors that are operating in neonatal irritability are also operating in infantile colic.

In addition to maternal psychological variables, it also seems to be valuable to examine paternal anxiety, as the father, as well as the mother, may be contributing to the environmental tension so many authors believe contributes to the emergence of infantile colic. Whereas an extensive literature exists on the psychological and emotional impact of pregnancy and parenthood on the mother, similar research and discussion focusing on the father is just beginning to be undertaken. Several authors have discussed and investigated the stress and anxiety that appear to be associated with impending and new fatherhood (Bernstein & Cyr, 1957; Fein, 1976; Hobbs, 1963, 1966; Lacoursiere, 1972; Schaefer, 1965). The transition to parenthood, after all, is a period of disequilibrium and reorganization for mothers and fathers alike (Hrobsky, 1977; Rossi, 1968; Zilborg, 1931).

Purposes of the Study

The purposes of the present study were
(1) to construct an instrument for the measurement of colicky behavior; (2) to investigate the relationship between multiple measures of parental psychosocial factors during the third trimester of pregnancy and early postpartum period and the occurrence of infantile colic;

(3) to investigate whether neonatal irritability during the first few days of life was related to the emergence of infantile colic in the next few months of life; and

(4) to investigate the relationship between infantile colic and infant temperament.

Definition of Terms

Anxiety was operationally defined by Spielberger, Gorsuch, and Lushene's (1970) State-Trait Anxiety Inventory.

> State anxiety (A-State) is conceptualized as a transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity. A-States may vary in intensity and fluctuate over time. Trait anxiety (A-Trait) refers to relatively stable individual differences between people in the tendency to respond to situations perceived as threatening with elevations in A-State intensity. (p. 3)

Infantile Colic was defined as a symptom-complex characterized by various durations, intensities, and frequencies of infant crying, frequently occurring in the late afternoon and evening, accompanied by indications of physical discomfort, beginning approximately 2 weeks after the expected date of birth, lasting approximately 3 months, for which no immediate explanation can be found.

Multipara was defined as a woman who has given birth two or more times.

Normotensive was defined as a measure of blood pressure that is within normal ranges.

Primipara was defined as a woman who has given birth for the first time.

Soothability was defined by the following infant behavior: "Whenever the baby cries, an explanation can easily be found. When the cause of

crying is attended to, the baby stops crying" within minutes (Anderson, 1980, adapted from Paradise, 1966).

Temperament was defined as behavioral style or the "how" of behavior rather than the content or motivations of behavior. Temperament was operationally defined by Carey and McDevitt's (1978) Infant Temperament Questionnaire (ITQ), the Infant Characteristics Questionnaire (ICQ) of Bates et al. (1979), and Rothbart's (1981) Infant Behavior Questionnaire (IBQ). Temperament for the ITQ was operationalized by Thomas and Chess's (1977) nine temperamental dimensions of activity, rhythmicity, approach or withdrawal, adaptability, threshold of responsiveness, energy level of response, mood, distractibility, and persistence. Also based on Thomas and Chess's categories, the ICQ of Bates et al. (1979) defines temperament in terms of the four factors of fussy-difficult, unadaptable, dull, and unpredictable. Rothbart's IBQ measures Thomas and Chess's nine categories as well as the child's reactivity and self-regulation through the scales of activity level, smiling and laughter, fear, distress to limitations, soothability, and duration of orienting.

Trimester was defined as one-third of the pregnancy period.

Significance of the Study

The significance of the present study can be viewed from a methodological, theoretical, and practical perspective. Several authors have related maternal anxiety to infantile colic; however, their results have been of questionable value because of the methodological limitations inherent in their studies. The present study attempted to circumvent these difficulties by using valid and reliable

measures of anxiety and colic and collecting anxiety data prior to the onset of colic.

Colic is a catchall term that has been used to describe a condition in early infancy which is characterized by unexplainable, unsoothable, excessive crying. The Colic and Soothability Scale (CASS), developed by the investigator, gives both a quantitative and a qualitative description of colicky behavior. In addition to a total colic score, the CASS yields seven category scores reflecting soothability, periodicity of crying, frequency of crying, duration of crying, intensity of crying, physical symptoms, and feeding behavior. Perhaps, colicky babies can be better classified according to feeding behavior, periodicity of crying, or exhibition of physical symptoms of discomfort. The CASS could also be a practical contribution in that pediatricians must rely on the often ambiguous descriptions and interpretations of infant crying given by parents. Use of a colic scale, such as the one developed for this study, might aid pediatricians and parents alike in clarifying the specific behaviors exhibited by the infant.

In addition to the methodological improvements offered by the present study, the investigation of the relationships between anxiety, temperament, and colic should prove to be of theoretical value. For years, both clinicians and researchers have advanced theories as to the cause of colic. One of the most popular etiological factors has been environmental tension, such as maternal anxiety. While clearly focusing on the psychological experiences of the mother, the present study also investigated fluctuations in paternal anxiety and its relationship to infant behavior.

Some authors (Brazelton, 1962; Carey, 1968; Cobb, 1956; Wessel et al., 1954) have hypothesized that colicky babies may somehow be temperamentally different. In fact, data from some studies suggest that colicky babies may have low thresholds for sensory stimulation and be, therefore, more sensitive to environmental tensions. No study, however, has looked at the interacting influence of environmental tension and temperament on infantile colic. The present study investigated this question. While Carey (1968) found sensory threshold to be a dimension of temperament relevant to the colicky infant, other dimensions, such as Rothbart's "distress to limitations," may be equally or more relevant. The use of multiple questionnaires, assessing a variety of temperamental dimensions, should permit a more encompassing investigation of temperamental differences in colicky babies.

A final contribution of the present study is a practical one. Because environmental tension and maternal anxiety have so frequently been associated with infantile colic, many parents tend to feel responsible for the seeming discomfort and unhappiness of their colicky infants. Feelings of responsibility and guilt may tend to perpetuate the vicious cycle of infant crying and parental anxiety (Brazelton, 1962). If colicky infants are found to be temperamentally different from other infants, some of the guilt and concern that parents of colicky infants have often experienced can be replaced with a greater understanding of the individuality of their infants.

While blame and guilt may be more common reactions to colic, parents may also react with anger and resentment toward their crying infant. It has been suggested that such emotions, when not dealt with properly, can lead to child abuse (Menaheim, 1979). Menaheim (1979)

described a case where a 2-month-old infant was treated for a subdural haematoma, bruises, fractures, and retinal haemorrhages. The infant had been brought, by the mother, complaining of unsoothable, irritable crying in her infant to many doctors in the previous weeks. The infant was diagnosed as having "colic." The only treatment given consisted of advice concerning feeding. The mother was left frustrated and unable to cope. Such a description is not meant to suggest that colic usually, or even often, leads to abuse. Its inclusion is meant only to illustrate the potential tragedy that can result from unsoothable, unexplained infant crying and to draw attention to the need to study the condition of the crying baby rather than to automatically apply the diagnosis of "colic."

Investigations into temperamental characteristics of colicky babies could be informative and helpful in terms of management of colic symptoms. If colicky babies do have lower thresholds for sensory stimuli, parents should be aware of this and educated as to how they can reduce infant tension aroused by an overstimulating internal and external environment. While knowledge of temperamental differences may be helpful in the management of colic, it is likely that the main value of such knowledge will simply be a better understanding of this common and worrisome infant condition. Such a contribution, however, should not be underestimated in its ability to relieve some of the tension that unsoothable, unexplainable infant crying often creates. In conclusion,

> The prevalence of colic, and the distress that it can cause to infants and parents, should be a sufficient stimulus to promote further investigation into the etiology and treatment of this pediatric problem. (Taylor, 1957, p. 461)

Summary

Infantile colic is a poorly defined condition usually occurring during the first 3 months of life and involving infant crying for which there is no known therapy which is uniformly helpful. Allergy, gastrointestinal upset, maternal anxiety, and infant temperament are only a few of the suggested etiologies for the onset of colic. Unfortunately, while the literature is replete with articles presenting the clinical opinions of pediatricians, little research addressing these etiologies has been undertaken.

The present study addressed the relationship between colic and several parent variables, primarily anxiety, and the infant variables of neonatal irritability and infant temperament. The problems that were addressed were both methodological and theoretical. Although research pertaining to infantile colic is sparse, that which has been done has often been ridden with methodological inadequacies. These inadequacies are most apparent in studies of the relationship between maternal anxiety and colic. The assessment of maternal anxiety has frequently been subjective and has usually occurred after the onset of colic, when it is not surprising to find elevations in caregiver anxiety. In addition to the inadequacies of the timing of data collection, most researchers have focused on maternal trait anxiety, rather than the less stable state anxiety, which may be the more sensitive indicator of anxiety experienced during the time-limited conditions of pregnancy and colic. A final problem with the previous research is the almost exclusive use of the global construct of "anxiety" to describe the psychosocial and emotional experiences of the mother.

The investigation of more specific and informative measures of maternal prenatal and postnatal experiences should be valuable in providing a better understanding of specific sources of maternal anxiety.

Methodological inadequacies have not been confined to the measurement of anxiety. The diagnosis of colic has often been based on clinical opinion which varies among clinicians due to the lack of an accepted definition for this infant condition. An instrument designed to place infants on a continuum of "colic-soothability" would be useful in the investigation of individual differences in the soothability of infants.

While several authors have focused on the relationship between maternal anxiety and infantile colic, others have suggested that the salience of environmental tension may be influenced by temperamental characteristics of the infant. For example, infants with lower thresholds for sensory stimulation might be more susceptible to influences of external tension. No study has investigated the interacting effects of maternal anxiety and infant temperament. In addition, researchers have generally focused on only one dimension of the problem. Attention has usually been given to the relationship between infant colic and either maternal emotional factors, infant physiological factors, or infant temperamental factors. Although colic is thought to have multiple etiologies, the interrelationships of several possible etiological factors have yet to be studied.

Most of the literature dealing with the relationship between prenatal anxiety and infant behavior focuses on the possible hormonal changes in the mother due to anxiety experienced during pregnancy and the transference of concomitant influences to the still developing

fetus. Several studies of prenatal maternal anxiety have examined subsequent infant irritability occurring during the first week of life. While a relationship between prenatal anxiety and neonatal irritability has been found by some researchers, the later irritability evidenced in colic has received less attention.

A final theoretical problem involved the exclusive attention given to maternal, as opposed to paternal, anxiety. The transition to parenthood is a stressful time for both mothers and fathers. If environmental tension is truly a factor in the etiology or perpetuation of infantile colic, the anxiety of the father, as well as the mother, should be a variable worthy of investigation.

The present study was designed to deal with the above-mentioned methodological and theoretical problems. The Colic and Soothability Scale (CASS) was constructed to measure colicky behavior. The relationships between colic and maternal and paternal, prenatal and postnatal, psychosocial factors, neonatal irritability and behavior, and infant temperament were then investigated. The significance of this study lies in the hope that it will add to the understanding of factors that are associated with the development of colic in infants.

CHAPTER II
REVIEW OF THE LITERATURE

Introduction

The review of the literature is divided into three parts. Part I deals with infantile colic, its definition, characteristics, suggested etiologies, and treatments. A review of studies investigating factors thought to be related to colic is also presented. Part II presents literature on prenatal anxiety and its relationship to selected maternal factors, obstetrical complications, childbirth abnormalities, blood pressure, and neonatal behavior. Included in this section is a review of animal studies designed to investigate the association between prenatal maternal anxiety and emotionality and behavior of animal offspring. Infant temperament and its relationships with infant behaviors are reviewed in Part III.

Part I: Infantile Colic

Background

One must have a concept of "normal" crying before the unique character of infantile colic can be fully appreciated. The crying of newly born babies serves as a survival mechanism. Crying expands the lungs at birth and improves pulmonary capacity during the first few days of life (Brazelton, 1962).

The signals and responses of infants and mothers are finely synchronized. The infant cry has been found to cause physiological changes in the mother. For example, the nursing mother's breasts fill with milk upon hearing an infant's cry (cited in Eiger & Olds, 1972). Through this primitive vocalization infants are usually able to ensure the proximity to caregivers that is so necessary for survival. "Normal" crying, therefore, serves a useful function.

Aldrich, Sung, and Knop conducted the first systematic study of crying in 1945. Their results, indicating that newborn babies cried more in the hospital than at home, led them to conclude that the individualized care from the mother was a definite comfort to the babies. Signals, such as crying, can obviously be responded to more rapidly and consistently when there is a one-to-one relationship between child and caregiver. Such a relationship rarely exists in a hospital nursery. The infant's cry is a signal of need and is a normal function of babies.

> However, when the cry is prolonged unduly or becomes the usual pattern of behavior, we feel the need to intervene and to ameliorate the situation. It should not be necessary for a baby to cry more than three minutes to indicate an ordinary need. (Aldrich et al., 1945, p. 428)

In his study of 80 mothers and their infants, Brazelton (1962) found that babies cried between 1-1/2 and 2-3/4 hours daily between the first and sixth weeks of life. He hypothesized that although this crying may be normal for infants in our culture, parents view any crying as representing failure. Their attempt to compensate for this supposed failure

> may create unnecessary stimuli for the newborn, and the resulting tension is added to his innate reasons for crying. An ever-increasing cycle in the duration of intensity of the crying may result in the picture of 24-hour "colic." (p. 579)

Definition of Colic

The literature presents definitions of colic that are numerous and varied. Several authors do not even define it. Definitions are usually similar, yet some revision, deletion, or addition has invariably been made.

In 1954, Illingworth reserved the term "three-month's colic" for

> a clinical entity in which the baby, in the first three months of life, has rhythmical screaming attacks in the evenings, which are not stopped when he is picked up, and for which there is no obvious explanation, such as hunger. (p. 174)

In the same year, Wessel et al. defined the colicky baby as one who

> otherwise healthy and well-fed, had paroxysms of irritability, fussing or crying lasting for a total of more than three hours a day and occurring on more than three days in any one week. (pp. 425-426)

This definition has been employed by many researchers (Carey, 1968; Cobb, 1956; Licamele et al., n.d.) who have desired a qualitative and quantitative definition of colic. Other researchers (Paradise, 1966; Stewart et al., 1954) have preferred to view colic on a continuum from none to severe with infants displaying varying degrees of soothability.

Some authors' views of the etiology of colic have influenced their definitions. Glaser (1956) retained much of Wessel et al.'s and Illingworth's definitions but added that the crying was due to abdominal pain. He also omitted Wessel et al.'s quantitative criteria for crying, as well as their emphasis on the evening as the time of day when colic occurs.

Licamele et al. (n.d.) recommended that a differentiation be made between a symptom of colic and the colic syndrome. An infant

who, infrequently, cries unsoothably or for unexplained reasons may be demonstrating symptoms of colic, but the term "colic syndrome" is reserved for infants whose behavior patterns constantly demonstrate colic symptoms. Extending Wessel et al.'s definition, Licamele et al. (n.d.) wrote

> This colic syndrome consists of paroxysms of irritability, fussing and crying lasting more than three hours a day and occurring on more than three days a week, frequently occurring in the evening, beginning two weeks past the EDC [expected date of delivery], lasting 3 months, in a well-fed, burped and changed infant without vomiting, diarrhea, constipation, rashes, rhinitis, wheezing or fever. (p. 11)

This comprehensive definition includes the main points of the most frequently cited definitions. In addition, it precludes the confusion between crying for unknown reasons and crying due to allergy and other reasons of organic origin. Regardless of the exact definition employed, the one aspect of colic that is uniformly agreed upon is that it involves infant crying for which there is no consistently workable solution.

Characteristics of Colic

Incidence. The reported incidence of colic is variable depending upon the particular sample of infants studied and the definition employed. Cobb (1956) found the incidence in his study to be 50%, whereas Levin (1950) found only .95% of infants in a New York Foundling Hospital to be colicky. Paradise (1966) found the incidence of colic to be 23% in his sample, which included all normal infants delivered at a large urban hospital over a 5-month period in 1951. In private practice, colic has been reported to occur in anywhere from 15%

(Breslow, 1957) to 40% (Taylor, 1957) of the cases. Rambar's (1956) suggestion that colic occurs more frequently in private groups than in clinic patients seems to be supported by findings that colic occurs more frequently, or is more often reported, among the children of highly educated and intelligent parents (Hide & Guyer, 1982; Paradise, 1966). Wessel et al. (1954), however, found no differences in educational backgrounds of mothers of fussy and contented babies. Meyer and Thaler (1971) found 11.6% of their sample of low birthweight infants became colicky between the 39th and 44th weeks of gestation. Licamele et al. (n.d.) have estimated the average incidence in the literature to be between 20% and 30%.

Onset and disappearance. Infantile colic has been most frequently described as beginning during the second or third week after birth and ceasing spontaneously around the third or fourth month of life, hence, the name "three-month colic." Although most authors have agreed with these dates for the onset and disappearance of colic, the onset in Illingworth's (1954) sample of colicky babies was between birth and 5 days of age in 15% of the cases. Brazelton (1962) found that colic began around the second week after birth. The intensity and duration of crying increased in severity until the sixth week when it reached a plateau before disappearing between the eighth and tenth weeks. Meyer and Thaler (1971) stated that colic usually begins between the 19th and 44th gestation week, whereas Pierce (1948), in his study of colic in premature babies, found that colic began 2 weeks after the expected date of birth regardless of the gestational age at birth.

There is much disagreement on the mechanism for the sudden onset and disappearance of colic at specific points in time. Those authors

who have viewed colic as an allergic manifestation have reasoned that it takes a few weeks for sensitization to take place, while the disappearance at 3 months is probably due to desensitization to foods or to loss of allergic reactivity of the gastrointestinal tract (Rambar, 1956). Those who have attributed colic to immaturity in the infant, whether it be immaturity of the digestive system or immaturity of the nervous system, have suggested that colic disappears by the third or fourth month by virtue of maturation (Illingworth, 1954; Paradise, 1966). Other authors' explanations have also been based on the premise that colic emerges from some form of immaturity in the infant. Benjamin (1961) stated that infants with low sensory thresholds are prone to colic "during the third or fourth weeks when babies go through a maturational spurt in sensory capacities but have not yet developed an adequate stimulus barrier" (p. 616). Craven (1979) suggested that colic stops at 3 months because at this age babies have developed forms of communication other than just crying. Brazelton (1962) found that as crying decreased other activities such as sucking, cooing, and turning over increased. Meyer (1958) felt that the advance in motor development reduced the frustration by providing infants with other outlets for their motor drives. Wolff (1969) found that the mother's face began to exert a calming influence over the infant by the fifth or sixth month which could explain the cessation of excessive crying. Explanations for the onset and disappearance of colic at a specific time in an infant's life have been absent from many of the other theories and studies pertaining to colic.

Feeding method. Method of feeding has been investigated in relation to the colic syndrome. Meyer (1958) reported that colic was seldom found among breast-fed infants, and Paradise (1966) found that

there was a lower, but nonsignificant, incidence of colic among infants maintained on breast feedings. In contrast, Illingworth (1954) found slightly more infants in the colic group than in the noncolic group to be breast-fed but considered this difference to be trivial. On the basis of these empirical findings, it would seem that method of feeding is not a factor in the emergence of colic.

Birth order. It has often been assumed that colic occurs more frequently among first-born children due to the inexperience of the new parents. Some authors (Bakwin, 1956; Bruce, 1961; Rambar, 1956; Spock, 1944) have written that colic is more common among first children; however, they produced no evidence for this conclusion. The results of more systematic investigations have demonstrated no significant differences in the occurrence of colic due to birth order (Illingworth, 1954; Meyer & Thaler, 1971; Paradise, 1966; Taylor, 1957).

Periodicity. The periodicity of colic has baffled many researchers. Although colic may occur at any time of the day or night, it tends to occur during the late afternoon and evening hours. Explanations for this phenomenon have ranged from suggestions that the mother's breast milk is low at the end of the day to the theory that family tensions are highest at the end of the day resulting in increased crying. Neither suggestion, however, explains all of the symptoms and characteristics of the colic syndrome. Those researchers suggesting etiologies of colic other than hunger or family tension have been unable to explain the predominant occurrence of colic in the evenings.

Other characteristics. On the basis of clinical observations of patients, Holmes (1969) viewed infantile colic as being characterized by excess motor activity, frequent hard crying, much flatus, an apparent desire

to eat more often and to take more at a feeding, above-average weight gain and growth in length, and continued overactivity and precocity in motor and mental development. Other pediatricians have concurred with these observations, but they have offered no empirical support for their beliefs. Colicky babies have been found to be above average in weight gain (Holmes, 1969; Illingworth, 1954; Taylor, 1957), although Paradise (1966) did not find this difference to be significant. Brazelton (1962) and Levine (1956) found that colicky infants demonstrated excessive motor activity, and other authors (Meyer, 1958; Holmes, 1969) have claimed that the colicky infant demonstrates exceptional activity in utero and precocity in motor and mental development after colic ends.

Future development. Although few valid data have been collected, via longitudinal studies, on the emotional and behavioral development of colicky babies, some authors have offered prognoses. McGee (1950) described the child who was a colicky infant as being a problem in school, "as he has difficulty keeping quiet and paying attention. He often molests other children" (p. 337). No evidence has been offered in support of this prognosis.

Other authors, offering brighter futures for colicky infants, have also been unable to provide evidence to support their claims. Meyer (1958) stated that "the child's future is secure and that the very symptoms which presently are disturbing will be virtues when [the child] has grown more mature" (p. 630). Holmes (1969) wrote that the once-colicky baby is active, restless, and talkative throughout childhood. He even ventured to make predictions for his later life:

> As an adult in sports, business and civic affairs, he is likely to be an energetic, enthusiastic participant rather than a spectator and, in turn, he will have colicky babies of his own when he becomes a father. (p. 568)

Research is needed to shed light on the future of the colicky baby.

Suggested Etiologies of Colic

The absence of a single agreed-upon definition for colic is easily understood when one examines the numerous and varied factors considered to be of etiological importance. Most authors have attributed colic to multiple causes with one or two being of major importance.

Factors considered to be etiologically important have included feeding problems (Craven, 1979, McGee, 1950), allergy (Breslow, 1956; Fries, 1956; Martin, 1956; McGee, 1950; Rambar, 1956; Speer, 1958; White, 1929), cow's milk intolerance (Harris, Petts, & Penny, 1977; Jakobsson & Lindberg, 1978, 1983; Lothe, Lindberg, & Jakobsson, 1982), immaturity of the intestinal tract causing excessive flatus (Stewart et al., 1954), spasms or kinks of the colon producing localized obstruction (Illingworth, 1954), immaturity of the central nervous system (Lipton, Steinschneider, & Richmond, 1960; Paradise, 1966; Spock, 1944), discharge of pent-up energy (Brazelton, 1962), constitutional hypertonicity (Meyer, 1958), unsatisfied need for oral gratification (Anderson, 1983; Levine & Bell, 1950), progesterone deficiency (Clark, Gains, & Bradford, 1963), soft tissue swelling around growing bones (Ditkowsky, 1970), infant fatigue (Stewart et al., 1954), frustration due to immaturity of motor skills (Meyer, 1958), low threshold for sensory stimuli (Benjamin, 1961; Carey, 1968; Korner, 1971; Meyer, 1958), inheritance of an overactive nervous system from one or

both parents (Holmes, 1969), and emotional factors, such as family tension and maternal anxiety transmitted either prenatally or postnatally (Bakwin, 1956; Bonar, 1935; Brazelton, 1962; Breslow, 1956; Brody, 1979; Carey, 1968; Cobb, 1956; Harley, 1969; Levine, 1956; Meyer, 1958; Rambar, 1956; Taylor, 1957; Weiland, Leider, & Mangham, 1957; Wessel et al., 1954). In summary, the most popular suggested etiologies of colic have related colic to allergy or cow's milk intolerance, immaturity of the gastrointestinal tract, central nervous system immaturity, or environmental tensions such as maternal anxiety.

In his extensive review of the literature, Illingworth (1954) cited a list of less popular causes for colic. Included in this list were

> congenital malformations of the alimentary tract, inguinal hernia, urethral colic, appendicitis, foreign bodies in the alimentary tract, lead poisoning, anal fissure, imperforate anus, peptic ulcer, disease of the gall bladder, respiratory tract or osseous system, congenital syphilis, volvulus, intussusception, renal colic, nasopharyngitis, otitis, pyelitis, tension developed IN UTERO from a hypothetical uterine handicap or transmitted from a high strung mother's nervous system, hyperacidity, exposure to cold, chilling of the extremeties, abdominal binders, toxins from the mother, tension due to lack of oral satisfaction, acidosis, introversion and accumulation of uric acid in the kidneys. (p. 167)

Such a list suggests that one must be extremely careful to differentiate between excessive unsoothable crying due to medical problems and truly unexplained colic.

Management of Colic

Specific treatments suggested for the management of colic reflect the author's views concerning the etiology of the condition. The

literature presents a variety of treatments, most of which can be grouped into three major categories: dietary therapy, pharmacological therapy, and psychological therapy. Dietary treatments have included elimination of cow's milk products from the diets of nursing mothers (Jakobsson & Lindberg, 1983; Lothe et al., 1982), changing formulas or feeding techniques (Jakobsson & Lindberg, 1978; McGee, 1950; Stewart et al., 1954; White, 1936), and introducing thickened cereal feedings (White, 1929). Pharmacological therapy has included enemas and suppositories (Holmes, 1969), antispasmodics and sedatives for the infant (Carey, 1968; Harley, 1969; Holmes, 1969; Illingworth, 1966; Taylor, 1957; White, 1929, 1979), oral progesterone homones (Clark et al., 1963), and whiskey (McGee, 1950). Although there is little evidence that pharmacological agents are effective in treating colic (O'Donovan & Bradstock, 1979), this form of therapy is still widely used among medical practitioners. Researchers and authors who have thought that colic is related to environmental tension and psychological variables in the external environment have encouraged the application of treatments including sedatives for the parents (Bakwin, 1956; Harley, 1969), education and reassurance for the parents, and treatment of anxieties (Brazelton, 1962; Carey, 1968; Harley; 1969, Holmes, 1969; Rambar, 1956; Taylor, 1957), and providing a calm, quiet environment (Neff, 1940). Additional therapies have included pacifiers (Anderson, 1983; Levine & Bell, 1950; Meyer, 1958; Spitz, 1951), placing the baby in a prone or semi-inclined position (Holmes, 1969; Snow, 1937), and application of heat or pressure to the abdomen (Holmes, 1969; Meyer, 1958; Wessel et al., 1954). Paradise (1966), believing central nervous system immaturity to be a central cause of

colic, suggested that a colicky baby can be soothed by sounds and vibrations which act to interrupt certain afferent proprioceptive stimuli. Even folk wisdom has its set of soothing techniques for the colicky infant, including taking the infant for car rides on bumpy roads and administering colic water, a mixture of water, sugar, and alcohol. The reader is referred to Asnes and Mones's (1982) and Illingworth's (1954) extensive reviews of the literature for more thorough reviews of the etiology and treatment of colic.

Although many techniques have been offered for the management of colic, none has been found to give complete or consistent relief. Meyer's (1958) comment, that the lack of facts concerning the etiology of colic is reflected in the absence of a valued therapeutic approach, could still be made today.

Colic Research

Perusal of the literature indicates that much of what has been written about infantile colic has been inspired by clinical experience rather than systematic research. Subjective impression and opinion concerning aspects of colic abound. Much of the research that has been undertaken has focused on the relationship between colic and cow's milk allergy, immaturity of the gastrointestinal tract, maternal anxiety, and infant temperament. A review of this research is presented below.

Cow's milk allergy. There is no doubt that allergy is responsible for colic symptoms in some babies. The number of cases to which this etiology can be applied, however, is debtable.

Intolerance of some infants to milk-based formulas has been recognized for years (Breslow, 1956; Harris et al., 1977; Lothe et al., 1982; White, 1929). In a double-blind study of the role of cow's milk in infantile colic in formula-fed infants, Lothe et al. (1982) found colic to be cow's-milk-dependent in approximately two-thirds of the infants fed cow's milk formula. This research, however, has been criticized by LeBlanc (1983) who claimed that the researchers failed to subject their data to appropriate tests for statistical significance and that the number of infants helped by switching formulas was actually much lower than that suggested. Lothe et al. responded to this criticism by agreeing that future studies should not use soy formula as a placebo because soy, like milk, has been shown to be an allergen for many infants.

Breast-fed infants may not be escaping the allergic problem of bottle-fed infants, as cow's milk proteins have been found in human breast milk (see Asnes & Mones, 1982). Some researchers (Jakobsson & Lindberg, 1978, 1983) have suggested that cow's milk products ingested by the lactating mothers of colicky infants could be responsible for colic symptoms in their infants. In a double-blind crossover study involving 66 mothers of breast-fed infants with colic, Jakobsson and Lindberg (1983) found infantile colic to be related to cow's milk consumption by the mother in one-third of infants. They suggested a diet free of cow's milk products as a first trial in the treatment of colic in breast-fed infants.

In another double-blind crossover study with 20 breast-fed infants with colic, Evans, Allardyce, and Fergusson (1981) were unable to uncover a relationship between colic and maternal ingestion of cow's

milk or presence of cow's milk antigens in breast milk. The relationship between colic in breast-fed infants and the ingestion of milk products by lactating mothers demands further investigation.

Gas and intestinal dysfunction. Because colicky babies frequently appear to have abdominal pain, intestinal gas and immaturity of the intestinal tract have been popular explanations for the colic syndrome. Many authors (Harley, 1969; Meyer, 1958; Illingworth, 1954), however, have rejected excess flatus as an etiological factor, as x-ray studies have usually failed to indicate excess gas in the intestines of colicky babies.

In Illingworth's (1954) x-ray study, neither of the two colicky babies showed a large amount of gas in the intestine during a colic attack, but all three controls did. The small sample size, however, makes these results tentative. Stewart et al. (1954) identified excessive gas in the gastrointestinal tracts of excessively crying babies; however, these results are not as informative as Illingworth's in that the authors did not indicate whether the infants were symptomatic at the time of the study.

Harley (1969) stated that "routine x-rays of infants frequently reveal marked gastric distention without indications of discomfort" (p. 139). Through use of x-rays, Harley found a normal amount of gas in the abdomens of crying babies. A second film, taken moments after the crying episode had ended, showed an excess of gas in the abdomen, yet the infant fell into a comfortable sleep. As a result of such comparisons, Harley concluded that "the distention is obviously the result of rather than the cause of crying" (p. 139).

Lack of a clear relationship between gas pain and colic does not preclude an association between colic and some type of immaturity of the gastrointestinal tract. Although Illingworth (1954) was unable to demonstrate excess gas in the intestines of colicky babies, he still felt that colic could result from spasms or kinks of the colon producing localized obstruction. Brennemann (1940) also suggested that the seeming intestinal discomfort of colicky babies resulted, not from excess flatus, but from ineffective intestinal peristalsis.

In a more recent study (Clark et al., 1963), significant amounts of pregnanediol monoglucurnide, a metabolite of progesterone, were found in the urine of noncolicky infants, but only trace amounts were found in the urine of eight colicky infants. When the colicky infants were given oral progesterone, they experienced a remission of colic symptoms. Clark et al. concluded that colic could be a manifestation of a transient progesterone deficiency state. They postulated that progesterone withdrawal causes uterine contractions in the pregnant woman and, therefore, colicky infants could be experiencing intestinal spasms as a result of progesterone deficiency. While the results of this study seem important, no other research has been undertaken to pursue investigation of this hypothesis.

Postpartum maternal anxiety. Although most authors and researchers have agreed that colic most likely stems from multiple causes, the emphasis on emotional factors in one or both parents has been made in almost every organized study of its occurrence (Brazelton, 1962; Breslow, 1956; Carey, 1968; Stewart et al., 1954; Taylor, 1957; Wessel et al., 1954).

Stewart et al. (1954) studied the interaction between parents and infants and concluded that colic resulted from unsatisfied internal needs or from inappropriate external stimulation. On the basis of observations of the infants and their parents, the investigators found that the mothers of excessively crying babies vascillated between overstimulating and understimulating their babies and were insecure, anxious, tense, and unable to achieve satisfaction from feeding or holding their infants. The results of this study, however, must be viewed in conjunction with its limitations. Not only was there no organized assessment of maternal emotional factors, these factors were evaluated after the onset of colic. In addition, no control group was employed, nor was sample selection described.

In 1956, Breslow conducted the first systematic study of the etiology of colic. He found that in 90 cases of infantile colic, 22% could be attributed to psychosomatic factors in the parents. He stated that there was marked evidence of emotional instability in the parents of infants in this group and suggested that the relationship between emotional factors and colic might be a causal one. However, assessment of emotional factors was made solely by clinical impression and after the onset of colic.

Taylor (1957) selected case notes of 100 colicky and 100 noncolicky infants from records in his pediatric practice. Upon comparison of the two groups, he found little or no difference in sex distribution, method of feeding, gastrointestinal disorders, allergic manifestations, or birth order. Colicky infants appeared to gain slightly more weight than the controls, be more likely to have siblings who suffered from colic, and have mothers who were "emotionally unstable in that

they were tense, anxious women who worried excessively about their babies" (p. 459). Again, however, there was no organized assessment of emotions prior to the onset of colic.

Infant temperament and postpartum maternal anxiety. Brazelton (1962) studied 80 mothers and their infants and found that "normal crying" during the second week of life lasted a median of 1-3/4 hours daily and gradually increased to a median of 2-3/4 hours at 6 weeks, reaching a plateau for 2 weeks before diminishing. He claimed that normal crying could be compounded by environmental tension and presented the following report as typical of those given by parents of heavy fussers:

> The young mother had believed the hospital nurses' reports that her baby was quiet in the nursery, and she was surprised by the amount of crying he did when they arrived home. She immediately felt guilty and responsible for this "change" in his behavior. She was breastfeeding him and blamed herself for lack of milk, and then for "bad milk." Her husband was also upset by the infant's crying, alternated between worrying about the possibility that something was wrong with the baby and being irritated with him for upsetting their homelife. The grandmother, who had come to help, felt helpless and concerned about her daughter's exhausted condition. Her ideas and criticisms thus added to everyone's mounting tension. The young mother did "everything she knew to do" when the infant cried. She rapidly ran the gamut of picking him up, holding and rocking him, walking around with him, patting him furiously, feeding him every hour, etc. Her tension and hostility to this situation mounted with her fatigue and realization of her helplessness to change it. The baby's crying, which had begun at rather reliably cyclic intervals, began to invade all periods, especially at night. The mother began to lose her milk with this strain, began to be less effective in handling the baby, was depressed and frightened by her negative feelings about the baby, and wished for someone who would take over. The father, who had other, professional demands on him, was frightened by the situation and tried to stay away from home during the fussy periods. The grandmother felt unsure of herself and was not able to take over effectively in these crying periods when the mother needed the help most. It

> became obvious to them all that the tensions transmitted themselves to the infant and increased his own reasons for crying. (pp. 586-587)

Six infants in this study were classified as heavy fussers and could be somewhat characterized by this report. Unfortunately, Brazelton did not comment on the emotional climate in the families of the other 74 infants. In addition to this limitation, the initial selection of subjects could be a critical factor in the author's results. The sample was not random in that mothers were chosen "because they presented a 'normal' positive approach to mothering their new babies. . . . They seemed to be relaxed, competent mothers" (p. 580). In addition, mothers were required to maintain daily records of their infants' crying for 12 weeks. Brazelton discussed the possibility of this being a selective factor in that "the willingness to cooperate in this type of study denoted a certain intellectual curiosity and/or intensity of the physician-mother relationship" (p. 580).

It would have been interesting if some measure of intelligence or educational level of the mothers had been reported, for Paradise (1966) has concluded that colic is related to maternal education and superior intelligence. If this is a valid conclusion, it is possible that Brazelton's conclusion that "normal" crying ranges from 1-1/2 to 2-3/4 hours daily during the first 6 weeks of life could be faulty. Perhaps, the sample was biased in favor of heavier fussers to begin with and, therefore, what Brazelton interpreted as normal crying was really colicky crying.

Whether or not "normal crying" was indeed being investigated, the question still remains as to whether "heavy fussers" cry more than "light fussers" prior to the compounding influence of environmental

tension, and, if so, why. Brazelton hypothesized that innate differences in the ability to assimilate tension could be responsible for this individual difference. It was found that heavy fussers demonstrated more total oral activity than light fussers, suggesting a vigorous congenital activity type that could be highly sensitive to accumulated tension.

Wessel et al. (1954) found that maternal emotional factors contributed to colic but added that the degree of colic was probably influenced by constitutional factors within the infant. However, as in previously cited studies, the assessment of emotional factors was of questionable reliability and validity. Paradise (1966) has cited several limitations to these researchers' assessment of family tension.

> Evaluation of family tension [was] based on retrospective review of records; bias [was] introduced both in initial selection of mothers for study (Yale Rooming-In Project) and in later elimination of those who failed to return questionnaire; colic itself might have (1) engendered family tension, or (2) prompted search for areas of family tension which, among contented infants, might have remained unexplained or undocumented. (p. 124)

In his study of 103 newborns of white, middle-class mothers, Carey (1968) found that 12.6% of his entire sample of infants were colicky. He employed a semistructured interview protocol to obtain a profile of maternal anxiety. The protocol consisted of six items which were designed to measure anxiety related to the mother's own rearing experience, her feelings from previous experience bearing and raising other children, her distress about her pregnancy itself, her anxiety about expected family supports at home, other maternal anxiety factors, and concerns about the baby. Each item was rated from 0 to 2 indicating little or no concern to great concern. Carey claimed that the

rating scale disclosed that postpartum distress resulted from situational stress (state anxiety) as well as maternal personality problems (trait anxiety). However, it is difficult to see how the scale taps both state and trait anxiety upon perusal of the items.

Based on this method of assessment, 3.2% of colicky babies had mothers who experienced no anxiety, while 27.5% of the colicky babies had mothers who experienced anxiety. This difference was highly significant ($\chi^2 = 13.4$, $p = 0.01$). Carey presented no data on the reliability or validity of this rating scale for his subjects and admitted that it had yet to be used by others to test its reliability. The sensitivity of the scale is highly suspect in that two-thirds of the mothers received a 0 anxiety rating. However, aside from the question of reliability of the scale, results may have been confounded by experimenter bias in that the investigator was aware of maternal anxiety ratings when he made the diagnosis of colic.

Although Carey's results indicated that a larger percentage of colicky babies than noncolicky babies had anxious mothers, he cautioned that anxiety was not the sole ingredient in the causation of colic in that most anxious mothers did not have colicky babies, while a few nonanxious mothers did. Such results led him to conclude that

> determining each infant's primary reactive pattern or temperamental characteristics might show that those infants who are generally more easily and intensely reactive to environmental stimuli are more susceptible to the disorganizing effects of maternal anxiety. (p. 593)

Maternal support system. The support a woman receives during and immediately after her pregnancy may be a factor worth considering in research investigating the relationship between maternal psychoemotional factors and infantile colic. Social support has been found to

be helpful in mediating stressful situations in the woman who is pregnant for the first time (Nuckolls, Cassel, & Kaplan, 1972). Pleshette et al. (1956) demonstrated a need for emotional support for primiparas, especially in the first trimester of pregnancy, and Williamson and Egeland (1981) emphasized the importance of social support for couples during late pregnancy and the early postpartum period.

Few studies have focused directly on the effects of the maternal support system on the course and outcome of pregnancy. In his study of maternal anxiety and infantile colic, Carey (1968) found the pregnant woman's expectations of support after pregnancy to be negatively associated with the emergence of infantile colic. He concluded, "Since three out of five mothers expecting trouble in their family supports had colicky babies, this form of anxiety appears to have the greatest predictive value" (p. 593).

No other research has been conducted that addresses the relationship between maternal support, during pregnancy or the postpartum period, and the emergence of infantile colic. However, in discussing the transition to parenthood, several authors (Hrobsky, 1977; Rossi, 1968; Shereshefsky & Yarrow, 1973) emphasized the importance of support for the continuity of harmonious family life. Hrobsky (1977) wrote of this transition period as a time of considerable anxiety and relearning and noted that the family's support system acted as a "safety valve" which helped stabilize the system by

> offering validation of parents' perceptions and allaying feelings of alienation experienced by new parents by reinforcing the universality of their reactions . . . releasing parents from some responsibilities and the intensity of the home situation . . . functioning as emotional sounding boards . . . providing concrete information on the care of the child . . . enhancing

> parents' enjoyment of their new adventures by simply sharing their experiences with them. (p. 464)

Paternal anxiety. To date, no study has examined the relationship between paternal psychosocial or emotional experiences and infantile colic. The literature focusing on the relationship between anxiety and infantile colic indicates that, while the father is often a particularly salient individual in the infant's life (Lamb & Lamb, 1976), exclusive attention has been given to the mother as the primary source of environmental tension. Since the transition to parenthood has been found to be a period of stress (Hrobsky, 1977) for both parents, the effects of paternal anxiety on the infant should not be ignored.

Several authors and researchers (Bernstein & Cyr, 1957; Boehm, 1930; Hobbs, 1963, 1966; Lacoursiere, 1972; Zilborg, 1931) have suggested that impending and new fatherhood are accompanied by increased psychological stress for the father. The interruption of routine habits and increased financial responsibility are major contributors to this increased stress (Fein, 1976; Hobbs, 1963, 1966; Lacoursiere, 1972). In prebirth interviews, Fein (1976) found expectant fathers to be concerned about labor and delivery, parenting, the emotional support they would receive after birth, and changes in their marriages and lifestyles.

While minor emotional problems associated with fatherhood are fairly common (Schaefer, 1965), psychiatric disorders associated with prospective fatherhood have also been documented (Earls, 1976; Lacoursiere, 1972; Zilborg, 1931). Such findings suggest that if environmental tension is an etiological factor in the occurrence of colic, the father's anxiety as well as that of the mother should be a variable worthy of investigation.

Studies not supporting the relationship between colic and maternal postpartum anxiety. In their classic studies, Illingworth (1954) and Paradise (1966) attempted to dispel what they viewed as the mythology surrounding infantile colic. Both researchers found colic to be unrelated to sex, weight gain, type of feeding, and family history of allergic or gastrointestinal disorders. In addition, Paradise found that it was also unrelated to family economic class, maternal age, birth order, and maternal emotional factors.

Although Paradise's research is valuable in that he attempted an organized assessment of maternal emotional factors prior to the onset of colic, it has been criticized for its use of the MMPI, and instrument designed to measure abnormal personality traits. Paradise himself suggested that the MMPI may not have been measuring emotional factors of etiological importance. The instrument does measure anxiety but not state anxiety, which might be the variable of most interest in a study of pregnant women and colicky infants. In support of this thesis is the fact that Paradise's own clinical assessment of maternal anxiety was not consistent with estimations of anxiety measured by the MMPI. Only 1 out of 10 women Paradise thought to be anxious received an elevated anxiety score on the MMPI. In addition, of the six women receiving elevated anxiety scores on the MMPI, only one was found to be anxious in the clinical interview.

On the basis of his findings refuting the suggested etiologies of most authors, Paradise concurred with the theory of Spock (1944) and Lipton et al. (1960) that colic is a function of central nervous system immaturity. He reasoned as follows:

> The frequency with which colic is encountered in our culture, its uniform incidence and pattern of occurrence in diverse groups of infants, its spontaneous remission by three or four months of age, its apparent familial predisposition, and its relative independence of environmental factors, together seem best explained by this theory. Accordingly, colic may be viewed as a normal, maturational phenomenon, with variations in its occurrence and severity perhaps genetically--or at least prenatally--determined. (p. 130)

Paradise's suggestion that colic may be influenced by prenatal factors was supported by the finding that two-thirds of the mothers in his study gave histories of heightened tension and depression during pregnancy while the remaining one-third indicated no change or improvement in emotional state. The incidence of colic was unusually low in the latter group with this difference being significant ($p = 0.04$). Therefore, while postnatal anxiety did not appear to be an etiological factor in this study, prenatal anxiety seemed to have a definite association with colic. The mechanism responsible for this relationship, however, has yet to be revealed.

Other authors (Meyer & Thaler, 1971; Illingworth, 1954) have argued against postnatal maternal anxiety and other emotional factors causing colic in that many infants have developed colic before being discharged from the hospital. This finding, along with the results of previous studies, seems to indicate that postnatal anxiety contributes more to the intensification of colic than to its etiology.

Although there is little evidence that prenatal factors cause colic, it seems plausible that they may influence the degree to which infants respond to stimuli, such as postnatal anxiety. Part II of the review of the literature focuses on prenatal maternal emotions and their effects on the course of pregnancy, labor and delivery, and the

infant, and Part III focuses on temperament, with an emphasis on its role in the colic syndrome.

Part II: Prenatal Anxiety

Introduction

Although the literature is replete with studies of the relationship between prenatal anxiety and various maternal, pregnancy-related, and neonatal factors, only two studies have investigated the relationship between prenatal anxiety and infantile colic. Lakin (1957) found a relationship between maternal anxiety during pregnancy and the development of colic in the neonate; however, his evaluation of maternal anxiety occurred after the onset of colic. Paradise (1966) found that the incidence of colic was significantly higher in mothers who gave histories of heightened emotional tension, or depression, or both, during pregnancy. Although the assessment of these emotions occurred on the second or third postpartum day, it was retrospective and, therefore, subject to unreliability.

Prenatal Anxiety and Maternal Factors

Prenatal anxiety has been related to maternal factors such as age, general education, length of marriage or relationship, and income. Glazer (1980) found a negative relationship between anxiety and these factors. Burstein, Kinch, and Stern (1974) found that anxiety in pregnancy decreased with age and number of previous pregnancies.

Prenatal Anxiety, Obstetrical Complications, and Childbirth Abnormalities

Prenatal anxiety has also been associated with pregnancy-related factors such as obstetrical complications and childbirth abnormalities. Upon administering a measure of trait anxiety to 146 women in their third trimester of pregnancy, Crandon (1979a,b) found that the incidence of pre-eclampsia, forceps delivery, prolonged and precipitate labor, postpartum haemorrhage, manual removal of the placenta, and clinical fetal distress were all significantly higher among the anxious women. These women were also more likely to have infants with lower apgar scores, a measure of the neonate's physical status minutes after birth. Lederman, Lederman, Work, and McCann (1981) also found associations between anxiety in labor and lower apgar scores. Davids and DeVault (1962) administered a battery of psychological tests to 50 clinic patients in their third trimester of pregnancy and found that highly anxious women and their babies were more likely to experience pregnancy, labor and delivery complications, and childbirth abnormalities. The reader is referred to McDonald (1968) for an extensive review of the literature pertaining to the role of emotional factors in obstetric complications.

Some researchers (Beck et al. 1980; Burstein et al., 1974; Farber et al., 1981; Gorsuch & Key, 1974; Jones, 1978) have found no relationship between trait anxiety and obstetrical complications and the condition of the fetus at birth. Grimm (1961) found no relationship between psychological tension in pregnancy and pregnancy complications and physical status of the newborn. However, he suggested that an association might have emerged had he investigated tension throughout pregnancy and not just during the last half of the third trimester.

Thinking that trait anxiety did not discriminate among exact levels of felt anxiety over a short period, Gorsuch and Key (1974) administered the State-Trait Anxiety Inventory (STAI) to 118 low SES clinic patients several times throughout their pregnancy. They found that while trait anxiety was not associated with pregnancy complications and childbirth abnormalities in their study, measures of state anxiety, obtained early in pregnancy, were. The following explanation was offered for their inability to replicate the results of previous studies:

> Lack of replication of former findings probably lies in the more explicit definition of trait anxiety used in the current study. The previous measures were trait anxiety scales given in the latter half of pregnancy; these measures probably measured some of the changes in state anxiety that occurred during pregnancy itself. However, the trait measures reflected not only trait anxiety before pregnancy but also state anxiety during the pregnancy; our data suggest it is only the latter component of their scores--and particularly the states of anxiety during the first trimester--that are related to the problems of pregnancy. Therefore, it seems a woman's having characteristically high anxiety before pregnancy is not a factor in obstetric abnormalities. (p. 361)

While the results of studies investigating the relationship between prenatal anxiety and childbirth complications and abnormalities have varied, most studies investigating severe or prolonged prenatal stress have demonstrated associations with major morphological anomalies such as cleft palate and Down's Syndrome as well as with many minor physical anomalies such as hernias (Sontag, 1941). Drillien's study (cited in Stott, 1973), associating prenatal stress with cleft lip in the newborn, suggested that "severe emotional stress during the pregnancy is more damaging to the child than physical illness" (p. 782). The results of Stott's (1973) study of prenatal anxiety indicated that "serious

continuous inter-person tension during pregnancy [is] followed by high child morbidity with what looks like a one-to-one relationship" (p. 777). While extreme and prolonged levels of prenatal maternal anxiety have been associated with obstetrical complications and childbirth abnormalities, the effects of lesser degrees and durations of anxiety need further clarification.

Maternal Blood Pressure and Pregnancy Outcomes

The effects of stress and anxiety on blood pressure have been well documented (see Isselbacher, Adams, Braunwald, Petersdorf, & Wilson, 1980). In turn, high maternal blood pressure has been found to cause morphological changes in the placenta and decreased interoplacental blood flow resulting in a less than optimal environment for the developing fetus (Chisholm et al., 1978). Page and Christianson (1976) found that higher maternal blood pressure in the fifth and sixth months of pregnancy was related to perinatal mortality and intrauterine growth retardation.

Within normotensive samples, variations in blood pressure have been associated with neonatal behavior. Chisholm et al. (1978) explained that

> the distinction between normotension and hypertension is arbitrary as blood pressure in pregnancy follows a normal distribution. Therefore, the causal mechanisms known to operate in hypertension in pregnancy could well be operating among normotensive mothers. (p. 175)

In cross-cultural studies with Navajo, Malay, Chinese, and Tamil mothers and infants, normal variations in prenatal blood pressure have been associated with neonatal irritability and lability of states, as measured by the Brazelton Neonatal Behavioral Assessment Scale

(Chisholm et al., 1978). In their Navajo sample, Chisholm et al. found the correlation between neonatal irritability and second trimester blood pressure to be as high as .71 ($p = .001$). The correlation between second trimester blood pressure and lability of states was also high at .73 ($p = .0001$). Korner et al. (1980) replicated this study with a sample of 70 middle class Caucasian mothers, all of whom were normotensive throughout pregnancy, and their infants. They found a lower, but still significant, correlation of .36 between maternal blood pressure in the third trimester and spontaneous crying, as measured by an electronic activity monitor. These results suggest that measure of blood pressure taken during the second and third trimesters of pregnancy are more predictive of neonatal irritability than those taken earlier in pregnancy.

In 1979, Woodson et al. conducted a follow-up study to the cross-cultural research undertaken by Chisholm et al. (1978). They were unable to replicate the association between second trimester blood pressure and neonatal irritability in a sample of 87 primiparous, English women. An association was found, however, between prenatal growth retardation and exposure to either oxytocin-stimulated labor or higher maternal blood pressure during spontaneous labor and lower intrapartum fetal heart rate. Also, greater infant irritability during the first postpartum week was associated with lower intrapartum fetal heart rate. In order to explain these relationships, the authors hypothesized that intrapartum hypoxia, or reduced oxygen transport to the fetus, was a mediator of the relationship between increased pregnancy and labor blood pressure and newborn irritability. They suggested that the relationship between maternal blood pressure and newborn irritability reflected the

ability, or inability, of the fetus to withstand the effects of varying degrees of hypoxia.

The association between maternal prenatal blood pressure and neonatal behavior could possibly have some bearing on research investigating the relationship between maternal prenatal anxiety and subsequent infant behavior. Although increases in prenatal maternal blood pressure could be due to several causes, increased emotional stress has been found to be an influential variable. The combined use of valid and reliable measures of prenatal anxiety and blood pressure data could help to clarify the relationship between maternal prenatal anxiety and infant irritability.

Maternal Prenatal Anxiety and Neonatal Behavior

While blood pressure is thought to be a physiological correlate of stress, psychological measures of stress have also been associated with neonatal behavior (Joffe, cited in Chisholm et al., 1978). Sontag (1944) reported associations between anxiety during pregnancy and the subsequent emotionality of offspring. Bakow et al. (cited in Farber et al., 1981) found the infants of highly anxious mothers to be less alert and responsive to stimulation, as measured by the Brazelton Scale, than infants of nonanxious mothers.

Ottinger and Simmons (1964) administered the IPAT Self-Analysis Form to expectant mothers during each trimester of pregnancy. They found that the infants of highly anxious mothers cried more before, but not after, feedings than did newborns of nonanxious mothers. Using the same measure of anxiety, Farber et al. (1981) found anxiety to be related to neonatal behavior and mother-infant interaction, but only

for female infants. Highly anxious mothers had less active and alert female infants and were slightly less skilled in feeding and play interaction and showed less positive affect toward their infants. However, these correlations were all found to be rather low. Davids (cited in Farber et al., 1981) found children of highly anxious mothers performed less well on Bayley mental and motor scales than did infants of less anxious mothers. These associations, however, raise questions concerning the hypothesized relationship between prenatal anxiety and infantile colic, as clinical impression suggests that colicky babies are precocious in mental and motor development. Or, perhaps, this impression is erroneous. Another explanation is that severe or prolonged anxiety may result in poor infant condition at birth and later developmental lags, while normal amounts of anxiety, at particular points in pregnancy, may produce maternal hormones that are transmitted directly to the fetus. In the latter case, the condition of hypoxic stress, or reduced oxygen transport to the fetus, may be bypassed. Additional research is needed to shed light on this question.

The above studies investigated prenatal psychological stress and behavioral outcomes. The only researchers to examine the relationship between maternal prenatal anxiety and the specific behavioral outcome of infantile colic have been Paradise (1966) and Lakin (1957). Both found that women demonstrating greater anxiety during pregnancy were more likely than nonanxious mothers to have colicky babies. Replication of these results, using more valid and reliable instrumentation, has not been forthcoming.

Animal Studies

There is still much to be learned about the effects of prenatal anxiety on individual differences in the human fetus and neonate. However, it is now known that the fetus can respond to agents that are maternally induced or received directly from the environment, or both (Sontag et al., 1969) For example, the fetus has been found to respond directly to sound stimulation (Sontag et al., 1969). It has also been demonstrated that maternal stress can influence fetal heart rate. As early as 1950, Montague cited evidence indicating that

> nervous changes in the mother may affect the fetus through the neurohumoral systems, i.e., the system comprising the interrelated nervous and endocrine systems acting through the fluid medium of the blood. He reported that there is good evidence that the mother's emotional states are, at least in chemical form, transmitted to the fetus. (cited in Davids & DeVault, 1962, p. 468)

Although the mechanisms governing the relationship between prenatal maternal anxiety and neonatal behavior are still unclear, animal studies have offered some interesting possibilities for the mechanisms operating in infrahuman subjects.

It has been shown that behavioral stress in pregnant rats and mice alters the behavior and emotionality of the offspring (Ottinger et al., 1963; Thompson et al., 1962). In order to investigate whether these changes resulted from secondary effects produced by an alteration of the placental exchange system or whether the fetus was affected directly by the passage of hormones across the placental barrier, Selye (cited in Lieberman, 1963) injected chicken eggs with epinephrine, a hormone known to be highly responsive to stress, and tested the offspring when they hatched. Results indicating that the

epinephrine-injected group's social responses were more vigorous and intense suggested that the hormone can act directly to alter the behavior of the offspring.

The results of Morishima, Pederson, and Finster's (1978) study of the influence of maternal psychological stress on rhesus monkey fetuses led them to conclude that maternal hyperexcitability can be hazardous to the fetus. Maternal agitation was induced by exposure to a bright light, considered to produce a mild degree of anxiety. A decrease in heart rate and arterial oxygenation was seen in all fetuses.

Lederman et al. (1981) cited research with primates and sheep which also produced evidence for the deleterious effects of experimentally induced maternal excitement on the fetal heart rate and health status. The hormone, epinephrine, was again implicated in affecting maternal blood flow to the fetus. Maternal epinephrine level and anxiety, measured at the onset of labor, demonstrated significant correlations of .57 and .33 respectively with fetal heart rate pattern ratings.

Animal studies have made valuable contributions toward the explanation of possible mechanisms for the association between maternal prenatal and labor anxiety and offspring behavior. It is now thought that the hormone epinephrine, a hormone highly responsive to stress, can affect fetal and neonatal behavior directly or by altering the maternal blood flow to the fetus. Future research is needed to determine whether similar mechanisms are operating in humans.

Part III: Temperament

Introduction

Part I of this review indicated that numerous authors have suggested that maternal emotional and psychological factors play a crucial role in the etiology or intensification of infantile colic. Several of these researchers (Brazelton, 1962; Carey, 1968; Wessel et al., 1954), however, have suggested that the influence of these factors is probably indirect as a result of the mediating influence of infant temperament. It has been suggested that infant temperamental characteristics, such as low sensory threshold, may predispose an infant to the colic syndrome. By virtue of their temperamental characteristics some infants may react to the disorganizing effects of maternal anxiety and other internal and external stimuli by developing colic. Other temperamental characteristics have also been associated with the onset of colic.

Historical Perspective

Although the concept of temperamental differences among individuals has been with us since ancient times (Stevenson & Graham, 1982), the construct of temperament has only recently been subjected to empirical investigation. In 1937, Gesell conducted one of the first studies reporting individual differences in infant behavior. Since then, other authors (Birns, 1965; Birns, Barten, & Bridger, 1969; Korner, 1971) have studied individual differences in neonatal response to stimulation with the idea that early characteristics may be precursors of later personality.

The New York Longitudinal Study (NYLS) (Thomas, Chess, Birch, Hertzig, & Korn, 1963), the first large-scale study of temperament, stimulated a mass of research. In an effort to investigate differences in personality patterns, data were collected over a period of several years, via parent interview, on 141 middle- to upper-middle-class subjects beginning during their first few months of life. Defining temperament as "behavioral style" or the "how" of behavior rather than the "what" or "why," nine categories of temperament were identified by an inductive content analysis of parent-interview protocols. The nine categories and their definitions, constituting the authors' operational definition of temperament, are as follows:

> (1) Activity Level: the motor component present in a given child's functioning and the diurnal proportion of active and inactive periods. Protocol data on motility during bathing, eating, playing, dressing and handling, as well as information concerning the sleep-wake cycle, reaching, crawling and walking, are used in scoring this category.
>
> (2) Rhythmicity (Regularity): the predictability and/or unpredictability in time of any function. It can be analyzed in relation to the sleep-wake cycle, hunger, feeding pattern and elimination schedule.
>
> (3) Approach or Withdrawal: the nature of the initial response to a new stimulus, be it a new food, new toy or new person. Approach responses are positive, whether displayed by mood expression (smiling, verbalizations, etc.) or motor activity (swallowing a new food, reaching for a new toy, active play, etc.). Withdrawal reactions are negative, whether displayed by mood expression (crying, fussing, grimacing, verbalizations, etc.) or motor activity (moving away, spitting new food out, pushing away new toy, etc.).
>
> (4) Adaptability: responses to new or altered situations. One is not concerned with the nature of the initial responses, but with the ease with which they are modified in desired direction.
>
> (5) Threshold of Responsiveness: the intensity level of stimulation that is necessary to evoke a discernible response, irrespective of the specific form that the response may take, or the sensory modality affected. The behaviors

utilized are those concerning reactions to sensory stimuli, environmental objects, and social contacts.

(6) Intensity of Reaction: the energy level of response, irrespective of its quality or direction.

(7) Quality of Mood: the amount of pleasant, joyful and friendly behavior, as contrasted with unpleasant, crying and unfriendly behavior.

(8) Distractibility: the effectiveness of extraneous environmental stimuli in interfering with or in altering the direction of the ongoing behavior.

(9) Attention Span and Persistence: two categories which are related. Attention span concerns the length of time a particular activity is pursued by the child. Persistence refers to the continuation of an activity in the face of obstacles to the maintenance of the activity direction. (Thomas & Chess, 1977, pp. 21-22)

Through the use of quantitative and qualitative analyses of data, Thomas and Chess identified three functionally significant temperamental constellations. The first, the "easy child," described 40% of their sample. These children were characterized by regularity, positive approach responses to new stimuli, high adaptability to change, and mild or moderately intense mood which was preponderantly positive. The second, the "difficult child," described 10% of the sample. These children were irregular in biological functions, responded with negative withdrawal to new stimuli, were nonadaptable or adapted slowly to change, and exhibited intense mood expressions which were frequently negative. The third, the "slow-to-warm-up child," described 15% of the sample. These children exhibited negative responses of mild intensity to new stimuli with slow adaptability after repeated contact. Although Thomas and Chess found the "difficult" pattern to be predictive of behavioral disorders and other aspects of future development, they cautioned that all three patterns represented variations of behavioral style within normal limits. It

is only through the interaction between temperament and environment, abilities, and motivations that behavior can be understood and perhaps predicted.

Listed among the strengths of the NYLS have been its large sample size, low attrition rate, its prospective nature, young subject ages at the onset of the study, concern with reliability and validity of parent ratings, the large number of data collection points, and length of the follow up (Persson-Blennow & McNeil, 1979). The study was not, however, without weaknesses in that the sample was not representative, siblings were used, and data were pooled.

Subsequent researchers have seen a need to simplify the rather elaborate data collection and analysis methods used in the NYLS. In 1970, Carey devised the Infant Temperament Questionnaire (ITQ), a parent report measure of temperament, with the intention of using it to identify and treat children in his pediatric practice who demonstrated the "difficult" child behavior pattern. In more recent years, several other parent report instruments have been constructed and used in the investigation of infant and child temperament. The clinical utility of these instruments has been defended by many researchers and clinicians (Carey, 1970, 1972, 1982; Chess, 1966, Chess, Thomas, & Birch, 1959; McInerny & Chamberlain, 1978; Thomas and Chess, 1977); however, many theoretical, conceptual, and methodological problems plague the study of temperament. Future research must be geared toward clarification of the origins, stability, definition, measurement, and clinical applications of temperamental differences (Carey, 1980).

Definition of Temperament

The literature is filled with definitions of temperament, presenting both minor and major variations. Stevenson and Graham (1982) have taken issue with the tendency to view temperament as behavioral style without any reference to the content of behavior. They have pointed out that the content of behavior often dictates style and, therefore, should be considered. Most researchers, however, have concurred that temperament is a component of personality that describes the "how" of behavior rather than the "what" or "why." Whether or not to include suggestions as to the origins of temperament in its definition, however, seems to be a matter of personal preference. While some theorists (Allport, 1961; Buss & Plomin, 1975) have emphasized the genetic component of temperament, others (Thomas & Chess, 1977; Carey & McDevitt, 1978) have focused on early-appearing stylistic differences in behavior, interacting with the environment with no implications as to etiology.

Recently, Rothbart and Derryberry (1981) have looked at temperament within a psychobiological, maturational, and socio-experiential framework. They defined temperament as constitutional individual differences in reactivity and self-regulation

> with "constitutional" seen as the relatively enduring biological makeup of the organism influenced over time by heredity, maturation, and experience. By "reactivity" we refer to the characteristics of the individual's reaction to changes in the environment, as reflected in somatic, endocrine, and autonomic nervous systems. By "self-regulation" we mean the processes functioning to modulate this reactivity, e.g., attentional and behavioral patterns of approach and avoidance. (p. 37)

Bates (1980) pooled the most frequently cited defining properties of temperament and arrived at a composite definition which described

temperament as having a constitutional basis, appearing in infancy and showing some degree of continuity, being an objectively definable characteristic of an individual, and being affected by the environment. The lack of agreement on a single conceptual definition of temperament has not seemed to be problematic, in a practical sense, in that most investigators continue to operationally define temperament according to the measures they use to assess it. Berger (1982) cautioned that the study of temperament, like the study of personality in general, is "diversity heading for chaos" (p. 180). He claimed that the lack of good theories is responsible for the lack of good definitions and presented three options for averting "chaos" in the study of temperament. He suggested that either theories could be improved, or temperament could simply be accepted as a "fuzzy entity," a term with a soft core and indefinite boundary. The third option would be to fall back on the same saying that users of intelligence tests have depended upon for years, "temperament is what temperament tests measure." It seems that this third option is the one that most researchers have inadvertently chosen.

Origins of Temperament

Although the utility of the temperament concept does not depend upon a delineation of its origins, some researchers have used the classic method of twin studies to investigate the existence of a genetic component to temperament. Rutter, Korn, and Birch (1963) found evidence for genetic components of the temperamental characteristics of activity, approach/withdrawal, and adaptability but none for regularity. Data also suggested that the genetic influence was

stronger in the first year of life than in either of the subsequent two years studied. Most researchers would probably agree with Rothbart's (1981) interactionist view expressed by her statement that

> temperament is assumed to have a constitutional basis, with "constitutional" defined as the relatively enduring biological makeup of the individual influenced over time by the interaction of heredity, life experience, and maturation. (p. 569)

Continuity and Stability

The average test-retest correlation for temperamental characteristics found in the literature has been estimated to be above .80 (Lyon & Plomin, 1981). Persson-Blennow and McNeil (1979) found stability correlations for temperamental characteristics for 6-month-olds, 1-year-olds, and 2-year-olds to range from .50 to .92 ($N = 14$, 2-3 week interval) for eight of nine temperament categories. These correlations are similar to those found in most temperament studies, but a little lower than those of Carey and McDevitt (1978). Stability has been found to vary depending on the particular temperamental characteristics being measured as well as the age period during which the assessment takes place.

Birns et al. (1969) found the traits of irritability, tension, sensitivity, and soothability to be stable from birth to 4 months of age. Stability was not demonstrated, however, for alertness, vigor, and maturity level. Based on these results, the researchers concluded that certain temperamental characteristics evidence themselves at birth and that these individual differences can play a major role in the personality of the infant.

While short-term stability correlations may be of a respectable magnitude, the long-term stability of temperamental characteristics has been more difficult to demonstrate. In their analysis of data from the NYLS, Persson-Blennow and McNeil (1979) found temperamental characteristics to be significantly stable only over relatively short intervals, suggesting slow changes rather than long-term stability. In a study of their own, these same authors (1982) found that over an 18-month period, most children changed their temperament type. In his review of studies, Rutter (1982) found considerable stability up to one year of age, but near zero correlations from year one to year five.

Some researchers, however, have found some continuity in temperament patterns. McInerny and Chamberlain (1978) found that infants assessed by Carey's ITQ to be of intermediate or difficult temperament at 6 months of age were seen by their mothers as "difficult" at age 2. Based on their very large sample of 1855 infants gathered from well-baby clinics in Helsinki, Huttunen and Nyman (1982) found significant positive correlations for seven of nine temperament dimensions studied at 6 and 8 months and again at 5 years of age.

The lack of long-term continuity found in most studies, however, may have many sources. Perhaps what changes is not temperament but the behaviors which define any particular temperament category. There is "some evidence that similarly named functions at two different ages may be based upon quite different behaviors, and that similar behaviors at two ages may reflect different underlying functions" (Rutter et al., 1963, p. 167). In addition to the possibility of functional inequivalence of behaviors is the suggestion that variability itself may be a stable attribute of some individuals (Rutter et al., 1963; Stevenson &

Graham, 1982). Such an "instability factor" has yet to be included in any measure of temperamental characteristics. As previously mentioned, another source of instability of temperament is its interaction with environmental influences, maturation, and abilities. As Thomas and Chess (1977) insisted:

> Continuity and predictability can thus not be assumed for a specific attribute or pattern of the child, whether it be temperament, intellectual functioning, motivational attributes or psychodynamic defenses. What is predictable is the process of organism-environment interaction. Consistency in development will come from continuity over time in the organism and significant features of its environment. Discontinuity will result from changes in one or the other which make for modifications and change in development. (p. 174)

Therefore, although some authors (Buss & Plomin, 1975) have made lifespan stability a requisite for temperament, others (Rothbart & Derryberry, 1981; Thomas & Chess, 1977) have insisted that temperament develops over time and is influenced by maturation in the context of experience. This view suggests

> that during periods when there are no major maturational shifts or changes in environmental conditions, stabilities in temperament will be found. We also expect that, even with maturational or experiential transitions in temperament, a child's previous temperamental characteristics will constrain the changes in behavior that can occur over time. Viewed in this way, temperament at time 1 will delimit the range of possible changes by time 2. As yet, we do not know the rules for these changes, but their identification should be a primary focus of future longitudinal study. (Rothbart & Derryberry, 1981, pp. 64-65)

Predictive Value of Temperament

Although there remains some question as to how predictive temperament measures are of future measures of temperament, several studies have found certain temperament attributes to have predictive value for

characteristics of the individual other than temperament itself. The utility of the temperament concept can be seen in understanding how children may react differently to the same environmental stimuli. For example, many newborns are able to follow a self-demand feeding schedule rather successfully. However, many infants exhibiting the temperamental characteristic of "irregularity" have been found to have difficulty forming regular patterns of response to basic biological functions and, therefore, do better on a more structured feeding schedule (Chess et al., 1959). Carey (1982) insisted that informing parents of their child's temperamental profile and its possible consequences can have a major impact on providing the child with an optimal environment for living.

Temperament and behavior disorders. It has been suggested that temperament can be linked to individual differences in the manner in which other people respond to the child, personality development, and childhood behavior disorders (Bates, 1980; Carey, 1980; Rutter, 1982; Thomas & Chess, 1977). Based on the results of their NYLS, Thomas and Chess (1977) concluded that "temperamental characteristics play significant roles in the genesis and evolution of behavior disorders in children" (p. 46). Additional evidence on the relationship between temperament and childhood behavior disorders has been sparse and inconclusive. It has been suggested, however, that if a relationship does indeed exist it is probably mediated by other variables, such as adverse parenting practices (Broussard & Hartner, 1971; Thomas & Chess, 1977).

Several clinicians (Carey, 1970, 1972; McInerny & Chamberlain, 1978; Thomas & Chess, 1977) have used temperament scales to identify children fitting the profile of the "difficult" child in the hope of preparing for or preventing future behavioral problems. However, other

authors (Bates, 1980; Hubert, Wachs, Peters-Martin, & Grandour, 1982), while encouraging further research on difficult temperament, have cautioned against its use in screening and intervention programs until the concept has been given a stronger empirical base.

Danger in "difficult child" label. Whether or not clinicians choose to use temperament measures for the purposes of intervention, it would seem wise to refrain from labeling a child as "difficult," as such a label may bring about a self-fulfilling prophecy. Some clinicians (Carey, 1982; McInerny & Chamberlain, 1978) have claimed that educating parents about the temperament of their child is a valuable way of ameliorating any uneasiness they may have about their child's behavior. In their study, McInerny and Chamberlain (1978) found that very few mothers thought their baby was difficult

> even when the rating is clearly so. When the baby is scored as "difficult," this is pointed out with the assurance that it is the baby's native temperament and not caused by anything the mother does or does not do. (p. 233)

The wisdom of such a statement is questionable in that it devalues the mother's opinion of her own child. It assumes that the mother's subjective opinion concerning the "difficulty" of her child is less accurate and valuable than the assessment provided by standardized instruments. Such an assumption may be erroneous in that the "difficulty" any child poses to a mother is obviously influenced by the mother's view of the child's behavior.

There is evidence that mothers do not define infant difficultness in the same manner as clinicians. While clinicians and researchers have described the "difficult" infant as being arrhythmic, withdrawing, having low adaptability, intense, and negative, mothers have been

found to be more bothered by negative mood and low distractibility or soothability (Carey & McDevitt, 1978). The mothers in another sample indicated that a fussy, hard-to-soothe baby was "difficult" (Bates, Bennett Freeland, & Lounsbury, 1979).

Perhaps mothers' perceptions of their infants' "difficulty" are more predictive of future development than the clinicians' and researchers' diagnostic labels. Broussard and Hartner (1971) found mothers' perceptions of their infants at 1 month of age to be predictive of later emotional development. The value of not bypassing parents' perceptions, even if this were possible, has already been emphasized. As Thomas and Chess (1977) stated:

> Temperament has its main impact on socially-relevant outcomes through a process of transaction between the child and social environment. It makes good sense then to measure the temperament or difficultness as it is perceived by important figures in the child's life. (p. 316)

In summary, while a cluster of temperament characteristics defining "difficult" temperament has been associated with later personality development and behavior patterns, further research is needed before such results should be applied to intervention programs for children with behavior disorders. Similarly, additional research is needed to shed light on relationships which have been found between temperament and other characteristics of the individual, such as developmental delay, school performance, the incidence of accidents and visits to the pediatrician for illness, and infantile colic (Carey, 1980).

Temperament and Infantile Colic

Several clinicians and researchers in the area of infantile colic have suggested that constitutional or temperamental differences may play a role in the degree to which any infant exhibits colic symptoms. When describing colicky infants, clinicians have frequently referred to their excessive motor activity and tendency to respond acutely to internal and external stimuli (Holmes, 1969; Levine, 1956; Meyer, 1958). Meyer (1958) thought that colic resulted from a combination of temperament and a frustrating immaturity which limited the infant's activity. He wrote:

> They [colicky infants] deviate from expected or conventional behavior because they vary (as do adults) in temperament, reaction to sensory stimuli, and in motor skills. (p. 629)

Benjamin (1961) suggested that infants with low sensory threshold are prone to colic

> during the third or fourth postnatal week, when all babies go through a maturational spurt in their sensory capacities but when they have not as yet developed an adequate stimulus barrier. (cited in Korner, 1971, p. 614)

Brazelton (1962) also hypothesized that heavy fussers may differ innately in their ability to assimilate stimuli. Several authors (Brazelton, 1962; Carey, 1968; Cobb, 1956; Wessel et al., 1954) have suggested that differing thresholds for sensory stimulation may regulate the degree to which infants react to internal and environmental tension.

Carey (1970) was the first to investigate the hypothesized relationship between temperament and infantile colic. Out of eight infants diagnosed as having colic, five were labeled as "difficult" or

"intermediate high," while three were labeled as "intermediate low," and none were labeled as "easy." This overrepresentation of colicky babies in the more difficult categories was found to be significant ($\chi^2 = 4.1$, $p < .05$). These results must be considered as tentative, however, as the sample size was quite small. Carey cautioned against viewing the colicky infant and difficult child as synonymous. Not all colicky infants were "difficult," and 9 of 11 difficult babies were not colicky.

In another study, Carey (1972) found 13 out of 200 babies to be colicky (7%). After the colic ceased, four were rated as "difficult," four as "intermediate high," four as "intermediate low," and one as "easy." Again the overrepresentation in the first two groups was found to be significant ($\chi^2 = 6.7$, $p < .01$) as was the difference between the number of colicky infants in the "difficult" group versus the "easy" group ($\chi^2 = 5.3$, $p < .05$). A more interesting finding in this study, however, was that 11 (or 85%) of the colicky babies had low sensory thresholds ($\chi^2 = 5.8$, $p < .02$), as measured by the ITQ.

Other temperamental characteristics have been related to colic. Colicky babies have been found to be more difficult on the rhythmicity factor (cited in Licamele et al., n.d.). More recently, Huttunen and Nyman (1982) found that infants having acute colic spasms were more "intense" and had more symptoms of "negative mood" in infancy. They also found that "intensity" at the infant age correlated with "low sensory threshold" at a later age ($r = .24$, $p < .001$). As a result of this finding, they questioned, "Could a high score in intensity at the infant age reflect a low sensory threshold to environmental stimuli?" If the answer is "yes," high levels of intensity among

colicky infants could also be a measure of their sensitivity to environmental stimuli.

In addition to viewing environmental tension and other external stimuli as impinging upon the sensitive colicky baby, one might also question the role of internal stimuli. Korner and Grobstein (1967) have suggested that "internal stimuli impinge on the manner in which external stimuli are dealt with" (p. 678). If colicky babies really do have abdominal cramps, this pain or discomfort could be more acutely experienced by an infant with a low sensory threshold.

Assessment of Temperament

Most research in the area of temperament has been based on parent questionnaires derived from the NYLS. Carey's (1970) Infant Temperament Questionnaire (ITQ), one of the earliest parent-report measures, was devised as a screening instrument for use by pediatricians and other clinicians dealing with children. Because of its increasing use in research, Carey and McDevitt (1978) revised the ITQ in a successful effort to improve its psychometric properties. The Revised Infant Temperament Questionnaire (RITQ) has now been standardized on infants from 4 to 8 months of age.

In 1979, Persson-Blennow and McNeil constructed a Swedish version of Carey's RITQ. Standardized on 6-month-olds, research with the instrument has basically confirmed the work of Carey.

In an effort to obtain a more valid measure of infant temperament, Bates et al. (1979) constructed a short screening device entitled the Infant Characteristics Questionnaire (ICQ). A factor analysis of the ICQ resulted in the identification of the four factors of Fussy-Difficult,

Dull, Unadaptable, and Unpredictable. The ICQ has been found to have a meaningful factor structure, acceptable test-retest reliability, and a low but statistically significant degree of mother and researcher observation agreement on the difficultness of 6-month-old infants. The ICQ and Carey's RITQ show a moderate degree of overlap, but they are not equivalent measures.

Rothbart's (1981) Infant Behavior Questionnaire (IBQ) was devised to measure an individual's reactivity and self-regulation, in addition to Thomas and Chess's nine temperament dimensions, and to identify conceptually distinct dimensions so that correlations between dimensions could be explained "without inflating them by using similar items on scales with different names" (p. 571). After conceptual and item analysis the six scales of Activity Level, Smiling and Laughter, Fear, Distress to Limitations, Soothability, and Duration of Orienting were developed with adequate conceptual and psychometric characteristics. The IBQ has been used with infants as young as 3 months old.

These instruments are representative, but not exhaustive, of the many measures constructed to assess temperament. See Hubert et al. (1982) for a more extensive review and critique of temperament measures.

Problems in the Assessment of Temperament

Although adequate test-retest reliability over short intervals has been demonstrated frequently for several measures of temperament, difficulties still remain in the measurement of temperamental attributes. The probability of functional inequivalence of different temperament categories suggests that "developmental changes may modify or alter the

particular manner in which a characteristic is manifest" (Rutter, 1982, p. 7).

Although some researchers have developed and used instruments yielding global descriptions of temperament (Buss & Plomin, 1975; Lyon & Plomin, 1981), most have felt that instruments tapping specific concrete behaviors in specific contexts would have a better chance of showing favorable psychometric properties. However, this attempt to gather information on behavioral style within specific contexts has often resulted in the emergence of context-specific factors which do not match the scale developer's conceptual categories (Huitt & Ashton, 1979).

Yarrow's (1963) concerns about the assessment of mother-child interaction could just as easily apply to the measurement of temperament.

> By requiring the mother to place her behavior on a scale point of frequency and intensity, we may be creating illusions about childrearing environments and losing important variations. In reality, behaviors of a given parent and child may not have a simple modal level of occurrence. They may occur in patterns of intensity and frequency which are distinct and different according to the situation, the developmental level of the child, and the psychological state of the mother. (p. 218)

Items on any questionnaire can only sample from the numerous possible contexts of behavior. A child may not show "persistence" in any of the situations tapped by a particular questionnaire; however, the child may show amazing persistence in other situations. The results of the questionnaire would be misleading in that they would rate the child as having low persistence without informing one of the actual selectivity of the persistence.

Another difficulty inherent in questionnaires using adverbs, such as "hard," "actively," and the like, is that the rater is usually

unaware of what the "norm" is when rating any particular behavior. Results, therefore, may indicate different frames of reference rather than true individual differences. The validity of parent-report questionnaires has been difficult to establish and has been cited as one of the main limitations of the assessment procedures currently in use.

Validity of Assessment Measures

Research investigating the validity of temperament assessment procedures has evidenced conflicting results. The validity coefficients for most standardized temperament questionnaires, however, have been significant, but low. Possible explanations for this low validity include criticism of the instruments themselves, invalid validity criteria, and the influence of parent perceptions.

Some researchers (Field, Dempsey, Hallock, & Shuman, 1978; Field & Greenberg, 1982) have found that parent and observer ratings of neonatal behaviors were highly correlated. Mothers rated their 3-day-old infants on the Mother's Assessment of the Behavior of Her Infant (MABI), a modified version of the Brazelton Neonatal Behavioral Assessment Scale, while trained testers evaluated the same infants using the original version of the Brazelton scale. Despite the mothers' lack of training, they agreed with the testers on at least 80% of the MABI item ratings (Field et al., 1978).

Broussard (1976) and Broussard and Hartner (1970) found mothers' perceptions of their infants' difficultness, as related to crying, spitting, feeding, elimination, sleeping, and predictability at 1 month of age, but not at 3 days, to be related to the infants' subsequent emotional development. Other researchers (Meares, Penman,

Milgrom-Friedman, & Baker, 1982), using Broussard's Neonatal Perception Inventory (NPI), found that the mothers' initial perceptions of their babies seemed to have little effect on their judgments of the infants' personalities 48 hours later. However, perceptions at 1 month of age seemed to be based on a combination of their infants' exhibited competencies and their own characteristics. Mothers in this study appeared to have fairly accurate perceptions of their 1-month-old infants' physical capabilities, as those infants perceived to be "not difficult" on the NPI had good state control, as assessed by the Brazelton.

Most researchers have found parent-report measures of infant temperament to be only minimally correlated with observations of the child by trained observers. The validity of these forms of assessment has, therefore, been questioned. Bates (1980) reviewed a number of studies and found significant, but low, parent-observer correlations ranging from .20 to .50. Sameroff, Seifer, and Elias (1982) found correlations between home and lab observations with parent response on Carey's ITQ to range from .01 to .26.

Inadequate instrumentation. One of several explanations that can be offered for these low correlations is that the assessment procedures are inadequate. Difficulties due to relativity of measures, long-term stability, social context, and functional inequivalence of different measures at different ages are just some of the possible factors undermining the valid use of parent-report measures. In defense of the temperament questionnaire, McNeil and Persson-Blennow (1982) made the following statement:

> In the first steps of constructing a questionnaire, it seems difficult enough to choose a sufficient number of behaviors, in situations for e.g. a six-month-old child,

> which represent abstractly defined concepts that are to become variables, and that keep mood separate from approach, activity separate from intensity, attention-persistence separate from distractibility, etc. The items have to be expressed in simple, unambiguous language and be clearly related to the mother's everyday experience with the child, yet they should be (we feel) at least somewhat independent of her management of the child. The choice and development of such items presents no easy task. The demands then placed on these poor items are that: they should be answerable by all parents and relevant to all children; they should have balanced distributions, and discriminate between high and low scorers on the variable; they should correlate highly with the score for the total variable, and not be thought by blind judges to represent other variables; they should be answered in the same way by the parent who is given the unexpected (and perhaps undesired) opportunity to complete the very same questionnaire twice within a short period of time; they should be answered similarly by the father whose primary experience with the baby often consists of short contacts in the morning and evening; they should reflect a behavioral style which the baby (and mother) will show when a scientist comes to observe them even on only one or two occasions; and, preferably, they should predict something important or abnormal about the child in the future. It is more than a rhetorical question to ask how many existing research methods of any type and field have even a majority of these desirable characteristics. (pp. 30-31)

Invalid validity criteria. A second explanation for the failure to establish higher validity correlations is that the validity criterion most frequently used is itself subject to invalidity. Because parent-parent agreement has usually been somewhat higher than parent-observer agreement, some researchers have questioned the frequently held assumption that observations necessarily yield valid data. "They do so only to the extent that the phenomena to be observed have not been destroyed, missed, or misinterpreted by the observer" (Yarrow, 1963, p. 223). There is little question that the presence of an observer can alter, and therefore "destroy," the behavior of those being observed (Werry, 1982), just as there is little doubt that "observers have

perceptions too" (Carey, 1982) and phenomena, such as reliability drift, can alter perceptions of what is being observed. The fact that observations are merely samples of behavior means that many behaviors in many situations are being "missed." Sameroff et al. (1982) found that agreement between two observations and interview ratings was higher than agreement between the observations themselves.

Sameroff et al. (1982) found correlations between home observation and lab observation to range from .04 to .38. Although these correlations are somewhat higher than those ranging from .01 to .26 for the parent-observer agreement, they are still unimpressive causing one to question the use of observations as the sole validating criterion for parent-report measures. Wilson's (1982) finding that questionnaire ratings for the Infant/Toddler Temperament Questionnaire correlated sigrificantly (.41-.52) with laboratory ratings at 6 to 12 months seems to support this view.

Influence of parent perception. A third possible source for the low parent-observer correlations is the influence of parent perceptions. Designers of recent parent-questionnaires have attempted to circumvent parent perceptions by writing items that tap the child's actual behavior in concrete situations. However, because temperament measures are not independent of the home environment (Rothbart, 1981), it has not been surprising that characteristics of parents would influence their ratings of their child's temperament. The fact that parent-report measures have more frequently been filled out by mothers than by fathers explains the focus on "maternal" rather than "paternal" influences on parent-report ratings.

Maternal characteristics and infant temperament. Maternal characteristics thought to be related to infant temperament have included anxiety, certain demographic characteristics, prenatal and postnatal adjustment, mother-infant interaction, and maternal perception of infant difficultness.

Several authors have linked maternal anxiety with infant temperamental characteristics. Maternal prenatal anxiety has been associated with neonatal irritability, as measured by the Brazelton and electronic activity monitors (Farber et al., 1981; Ottinger & Simmons, 1964). Others (Sameroff et al., 1982; Vaughn, Deinard, & Egeland, 1980) have found prenatal anxiety to be related to perceptions of infant temperament. Carey (1980) has suggested that the relationship between anxiety and temperament may have many sources. Anxiety may (1) directly affect the fetus, (2) influence the postnatal mother-infant interaction, (3) influence reported perceptions of the infant, or (4) both maternal anxiety and infant behavior may result from some third common biologic or environmental factor. Research has not yet been able to establish a causal relationship between anxiety and infant temperament.

The relationship between mother-infant interaction and infant temperament is unclear in that most studies show conflicting results (cited in Bates, 1980). Although specific temperamental characteristics cannot be predicted on the basis of maternal-infant interaction patterns, it is assumed that this interaction must influence the subsequent personality development of the child (Meares et al., 1982) for infants with differing temperamental characteristics elicit different responses from individuals in their environments (Thomas & Chess, 1977).

Some researchers have investigated the relationship between temperament and several maternal characteristics including race, mental health, socioeconomic status (SES), parity, and personality. Sameroff et al. (1982) found that infants of lower socioeconomic status and Black and mentally ill mothers were rated as more difficult on Carey's RITQ. During their third trimester of pregnancy, Vaughn et al. (1980) had 187 low SES, mostly single, primiparas complete a battery of psychological tests, including the IPAT, Broussard's NPI, and the Schaefer and Manheimer Pregnancy Research Questionnaire. At 3 and 6 months after birth, infants were observed at home, and mothers completed Carey's ITQ. Results indicated that differences existed between mothers of "easy" and "difficult" babies with mothers who rated their infants as "difficult" on the RITQ being more anxious, having less desire for pregnancy, and lower maternal feelings, and believing prenatally that their infants would be "difficult." The authors concluded that the RITQ data were related "more to maternal characteristics and expectations concerning the behavior of infants than they are to actual infant behaviors" (p. 513). This study has been criticized, however, because no statistical measure of the strength of correlations between maternal feelings and ITQ findings and no data on correlations of ITQ data with appropriate observations of infant behavior were presented (Carey, 1980). However, these results cannot be totally dismissed in that other authors (Bates et al., 1979) have also found maternal characteristics to be related to measures of infant temperament. Bates et al. (1979) found that maternal personality factors, SES, and parity all entered the regression equation before the single observed behavior of fussiness, suggesting that maternal characteristics are more predictive

of infant temperament than fussiness ratings made by observers. This finding has been cited by several authors as supporting the claim that infant temperament measures are better measures of maternal than infant characteristics. However, these same authors failed to report that

> when observer "ratings" rather than observed behavior scores were entered into the regression equation, the observers' ratings of fussy-difficult did make a positive contribution to the prediction of mothers' ratings of difficultness. . . . This might be expected, since the observers' ratings were made on a scale identical to the mothers' ratings, and the scale may have tapped aspects of the child's behavior not measured by the observation codes. (Rothbart & Derryberry, 1981, p. 76)

Other researchers have found maternal perceptions of their infants' difficultness, as measured by Broussard's NPI, to be correlated with other maternal characteristics. Broussard and Hartner (1971) found maternal perceptions of the 1-month-old, but not 3-day-old, infants to be associated with depression, negative aspects of childrearing, and irritability, as measured by Schaefer and Manheimer's Postnatal Research Inventory. They also found this relationship to be independent of parents' educational level, father's occupation, change in income since delivery, prenatal or postpartum complications, the type of delivery, family moves, and sex of the child. The finding that 54% of the women shifted their perceptions from 3 days to 1 month has led the authors to emphasize the need for adequate support systems for mothers during the early postpartum period when perceptions are still in a "fluid state."

Meares et al. (1982) found that mothers who were flexible and prepared for motherhood did not perceive their infants as likely to be difficult in terms of crying, as measured by the NPI. However, based on results of the baby's assessment by trained testers on the Brazelton

Scale, the authors concluded that the mothers' perceptions of their infants were a function of the babies' exhibited capacities, as well as the mothers' own characteristics. Although researchers differ in the degree to which they believe maternal and infant characteristics influence maternal ratings of infant behavior, most would agree that both are sources. Sameroff et al. (1982) cautioned that researchers using temperament questionnaires "must entertain the possibility that these measures might reflect children's behaviors, more likely reflect parental characteristics and most likely reflect a complex combination of the two" (p. 173).

Although research is still needed to clarify the influences on questionnaire ratings, progress has been made in establishing their validity. Carey and McDevitt (1978) have cited studies using their RITQ that have verified that "difficult babies do cry more" (p. 738), and, as recently as 1982, Carey stated that

> evidence is accumulating that parental ratings of temperament are largely valid, if we accept as an adequate measure of parental validity an agreement with the brief professional ratings (or are they perceptions?) of the child that have generally been used so far. (p. 195)

The probability that parent questionnaires are measuring infant temperament is also increased by the consistent finding of significant, although low, correlations between parents and observers (Bates et al., 1979). To say that parent ratings are to some extent confirmed by the way the observer perceives the child is not to deny the influence of parent perception. However, this influence is probably unavoidable in that the temperament scales presently in use "measure an infant's behavior as seen in a particular social system involving caregivers and siblings" (Rothbart & Derryberry, 1981, p. 70). In addition, the

confounding of infant temperament and parent perception may not preclude the usefulness of temperament questionnaires, for "in the long run the parents' perceptions of their child may have a greater impact on their child's development than the child's own temperament" (Sameroff et al., 1982, p. 172).

Summary

Lack of agreement concerning the etiology and treatment of infantile colic has contributed to the inconsistencies in its definition. As a result, most authors have chosen to describe, rather than define, colic. The one aspect of this syndrome that is usually agreed upon is that it involves infant crying for which there is no known treatment that gives consistent or complete relief.

While most authors agree that several factors are involved in the etiology of colic, a large number of studies emphasized the role of maternal anxiety, expressed either prenatally or postnatally, in the etiology or intensification of colic. Important methodological flaws, however, have limited the value of many of these studies. Not only has the assessment of maternal emotions often been subjective, but it has taken place after the onset of colic. It is not surprising to find elevated anxiety scores in mothers living with colicky babies.

In his classic study, Paradise (1966) dispelled many of what he considered to be the "myths" that have been perpetuated about colic. Paradise found the incidence of colic to be unrelated to family economic class, maternal age, birth order, sex, weight gain, type of feeding, family history of allergic or gastrointestinal disorder, and postnatal maternal emotional factors. Superior maternal intelligence, advanced

maternal education, and prenatal emotional factors were associated with a higher than average incidence of infantile colic. Paradise's study seems to indicate that if maternal anxiety contributes to infantile colic, the influence is most likely to occur prenatally. Postnatal anxiety probably acts to intensify, but not cause, colic.

The literature on prenatal emotional and psychological factors and their relationship to infantile colic is sparse. Only Paradise and Lakin found associations between these variables. The studies exploring the relationship between prenatal anxiety and pregnancy complications, birth abnormalities, and neonatal behavior are numerous and emphasize the influence that such emotional factors can have on the mother, fetus, and neonate. A few studies carried their investigations into the behavior of the neonate. Ottinger and Simmons (1964) found infants of highly anxious mothers to cry more before, but not after, feedings, than infants of less anxious mothers. Chisholm et al. (1978) found a significant correlation of .71 between maternal blood pressure, a physiological correlate of stress, and newborn irritability. Other studies have associated prenatal anxiety with state changes, activity level, and infant-parent interaction. Future replications, however, are needed to lend more credence to these results.

Animal studies have supported many of the findings of research with human subjects. Emotionality and behavior of animal offspring have been associated with prenatal maternal anxiety. Although the mechanisms for this relationship in humans are still far from clear, studies with animals suggest that alterations in the placental-interchange, as well as direct action of maternal hormones, resulting from maternal stress, on the fetus, are both legitimate hypotheses.

Results of hypertension research have demonstrated neonatal abnormalities via reduction of oxygen transport to the fetus. Such an explanation for the emergence of infantile colic is doubtful, however, as colicky babies are thought to exhibit both motor and mental precocity. The more likely explanation is that, somehow, the fetus is directly affected by the hormonal changes, produced by stress, within the mother.

Several investigators who have linked colic with maternal or family tension have qualified this relationship by hypothesizing that the degree to which an infant manifests colic symptoms may be determined by constitutional or temperamental factors. Infants have been found to respond differentially to varying types and degrees of stimulation. Benjamin (1961) hypothesized that infants with low thresholds for sensory stimulation may be prone to colic "during the third or fourth postnatal week, when all babies go through a maturational spurt in their sensory capacities but when they have not as yet developed an adequate stimulus barrier" (cited in Korner, 1971, p. 614). A low sensory threshold might not only sensitize the colicky infant to internal discomforts, but it might also make environmental tension and influences particularly disorganizing.

Other temperamental attributes may also be characteristic of the colicky infant. Huttunen and Nyman (1982) found that infants having acute colic spasms were more "intense" and had more symptoms of "negative mood" in infancy. Other researchers (cited in Licamele et al., n.d.) have found colicky babies to be less rhythmic than those not exhibiting colic symptoms.

Meyer (1958) speculated that colic resulted from a combination of temperament and a frustrating immaturity which limits the infant's motor

outlets. If his hypothesis is correct, it is conceivable that Rothbart's "Frustration to Limitations" temperament dimension may be important in describing the colicky infant. Clinical impressions of the colicky baby as being precocious in motor and mental development seem to suggest that this temperamental characteristic may be a relevant one.

The research linking prenatal maternal anxiety with neonatal irritability and activity could be seen as supporting the hypothesis that anxiety is associated with infant temperament, as both of these behaviors have been considered to reflect temperament. Prenatal maternal anxiety has also been associated with infant temperament, as measured by parent-report questionnaires (Sameroff et al., 1982; Vaughn et al., 1980). However, the identification of specific temperamental characteristics in infants has been difficult in that measurement scales tend to reflect parent characteristics as well as infant behavior. This distortion of infant characteristics, however, may not only be unavoidable, it may be necessary in that temperament itself is assumed to be inseparable from environmental influences. "Perceptions of infant temperament may actually be more important to the child's future development than the child's temperament itself" (Sameroff et al., 1982, p. 172).

The present study was intended to contribute to knowledge of the influences of parental psychosocial and emotional factors and infant temperament on infantile colic.

CHAPTER III
METHODOLOGY

Introduction

The literature review presented in Chapter II indicated that the study of infantile colic has, for the most part, received inadequate attention. Researchers who have investigated the problem have generally focused on only one dimension of the problem. Attention has usually been focused on the relationship between infantile colic and either maternal emotional factors, infant physiological factors, or infant temperamental factors.

The present study was designed to study the interrelationships among several demographic factors, parent psychosocial and emotional factors, infant factors and infantile colic, measured during the sixth week of life. The variables of interest were organized into three categories: demographic and descriptive variables, parent psychosocial and emotional variables, and infant variables. Specifically, the present study addressed the following questions:

I. What is the relationship between certain demographic and descriptive characteristics and infantile colic?

II. What is the relationship between infantile colic and selected parent psychosocial and emotional factors assessed prenatally and postnatally?

III. What is the relationship between selected infant behaviors observed during the first week of life and infantile colic?

IV. What is the relationship between infantile colic and infant temperament characteristics assessed at 3 and 8 months of age?

The methodology employed to investigate these questions is discussed in this chapter. Information relevant to sample selection, variables, research procedures, instrumentation, hypotheses, and methods of statistical analysis is presented in the following sections.

Sample

The participants for this study consisted of 163 couples who were recruited from prepared childbirth classes conducted through the Birthplace, Alachua General Hospital, Shands Hospital, and private obstetrical practices, all located in Gainesville, Florida. Although emphasis on content varied depending upon the individual instructor, classes generally dealt with the process of conception, reproduction, implantation, fetal growth, and labor. In all classes, the focus was placed on labor and delivery and on how both parents could take an active and important role in the birth of their child.

Recruitment of subjects began in November of 1982 and continued until March of 1983 when a sample size of 170 couples was achieved. Five couples dropped out of the study for reasons including family illness and death, overwhelming responsibilities after the baby's birth, and marital discord. Two families were eliminated from the study because of the birth of twins. Approximately 80% of the invited sample consented to participate in the study.

The average age for mothers and fathers was 26 years and 29 years, respectively. The mean number of years completed in college was 2 years for mothers and 3 years for fathers. Most couples were White,

married, and expecting their first child. Demographic and descriptive statistics for the sample are presented in Tables 3.1 to 3.6.

Table 3.1

Mean Age, Education, and Parity for Parents

	M	N	SD	Min.	Max.
Mother's Age	26.52 years	163	4.28	18	38
Father's Age	29.33 years	161	5.57	18	63
Mother's Education	14.21 (2 years college)	163	2.27	9	20
Father's Education	15.02 (3 years college)	161	2.70	10	21
Parity (including this birth)	1.43 children	131	.77	1	5

Table 3.2

Frequency Distribution of Sample by Race

Race	Frequency	%
White	151	92.64
Black	9	5.52
Other	3	1.84

Table 3.3

Frequency Distribution of Sample by Marital Status

Marital Status	Frequency	%
Married	156	96.30
Unmarried	3	1.85
Unknown	4	1.85

Table 3.4

Frequency Distribution of Sample by Mother's and Father's Occupation

	Mother's Occupation		Father's Occupation	
	Frequency	%	Frequency	%
Blue Collar	12	7.45	66	41.51
White Collar	60	37.27	35	22.01
Semiprofessional	38	23.60	32	20.13
Professional	4	2.48	14	8.81
College Student	3	1.86	9	5.66
Homemaker	44	27.33	1	.63
Unemployed	0	0.00	2	1.26

Table 3.5

Frequency Distribution of Sample by Mother's Parity

Parity	Frequency	%
1 (primipara)	92	70.23
2	27	20.61
3	8	6.11
4	3	2.29
5	1	0.76

Table 3.6

Frequency Distribution of Sample by Infant Gender

Gender	Frequency	%
Males	82	50.31
Females	74	45.40
Unknown	7	4.30

Variables

The present study investigated the relationship between variables and subsets of variables and measures of infantile colic, collected at 6 weeks of age. Variables were organized into the three categories of demographic, parent, and infant factors.

Demographic Variables

The demographic and descriptive variables of particular interest included parent educational level, occupation, birth order, allergy, and feeding method, all of which have been cited, in research or theory, as having some association with colic. Other demographic and descriptive characteristics which were also investigated included parents' age, number of times pregnant, baby's sex, mother's drug use in labor and delivery, father's work hours, baby's birthweight, baby's gestational age, and gastrointestinal distress.

Parent Variables

Psychosocial and emotional experiences of parents during pregnancy and the postpartum period were investigated through the global construct of parent anxiety, as well as through more specific measures of maternal prenatal emotional experiences and maternal postpartum fatigue and support.

Parent anxiety and environmental tension have frequently been linked with the onset and severity of infantile colic. A differentiation was made in the present study between state and trait anxiety as it was hypothesized that state anxiety, as defined as a transitory emotional state of tension and apprehension, might be a more appropriate measure of anxiety assessed during the time-limited conditions of pregnancy and colic than the more stable measure of anxiety proneness (trait anxiety). Measures of state and trait anxiety were, therefore, collected at different points during the study.

The influences of parental anxiety may be exerted prenatally, through maternal hormonal changes affecting the developing fetus, or postnatally via the communication of tension to the newborn infant. To avoid methodological shortcomings of previous studies, the parent variable of anxiety was assessed at several different junctures in the study. Anxiety measures were collected during pregnancy and as soon after birth as possible, in an effort to obtain data prior to the onset of colic.

Because it was hypothesized that more specific measures of parent psychosocial and emotional experiences might be more informative than the global construct of anxiety, measures of maternal prenatal experiences and postpartum fatigue and support were collected. Mother's fears for herself and her infant, desire for pregnancy, dependency, irritability, maternal feelings, and depression could possibly pinpoint more specific sources of maternal prenatal anxiety.

Other possible sources of state anxiety could be the fatigue experienced by the new mother as well as the existence or nonexistence of an adequate support system. The mother's perceptions of support, however, might be more crucial than the actual support provided in terms of caring for the baby. Therefore, in addition to the general variable of state-trait anxiety, more specific variables of maternal prenatal experiences, postpartum fatigue, and support were investigated.

Infant Variables

While colic has often been related to factors in the infant's environment, it has been postulated that the condition may stem from factors within the infant. Because infantile colic is a time-limited

condition, usually occurring between 2 and 12 weeks of age, it was thought that insights into potential infant correlates of colic might be achieved through the investigation of infant behaviors exhibited prior to the onset of colic and after its disappearance. Therefore, measures of infant neonatal behavior and infant temperament, measured during the third and eighth months, were collected.

Dependent Variable

The above-mentioned demographic, parent, and infant variables have been suggested as having some association with the dependent variable, colic. Although colic has been defined in various ways, its description has usually included references to soothability, feeding behavior, and physical symptoms of discomfort. The frequent association of these behaviors with colic has suggested that any measure of colic include reference to these common symptoms.

Procedure

The cooperation of prepared childbirth instructors from the Birthplace, Alachua General Hospital, Shands Hospital, and private obstetrical practices in Gainesville, Florida, was obtained in an effort to recruit subjects for this study. Only one instructor declined to cooperate because of the affiliated obstetrician's reluctance to involve his patients.

The investigator attended approximately 30 childbirth classes over a 4-month period of time for the purpose of personally soliciting the cooperation of expectant parents. It was thought that such personal contact would encourage greater participation and commitment to the

study. All prospective subjects were provided with an informed consent form describing the purpose and nature of the research (see Appendix A) and a packet of four envelopes containing the instruments to be completed for the duration of the study and letters explaining when and how these instruments should be completed.

Envelope #1 contained questionnaires designed to obtain demographic, anxiety, and maternal prenatal data during the third trimester of pregnancy. Envelope #2 contained instruments designed to obtain demographic data and information pertaining to experiences related to birth and the immediate postpartum period, anxiety data, and a measure of mother's fatigue. Measures of infant behaviors were also included in this envelope which was to be completed during the first week after birth. Instruments for collecting colic data were contained in Envelope #3 along with measures of anxiety and maternal support. Subjects were requested to complete this envelope any time during the sixth postpartum week. Envelope #4 contained forms for the collection of demographic and descriptive data, anxiety questionnaires, and temperament questionnaires, all to be completed when infants turned 3 months of age. Self-addressed stamped envelopes were provided for the purpose of returning forms to the investigator. Subjects were requested to telephone the investigator as soon after their infants' births as possible so that the investigator would know when subsequent envelopes were due. Subjects could then be contacted, by phone or mail, to remind them to complete forms within the specified time frames.

After Envelope #4 was received, the investigator conducted follow-up interviews with mothers to gather additional information which had not previously been obtained and to have the mothers describe their

infants' behavior in their own words. Over half of the mothers were interviewed over the telephone while the remainder received questions, similar to those asked in interviews, in the mail.

Because the possibility existed that the continuation of colic into the third month was confounding the results of the third month temperament questionnaires, duplicate copies of the temperament questionnaires were sent to mothers directing them to complete them when their infants reached 8 months of age.

Instrumentation

The following instruments were employed to obtain demographic and descriptive information as well as measures of prenatal and postnatal parent factors, first week infant behavior, and third and eighth month temperament. Information is also provided on instruments and items developed by the investigator for the purpose of collecting data on colic, the dependent variable. A summary of the variables, instrumentation, and timing of data collection is presented in Table 3.7.

Demographic Questionnaires

Demographic information on the participants was collected at two points in time. Basic introductory information was collected during the third trimester of pregnancy. Data related to labor, delivery, and the newborn infant were collected during the first postpartum week.

1. Demographic Data Sheet I (See Appendix B)

Demographic Data Sheet I, completed during the third trimester of pregnancy, was designed to obtain basic demographic data, such as education, age, race, occupation, and so forth.

Table 3.7

Variables, Instrumentation, and Timing of Data Collection

Variable(s)	Instrument	Timing of Data Collection: Prenatal, Third Trimester	Postnatal, Week 1	Week 6	Week 12	Week 32
Demographic:						
Education, Age, Race, Occupation, Times Pregnant, Birth Order, Baby's Sex, Drug Use, Father's Work Hours, Feeding Method, Birthweight, Gestational Age, Allergy, Gastrointestinal Distress	Demographic Data Sheets I, II	*	*			
Parent:						
Anxiety	STAI	*	*	*	*	
Seven Subscales of PRI	PRI	*				
Maternal Fatigue	1 Item from Demographic Data Sheet II		*			
Maternal Support	MSQ			*		
Infant:						
Infant Irritability	MABI		*			
4 Dimensions of MABI	MABI		*			
Temperament	ITC, IBQ, RITQ				*	*
Dependent Variables:						
Colic	CASS			*		
	MYRATE				*	

Note. * = Instrument completed.

2. Demographic Data Sheet II (See Appendix C)

Demographic Data Sheet II, completed during the first postpartum week, was designed to obtain information on birth and early postpartum experiences. Demographic data concerning the newborn were also obtained through this form.

Parent Measures

Parent psychosocial and emotional variables were investigated through the use of two standardized instruments and two instruments developed by the investigator. The global construct of anxiety was assessed prenatally and postnatally by the State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch, and Lushene, 1970), while more specific maternal prenatal factors were investigated via the Schaefer and Manheimer (1960) Pregnancy Research Inventory. The Maternal Support Questionnaire (MSQ) was adapted by the investigator to measure maternal support, while a single question, posed during the first postpartum week, provided data on maternal fatigue.

1. State-Trait Anxiety Inventory (STAI)

The State-Trait Anxiety Inventory (STAI) was completed, independently, by mother and father at four different points during the study. Both parents completed the STAI during the third trimester of pregnancy and first, sixth, and twelfth postpartum weeks.

The STAI is composed of 20 items measuring an individual's state anxiety and 20 items measuring trait anxiety. The main advantage of this measure of anxiety over those frequently encountered is that it differentiates between trait and state anxiety. State anxiety items measure a transitory emotional state characterized by consciously

perceived feelings of tension and apprehension whereas trait anxiety items reflect the relatively stable individual differences in anxiety proneness or the tendency to respond to situations perceived as threatening with elevations in state anxiety (Spielberger et al., 1970). In other words, items measuring trait anxiety are of the type investigating how an individual generally feels, while state anxiety items measure how an individual feels at the present moment. Since pregnancy and infantile colic are time-limited conditions, state anxiety might be the more relevant measure in this study.

Test-retest reliabilities on the STAI, for college undergraduates, were reported by Spielberger et al. (1970). As would be expected, trait stability coefficients ranged from .73 to .86 and were higher than state coefficients, which ranged from .16 to .54.

Coefficient alphas have been computed for samples of high school juniors, college freshmen, and introductory psychology students. These coefficients, which are more suitable measures of reliability for the state items than are stability coefficients, have ranged from .83 to .92 for the state items and .86 to .92 for the trait items.

The STAI has demonstrated relatively high correlations with other measures of anxiety lending support for its convergent validity. It has been found to correlate .75 and .76 with the IPAT Self-Analysis Form (Cattell & Scheier, 1963) and .80 and .79 with the Taylor (1953) Manifest Anxiety Scale, when administered to undergraduate college females (N = 126) and males (N = 80).

Reliability and validity of the STAI were assessed for the present study sample. Since the STAI was administered at four different points in time, stability coefficients were available for mother's and father's

state and trait anxiety for six time intervals (see Tables 3.8 and 3.9). Stability coefficients for mother's state and trait anxiety ranged from .20 to .43 and .42 to .69, respectively, while father's state and trait anxiety ranged from .36 to .59 and .58 to .74, respectively. As expected, mother's and father's trait anxiety evidenced greater stability than did their state anxiety. Although all stability coefficients were significant at .0001, state anxiety coefficients were not as low and trait coefficients were not as high as those found in Spielberger et al's normative sample. Such results may have several explanations. First, trait coefficients may be lower than expected because pregnancy and the early postpartum periods are periods of such disequilibrium (Hrobsky, 1977; Rossi, 1968; Zilborg, 1931) that an individual's trait anxiety may reflect a more than usual amount of state anxiety. Second, state coefficients may be somewhat higher than expected because the directions for the state form read "indicate how you feel right now, that is, at this moment." Providing a specific and uniform frame of reference, such as "indicate how you've felt during the third trimester of pregnancy," may have been more appropriate for detecting variations in state anxiety from one point in time to another.

Spielberger et al. (1970) found correlations between state and trait scales to range from .44 to .67 for male and female undergraduate students, respectively. Correlations between scales in the present study were somewhat higher, ranging from .66 to .74 for mothers and .60 to .81 for fathers. Spielberger et al. suggested that the correlations between scales could be influenced by the amount of stress characterizing the period when the state scale was completed. Again,

Table 3.8

Correlation Matrix for Mother's State and Trait Anxiety Measured at Four Different Points in Time

	Anxiety Scales							
	SM-P	SM-1	SM-6	SM-12	TM-P	TM-1	TM-6	TM-12
SM-P		.3675[a] .0001[b] 150[c]	.3143 .0001 147	.2665 .0015 139	.6681 .0001 155	.4840 .0001 149	.2931 .0003 147	.2588 .0021 139
SM-1			.3469 .0001 142	.2008 .0191 136	.3757 .0001 145	.7424 .0001 150	.5291 .0001 142	.3713 .0001 136
SM-6				.4258 .0001 138	.3469 .0001 142	.4093 .0001 146	.6559 .0001 148	.4449 .0001 138
SM-12					.2665 .0015 139	.3139 .0002 135	.4712 .0001 138	.5880 .0001 141
TM-P						.6580 .0001 145	.5291 .0001 142	.5180 .0001 134
TM-1							.6323 .0001 141	.5681 .0001 135
TM-6								.6893 .0001 138
TM-12								

Note 1. S--State anxiety; T--Trait anxiety; M--Mother; P--Third pregnancy trimester; 1--First postpartum week; 6--Sixth postpartum week; 12--Twelfth postpartum week.

Note 2. All correlation coefficients are significant at $p < .01$.
[a]Pearson product moment correlation coefficient.
[b]Probability level for the hypothesis test $\rho = 0$.
[c]Sample size N.

Table 3.9

Correlation Matrix for Father's State and Trait Anxiety Measured at Four Different Points in Time

	Anxiety Scales							
	SF-P	SF-1	SF-6	SF-12	TF-P	TF-1	TF-6	TF-12
SF-P		.3612[a] .0001[b] 144[c]	.4327 .0001 138	.4919 .0001 128	.7070 .0001 153	.5251 .0001 144	.3771 .0001 138	.5089 .0001 128
SF-1			.5899 .0001 135	.3569 .0001 124	.3125 .0002 141	.6879 .0001 141	.4750 .0001 135	.3332 .0002 123
SF-6				.5468 .0001 126	.4834 .0001 135	.5352 .0001 135	.5982 .0001 141	.5344 .0001 125
SF-12					.5269 .0001 126	.6041 .0001 124	.5122 .0001 126	.8069 .0001 129
TF-P						.6874 .0001 141	.5765 .0001 135	.6953 .0001 126
TF-1							.7386 .0001 135	.7433 .0001 123
TF-6								.6407 .0001 125
TF-12								

Note 1. T--Trait anxiety; S--State anxiety; F--Father; P--Third pregnancy trimester; 1--First postpartum week; 6--Sixth postpartum week; 12--Twelfth postpartum week.

Note 2. All correlation coefficients are significant at $p < .01$.
[a]Pearson product moment correlation coefficient.
[b]Probability level for the hypothesis test $\rho = 0$.
[c]Sample size N.

because STAI instructions were not altered to reflect a specific period in time, fine distinctions between state and trait anxiety may have been blurred. Another possible explanation for the rather high interscale correlations is that some subjects may have failed to notice the differences in the instructions for the state and trait scales. Although the differentiating characteristics of the instructions for each scale were underlined in red to alert subjects to their differences, the possibility still exists that some subjects may have failed to read and understand the different instructions.

2. Pregnancy Research Inventory (PRI) (See Appendix D)

The Pregnancy Research Inventory (PRI) was completed by mothers during the third trimester of pregnancy. The inventory consists of 128 multiple-choice format items comprising eight scales: (1) Health problems during pregnancy, (2) Fears for self, (3) Lack of desire for pregnancy, (4) Dependency, (5) Fears for baby, (6) Irritability and tension in the mother, (7) Lack of maternal feelings, and (8) Depression and withdrawal. This instrument was thought to tap specific sources of maternal prenatal state and trait anxiety.

Freese and Thoman (1978) have reported internal consistency and stability coefficients for the seven scales used in this study. Internal consistencies for primiparas ranged from .66 to .86 for all scales except Lack of Maternal Feeling which demonstrated an internal consistency of .39. Internal consistencies for multiparas ranged from .57 to .89. Stability coefficient ranged from .79 to .97 for primiparas and .90 to .98 for multiparas. The sample for obtaining these correlations consisted of 40 married women, 20 primiparas and 20 multiparas, from middle- to lower-middle-class families. The PRI

was administered 26 to 38 days prior to due dates and readministered 2 days later. Validity assessments for the PRI have either not been conducted or were unable to be located by the investigator.

Although reliability and validity estimates were not computed for the sample in the present study, Freese and Thoman (1978) have suggested that the PRI "can be used by other investigators with the assurance that [it] will provide reliable assessments of certain maternal characteristics that may be of importance during the late prenatal [period]" (p. 96). The similarity between the sample used by Freese and Thoman and the one available for the present study lends some assurance as to the reliability of the PRI. Validity data for the present study sample were not obtained.

3. Maternal Fatigue Item

A measure of mother's first postpartum week fatigue was obtained through the structured response to the following question, included on Demographic Data Sheet II:

How tired do you feel now? (Circle one response)

1. Extremely tired
2. Very tired
3. A little tired
4. Not very tired
5. Not tired at all

4. Maternal Support Questionnaire (MSQ) (See Appendix E)

The Maternal Support Questionnaire is a 22-item questionnaire adapted from the postpartum questionnaire developed by Pleshette, Asch, and Chase (1956) and a measure of support questionnaire developed by Steglin (1983). The MSQ was designed to investigate the mother's actual support system, the support provided by the father, and the mother's perceptions of the adequacy of her support system.

The construction of the MSQ was investigated in a pilot study conducted 3 months prior to data collection (see Appendix F for Consent Form). Mothers of 1- to 10-week-old infants, who were patients of a private pediatric group in Gainesville, Florida, volunteered to complete the MSQ and discuss their reactions to it in an interview with the investigator. After a few changes in wording were made, all mothers felt that the MSQ was relatively easy to understand and to complete. When asked if the MSQ posed pertinent questions related to their support systems, mothers responded in the affirmative. No suggestions for inclusion of additional items or exclusion of present ones were made. Reliability and validity data on the PRI were not obtained.

5. Interview Schedule (See Appendix G)

Between 3 and 4 months after birth, mothers were interviewed as a means of obtaining some additional information about their infants' behavior, particularly crying behavior, during the first 3 months of life. In addition to structured questions designed to obtain specific information related to infant behavior, mothers were requested to describe their infants' crying behavior, during the first 3 months of life, in their own words.

Infant Measures

Infant behavior was assessed during the first postpartum week and third and eighth months after birth. The MABI was chosen to assess selected infant behaviors, specifically irritability, during the first week of life. Three different temperament questionnaires were administered at 3 and 8 months of age in an effort to cover several temperament dimensions.

1. Mother's Assessment of the Behavior of Her Infant (MABI) (See Appendix H)

The Mother's Assessment of the Behavior of Her Infant (MABI), developed by Field, Dempsey, Hallock, and Shuman (1978), was completed by mothers during the first postpartum week. The MABI, a modified version of the Brazelton Neonatal Behavioral Assessment Scale (Brazelton, 1973), was developed in an attempt to determine how closely mothers' assessments of neonatal behavior approximated those of trained Brazelton testers. While the neurological reflex items on the unmodified Brazelton Scale have been omitted from the MABI, all of the behavioral items have been retained, including the newborn's orienting response to inanimate visual and auditory stimuli, attention to faces and voices, arousability, motor maturity, cuddliness, consolability, and self-quieting ability. Although the language on the MABI has been simplified, and the scale has been reduced from a 9-point to a 4-point scale the performance continuum of the Brazelton scale has been preserved.

The authors also adapted Brazelton's a priori scoring dimensions for use on the MABI. The first dimension, Interactive Processes, deals with the infant's capacity to respond to social stimuli and is evaluated by the infant's orientation, cuddliness, and consolability with intervention. The second dimension, Motoric Processes, deals with the infant's ability to maintain adequate tone, control motor behavior, and perform integrated motor actions. The third dimension, State Control, focuses on the infant's ability to organize his or her state and to habituate to stimuli in the environment. The fourth dimension, Physiological Response to Stress, is measured by the infant's tremulousness, startles, and skin color lability.

The developers of the MABI had a sample of 64 mothers assess their infants at 3 days of age and found that mothers and trained testers agreed on at least 80% of the MABI items. There were no significant differences between mothers' assessments and trained testers' assessments of newborns except on the Social Interactive Processes dimension where trained testers assigned more optimal ratings. No correlation has been provided for the MABI and Brazelton, but MABI and Brazelton correlations with 8-month Bayley motor scores were similar. Mothers' Motoric Process scores for term newborns were correlated with 8-month Bayley motor scores $r = .34$ ($p < .05$), while the correlation for trained testers was $r = .38$ ($p < .05$). Estimates of reliability and validity were not obtained for the present study sample.

2. Revised Infant Temperament Questionnaire (RITQ)

The Infant Temperament Questionnaire, developed by Carey (1970), was completed by mothers during the third and eighth months after birth. The RITQ is an attempt to measure the nine temperament categories first proposed by Thomas et al. (1963). It was later revised by Carey and McDevitt (1978) in a successful attempt to improve its psychometric properties. It has been standardized on infants from 4 to 8 months of age.

Carey (1970) reported internal consistencies for the nine temperament categories (Activity, Rhythmicity, Approach, Adaptability, Intensity, Mood, Persistence, Distractibility, Threshold) ranging from .49 for Distractibility to .71 for Approach. Stability coefficients ranged from .66 for Intensity to .81 for Mood.

Vaughn et al. (1980) reported test-retest coefficients for the nine temperament categories, based on a sample of 187 infants who were

administered the RITQ at 3 and 6 months of age. Low, but significant ($p < .01$), correlations were found for all categories. Stability coefficients ranged from .20 for Persistence to .60 for Threshold to Stimulation.

The authors of the RITQ provided neither convergent nor discriminant validity data for their temperament scales. However, Bates (1979) found some convergence between his Infant Characteristics Questionnaire (ICQ) Fussy-Difficult factor and the RITQ Mood scale (r = .61, N = 82), the ICQ Unadaptable factor and the RITQ Approach scale (r = .43, N = 82), and the ICQ Unpredictable factor and RITQ Rhythmicity scale (r = .51, N = 82).

Stability coefficients for the RITQ for the present sample were based on the administration of the measure at 3 and 8 months of age. While the present study sample differed from Vaughn et al.'s (1980) sample, consisting of young, single, and economically disadvantaged primiparas, the coefficients for both samples were similar. The stability correlations for the present sample ranged from .34 ($p < .0001$) for Rhythmicity to .48 ($p < .0001$) for Threshold to Stimulation (see Table 3.10).

Convergent validity coefficients for the present sample were obtained for the RITQ scales of Activity, Mood, Rhythmicity, and Adaptability by correlating them with equivalent dimensions of Bates's ICQ and Rothbart's IBQ. Significance was reached for all correlations ($p < .01$), except for the RITQ Mood scale and IBQ Smiling and Laughter dimension (see Table 3.11).

Table 3.10

Stability Coefficients for the Nine Temperament Scales of the RITQ for the Present Study Sample

RITQ Scale	*r* (3-8 months)
Activity	.463*
Rhythmicity	.335*
Adaptability	.431*
Approach	.470*
Threshold	.480*
Intensity	.332*
Mood	.452*
Distractibility	.423*
Persistence	.412*

Note. *N* = 99.

*$p < .0001$.

Table 3.11

Convergent Validity Coefficients for RITQ Scales of Activity, Mood, Rhythmicity, and Adaptability

	3 Months			8 Months		
Temperament Scales	*r*	*p*	*N*	*r*	*p*	*N*
RITQ Activity and IBQ Activity	.428	.0001*	138			
RITQ Mood and ICQ Fussy-Difficult	.368	.0001*	140	.529	.0001*	104
IBQ Smiling and Laughter	.213	.0120	138			
RITQ Rhythmicity and ICQ Unpredictable	.331	.0001*	140	.478	.0001*	104
RITQ Adaptability and ICQ Unadaptable	.553	.0001*	140	.489	.0001*	104

Note. Since negative correlations were a function of arbitrary scaling of instruments, negative signs have been changed to positive signs for the sake of clarity.

*$p < .01$.

3. Infant Behavior Questionnaire (IBQ)

The Infant Behavior Questionnaire (IBQ), developed by Rothbart (1981) was completed by mothers during the third and eighth months after birth. The IBQ was developed in an effort to tap conceptually distinct temperament dimensions. The administration of the IBQ was of value in the present study for two reasons. First, it is one of the only temperament questionnaires that has been standardized on infants as young as 3 months old. Second, Meyer's (1958) speculation that colic may be due to the infant's frustrating immaturity suggests that the IBQ dimension "Distress to Limitations" may be particularly relevant to the colicky baby.

Coefficient alphas for the six temperament scales of the IBQ have ranged from .73 to .84 for Activity level, .73 to .85 for Smiling and Laughter, .80 to .84 for Fear, .75 to .84 for Distress to Limitations, .73 to .84 for Soothability, and .67 to .75 for Duration of Orienting. These ranges are based on the internal consistencies for 3, 6, 9, and 12 month forms of the IBQ. Validation studies are presently being conducted by the developer of the IBQ.

Test-retest correlations of the IBQ dimensions for the present sample were based on the administration of the measure at 3 and 8 months of age. Stability coefficients were computed for the dimensions of Frustration to Limitations (r = .388, p < .0001, N = 96), Duration of Orienting (r = .401, p < .0001, N = 96), and Distress and Latency to Novel Stimuli (r = .352, p < .0004, N = 96).

Convergent validity coefficients for the present sample were obtained for the Activity and Smiling and Laughter dimensions of the IBQ. The 3-month-old IBQ Activity dimension correlated .428

($p < .0001$, $N = 138$) with Carey's RITQ Activity scale, while the 3-month-old IBQ Smiling and Laughter dimensions correlated .213 ($p < .0123$, $N = 138$) with the RITQ Mood scale and .352 ($p < .0001$, $N = 138$) with Bates' ICQ Fussy-Difficult factor. Since negative correlations were a function of arbitrary scaling of instruments, negative signs have been changed to positive signs for the sake of clarity.

4. Infant Characteristics Questionnaire (ICQ) (See Appendix I)

The Infant Characteristics Questionnaire (ICQ), developed by Bates et al. (1979) for the primary purpose of assessing the construct of "difficult" temperament, was completed by mothers during the third and eighth months after birth. The authors believe that the 6-month version of the ICQ is appropriate for parents of infants 4 to 7 months of age.

The ICQ yields scores for the four temperament factors of Fussy-Difficult, Unadaptable, Dull, and Unpredictable. Bates et al. (1979) have reported psychometric and validation results on these four factors. Internal consistencies ($N = 196$) were reported to be .39 for Dull, .50 for Unpredictable, .75 for Unadaptable, and .79 for Fussy-Difficult. Test-retest reliability ($N = 112$) were reported as follows: .47 for Unpredictable, .54 for Unadaptable, .57 for Dull, and .70 for Fussy-Difficult. While mother-father ICQ convergence ($N = 89$) ranged from .38 for Unpredictable to .61 for Fussy-Difficult, the only factor to reach significance ($p < .05$) in the test of observer-parent ICQ convergence was Fussy-Difficult (Observer-Mother: $r = .34$, $N = 98$; Observer-Father: $r = .40$, $N = .40$).

Test-retest correlations on the ICQ for the present study sample were based on its administration at 3 and 8 months of age. Stability coefficients for the four IBQ factors were as follows: Fussy-Difficult, $r = .667$ ($p < .0001$, $N = 101$), Unadaptable, $r = .493$ ($p < .0001$, $N = 101$), Dull, $r = .390$ ($p < .0001$, $N = 101$), and Unpredictable, $r = .328$ ($p < .0008$, $N = 101$).

Convergent validity data for the present sample were obtained for the factors of Fussy-Difficult, Unpredictable, and Unadaptable at 3 and 8 months of age and are as follows: Fussy-Difficult was correlated .368 ($p < .0001$, $N = 140$) with Carey's RITQ Mood scale when assessed at 3 months of age and .529 ($p < .0001$, $N = 104$) when assessed at 8 months of age. The 3-month Fussy-Difficult factor correlated .352 ($p < .0001$, $N = 138$) with Rothbart's IBQ Smiling and Laughter dimension. Significant correlations ($p < .0001$) were also found for the ICQ factor of Unpredictable and the RITQ scale of Rhythmicity (3 months: $r = .331$, $N = 140$; 8 months: $r = .478$, $N = 104$) and the ICQ Unadaptable factor and the RITQ scale of adaptability (3 months: $r = .553$, $N = 140$; 8 months: $r = .489$, $N = 104$).

Measurement of Colic

Because colic is usually diagnosed by clinical judgment and rarely studied systematically, colic instruments had to be developed or adapted by the investigator.

During the 3 months prior to data collection, a pilot study was conducted to test the construction of the Colic and Soothability Scale (CASS) and Cry Scale (CS). Twenty mothers of 1- to 10-week-old infants, who were patients of a private pediatric group in Gainesville,

Florida, volunteered to complete these questionnaires and discuss their reactions to them in a telephone interview with the investigator. Aside from a few changes in the wording of some items, few changes were made in the CASS and CS. After changes were made, all mothers felt that the forms were relatively easy to understand and to complete. Mothers also expressed the opinion that completing the CASS and CS over a 5-day period made them feel more comfortable with the validity of their responses.

Although the CASS was chosen as the primary instrument for collection of colic data, several measures of infant crying and colic were developed in an attempt to investigate different perspectives of infant colic. Infant colic was, therefore, investigated via the following instruments and items.

1. Colic and Soothability Scale (CASS) (See Appendix J)

The Colic and Soothability Scale (CASS), developed by the investigator, was completed by mothers on five consecutive days during the sixth postpartum week. The 12-item scale was developed in an effort to obtain quantitative and qualitative information on colicky behavior. It was developed by first identifying a domain of behavior that experts have agreed upon as being frequently observed in the colicky baby. The major categories of behaviors arrived at consisted of Soothability, Periodicity of Crying, Frequency of Crying, Duration of Crying, Intensity of Crying, Physical Symptoms, and Feeding Behavior. On the assumption that colic exists on a continuum, items were constructed on a 5-point rating scale.

Strengths. A major advantage of the CASS is that it quantifies and qualifies aspects of colicky behavior. A total colic-soothability

score can be obtained for each infant, permitting placement on a continuum ranging from soothable-noncolicky to unsoothable-colicky. In addition to total scores, the CASS also yields category scores for the above-mentioned behavior domains. In an attempt to circumvent the influence of parent perceptions, ratings for several items are based on observable infant behaviors. The administration of the scale on five consecutive days, during the infant's sixth week of life, is an attempt to improve the reliability of ratings obtained by CASS.

Limitations. Although several item responses have been based on specific observable infant behaviors, a few item responses have retained a format that increases the possibility of response bias. Whenever responses of the "almost always" to "almost never" type are used, ambiguity is increased. One respondee's "sometimes" may be another's "frequently." However, this is a shortcoming inherent in this format and must, therefore, be thought of as error due to individual differences.

Another limitation of the CASS is that it forces the rater to make a choice among responses. Because the rater can circle only one response, information on the degree of applicability of the other responses is lost. Hence, finer discriminations among the behavior of different infants cannot be made.

Because parents often tend to minimize the crying behavior of their infants (Carey & McDevitt, 1978), information obtained by the CASS may be less than accurate. Social desirability is a frequent problem in instruments of this type and can only be reduced by trying to alleviate parents' concerns about socially acceptable behavior. Included in the directions for CASS is a statement that there are no good or bad answers, only responses that best describe each infant.

To further guard against possible response bias due to differing reactions to the term "colic," the title appearing on parents' copies of the CASS read "Infant Behavior Scale."

The tendency to avoid extreme ratings is another characteristic problem of rating scales. Explicit directions to guard against the tendency to rate toward the middle of the scale when a more extreme rating would be more appropriate were given along with other specific rating directions intended to increase the reliability of responses (Mehrens & Lehman, 1973).

Scoring of CASS. Total CASS scores were obtained by computing the average response for each item over a 5-day period and then summing the averages. Items 1, 2, 4, 5, 7, 8, 9, 10, 11, and 12 were included in the calculation of total scores. Items 3 and 6 were omitted because they dealt with physical symptoms such as gas and discomfort which may have been due to allergy. A distinction between allergic colic and colic due to unknown causes was desired.

Subscale scores were obtained in the same manner as total scores. The items employed to represent each subscale were as follows: Frequency (items 11 and 12), Physical Symptoms (items 3, 6, and 10), Feeding Behavior (items 1, 8, and 13), Soothability (items 5 and 7), Time of Day (item 2), Duration (item 4), and Intensity (item 9).

Reliability and validity of CASS. Internal consistency, measured by coefficient alpha, for total CASS socres was $r = .818$.

Validity was assessed by correlating total CASS scores with other measures of colic, constructed by the investigator (see Table 4.1). Correlations between CASS scores and other measures of colic ranged from .727 ($p < .0001$) for the Cry Scale (CS) to .533 ($p < .0001$) for the Mother's Rating of Colic (MRCOLIC). Although moderate and

significant correlations between total CASS scores and other measures of colic appear to support the validity of the CASS, such results must be viewed cautiously as the validation criteria themselves have not been subjected to validation tests.

2. The General Colic and Soothability Scale (GCASS)

The GCASS is identical to the CASS except that mothers were requested to complete each item on the CASS from the viewpoint of their infants' most common pattern of behavior during the first 3 months of life.

3. Cry Scale (CS) (See Appendix K)

The Cry Scale (CS), comprised of one item, was completed by the mother on 5 consecutive days during the infant's sixth week of life. On each day, mothers were requested to rate their infants' soothability on a scale from 1 (very soothable) to 4 (very unsoothable). Scores for the CS were obtained by summing daily ratings across the 5 days.

The Cry Scale was adapted from Anderson's (1980) colic scale which was based on a colic classification system developed by Paradise (1966). Changes in the original scale were made, by the investigator, in order to separate the confounding variable of parental emotional response from infant behavior.

4. General Cry Scale--Mother (GCSM)

The GCSM is identical to the Cry Scale except that mothers were requested to rate their infants' most general or common behavior pattern during the first 3 months of life on a scale from 1 (very soothable) to 4 (very unsoothable).

5. General Cry Scale--Father (GCSF)

The GCSF is identical to the Cry Scale except that fathers were requested to rate their infants' most general or common behavior

pattern during the first 3 months of life on a scale from 1 (very soothable) to 4 (very unsoothable).

6. Investigator's Rating of Colic (MYRATE)

This variable, based on the third month interview with the mother, was created by the investigator as a means of classifying infants according to the rating system established by Paradise (1966). Although the CS, GCSM, and GCSF also performed this function, it was felt that a more objective rating might be achieved by the investigator.

Each infant was rated on a scale from 1 to 4 (1--No colic, 2--Mild colic, 3--Moderate colic, 4--Severe colic) depending upon how well his or her behavior, as described by the mother, fit into the following categories:

> Group 1 (None).--There was no crying whatsoever which could not be accounted for by the mother on some obvious basis.
>
> Group 2 (Mild).--There were episodes of unexplained crying or fussiness which were so mild, brief, or easily ameliorated as to be considered insignificant or trivial.
>
> Group 3 (Moderate).--There were unexplained episodes of sustained crying of moderate severity, occurring often enough to be considered troublesome or distressing. Holding or rocking resulted in only partial or inconsistent relief. Infants with frequent but short periods of intense crying were also included in this group.
>
> Group 4 (Severe).--These infants had prolonged and intense periods of crying or screaming throughout the first three months of life or longer, not lessened by any attempted method of control, and of overriding concern to the mother. (Paradise, 1966, p. 193)

7. Pediatrician's Rating of Colic (PEDCOL)

This variable was obtained through the following question from Demographic Data Sheet III:

> Has your pediatrician ever used the word "colic" when describing your baby? Yes No

Although this item was included as an attempt to achieve an objective diagnosis of colic from a qualified source, caution must be used in its interpretation, for pediatricians were not personally asked about their diagnoses of colic.

8. Mother's Rating of Colic (MRCOLIC)

This variable was obtained by the following question from Demographic Data Sheet III:

> Colic is a term that is often used to describe the unexplainable, unsoothable crying or fussing of a young baby. Colicky babies frequently appear to be in physical discomfort from gas or intestinal cramps.
>
> Based on the above description, how colicky would you say your baby was during his or her first few months of life?
>
> 1. Extremely colicky
> 2. Very colicky
> 3. Somewhat colicky
> 4. Not very colicky
> 5. Not at all colicky

The MRCOLIC was an attempt to have mothers rate the degree of colic in their infants given the same frame of reference for interpreting the term "colic."

9. Mother's Rating of Crying (RATECRY)

Since the term "colic" holds negative connotations for many mothers, mothers were requested to rate their infants' "crying" behavior during the first 3 months of life. The RATECRY was obtained by the following question from the Interview Schedule:

> Was there much unsoothable or unexplainable crying in the first three months of your baby's life? (Unsoothable: fussed, whined, cried after being fed, changed, etc. Couldn't be made completely happy or content.)

1. A great deal
2. Some
3. A little
4. Not much
5. None

10. Health Inventory (HI)

At 6 weeks of age, mothers were requested to indicate whether infants had demonstrated any of 20 behaviors or problems contained on a Health Inventory Form. The variable, HI, simply assessed mother's response to the question

Does your infant have colic? Yes No

This item, unlike MRCOLIC, presented no frame of reference for interpreting the term colic.

Hypotheses

Hypotheses relating demographic, parent, and infant variables to infant colic were tested. Hypotheses 1 through 9, and Hypothesis 13, were tested using regression analysis. General Linear Model (GLM) procedures were employed in testing partial regression coefficients, whereas stepwise procedures were used to reduce the model to the best set of predictors. Hypotheses 10 through 12 were tested using correlational methods. Because of the large number of tests conducted, the level of significance set for all models was alpha = .01. This criterion level was set in an attempt to reduce the chances of making Type I errors over the entire set of analyses.

Hypotheses, organized according to whether they involve demographic, parent, or infant variables, are presented below.

Demographic Variables

Hypothesis 1: There is no linear relationship between father's education, mother's education, mother's age, father's occupation, mother's occupation, race, number of pregnancies, and total CASS scores collected 6 weeks after birth.

Hypothesis 2: There is no linear relationship between father's education, mother's parity, baby's sex, initial feeding method, mother's use of drugs in labor and delivery, father's work hours, baby's birthweight, gestational age, and total CASS scores collected 6 weeks after birth.

Parent Variables

Hypothesis 3: When father's education is controlled for, there is no linear relationship between mother's and father's prenatal (third trimester) state and trait anxiety and total CASS scores collected 6 weeks after birth.

Hypothesis 4: When father's education and mother's and father's prenatal state anxiety are controlled for, there is no linear relationship between the seven Pregnancy Research Inventory scales (Fears for Self, Lack of Desire for Pregnancy, Dependency, Fears for Baby, Irritability and Tension, Lack of Maternal Feelings, Depression and Withdrawal) and total CASS scores collected 6 weeks after birth.

Hypothesis 5: When father's education and mother's prenatal state anxiety are controlled for, there is no linear relationship between mother's and father's first postpartum week state and trait anxiety and total CASS scores collected at 6 weeks after birth.

Hypothesis 6: When father's education and mother's first postpartum week state anxiety are controlled for, there is no linear relationship between mother's fatigue during the first postpartum week and total CASS scores collected 6 weeks after birth.

Hypothesis 7: When father's education and mother's first postpartum week fatigue and state anxiety are controlled for, there is no linear relationship between maternal support and total CASS scores, both collected 6 weeks after birth.

Infant Variables

Hypothesis 8: When father's education, mother's first postpartum week fatigue and state anxiety, and mother's perception of support are controlled for, there is no linear relationship between the four dimensions of the Mother's Assessment of the Behavior of her Infant (MABI) and total CASS scores collected 6 weeks after birth.

Hypothesis 9: When father's education and mother's first postpartum week fatigue and state anxiety are controlled for, there is no linear relationship between neonatal irritability scores collected during the first week of life and total CASS scores collected 6 weeks after birth.

Hypothesis 10: There is no relationship between the nine temperament subscales of Carey's Revised Infant Temperament Questionnaire (Activity, Rhythmicity, Approach, Adaptability, Intensity, Mood, Persistence, Distractibility and Threshold to Stimulation), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

Hypothesis 11: There is no relationship between the four factors of Bates's Infant Characteristics Questionnaire (Fussy-Difficult, Unpredictable, Dull, Unadaptable), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

Hypothesis 12: There is no relationship between the five temperament subscales of Rothbart's Infant Behavior Questionnaire (Activity Level, Smiling and Laughter, Frustration to Limitations, Duration of Orienting and Fear), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

Hypothesis 13: When father's education, mother's first postpartum week state anxiety and fatigue, and 3-month-old infant Threshold to Stimulation are in the model, there are no interactions between mother's first postpartum week state anxiety or fatigue and 3-month infant Threshold to Stimulation in the prediction of colic scores collected 6 weeks after birth.

CHAPTER IV
RESULTS

Introduction

The present study was designed to investigate (1) the relationships between multiple measures of parent psychosocial factors during the third trimester of pregnancy and early postpartum period and the occurrence of infantile colic; (2) whether neonatal behaviors, especially irritability, during the first week of life are related to the emergence of infantile colic in the next few months of life; and (3) the relationship between infantile colic and infant temperament.

A sample of 163 infants was available to study the above-mentioned questions. Males and females were fairly equally represented with approximately half of the infants being male and half being female. While the entire sample provided data for some analyses, the sample size is not consistent throughout all analyses as some subjects failed to complete all questionnaires. Demographic and descriptive characteristics of the study sample were presented in Chapter III. Descriptive statistics for variables are presented in Appendix L.

Chapter IV is organized so that ancillary analyses are presented first, then the main hypotheses are tested. Ancillary analyses include a description of the characteristics of infantile colic and correlations between independent and dependent variables. Hypotheses are then tested using regression and correlational analyses.

Characteristics of Colic

Introduction

Many of the general characteristics of infantile colic, which have been cited in the literature, were investigated in this study. Several measures of infant crying and colic were collected in an attempt to investigate different perspectives of infantile colic. Since it was felt that colic exists on a continuum, instruments capable of producing continuous variables were constructed. Subscale and total scores were calculated for the Colic and Soothability Scale (CASS), General Colic and Soothability Scale (GCASS), Cry Scale (CS), and General Cry Scales (GCSM and GCSF). In order to provide some consistency with previous research, most of which has dealt with colic as a dichotomous variable, instruments designed to provide categorical data were constructed. Therefore, scores were also obtained for the Investigator's Rating of Colic (MYRATE), Mother's Rating of Colic (MRCOLIC), Mother's Rating of Crying (RATECRY), Health Inventory (HI), and Pediatrician's Rating of Colic (PEDCOL).

For the following reasons, total CASS scores were chosen as the major dependent variable: (1) The CASS reflects the domain of behaviors that experts have agreed upon as being frequently observed in the colicky baby; (2) correlations between CASS subscale scores and independent variables were lower than those between total CASS scores and independent variables; (3) all subscales, except the Time of Day subscale, were moderately correlated among themselves (r = .31 to .59, p < .0001) leading one to question the use of subscales (see Appendix M-1); and (4) most measures of colic correlated more highly

with total CASS scores than with any other measure of colic, lending credibility to the validity of total CASS scores (see Table 4.1).

The Investigator's Rating of Colic (MYRATE) was selected as the major categorical measure of colic because the rating system was based on the already established classification system of Paradise (1966), and it exhibited a moderate correlation (r = .58, p < .0001) with total CASS scores.

Therefore, while several measures of the dependent variable were available, CASS was used in the testing of hypotheses and MYRATE was used in the ancillary analyses of data on the incidence of colic, its onset and disappearance, and its relationship with feeding method, birth order, periodicity of crying, allergy, and gastrointestinal distress. These characteristics and descriptors of colic are presented in the sections below.

Incidence

Colic and Soothability (CASS) scores, collected 6 weeks after birth, were distributed around a mean of 22.66 and had a standard deviation of 5.03 (N = 147). While the possible range of scores was 12 to 60, the minimum and maximum values obtained for this sample were 12.6 and 37.8, respectively.

In order to allow comparison with previous literature, categorical variables, assessed by MYRATE, MRCOLIC, RATECRY, HI, and PEDCOL were employed to present incidence data in terms of percentages. The incidence of moderate and severe colic ranged from 25% to 36% depending upon the measure used to define it. The MYRATE placed approximately 35% of infants in the moderate and severe colic groups, while MRCOLIC

Table 4.1

Intercorrelation Matrix of Eight Measures of Infantile Colic

	Colic Measures						
	CASS	CS	GCASS	GCSM	GCSF	MYRATE	MRCOLIC
CASS							
CS	.7265[a] (146)[b]						
GCASS	.6869 (120)	.5455 (119)					
GCSM	.5365 (121)	.6447 (121)	.6911 (118)				
GCSF	.4919 (110)	.5959 (110)	.4765 (106)	.7103 (111)			
MYRATE	.5841 (130)	.5095 (129)	.5459 (110)	.6012 (112)	.4572 (102)		
MRCOLIC	.5326 (135)	.4418 (134)	.5239 (114)	.5176 (115)	.4289 (104)	.6954 (126)	
RATECRY	.6498 (127)	.5444 (126)	.5734 (108)	.5667 (110)	.4881 (100)	.6343 (130)	.7428 (124)

Note 1: Since negative correlations were a function of arbitrary scaling of instruments, negative signs have been changed to positive signs for the sake of clarity.

Note 2: All correlation coefficients are significant at $p < .0001$.

[a]Pearson product moment correlation coefficient.
[b]Sample size N.

gave 25% of infants similar ratings. The RATECRY yielded figures similar to MYRATE as it placed approximately 36% in the moderately colicky group.

The HI and PEDCOL gave more conservative estimates of the incidence of colic at 6 weeks. When asked, at 6 weeks after birth, whether or not their infants had colic, approximately 19% of mothers responded in the affirmative. When asked at 3 months of age whether or not their pediatricians had ever used the term "colic" in reference to their infant, approximately 13% indicated yes. As noted earlier, caution must be used when interpreting this final measure, however, as doctors were not asked directly about their diagnoses of colic (see Table 4.2).

Table 4.2

Incidence of Colic for Various Colic Measures (in %)

Colic Measure	N	Degree of Colic				
		None	Mild	Moderate	Severe	
MYRATE	133	28.57	36.84	24.81	9.77	
		Not at all colicky	Not very colicky	Somewhat colicky	Very colicky	Extremely colicky
MRCOLIC	139	42.45	33.09	12.95	10.07	1.44
		None	Not much	A little	Some	A great deal
RATECRY	130	13.85	29.23	2.077	24.62	11.54
		No mention of colic			Yes, mentioned colic	
PEDCOL	140	86.53			12.77	
		No, does not have colic			Yes, has colic	
HI	150	81.33			18.67	

Onset and Disappearance

Mothers noticed an increase in crying at approximately 2 weeks of age. Crying increased until the fourth week of life when it peaked, reached a plateau, then decreased until beginning to subside around 10 weeks of age (see Table 4.3). These figures for onset and disappearance were similar whether infants were assigned to the no colic, mild colic, moderate colic, or severe colic groups, as defined by MYRATE. However, variability of ages differed for infants in the four colic groups, with infants in the moderate and severe colic groups evidencing less variability than those in the no and mild colic groups (see Table 4.4). All infants in the severe colic group had begun increased crying by 3-1/2 weeks of age, whereas the maximum value for infants in the no colic group was 8 weeks.

Table 4.3

Means and Standard Deviations for Onset and Disappearance of Increased Infant Crying

Increased Crying	N	M	SD
Onset	88	1.94 weeks	1.65
At Worst	67	3.94 weeks	2.79
Disappearance (subsiding)	87	10.50 weeks	3.35

Feeding Method

Differences in degree of colic evidenced by infants maintained on breast-feedings, bottle-feedings, and a combination of the two feeding

Table 4.4

Descriptive Statistics for Onset and Disappearance of Increased Crying for Infants in the Four MYRATE Colic Groups

MYRATE Group	M	N	SD	Minimum Value	Maximum Value	Range
No Colic						
Onset (weeks)	2.26	14	2.17	3 (days)	8	8
At Worst (weeks)	3.01	13	3.26	0 (days)	12	12
Disappearance (weeks)	14.20	13	5.04	2	14	7
Mild Colic						
Onset (weeks)	2.04	32	1.74	1 (day)	8	8
At Worst (weeks)	4.49	25	3.14	1 (day)	12	12
Disappearance (weeks)	9.4	33	6.9	2	14	12
Moderate Colic						
Onset (weeks)	1.94	29	1.56	1 (day)	6	6
At Worst (weeks)	4.21	21	2.23	1	8	7
Disappearance (weeks)	10.70	28	4.10	4	14	10
Severe Colic						
Onset (weeks)	1.39	13	1.00	1 (day)	3.5	3.2
Worst (weeks)	2.96	8	1.92	4 (days)	6	5.5
Disappearance (weeks)	9.15	13	2.7	4	13	9

methods was investigated. Chi-square analyses performed on MYRATE and Feeding Methods during the first week of life, χ^2 (9, N = 132) = 0.12, p < .437, and third month of life, χ^2 (6, N = 128) = 1.85, p < .933, were nonsignificant at .01. Feeding method, therefore, did not appear to be related to colic.

Birth Order

The relationship between birth order and ratings on the MYRATE scale was analyzed using the chi-square procedure. Results showed no significant difference in colic ratings among first- through fifth-born infants, χ^2 (12, N = 131) = 20.47, p < .059). However, while first- and second-born infants were similarly spread among different colic groups, 75% of third-born children were placed in the moderate colic group, compared to 23.91% of first-borns and 11.11% of second-born children. Interpretation of these figures must be made with caution, however, as the sample size for third-born children was small (N = 6).

While no significant differences in colic ratings due to birth order were established, there was slightly more colic among first-born than second-born children. In an attempt to account for this difference, additional correlations were computed between colic and anxiety by parity, and colic and mother's postpartum milk consumption. The former correlation was nonsignificant at .01, r = -.037, (p < .7342, N = 88). The relationship between maternal postpartum state anxiety and colic was not greater for first mothers than for more experienced mothers. However, primiparas were found to consume significantly more milk than multiparas in the postpartum period (r = -.227, p < .01, N = 100).

Periodicity

During telephone interviews, 68 mothers were asked to indicate during what part of the day most of their baby's fussy periods occurred. Fifty-seven percent indicated that fussy periods occurred only in the evenings, whereas 24% stated that fussy periods occurred any time during the day or night. A chi-square analysis on Periodicity of Crying and MYRATE indicated a significant difference in periodicity of crying among infants in the different colic groups, χ^2 (12, N = 68) = 47.44, $p < .001$. Over 85% of infants in the mild colic group fussed only in the evening compared with 52% in the moderate colic group, and 0% in the severe colic group (see Table 4.5).

Table 4.5

Periodicity of Crying for Infants in Four MYRATE Colic Groups (in %)

		Periodicity of Crying		
MYRATE Group	N	Only Evening	Mostly Evening	Anytime
No Colic	3	50.00	00.00	25.00
Mild Colic	27	85.71	3.57	7.14
Moderate Colic	25	52.00	16.00	32.00
Severe Colic	11	0.00	54.55	45.45

Infants having, or perceived as having, colic cried any time of the day or night. Crying which was restricted to the evening hours, unless it was very severe, was perceived as being more "normal" crying.

Such conclusions are supported by the finding that 65% of the infants whom pediatricians used the term "colic" in reference to cried any time of the day or night, χ^2 (8, N = 67) = 15.80, p < .045 (see Table 4.6).

Table 4.6

Periodicity of Crying as Measured by PEDCOL (in %)

		Periodicity of Crying		
PEDCOL Rating	N	Only Evening	Mostly Evening	Anytime
Yes	11	9	27	64
No	53	65	15	16

Allergy

Allergies offered a possible explanation for the colic in only a small percentage of infants. At 6 weeks after birth, mothers were asked to indicate whether or not allergies were noticeable in their infants. A chi-square analysis performed on MYRATE and Allergies noticeable at 6 weeks of age was nonsignificant, χ^2 (3, N = 130) = 2.61, p < .456.

Attempting to differentiate between allergic colic and colic resulting from unknown causes, Licamele et al. (n.d.) eliminated infants suffering from vomiting, diarrhea, constipation, and rashes in their definition of colic. When these symptoms were investigated in the present study, there were no significant differences in the allergic manifestations of diarrhea, χ^2 (3, N = 131) = 4.025, p < .2588, constipation, χ^2 (3, N = 130) = 2.959, p < .3980, skin irritations,

χ^2 (3, N = 131) = 1.263, p < .8534, and spitting up, χ^2 (3, N = 131) = .784, p < .8534 in 6-week-old infants with different colic ratings.

Family history of allergies also was unrelated to colic. There were no significant differences in colic ratings of infants of parents who had and had not ever had allergies, χ^2 (3, N = 125) = 4.16, p < .245. In fact, parents of infants in the severe colic group reported having fewer allergies than parents of infants in the other groups.

Although the present study did not systematically investigate the role of cow's milk protein intolerance in the development of colic, the number of ounces of milk consumed by nursing mothers during the postpartum period was correlated with total CASS scores as well as CASS subscales. Although the correlation between milk consumed by the lactating mother and total CASS scores was nonsignificant, r = .163 (p < .0768, N = 119), the correlation between milk consumption and the soothability subscale reached significance, r = .264 (p < .0037, N = 119). Nursing mothers who consumed more milk after pregnancy had less soothable infants at 6 weeks after birth than did mothers who consumed less milk.

Gastrointestinal Distress

The relationship between gastrointestinal distress and colic was investigated in three ways. The degree of colic was studied in relation to (1) the amount of gas passed by the infant, (2) the apparent existence of gas pains in the infant, and (3) the amount of gas the infant passed during crying periods.

When asked, 6 weeks after birth, whether or not their infants "passed much gas," 67.33% of mothers responded in the affirmative. A

chi-square analysis performed on "gas-no gas" and MYRATE indicated that there was no significant difference in the amount of gas passed by infants in the four colic groups, χ^2 (3, N = 131) = 5.80, p < .122.

When asked if their infants seemed to have gas pains, a significant difference did emerge, χ^2 (3, N = 130) = 14.44, p < .002, with 43.24% of mothers of infants in the no colic group claiming that their infants experienced gas pains, while 92.31% of mothers with infants in the severe colic group made such claims (see Table 4.7).

Table 4.7

Experience of Gas Pains in 6-Week-Old Infants in Four MYRATE Colic Groups (in %)

		Gas Pains	
MYRATE Group	N	No	Yes
No Colic	37	56.76	43.24
Mild Colic	48	41.67	58.33
Moderate Colic	32	21.88	78.13
Severe Colic	13	7.69	92.31

Similar results were obtained when a chi-square analysis was performed on MYRATE and item 3 on the GIBS ("During your baby's fussing and crying periods, does she draw knees up against her abdomen as if there were abdominal pain or cramps?"), χ^2 (12, N = 114) = 23.34, p < .025. The majority of mothers of infants in the no colic and mild colic groups claimed that their infants never or almost never experienced cramps during crying periods, while the majority of mothers of

infants in the moderate and severe colic groups indicated that their infants sometimes and almost always had cramps (see Table 4.8).

Table 4.8

Frequency of Cramps During Crying Periods in Infants in Four MYRATE Colic Groups (in %)

		Gas Pains During Crying Periods				
MYRATE Group	N	Never	Almost Never	Sometimes	Almost Always	Always
No Colic	31	51.61	25.81	19.35	3.23	0.00
Mild Colic	42	42.86	19.05	28.57	7.14	2.38
Moderate Colic	30	23.33	13.33	46.67	10.00	6.67
Severe Colic	11	9.09	0.00	54.55	27.27	9.09

When asked, by item 6 of the GIBS, if their infants passed much gas during their crying periods, a significant difference was found among mothers of infants in the different colic groups, χ^2 (12, N = 113) = 32.58, p < .001. While the majority of mothers of infants in the no colic and mild colic groups claimed that their infants almost never or sometimes passed gas during crying periods, the majority of mothers in the more colicky groups claimed that their infants sometimes and almost always exhibited this behavior (see Table 4.9).

Relationships Among Variables

Prior to testing regression equations, Pearson product moment correlation coefficients were computed for CASS scores and all

Table 4.9

Frequency of Gas Passed During Crying Periods for Infants in Four MYRATE Colic Groups

		Passes Gas During Crying Periods				
MYRATE Group	N	Never	Almost Never	Sometimes	Almost Always	Always
No Colic	30	16.67	33.33	40.00	10.00	0.00
Mild Colic	42	11.90	38.10	45.24	4.76	0.00
Moderate Colic	30	6.67	13.33	36.67	33.33	10.00
Severe Colic	11	0.00	18.18	18.18	54.55	9.09

variables entered into regression analyses. Correlation Coefficients and p-values are presented for demographic, parent, and infant variables. The criterion set for statistical significance for all correlations was .01.

Demographic and Descriptive Characteristics

Pearson product moment correlation coefficients were computed for father's education, mother's education, mother's age, father's age, number of times mother had been pregnant, mother's parity, father's work hours, baby's birthweight, gestational age, and total CASS scores. The results, presented in Table 4.10, indicate that only father's education was significantly correlated with total CASS scores ($p < .01$). Fathers who had completed more years of schooling had infants with higher 6-week colic scores.

Table 4.10

Correlation Coefficients for Demographic and Descriptive Variables and Total CASS Scores

	r	*p*	*N*
Father's Education	.273	.0009*	145
Mother's Education	.205	.0129	147
Mother's Age	.142	.0867	147
Father's Age	.010	.9019	147
Times Pregnant	-.071	.4242	128
Parity (Birth Order)	-.132	.1387	128
Father's Work Hours	.012	.8875	138
Baby's Birthweight	-.118	.1579	146
Gestational Age	-.113	.1786	142

*$p < .01$.

Parent Characteristics

Anxiety. Pearson product moment correlation coefficients were computed for mother's and father's prental and first postpartum week state and trait anxiety and total CASS scores. While mother's and father's prenatal state and trait anxiety were not significantly correlated with CASS scores collected 6 weeks after birth, mother's first postpartum week state and trait anxiety scores were positively related to CASS scores. Father's first postpartum week state and trait anxiety scores were not significantly related to CASS scores (see Table 4.11).

Table 4.11

Correlation Coefficients for Mother's and Father's Prenatal and First Postpartum Week State and Trait Anxiety and Total CASS Scores

	r	*p*	*N*
Mother's Prenatal State Anxiety	.146	.0801	145
Mother's Prenatal Trait Anxiety	.121	.1559	140
Father's Prenatal State Anxiety	.175	.0378	141
Father's Prenatal Trait Anxiety	.122	.1524	138
Mother's First Postpartum Week State Anxiety	.297	.0003*	142
Mother's First Postpartum Week Trait Anxiety	.322	.0001*	141
Father's First Postpartum Week State Anxiety	.046	.5549	137
Father's First Postpartum Week Trait Anxiety	.110	.2012	137

*$p < .01$.

Pregnancy Research Inventory variables. Pearson product moment correlation coefficients were calculated for the seven subscales of the Pregnancy Research Inventory (PRI) and total CASS scores. While prenatal maternal state and trait anxiety scores were not related to 6 week total CASS scores, mother's Fear for Herself during her third trimester of pregnancy was related to CASS scores ($r = .254$, $p < .0020$). However, no other PRI scales were significantly related to total CASS scores (see Table 4.12).

Table 4.12

Correlation Coefficients for the Seven Subscales of the Pregnancy Research Inventory and Total CASS Scores

PRI Subscales	*r*	*p*
Mother's Fear for Herself	.254	.0020*
Desire for Pregnancy	-.003	.9685
Dependency	.015	.8563
Fear for Baby	.114	.1704
Irritability	.147	.0783
Maternal Feelings	.072	.3886
Depression	.155	.0623

Note. $N = 145$.
$^*p < .01$.

Mother's first postpartum week fatigue. Mother's first postpartum week fatigue was found to be correlated with total CASS scores collected 6 weeks after birth ($r = -.355$, $p < .0001$, $N = 145$). Mothers who reported themselves as being more tired during the first postpartum week had babies with higher colic scores at 6 weeks of age.

Maternal support. Although mother's actual support and support provided by the father were not found to be significantly related to total CASS scores, the mother's perception of support was significantly correlated ($r = -.326$, $p < .0001$, $N = 147$) with CASS scores. As mothers' perceptions of a strong support system decreased, infant colic scores increased (see Table 4.13).

Table 4.13

Correlation Coefficients for the Three Subscales of the Maternal Support Questionnaire and Total CASS Scores

MSQ Subscales	*r*	*p*	*N*
Mother's Actual Support	-.106	.2024	147
Father's Support	.066	.4319	143
Mother's Perception of Support	-.326	.0001*	147

*$p < .01$.

Infant Characteristics

Neonatal irritability in the first postpartum week. Pearson product moment correlation coefficients were computed for neonatal irritability, as measured by the MABI, and total CASS scores collected 6 weeks after birth. Neonatal irritability and total CASS scores were found to be weakly, but significantly, correlated ($r = .263$, $p < .0016$, $N = 141$). Infants who were rated by mothers as being more irritable during the first postpartum week received higher colic scores at 6 weeks of age.

Four dimensions of the MABI. Pearson product moment correlation coefficients were computed for the four dimensions of the MABI and total CASS scores. Correlation coefficients, presented in Table 4.14, indicate that none of the four dimensions were correlated with total CASS scores.

Table 4.14

Correlation Coefficients for the Four Dimensions of the MABI and Total CASS Scores

MABI Dimensions	*r*	*p*	*N*
Social Interactive Processes	.063	.4583	139
Motoric Interactive Processes	.041	.6272	141
State Control	.145	.0860	142
Physiologic Response to Stress	-.020	.8186	140

Summary of Correlation Analyses

Pearson product moment correlation coefficients were computed for total CASS scores and all continuous demographic, parent, and infant variables entered into regression analyses. The level of significance set for all analyses was .01.

The only demographic variable found to be significantly correlated with CASS scores was father's education ($r = .273$, $p < .0009$, $N = 145$). Fathers with more years of education had infants with higher 6 week colic scores.

Correlations between CASS scores and parent variables were computed next. Neither mother's nor father's prenatal state or trait anxiety was significantly correlated with CASS scores. However, mother's first postpartum week state anxiety ($r = .297$, $p < .003$), $N = 142$) and trait anxiety ($r = .322$, $p < .0001$, $N = 141$) were found to be positively correlated with CASS scores. Father's first postpartum week state and trait anxiety, however, failed to reach

significance. Mothers who experienced higher levels of state and trait anxiety during the first week after birth had infants with higher colic scores at 6 weeks of age.

The only subscale of the Pregnancy Research Inventory (PRI) to correlate significantly with CASS scores was Mother's Fear for Herself (r = .254, p < .0020, N = 145). Mothers experiencing more fear for themselves during the pregnancy period were more likely to have infants with higher colic scores than mothers not experiencing similar fear. The mother's Desire for Pregnancy, Dependency, Fear for Her Baby, Irritability, Maternal Feelings, and Depression were not significantly correlated with CASS scores.

Mother's first postpartum week fatigue demonstrated a higher correlation with CASS scores than any other demographic, parent, or infant variable, although mother's perception of support and first postpartum week trait anxiety correlations were nearly as high. Mothers who reported more fatigue during the first postpartum week were more likely to have infants with higher colic scores at 6 weeks after birth (r = -.355, p < .0001, N = 145). Also, mothers with more negative perceptions of their support systems had infants with higher colic scores at 6 weeks of age. However, the mother's actual support system and support provided by the father in terms of actual caregiving activities were not correlated with CASS scores.

The infant variable of neonatal irritability demonstrated a weak, but significant, relationship with colic scores (r = .263, p < .0016, N = 141). Colicky infants were more likely than noncolicky infants to have been irritable during their first week of life. None

of the MABI dimensions were found to correlate significantly with CASS scores.

Hypotheses

The correlational analyses section considered the relationship between colic and one other variable. The present section examines the relationship between several predictor variables and colic.

Hypotheses and analyses are presented in the following order:

(1) demographic and descriptive characteristics related to colic;

(2) parental characteristics related to colic; and

(3) infant characteristics related to colic.

Hypotheses involving each set of characteristics also follow a temporal order. The investigation of prebirth variables is presented, followed by an investigation of postbirth variables. Postbirth variables are organized according to whether they were collected during the first, sixth, twelfth, or thirty-second week after birth.

Hypotheses were tested with general linear model (GLM) and stepwise regression procedures. General linear model procedures were used to test specific hypotheses, while the stepwise procedure was used to identify the most predictive models. The level of significance set for all analyses was alpha = .01. This stringent criterion level was set because of the large number of tests conducted and the desire to reduce the chances of making Type I errors over the entire set of analyses.

Variables that were found to be predictive of total CASS scores were controlled for in subsequent analyses. The procedure for testing

temperament hypotheses was correlational due to the collection of temperament data after the collection of the CASS data.

Demographic and Descriptive Variables

Prebirth.

Hypothesis 1: There is no linear relationship between father's education, mother's education, mother's age, father's occupation, mother's occupation, race, number of pregnancies, and total CASS scores collected 6 weeks after birth.

A test of the overall regression model containing father's education, mother's education, mother's age, father's occupation, mother's occupation, race, and number of pregnancies was nonsignificant at the .01 level, F (18,107) = 1.03, p < .4352. Tests of the partial regression coefficients also yielded nonsignificant findings for all variables. The inclusion of all variables in the model resulted in an R^2 of .147 (see Table 4.15). The intercorrelations between all demographic and descriptive variables are presented in Appendix M-2.

When father's education, mother's education, mother's age, father's age, and number of pregnancies were allowed to vary in a stepwise regression analysis, father's education accounted for 7% of the variance in colic scores, which was significant at .01, F (1,125) = 9.42, p < .003. Fathers with more years of education had infants with higher 6 week colic scores. Mother's education, parents' ages, and number of times mother had been pregnant were not predictive of colic scores and together contributed only 2% additional explained variance (see Table 4.16).

Table 4.15

Regression Model Estimating the Relationship Between Prebirth Demographic and Descriptive Variables and Total CASS Scores

	F	$p <$	R^2
Model	1.03	.4352	.147
Father's Education	1.70	.1949	
Mother's Education	0.25	.6182	
Mother's Age	2.06	.1541	
Father's Occupation	0.54	.7780	
Mother's Occupation	0.41	.8448	
Race	0.48	.6216	
Times Pregnant	0.92	.3408	

Note. N = 126.

*p < .01.

Table 4.16

Stepwise Regression Analysis Estimating the Relationship Between Prebirth Demographic Variables and Total CASS Scores

	F	$p <$	R^2	R^2 Increase
Father's Education	9.42	.0026*	.070	
Times Pregnant				.003
Mother's Age				.008
Father's Age				.007
Mother's Education				.003

Note. N = 127.

*p < .01.

Because continuous variables entered into the stepwise analysis explained only a little more than half of the variance accounted for by the full model, an analysis of covariance was performed on father's education, race, mother's occupation, and father's occupation to determine whether or not any of the categorical variables, which had not been placed in the stepwise analysis, were related to total CASS scores when nonsignificant continuous variables were excluded from the analysis. Results for the full model, F (14,127) = 1.41, $p < .157$, were nonsignificant at the .01 level. All regression coefficients, once again, failed to reach the criterion of .01 for significance (see Table 4.17).

Table 4.17

Analysis of Covariance Performed on Father's Education, Race, Mother's Occupation, Father's Occupation, and Total CASS Scores

	F	$p <$	R^2
Model	1.41	.1568	.135
Father's Education	3.74	.0552	
Race	1.07	.3454	
Mother's Occupation	0.43	.8255	
Father's Occupation	0.72	.6330	

Note. N = 142.

*$p < .01$.

The relationship between the categorical variables of race, father's occupation, and mother's occupation and the four MYRATE colic groups was investigated using chi-square procedures. When race was placed in a chi-square analysis with MYRATE, significance was not demonstrated, χ^2 (6, $\underline{N}$ = 133) = 8.86, $\underline{p}$ < .182. However, while over 36% of infants of white parents were placed in the moderate and severe colic groups, only a little more than 16% of black infants were placed in the moderate colic group and none received a rating of severe colic. Caution must be used when interpreting these results due to the small number of black subjects.

Although significance was not reached, χ^2 (18, $\underline{N}$ = 131) = 22.51, $\underline{p}$ < .210, the infants of almost 70% of blue collar fathers were rated as exhibiting no colic or mild colic and only 5% were rated as exhibiting severe colic, while infants of over 61% of professional fathers were rated as exhibiting moderate and severe colic and none were rated as demonstrating no colic. When mother's occupation was placed in a chi-square analysis with MYRATE, the same pattern emerged. There was a heavier concentration of blue collar mothers in the no colic and mild colic groups and semiprofessionals and professionals in the moderate and severe colic groups. However, chi-square analysis was again nonsignificant at .01, χ^2 (15, $\underline{N}$ = 133) = 20.16, $\underline{p}$ < .166. Lack of significant results, however, could again be due to the large number of empty cells in the chi-square analysis.

The results of the above chi-square analyses suggest a relationship between education and occupation. Such a relationship is probably responsible for the failure of father's and mother's occupations to reach significance in the regression analyses. It also explains the

finding that although father's education was the only significant predictor of colic in the stepwise analysis, it explained only half of the variance in the full model containing parents' race and occupation. The continuous nature of the variable father's education, as well as the fact that it reached significance in regression analyses when categorical variables did not, made father's education the most appropriate demographic variable to control for in subsequent analyses.

Postbirth.

Hypothesis 2: There is no linear relationship between father's education, mother's parity, baby's sex, initial feeding method, mother's use of drugs in labor and delivery, father's work hours, baby's birthweight, gestational age, and total CASS scores collected 6 weeks after birth.

A test of the overall regression model, containing father's education, birth order, baby's sex, feeding method, mother's use of drugs in labor and delivery, father's work hours, birthweight, and gestational age, F (10,106) = 1.79, $p < .0707$, was nonsignificant at the .01 level. Tests of the partial regression coefficients also yielded nonsignificant findings for all variables. The inclusion of all variables in the model resulted in an R^2 of .145 (see Table 4.18).

When father's education, birth order, father's work hours, gestational age, and birthweight were entered into a stepwise regression analysis, father's education accounted for 6% of the variance in the dependent variable, which was significant at .01, F (1,118) = 7.69, $p < .0065$ (see Table 4.19). The difference in variance explained by father's education in previous and subsequent analyses is probably due to slight variations in sample size and composition from one analysis to another.

Table 4.18

Regression Model Estimating the Relationship Between Postbirth Demographic and Descriptive Variables and Total CASS Scores

	F	$p <$	R^2
Model	1.79	.0707	.145
Father's Education	4.34	.0396	
Birth Order	2.03	.0158	
Baby's Sex	1.29	.2587	
Feeding Method	1.10	.3527	
Drug Use in Labor/Delivery	0.21	.6478	
Father's Work Hours	0.19	.6666	
Birthweight	0.09	.7634	
Gestational Age	2.78	.0986	

Note. N = 117.

Table 4.19

Stepwise Regression Analysis Estimating the Relationship Between Father's Education and Postbirth Demographic and Descriptive Variables and Total CASS Scores

	F-Value	$p <$	R^2	R^2 Increase
Father's Education	7.69	.0065*	.061	
Gestational Age				.021
Birth Order				.014
Father's Work Hours				.001
Birthweight				.000

Note. N = 120.

*p < .01.

The relationships between categorical variables and MYRATE were investigated using chi-square procedures. Chi-square analyses found baby's sex, χ^2 (3, N = 132) = 2.39, p < .496), third month feeding method, χ^2 (6, N = 128) = 1.85, p < .933, and mother's use of drugs in labor and delivery, χ^2 (3, N = 129) = 1.53, p < .675, to be nonsignificant at .01.

Parent Variables

Prebirth--Anxiety.

Hypothesis 3: When father's education is controlled for, there is no linear relationship between mother's and father's prenatal (third trimester) state and trait anxiety and total CASS scores collected 6 weeks after birth.

A test of the regression model containing father's education and mother's and father's prebirth state and trait anxiety, F (5,129) = 4.35, p < .0012, was significant at .01 and produced an R^2 of .144. Tests of the partial regression coefficients yielded nonsignificant results for mother's and father's prenatal state and trait anxiety. Father's education, however, remained significant at .0001 (see Table 4.20).

When mother's and father's prenatal state and trait anxiety were allowed to vary with father's education in a stepwise regression equation, both father's education and mother's prenatal state anxiety made significant contributions to the prediction of CASS total scores, F (2,132) = 9.38, p < .0002 (see Table 4.21). While father's education continued to explain the most variance (R^2 = .075), mother's prenatal state anxiety explained 5% of the variance and nonsignificant variables explained only an additional 2% of variance of CASS scores.

Table 4.20

Regression Model Estimating the Relationship Between Mother's and Father's Prenatal State and Trait Anxiety and Total CASS Scores

	F	$p <$	R^2
Model	4.35	.0012*	.144
Father's Education	16.41	.0001*	
Mother's Prenatal State Anxiety	2.33	.1294	
Mother's Prenatal Trait Anxiety	0.20	.6561	
Father's Prenatal State Anxiety	1.89	.1718	
Father's Prenatal Trait Anxiety	0.15	.6968	

Note. N = 135.

*p < .01

Table 4.21

Stepwise Regression Analysis Estimating the Relationship Between Mother's and Father's Prenatal State and Trait Anxiety and Total CASS Scores

	F	$p <$	R^2	R^2 Increase
Model	9.38	.0002*	.124	
Father's Education	16.30	.0001*		.075
Mother's Prenatal State Anxiety	7.46	.0072*		.030
Father's Prenatal State Anxiety				.018
Mother's Prenatal Trait Anxiety				.001
Father's Prenatal Trait Anxiety				.001

Note. N = 135.

*p < .01.

Prebirth--Other maternal characteristics.

Hypothesis 4: When father's education and mother's and father's prenatal state anxiety are controlled for, there is no linear relationship between the seven Pregnancy Research Inventory scales (Fears for Self, Lack of Desire for Pregnancy, Dependency, Fears for Baby, Irritability and Tension, Lack of Maternal Feelings, Depression and Withdrawal) and total CASS scores collected 6 weeks after birth.

A test of the regression equation containing father's education, mother's and father's prenatal state anxiety, and the seven maternal Pregnancy Research Inventory scales was significant, F (10,129) = 3.08, $p < .0015$, and explained 19% of the variance in CASS scores. While father's education remained significant, mother's prebirth state anxiety failed to reach significance, and all other partial regression coefficients were nonsignificant at .01 (see Table 4.22). Intercorrelations between the independent variables entered into this analysis are presented in Appendix M-4.

When the above variables were placed in a stepwise analysis, father's education and mother's prenatal state anxiety once again reached significance at .01, F (2,137) = 11.65, $p < .0001$. Together, father's education and mother's prenatal state anxiety accounted for almost 15% of the variance in colic scores. Father's prenatal state anxiety accounted for only 2% of the variance, while the seven Pregnancy Research Inventory scales contributed only an additional 2% explained variance. Father's prenatal anxiety and all seven Pregnancy Research Inventory scales failed to meet the .01 significance level for entry into the model. Results of this analysis are presented in Table 4.23.

Table 4.22

Regression Model Estimating the Relationship Between the Subscales of the Pregnancy Research Inventory and Total CASS Scores

	F	$p <$	R^2
Model	3.03	.0015*	.193
Father's Education	18.16	.0001*	
Mother's Prenatal State Anxiety	2.60	.1095	
Father's Prenatal State Anxiety	2.08	.1515	
Fears for Self	0.06	.8148	
Desire for Pregnancy	1.83	.1783	
Dependency	0.17	.6810	
Fears for Baby	0.20	.6530	
Irritability and Tension	0.13	.7188	
Maternal Feelings	1.54	.2170	
Depression and Withdrawal	0.58	.4486	

Note. N = 140.

*p < .01.

Table 4.23

Stepwise Regression Analysis Estimating Relationship Between the Seven Scales of the Pregnancy Research Inventory and Total CASS Scores

	F	*p* <	R^2	R^2 Increase
Model	11.65	.0001*	.145	
Father's Education	20.30	.0001*		.088
Mother's Prenatal State Anxiety	9.14	.0030*		.057
Father's Prenatal State Anxiety				.018
Mother's Depression				.010
Mother's Desire for Pregnancy				.008
Maternal Feelings				.002
Dependency				.001
Fears for Baby				.001
Irritability				.001
Fears for Self				.000

Note. *N* = 140.

*$p < .01$.

Postbirth--Anxiety.

Hypothesis 5: When father's education and mother's prenatal state anxiety are controlled for, there is no linear relationship between mother's and father's first postpartum week state and trait anxiety and total CASS scores collected 6 weeks after birth.

A test of the overall regression model, containing father's education, mother's prenatal state anxiety, and mother's and father's postpartum state and trait anxiety, was significant, F (6,129) = 6.22, $p < .0001$, and explained 23% of the variance in total CASS scores. Tests of partial regression coefficients indicated that father's education again reached significance, while all other variables remained nonsignificant. When father's education was controlled for, mother's prenatal state anxiety and mother's and father's first postpartum week state and trait anxiety were not related to infant colic scores at 6 weeks of age (see Table 4.24). Intercorrelations between the independent variables entered into this analysis are presented in Appendix M-5.

However, when variables were permitted to vary in a stepwise regression analysis, father's education remained significant and mother's postpartum state anxiety replaced mother's prenatal state anxiety in the model, F (2,133) = 17.59, $p < .0001$ (see Table 4.25). Together, father's education and mother's postpartum state anxiety accounted for almost 21% of the variance in colic scores, just 2% less than all of the variance explained by the full model containing four additional anxiety variables.

Table 4.24

Regression Model Estimating the Relationship Between Mother's and Father's First Postpartum Week State and Trait Anxiety and Total CASS Scores

	F	$p <$	R^2
Model	6.22	.0001*	.225
Father's Education	20.12	.0001*	
Mother's Prenatal State Anxiety	1.15	.2851	
Father's First Postpartum Week State Anxiety	0.05	.8325	
Father's First Postpartum Week Trait Anxiety	0.00	.9464	
Mother's First Postpartum Week State Anxiety	3.53	.0626	
Mother's First Postpartum Week Trait Anxiety	0.54	.4645	

Note. N = 136.

*p < .01.

Table 4.25

Stepwise Regression Analysis Estimating the Relationship Between Mother's and Father's First Postpartum Week State and Trait Anxiety and Total CASS Scores

	F	$p <$	R^2	R^2 Increase
Model	17.59	.0001*	.209	
Father's Education	22.17	.0001*		.103
Mother's First Postpartum Week State Anxiety	17.90	.0001*		.106
Mother's Prenatal State Anxiety				.012
Mother's First Postpartum Week Trait Anxiety				.003
Father's First Postpartum Week State Anxiety				.000
Father's First Postpartum Week Trait Anxiety				.000

Note. N = 136.

*p < .01.

Postbirth--Maternal Fatigue.

Hypothesis 6: When father's education and mother's first postpartum week state anxiety are controlled for, there is no linear relationship between mother's fatigue during the first postpartum week and total CASS scores collected 6 weeks after birth.

A test of the full model, containing father's education, mother's first postpartum week fatigue and state anxiety resulted in significance, F (3,135) = 16.22, $p < .0001$. All partial regression coefficients made significant contributions to the prediction of CASS scores, producing an R^2 of .265 (see Table 4.26). Fathers with more years of education and mothers who were more tired and anxious during the first postpartum week had infants with higher colic scores at 6 weeks after birth. (See appendix M-6 for independent variables tested in Hypotheses 6 through 9.)

A second GLM regression analysis was performed to investigate whether maternal first postpartum week state anxiety and fatigue reached significance because they were confounded by infant crying which began prior to the mother's completion of first postpartum week forms. The variable CFC (Control for Crying) was created by finding the difference between the dates when mothers completed first week forms and when mothers claimed that infants demonstrated increased crying. The variable CFC was placed in a regression equation along with father's education, mother's first postpartum week state anxiety, and fatigue. Interactions between CFC and anxiety and CFC and fatigue were also investigated. Although none of the control terms reached significance at .01, an increase in R^2 of 10% was noted (see Table 4.27).

Table 4.26

Regression Model Estimating the Relationship Between Mother's First Postpartum Week Fatigue and Total CASS Scores

	F	$p <$	R^2
Model	16.22	.0001*	.265
Father's Education	17.45	.0001*	
Mother's First Postpartum Week Fatigue	9.88	.0021*	
Mother's First Postpartum Week State Anxiety	8.10	.0051*	

Note. N = 139.

*p < .01.

Table 4.27

Regression Model Estimating the Relationship Between Mother's First Postpartum Week Fatigue and Total CASS Scores Including Interaction Terms

	F	$p <$	R^2
Model	8.93	.0001*	.370
Father's Education	13.26	.0005*	
Mother's First Postpartum Week State Anxiety	8.96	.0035*	
Fatigue	13.78	.0004*	
CFC	0.83	.3634	
CFC * Mother's First Postpartum Week State Anxiety	0.06	.8059	
CFC * Fatigue	3.41	.0681	

Note. N = 98.

*p < .01.

When father's education and mother's first postpartum week state anxiety and fatigue were allowed to vary in a stepwise procedure, all variables once again met the .01 significance level for entry into the model, F (3,129) = 14.96, p < .0001. While mother's first postpartum week state anxiety remained significant, fatigue entered the model immediately after father's education and explained more variance in CASS scores than did anxiety. Fatigue explained an additional 12% of the variance in the dependent variable after father's education was controlled for, while mother's first postpartum week state anxiety explained an additional 4% of the variance (see Table 4.28).

Table 4.28

Stepwise Regression Analysis Estimating the Relationship Between Mother's First Postpartum Week Fatigue and Total CASS Scores

	F	p <	R^2	R^2 Increase
Model	14.96	.0001*	.258	
Father's Education	16.46	.0001*		.102
Mother's First Postpartum Week Fatigue	9.43	.0026*		.116
Mother's First Postpartum Week State Anxiety	6.99	.0092*		.040

Note. N = 133.

*p < .01.

Postbirth--Maternal support.

Hypothesis 7: When father's education and mother's first postpartum week fatigue and state anxiety are controlled for, there is no linear relationship between maternal support and total CASS scores, both collected 6 weeks after birth.

A test of the overall model, containing father's education, mother's first postpartum week fatigue and state anxiety, and mother's actual support and perception of support was significant at .01, F (5,133) = 10.75, $p < .0001$, and explained 29% of the variance in CASS scores. Tests of the partial regression coefficients indicated that only father's education and mother's first postpartum week fatigue made significant contributions to the prediction of CASS scores. While mother's support and perception of support failed to reach significance ($p < .01$), their entry into the model prevented mother's postpartum week state anxiety from maintaining significance (see Table 4.29). Fathers with more years of education and mothers who claimed to be more tired during the first week after birth had infants with higher colic scores at 6 weeks of life.

When mother's perception of support and actual support were allowed to vary in a stepwise analysis, along with father's education and mother's first postpartum week fatigue and state anxiety, mother's state anxiety entered the model after mother's fatigue and father's education, F (3,130) = 16.22, $p < .0001$. Mother's actual support and perception of support failed to satisfy the .01 significance criterion set for entry into the model. The addition of mother's perception of support added only 2% additional explained variance in CASS scores. While such a contribution to the explained variance was small, it was more than the .13% explained variance contributed by the addition of

Table 4.29

Regression Model Estimating the Relationship Between Mother's Support and Total CASS Scores

	F	$p <$	R^2
Model	10.75	.0001*	.288
Father's Education	16.36	.0001*	
Mother's First Postpartum Week Fatigue	7.93	.0056*	
Mother's First Postpartum Week State Anxiety	4.61	.0336	
Mother's Perception of Support	4.18	.0428	
Mother's Actual Support	0.25	.6154	

Note. N = 139.

*p < .01.

mother's actual support to the model. It would, therefore, appear that the mother's perception of her support system is of greater importance in the prediction of colic scores than the support she is actually offered (see Table 4.30).

Infant Variables

Neonatal behavior--Week 1.

Hypothesis 8: When father's education, mother's first postpartum week fatigue and state anxiety, and mother's perception of support are controlled for, there is no linear relationship between the four dimensions of the Mother's Assessment of the Behavior of Her Infant (MABI) and total CASS scores collected 6 weeks after birth.

Table 4.30

Stepwise Regression Analysis Estimating the Relationship Between Mother's Support and Total CASS Scores

	F	$p <$	R^2	R^2 Increase
Model	16.22	.0001*	.265	
Mother's First Postpartum Week Fatigue	9.88	.0021*		.148
Father's Education	17.45	.0001*		.072
Mother's First Postpartum Week State Anxiety	8.10	.0051*		.044
Mother's Perception of Support				.022
Mother's Actual Support				.001

Note. N = 134.

* $p < .01$.

The overall test of the model containing father's education, mother's first postpartum week fatigue and state anxiety, mother's perception of support, and the four dimensions of the MABI, resulted in a significant F-ratio, F (8.122) = 6.37, $p < .0001$, and explained close to 30% of the variance in CASS scores. The only partial regression coefficients to reach significance were father's education and mother's fatigue. The infant's Social Interactive Processes, Motoric Interactive Processes, State Control, and Physiologic Response to Stress, as measured by the MABI, were not related to colic at 6 weeks of age, after controlling for father's education, mother's first postpartum week fatigue and state anxiety, and mother's perception of

support. Fathers with more years of education and mothers who reported being more tired during the week after birth had infants with higher colic scores at 6 weeks of age. Results of this analysis are presented in Table 4.31.

Table 4.31

Regression Model Estimating the Relationship Between the Four Dimensions of the MABI and Total CASS Scores

	F	$p <$	R^2
Model	6.37	.0001*	.295
Father's Education	12.98	.0005*	
Mother's First Postpartum Week Fatigue	8.04	.0054*	
Mother's First Postpartum Week State Anxiety	1.12	.2924	
Mother's Perception of Support	5.11	.0256	
Social Interactive Processes	0.01	.9202	
Motoric Interactive Processes	0.00	.9528	
State Control	2.04	.1560	
Physiologic Response to Stress	0.38	.5385	

Note. $N = 131$.

*$p < .01$.

When the four dimensions of the MABI were allowed to vary in a stepwise regression analysis, along with father's education, mother's first postpartum week fatigue and state anxiety, and mother's perception of support, mother's fatigue, father's education, and mother's

perception of support were, again, the only variables to reach significance, F (3,119) = 15.61, p < .0001. All four MABI dimensions again failed to reach significance at .01. The dimensions of State Control, however, replaced mother's first postpartum week state anxiety in a subsequent model (see Table 4.32).

Table 4.32

Stepwise Regression Analysis Estimating the Relationship Between Four Dimensions of the MABI and Total CASS Scores

	F	p <	R^2	R^2 Increase
Model	15.61	.0001*	.269	
Mother's First Postpartum Week Fatigue	11.91	.0008*		.148
Father's Education	13.28	.0004*		.075
Mother's Perception of Support	8.09	.0052*		.047
State Control				.016
Mother's First Postpartum Week State Anxiety				.007
Physiologic Response to Stress				.002
Social Interactive Processes				.000
Motoric Interactive Processes				.000

Note. N = 123.

*p < .01.

With mother's first postpartum week state anxiety eliminated from the model, mother's fatigue surpassed father's education in the amount of variance it explained in CASS scores. Alone, fatigue explained about 15% of the variance in colic scores, while father's education continued to explain approximately 7% of the variance and mother's perception of support explained about 5%. Together, mother's first postpartum week state anxiety and the four MABI dimensions contributed only approximately 2% additional explained variance in colic scores.

In order to further investigate the relationship between State Control and infantile colic, Pearson product moment correlation coefficients were computed between the MABI State Item (Item 15) and total CASS scores for each of the four MYRATE groups. Although none of the correlations were significant at $p < .01$, a pattern emerged suggesting that the relationship between neonatal state and 6-week colic scores may be dependent upon the infant's colic rating. Correlations for infants in the no colic and mild colic groups were .238 ($p < .1505$, $N = 38$) and .275 ($p < .0746$, $N = 43$), respectively, suggesting that less colicky infants who cried more during the first postpartum week had higher colic scores at 6 weeks of age. Correlations for infants in the moderate and severe colic groups were -.174 ($p < .3416$, $N = 32$) and -.399 ($p < .772$, $N = 13$), respectively, suggesting that more colicky infants who were sleepy or quiet when awake during the first week after birth had higher colic scores at 6 weeks after birth. These interpretations must be thought of as speculative in that, as previously mentioned, none of the correlations satisfied the .01 criterion set for significance.

Neonatal irritability--Week 1.

Hypothesis 9: When father's education and mother's first postpartum week fatigue and state anxiety are controlled for, there is no linear relationship between neonatal irritability scores collected during the first week of life and total CASS scores collected 6 weeks after birth.

A test of the overall model, containing father's education, mother's first postpartum week state anxiety and fatigue, mother's perception of support, and neonatal irritability, was significant, F (5,130) = 11.81, $p < .0001$, and explained over 31% of the variance in CASS scores. While father's education and mother's fatigue, again, maintained their significance, all other variables failed to reach the criterion level of .01 for significance (see Table 4.33). Fathers with more years of education and mothers who reported being more tired during the week following birth had babies with higher colic scores during the sixth week of life.

When allowed to vary in a stepwise regression analysis with father's education, mother's first postpartum week fatigue and state anxiety, and mother's perception of support, neonatal irritability emerged as a weak but significant predictor of total CASS scores. While the inclusion of neonatal irritability in the model prevented mother's first postpartum week state anxiety and mother's perception of support from reaching significance, it explained only an additional 5% of the variance in the dependent variables when mother's fatigue and father's education were already in the model. Once again, mother's first postpartum week fatigue emerged as the strongest predictor of CASS scores, contributing over 14% of the explained variance, while father's education continued to evidence an R^2 increase

Table 4.33

Regression Model Estimating the Relationship Between Neonatal Irritability and Total CASS Scores

	F	$p <$	R^2
Model	11.81	.0001*	.312
Father's Education	15.52	.0001*	
Mother's First Postpartum Week Fatigue	7.99	.0055*	
Neonatal Irritability	5.62	.0192	
Mother's First Postpartum Week State Anxiety	3.11	.0803	
Mother's Perception of Support	2.48	.1176	

Note. N = 136.

*p < .01.

of .0754. With the three significant variables in the model, an R^2 of .27 was attained, F (3,132) = 16.41, p < .0001 (see Table 4.34). Mother's first postpartum week state anxiety and mother's perception of support contributed less than 4% additional explained variance.

The stepwise analysis described above produced the best model for the prediction of 6-week colic scores. Irritable newborns having fathers with more years of education and mothers reporting more fatigue after birth were more likely to be colicky at 6 weeks of age than were less irritable newborns having fathers with less education and mothers reporting less fatigue.

Table 4.34

Stepwise Regression Analysis Estimating the Relationship Between Neonatal Irritability and Total CASS Scores

	F	$p <$	R^2	R^2 Increase
Model	16.41	.0001*	.272	
Mother's Fatigue	19.32	.0001*		.144
Father's Education	12.51	.0006*		.075
Neonatal Irritability	9.42	.0026*		.052
Mother's First Postpartum Week State Anxiety				.027
Mother's Perception of Support				.013

Note. N = 136.

*p < .01.

In order to further investigate the relationship between neonatal irritability and total CASS scores, Pearson product moment correlation coefficients were computed between the MABI Irritability item (Item 16) and total CASS scores for each of the four MYRATE groups. Correlations for infants in the no colic and mild colic group were .3052 (p < .0624, n = 38) and .2274 (p < .1475, n = 42), respectively. Correlations for infants in the moderate and severe colic groups were -.1141 (p < .5410, N = 31) and -.0627 (p < .8389, N = 13), respectively. Although none of the correlations were significant at .01, a pattern emerged suggesting that the relationship between neonatal irritability and colic was stronger for infants in the less colicky groups than for infants in the more colicky groups.

Temperament--Months 3 and 8.

Hypothesis 10: There is no relationship between the nine temperament subscales of Carey's Revised Infant Temperament Questionnaire (Activity, Rhythmicity, Approach, Adaptability, Intensity, Mood, Persistence, Distractibility, and Threshold for Stimulation), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

The correlations presented in Table 4.35 indicate that the null hypothesis was rejected for both the 3- and 8-month temperament subscales. While Rhythmicity (r = .232, p < .0065), Mood (r = .375, p < .0001), and Distractibility (r = .221, p < .0097) were significant at 3 months of age, the only 8-month temperament subscale to reach significance was Mood (r = .287, p < .0039). Infants with higher 6-week CASS scores were more likely to be less rhythmic and distractible at 3 months of age and more variable in mood at 3 and 8 months of age than infants with lower 6-week CASS scores (see Table 4.35). Intercorrelations between RITQ subscales are presented in Appendix M-7.

In addition to completing the Infant Temperament Questionnaire (RITQ) at 3 and 8 months after birth, mothers were requested to rate their infants' Regularity, Adaptability, Activity, Approach and Withdrawal, Sensory Threshold, Intensity, Mood, Distractibility, and Persistence on a scale from 1 to 3 (1 = average, 2 = difficult, 3 = easy). Chi-square analyses were performed on these temperament characteristics and MYRATE to investigate whether or not the mother's perceptions of her infant's temperament varied with the child's colic rating at 6 weeks of age.

There were no significant differences (p < .01) in the mother's perceptions for the temperament characteristics of Activity, Regularity,

Table 4.35

Correlation Coefficients for RITQ Subscales at 3 and 8 Months of Age and Total CASS Scores

RITQ Subscales	3 Months		8 Months	
	r	*p*	*r*	*p*
Activity	-.045	.6040	.070	.4938
Rhythmicity	.232	.0065*	.027	.7906
Approach	.195	.0232	.206	.0408
Adaptability	.181	.0354	.090	.3770
Intensity	-.019	.8240	.041	.6855
Mood	.375	.0001*	.287	.0039*
Persistence	.133	.1232	.036	.7227
Distractibility	.221	.0097*	.141	.1628
Threshold	.025	.7697	-.159	.1150

Note. 3 Months: $N = 136$. 8 Months: $N = 99$.

*$p < .01$.

Approach, Sensory Threshold, and Distractibility at 3 and 8 months of age. However, trends toward significance were noted in the mother's perception of her infant's Adaptability, χ^2 (6, $N = 125$) = 14.27, $p < .027$, Intensity, χ^2 (6, $N = 124$) = 10.49, $p < .105$, and Mood, χ^2 (3, $N = 124$) = 10.56, $p < .014$, at 3, but not 8, months of age. Infants in the severe colic group were rated as being more variable in adaptability and mood and more intense than infants in the other colic groups. Also, while 3-month-old infants in the four colic groups were rated similarly with respect to Persistence, some differences were noted

by 8 months of age. Fifty-five percent of infants who had received a no colic rating at 3 months were rated by mothers as persistent at 8 months, while only 33% of infants receiving a difficult rating at 3 months were rated as persistent at 8 months, χ^2 (6, N = 91) = 11.67, p < .070.

Mothers were also requested to rate their infants' temperaments as average, more difficult than average, or easier than average. Chi-square analyses were performed on MYRATE and mothers' ratings at 3 and 8 months of age. A significant difference emerged between MYRATE ratings and the mother's rating of her infant's overall temperament at 3 months of age, χ^2 (6, N = 123) = 22.55, p < .001. The majority of infants in the severe colic group were rated as being average in temperament or more difficult than average, while the majority of infants in the no colic group were rated by mothers as easier than average. This same pattern was still evident at 8 months of age; however, the differences in ratings were not significant, χ^2 (6, N = 90) = 5.65, p < .463. Also, while few infants received a "more difficult than average" rating at 8 months of age, none of those who did were from the severe colic group.

Hypothesis 11: There is no relationship between the four factors of Bates's Infant Characteristics Questionnaire (Fussy-Difficult, Unpredictable, Dull, Unadaptable), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

Three factors of the 3-month Infant Characteristics Questionnaire (ICQ) were found to be significantly related to total CASS scores (see Table 4.36). The Pearson product moment correlations were .494 (p < .0001) and .222 (p < .0092) for Fussy-Difficult and Unpredictable,

respectively, at 3 months of age. While Fussy-Difficult remained significant at 8 months (r = .419, p < .0001), Unpredictable lost its significance. However, the Unadaptable subscale, which approached significance at 3 months, became significant at 8 months of age (r = .292, p < .0032). Intercorrelations between the ICQ factors are presented in Appendix M-8.

Table 4.36

Correlation Coefficients for 3- and 8-Month ICQ Temperament Factors and Total CASS Scores

	3 Months		8 Months	
ICQ Factors	r	p	r	p
Fussy-Difficult	.494	.0001*	.419	.0001*
Unadaptable	.193	.0241	.292	.0032*
Dull	.020	.8210	.179	.0754
Unpredictable	.222	.0092*	.096	.3441

Note. 3 Months: N = 137. 8 Months: N = 100.

*p < .01.

Hypothesis 12: There is no relationship between the five temperament subscales of Rothbart's Infant Behavior Questionnaire (Activity Level, Smiling and Laughter, Frustration to Limitations, Duration of Orienting, and Fear), when administered at 3 and 8 months of age, and total CASS scores collected 6 weeks after birth.

The correlations presented in Table 4.37 indicate that the 3-month subscales Frustration to Limitations, Duration of Orienting, and Smiling

and Laughter were significantly correlated with total CASS scores ($p < .01$). However, while no data were available for Smiling and Laughter and Activity Level at 8 months, Duration of Orienting, collected at 8 months, was no longer significantly correlated with 6 weeks CASS scores. While the strength of the correlation decreased somewhat, Frustration to Limitations remained significantly correlated at 8 months of age ($r = .303$, $p < .0024$). Infants who had been colicky at 6 weeks of age had shorter periods of orienting and demonstrated less smiling and laughing at 3 months of age than infants who had not been colicky. Also, 3- and 8-month-old infants who exhibited greater frustration to limitations were more likely to have been colicky at 6 weeks of age than infants who exhibited less frustration. (See Appendix M-9 for Intercorrelations between IBQ dimensions.)

Table 4.37

Correlation Coefficients for 3- and 8-Month IBQ Temperament Subscales and Total CASS Scores

	3 Months		8 Months	
IBQ Dimensions	*r*	*p*	*r*	*p*
Activity Level	-.010	.9123	----------	
Frustration to Limitations	.546	.0001*	.303	.0024*
Duration of Orienting	-.221	.0104*	-.112	.2713
Smiling and Laughter	-.280	.0011*	----------	
Fear	.182	.0352	.295	.0548

Note. 3 Months: $N = 134$. 8 Months: $N = 98$.

*$p < .01$.

Infant and Parent Variables

Interaction between maternal anxiety and fatigue and infant temperament.

Hypothesis 13: When father's education, mother's first postpartum week state anxiety and fatigue, and 3-month-old infant Threshold to Stimulation are in the model, there are no interactions between mother's first postpartum week state anxiety or fatigue and 3-month infant Threshold to Stimulation in the prediction of colic scores collected 6 weeks after birth.

A test of the regression model containing father's education, mother's first postpartum week state anxiety and fatigue, the 3-month infant temperamental characteristic of Threshold to Stimulation, and the interactions between mother's first postpartum week state anxiety and fatigue and infant's threshold to stimulation was significant, F (6,123) = 7.35, $p < .0001$, and explained 26% of the variance in total CASS scales. Tests of the partial regression coefficients yielded nonsignificant results for all variables except father's education, which remained significant at .0002 (see Table 4.38). The interactions between mother's first postpartum week state anxiety and fatigue, and 3-month infant threshold to Stimulation, were not predictive of 6-week colic scores.

Summary of Results

The present study was designed to investigate the relationship between infant colic and several demographic factors, parent psychosocial and emotional factors, and infant factors. While numerous measures of infant crying and colic were collected in an attempt to

Table 4.38

Regression Model Estimating the Relationship Between the Interactions Between Mother's First Postpartum Week State Anxiety and Fatigue and 3-Month Infant Threshold to Stimulation and Total CASS Scores

	F	$p <$	R^2
Model	7.35	.0001*	.264
Father's Education	14.32	.0002*	
Mother's First Postpartum Week Fatigue	0.00	.9449	
Mother's First Postpartum Week State Anxiety	0.10	.7557	
Infant Threshold to Stimulation	0.08	.7845	
Interaction between Mother's Fatigue and Infant Threshold	0.54	.4652	
Interaction between Mother's State Anxiety and Infant Threshold	0.22	.6396	

Note. N = 130.

*p < .01.

investigate different perspectives of infant colic, analyses were performed on data obtained with the Colic and Soothability Scale (CASS) and the Investigator's Rating of Colic (MYRATE). Total scores collected with the CASS, which placed infants on a colic continuum, were used in most analyses, whereas the MYRATE scores were used when colic was being viewed as a categorical variable.

Ancillary analyses included a description of the characteristics of infant colic and correlations between independent and dependent variables. Data on the incidence of colic, its onset and disappearance,

periodicity, and relationship with feeding method, birth order, allergy, and gastrointestinal distress were presented via descriptive statistics and chi-square analyses. Hypotheses, organized according to whether demographic, parent, or infant variables were being analyzed, were tested using regression and correlational analyses. The level of significance set for all analyses was .01.

Characteristics of Colic

Incidence. Depending upon the measure used to define it, the incidence of moderate and severe colic ranged from 25% to 36% of infants in sample. The MYRATE placed approximately 35% of infants in the moderate and severe groups, whereas CASS scores were distributed around a mean of 22.66 and had a standard deviation of 5.03. While the possible range of scores was 12 to 60, the minimum and maximum values obtained for this sample were 12.6 and 37.8, respectively.

Onset and disappearance. The mean age for onset of increased crying was approximately 2 weeks, while crying tended to subside around 11 weeks after birth. These ages were similar for infants in all four of the MYRATE colic groups; however, variability for onset and disappearance differed depending upon the colic rating. Infants in the moderate and severe colic groups demonstrated less variability than did infants in less colicky groups.

Feeding method, birth order, periodicity, allergy, and gastrointestinal distress. The relationships between colic and feeding method, birth order, periodicity of crying, allergy, and gastrointestinal distress were investigated using chi-square procedures. While colic did not appear to be related to feeding method,

birth order, or allergy, a relationship did emerge with periodicity of crying. Infants in the moderate and severe colic groups cried any time of day or night, while infants in the no colic and mild colic groups restricted most of their crying to the evening hours.

Most infants, regardless of their colic rating, were reported to "pass gas"; however, more infants in the moderate and severe colic groups were perceived by mothers as having more concomitant pain and discomfort. Mothers of infants in the more colicky groups also claimed that their infants passed more gas during crying periods than did mothers of less colicky infants.

Hypotheses

Analysis of data was organized according to the presentation of prebirth and postbirth demographic and descriptive variables, parent variables, and infant variables. Hypotheses were tested using General Linear Model (GLM) and stepwise regression procedures. A summary of hypothesis testing is presented in Table 4.39

Demographic and descriptive variables. When the relationship between colic and several demographic and descriptive variables was investigated, the variables of mother's education, mother's age, parents' occupations, number of pregnancies, race, birth order, baby's sex, feeding method, mother's use of drugs in labor and delivery, birthweight, father's work hours, and gestational age were found not to be predictive of total CASS scores. Father's education, however, was consistently predictive of colic throughout the course of all regression analyses, explaining approximately 8.5% of the variance in colic scores. Fathers with more years of education tended

to have more colicky infants. Not only was father's education the only demographic and prebirth variable to maintain its significance in all analyses, it contributed more explained variance in colic scores than did any other variable, with the exception of mother's first postpartum week fatigue.

Parent variables. The relationship between colic and mother's and father's prenatal trait and state anxiety was investigated. Mother's prenatal state anxiety entered the stepwise regression equation with father's education, but it explained only 3% additional variance in colic scores and was unable to maintain significance when postbirth variables entered the model. Mother's prenatal state anxiety, therefore, demonstrated only a weak relationship with colic when other parent variables were considered. The relationship between colic and the seven scales of the Pregnancy Research Inventory (PRI) was tested next and found to be nonsignificant for all scales.

Following tests of the relationship between colic and parent prenatal variables, the relationship between mother's and father's first postpartum week state and trait anxiety and colic was investigated. Neither father's first postpartum week state or trait anxiety, nor mother's trait anxiety, reached significance. Mother's postpartum state anxiety replaced her prenatal state anxiety in the model and contributed an additional 10% explained variance in colic scores when father's education was controlled for. Mother's postbirth state anxiety, therefore, emerged as a more powerful predictor than her prenatal state anxiety. Mothers with increased state anxiety during the early postpartum period tended to have infants with higher colic scores at 6 weeks of age.

Although mother's postpartum state anxiety remained significant, its value decreased when mother's first postpartum week fatigue entered the model. Mother's fatigue entered stepwise regression models first in all subsequent analyses and explained an average of 14% of the variance in colic scores. Mothers who reported more fatigue in the early postpartum period had more colicky babies than mothers who reported feeling less tired immediately after birth.

The relationship between colic and maternal support system was tested next. When mother's perception of support and her actual support were placed in a regression equation with father's education and mother's first postpartum week state anxiety and fatigue, mother's state anxiety lost significance. The correlation between mother's state anxiety and her perception of support prevented either variable from reaching significance when both were placed in the regression model. In a stepwise analysis, with the same variables, however, mother's state anxiety regained significance explaining 4% of the variance in CASS scores compared with 2% explained by the now non-significant mother's perception of support. Therefore, while mothers who felt supported at 6 weeks after birth had less colicky infants than mothers who did not perceive themselves as having strong support networks, the predictive value of this relationship was greatly reduced when other variables were considered.

Infant variables. The relationship between colic and infant behaviors exhibited prior to the onset of colic and after its disappearance was investigated. Neonatal behaviors included infant irritability and performance on the four dimensions of the MABI, all observed during the first week of life. The relationship between

colic and infant temperament was investigated at 3 and 8 months of age.

The relationship between colic and performance on the four MABI dimensions was tested. Although none of the dimensions reached significance, the dimension of State Control did replace the mother's first postpartum week state anxiety in a subsequent analysis at a less stringent significance level. Pearson product moment correlation coefficients computed between the MABI State item (Item 15) and total CASS scores for each of the four MYRATE groups were nonsignificant. However, a pattern emerged suggesting that the relationship between neonatal state and 6-week colic scores may be dependent upon the infant's colic rating. Infants who cry more during the first postpartum week may have higher colic scores at 6 weeks of age, but this relationship may only apply for infants who are not very colicky in the first place.

First week neonatal irritability replaced mother's first postpartum week state anxiety in a stepwise regression model containing father's education and mother's fatigue. It, however, explained only 5% of the 27% explained variance in colic scores. Therefore, while irritability during the early postpartum period appeared to be related to colic at 6 weeks of age, the relationship was tenuous and explained only a small percentage of the variation in the dependent variable. To further investigate the relationship between neonatal irritability and colic, Pearson product moment correlation coefficients were computed between the MABI irritability item and total CASS scores for each of the four MYRATE colic groups. While none of the correlations were significant at .01, a pattern did emerge which suggested that the

relationship between neonatal irritability and colic was stronger for infants in the no and mild colic groups than for infants in the moderate and severe groups.

Correlations between colic and 3- and 8-month temperament were computed and tested for significance. Temperament characteristics related to colic at 3 months of age were Rhythmicity (Predictability), Mood (Fussy-Difficult, Smiling and Laughter), Distractibility, Duration of Orienting, and Frustration to Limitations. Infants with higher 6-week colic scores were less rhythmic, distractible, and more variable in mood at 3 months of age than were noncolicky infants. Their duration of orienting was shorter, and they exhibited greater frustration to their limitations than did less colicky infants.

The only temperament characteristics to remain significantly related to colic from 3 to 8 months of age were Mood and Frustration to Limitations. Also, though no differences emerged in the adaptability of 3-month-old infants with varying degrees of colic at 6 weeks of age, once-colicky infants were less adaptable at 8 months of age than were infants who had been less colicky at the earlier age.

The temperamental characteristic of Threshold to Simulation was not found to be significantly correlated with colic scores at 3 or 8 months of age. The interactions between this temperamental characteristic and mother's postpartum fatigue and state anxiety were tested with the thought that infants with lower thresholds may react to environmental stress, such as maternal anxiety and fatigue, by developing colic. Tests of these interactions, however, were nonsignificant.

Summary

The best set of predictors of infantile colic, selected by stepwise regression analyses, included the demographic variable of father's education, the parent variable of mother's first postpartum week fatigue, and the infant variable of neonatal irritability. Fatigue emerged as the strongest predictor, contributing 14% of the explained variance in colic scores. Father's education contributed approximately 8% of the explained variance, while neonatal irritability explained only an additional 5%. Irritable newborns having fathers with more years of education and mothers reporting more fatigue in the early postpartum period were more likely to be colicky at 6 weeks of age than were less irritable newborns having fathers with less education and mothers reporting less fatigue. It was suggested, however, that the relationship between neonatal irritability and colic may be stronger for less colicky infants.

Although temperament characteristics were not tested with regression procedures because of the timing of data collection, their relationships with colic were tested via Pearson product moment correlation coefficients. Infants who were more colicky at 6 weeks of age tended to be more variable in mood, less rhythmic, less distractible, have shorter periods of orienting, and exhibited more frustration to limitations at 3 months of age, than did infants who were less colicky at 6 weeks of age. The relationship between colic and Mood and Frustration to Limitations remained significant at 8 months of age, while Adaptability, which had not been significantly related at 3 months, became related 5 months later.

Table 4.39

Summary Table for Testing of Hypotheses

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Demographic							
Prebirth: 1	Father's Education, Mother's Education, Father's Occupation, Mother's Occupation Race, Times Pregnant	All N.S. N = 126	.147	Father's Education (.07)[a] N = 127	.070		
Postbirth: 2	Father's Education, Birth Order, Baby's Sex, Feeding Method, Drugs, Father's Work Hours, Birthweight, Gestational Age	All N.S. N = 117	.145	Father's Education (.06) N = 120	.060		
Parent							
Prebirth--Anxiety 3	Father's Education, Mother's and Father's Prenatal State and Trait Anxiety	Father's Education N = 135	.144	Father's Education (.08) Mother's Prenatal State Anxiety (.03) N = 135	.124		

Table 4.39 (Continued)

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Parent (Cont'd)							
Prebirth: Pregnancy Research Inventory 4	Father's Education, Mother's and Father's Prenatal State Anxiety, 7 Scales of PRI	Father's Education N = 140	.193	Father's Education (.09) Mother's Prenatal State Anxiety (.06) N = 140	.145		
Postbirth--Anxiety: 5	Father's Education, Mother's and Father's First Postpartum Week State Anxiety	Father's Education N = 136	.225	Father's Education (.1028) Mother's Postpartum State Anxiety (.1064) N = 136	.209		

Table 4.39 (Continued)

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Parent (Cont'd)							
Postbirth--Fatigue: 6	Father's Education, Mother's Postpartum State Anxiety and Fatigue	Father's Education, Mother's Anxiety and Fatigue N = 139	.265	Father's Education (.10) Mother's State Anxiety (.04) Fatigue (.12) N = 133	.258		
Postbirth--Maternal Support: 7	Father's Education, Mother's Postpartum State Anxiety and Fatigue, Mother's Actual Support and Perception of Support	Father's Education, Mother's Fatigue	.288	Father's Education (.07) Fatigue (.15) Mother's Anxiety (.04) N = 134	.265		

Table 4.39 (Continued)

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Infant							
Neonatal Dimensions of MABI: 8	Father's Education, Mother's Fatigue, Postpartum State Anxiety, Perception of Support, 4 Dimensions of MABI	Father's Education, Mother's Fatigue N = 131	.295	Father's Education (.07) Perception of Support (.05) Fatigue (.15) N = 123	.269		
Neonatal Irritability: 9	Father's Education, Mother's First Postpartum Week State Anxiety and Fatigue, Perception of Support, Neonatal Irritability	Father's Education, Mother's Fatigue N = 136	.312	Father's Education (.08) Neonatal Irritability (.05) Maternal Fatigue (.14) N = 136	.271		

Table 4.39 (Continued)

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Infant (Cont'd)							
Temperament--RITQ: 10	Activity, Approach, Rhythmicity, Intensity, Adaptability, Mood, Persistence, Distractibility, Threshold to Stimulation					Rhythmicity (r = .23, p < .0065) Mood (r = .38, p < .0001) Distractibility (r = .22, p < .0097)	Mood (r = .29 p < .0039)
						N = 136	N = 99
Temperament--ICQ: 11	Fussy-Difficult, Unpredictabile, Unadaptabile, Dull					Fussy-Difficult (r = .49, p < .0001) Unpredictable (r = 22, p < .0092	Fussy-Difficult (r = .42 p < .0001) Unadaptable (r = .29, p < .0032)
						N = 137	N = 100

Table 4.39 (Continued)

Hypothesis	Variables	Regression Analyses: Significant Variables	Regression Analyses: R^2	Stepwise Analyses: Significant Variables	Stepwise Analyses: R^2	Significant Correlations: 3 Months	Significant Correlations: 8 Months
Infant (Cont'd)							
Temperament--IBQ: 12	Activity, Duration of Orienting, Fear, Smiling and Laughter, Frustration to Limitations (Activity and Smiling and Laughter available only for 3 months)					Frustration to Limitations (r = .55, p < .0001) Duration of Orienting (r = -.22, p < .0104) Smiling and Laughter (r = -.28, p < .0011) N = 134	Frustration to Limitations (r = .30, p < .0024) N = 98
Interaction Between Maternal Anxiety and Infant Threshold to Stimulation 13	Father's Education, Mother's First Post-partum Week Fatigue and State Anxiety, Threshold to Stimulation, Fatigue x Threshold, Anxiety x Threshold	Father's Education	.26				

[a] R^2 Increase.

CHAPTER V
DISCUSSION

Introduction

The present study was designed to investigate the relationship between infantile colic and several demographic, parent, and infant variables. Results of this investigation were presented in Chapter IV. A discussion of these results appears in the present chapter, along with a description of the limitations of the study and suggestions for future research.

Characteristics of Colic

Incidence

The incidence of moderate to severe colic in the present study ranged from 19% to 36%, depending upon the measure used to define it. Such figures correspond with the average incidence of colic reported in the literature of between 20% to 30% (Licamele et al., n.d.).

While the incidence of 34.6% reported by the Investigator's Rating of Colic (MYRATE) was higher than the 23% reported by Paradise (1966), it is within the range of cases reported by private pediatricians. The reported incidence of colic in private medical groups has ranged from 15% (Breslow, 1957) to 40% (Taylor, 1957), somewhat higher than the incidence reported in the general population (Rambar, 1956). The slightly higher incidence reported by MYRATE might, therefore, be due

to the fact that most subjects in the present study were patients of private physicians.

The measures Mother's Rating of Colic (MRCOLIC) and Health Inventory (HI) presented a somewhat lower incidence of colic than that reported by MYRATE. This discrepancy could be explained by the fact that MYRATE was influenced by the investigator's perceptions of colic, while MRCOLIC and HI were measures designed to investigate the mother's perception of colic. Perhaps, mothers are better able to assess the existence and degree of colic in their infants than outside observers who base their ratings on descriptions and samples of behavior. Therefore, MRCOLIC and HI could be the more valid measures of colic. An equally plausible explanation for mothers reporting less colic could be that the term "colic" has acquired negative or undesired connotations and, therefore, the use of the label is avoided. Mothers may also tend to reject the label "colic" because they are unsure of its meaning. Interviews with mothers in this study tended to indicate that most mothers associated the term colic with crying resulting from gas, inadequate mothering, family stress, a spoiled child, or the child's personality.

Because of the defensiveness the term "colic" seemed to engender in interviews, it was thought that a measure such as RATECRY, which avoided the use of the term "colic," might be a less biased measure of colic as reported by mothers. It was felt that the term "crying" was the best substitute for the label "colic" because, during interviews, most mothers defined colic as uncontrollable, persistent crying. The similarity between the incidence of colic reported by RATECRY and MYRATE, 36.2% and 34.6%, respectively, could be viewed as supporting

this line of reasoning. However, such interpretations must be made with caution as RATECRY and MYRATE are not identical measures.

Again, the incidence of colic reported by PEDCOL must be interpreted with caution as it did not directly assess the existence or degree of colic. The lower incidence of colic reported by PEDCOL could be explained by the fact that, although mothers were asked to indicate whether or not their pediatricians had ever used the term colic when describing their infants, the pediatricians themselves were never consulted regarding their diagnoses.

The results of the present study indicate that a true picture of the incidence of colic cannot be determined until the term becomes better defined. However, the fact that, regardless of the definition employed, the incidence of colic ranged from 19% to 36% indicates that enough infants experience this condition to warrant further investigation into this pediatric problem.

Onset and Disappearance

The average ages for onset and disappearance of increased crying in the present study correspond with those reported in the literature. Brazelton (1962) found colic to begin around 2 weeks after birth, peak at 6 weeks, and subside between 8 to 10 weeks. These ages parallel those found in the present study, with the exception that mothers reported crying to be at its worst around 4 weeks of age.

While the mean ages for onset and disappearance of increased crying were similar whether infants were assigned to the no colic, mild colic, moderate colic, or severe colic groups, as defined by MYRATE, the variability of ages differed for infants in the four colic

groups. Infants in the moderate and severe colic groups exhibited less variability in ages than did infants in the no colic and mild colic groups.

The similarity of mean ages for onset and disappearance of increased crying among infants in different colic groups seems to suggest a pattern in crying which is common among most babies. Regardless of whether infants cry very little or a great deal, they cry more beginning around 2 weeks after birth and begin to cry less as they approach their third month of life. As Brazelton (1962) suggested, this crying may serve some type of developmental purpose yet to be completely understood.

The decreased variability of ages for onset and disappearance of crying among more colicky infants is a result worthy of consideration. Increased crying was exhibited by all infants in the severe colic group by 3-1/2 weeks of age, whereas the maximum age noted for infants in the no and mild colic groups was 8 weeks. Similarly, all infants in the severe colic group demonstrated decreased crying by 13 weeks, whereas infants in the other colic groups demonstrated greater variability in ages.

One possible explanation for the difference in variability among different colic groups could be that colic is a specific condition that exaggerates what may be a normal developmental phase experienced by all infants. The excessive fussing and crying associated with colic could make ages for onset and disappearance of crying more pronounced among such infants.

Perhaps the crying of less colicky infants reflects a greater range of causes, from simple hunger to desire for comfort, whereas

the crying behavior of more colicky infants is resulting from a more specific and singular cause. The rather close adherence to the mean ages for onset and disappearance may suggest a more common source of crying among more colicky infants.

Periodicity of Crying

The present study indicated that most babies, colicky and non-colicky, cried more during the late afternoon and evening hours than at any other time of the day or night. These results support those of Bernal (1972) who studied 77 mother and baby pairs during the first 10 days of life. Data from this study showed a 24-hour pattern in crying, with a peak between 6 p.m. and midnight. This pattern emerged regardless of the infant's order of birth.

The literature supports the view that while colic may occur at any time of the day or night, it tends to occur during the late afternoon and evening hours. Results of the present study, however, indicate that less colicky infants cried almost exclusively in the evening, whereas approximately half of the infants in the severe colic group cried any time of the day or night, and none cried exclusively during the evening hours. Again, this difference in periodicity of crying among infants exhibiting varying degrees of colic may reflect a phenomenon distinct from the developmental phase most infants experience.

Variables Thought to be Related to Colic

The literature is replete with suggestions pertaining to the etiology of colic. Although a consensus concerning the etiology of colic does not exist, most researchers would agree that there are

probably many causes of the condition. Some of the more often cited causes of colic include sources within the child, such as gas and allergy due to feeding method and milk intolerance, maturation of the gastrointestinal and nervous systems, and infant temperament, whereas others have focused on sources in the child's environment, specifically environmental tension and maternal anxiety.

While the independent variables investigated in this study included the parent variables of anxiety, maternal support and fatigue and other maternal psychosocial factors, and the infant variables of neonatal behavior and later temperament, some data were available on the relationships between colic and feeding method, allergy and milk intolerance, and gastrointestinal distress. Results related to these factors will be discussed first, followed by a discussion of the parent and infant variables mentioned above.

Feeding Method

It has often been thought that infants maintained on breast-feedings, as opposed to bottle feedings, have less of a chance of developing colic; however, evidence in support of this hypothesis has not been forthcoming. In 1958, Meyer wrote that "Most observant physicians will concur that the colicky complex . . . is seldom found in the breast-fed infant" (p. 628). Based on interviews with mothers in the present study, it appears that this belief is still in existence today.

The results of the present study, however, support the findings of researchers (Illingworth, 1954; Paradise, 1966) who have reported no significant differences in colic in breast-fed and bottle-fed

infants. At this point in time, then, it can be stated that feeding method seems to have little to do with the emergence of infantile colic. This, however, is not to infer that infant diet is not related to colic, for some researchers (Jakobsson & Lindberg, 1978, 1983; Lothe et al., 1982) have identified intolerance to cow's milk, in bottle-fed and breast-fed infants, as an etiological factor in the occurrence of colic.

Allergy and Cow's Milk Intolerance

Allergies have sometimes been cited as a factor in the onset of colic (Breslow, 1956; Martin, 1956; McGee, 1950; Rambar, 1956; Speer, 1958; White, 1929). However, the results of the present investigation support studies reporting no significant relationship between colic and infant allergies or family history of allergy (Cobb, 1956; Illingworth, 1954; LeBlanc, 1983; Paradise, 1966).

Attempting to differentiate between allergic colic and colic resulting from unknown causes, Licamele et al. (n.d.) eliminated infants suffering from vomiting, diarrhea, constipation, and rashes in their definition of infantile colic. When these symptoms were investigated in the present study, there were no significant differences in the occurrence of diarrhea, constipation, skin irritations, or spitting up in infants in the four colic groups, suggesting that allergy probably was not a major factor in the onset of colic.

These results do not suggest that allergy is not a factor in the occurrence of colic, only that it does not seem to be associated with its occurrence in the majority of cases. Although this study did not systematically investigate the role of milk intolerance in the onset

of colic, a small but significant relationship was found between the postpartum milk consumption of nursing mothers and infant soothability, as measured by the Soothability subscale of the CASS. The more milk mothers consumed, the less soothable their infants were at 6 weeks of age. This finding, along with Jakobsson and Lindberg's (1983) finding that colic was due to milk intolerance in one-third of the breast-fed infants in their study, suggests that the relationship between colic and milk allergy deserves further investigation.

Future researchers would be prudent in differentiating between allergic colic and colic due to factors which are yet to be understood. It is important that the results of the present study are not interpreted as rejecting allergy as a factor in the occurrence of colic. Although it may not explain colic in the majority of cases, its accurate diagnosis in some infants could result in therapeutic measures capable of providing relief to both infant and parent. In other words, although "an allergic etiology probably accounts for only a small fraction of the colic seen in infancy . . . it is worth emphasis because it is in this field that one can present objective evidence" (Fries, 1956, p. 830).

Gastrointestinal Distress

Although gas and intestinal cramps have long been considered classic symptoms of colic, x-ray studies (Harley, 1969; Illingworth, 1954; Meyer, 1958) have cast suspicion on the causal relationship between gas and colic. The results of the present study suggest that all babies have gas. Mothers of colicky babies, however, reported more gas pain and discomfort in their infants than did mothers of

noncolicky babies. This finding leads one to question why, if all babies have gas, only some babies experience discomfort associated with it. One explanation could be that colicky babies really do experience more pain due to temperamental or organic reasons. Perhaps, the gas or intestinal discomfort experienced by some babies is the result of an undiagnosed allergy or intolerance to cow's milk (Jakobsson & Lindberg, 1983). Another possible explanation is that mothers of colicky babies are always scanning the environment, searching for explanations for their infants' crying. Whereas the gas goes relatively unnoticed in the noncrying infant, when the baby is crying it becomes a cue to the mother that the baby might be in pain.

The direction of causation, however, is debatable in that it is difficult to determine whether gas is the cause or result of excessive crying. X-ray studies showing an increase in gas in the intestines of infants after, but not before, periods of excessive crying (Harley, 1969) seem to suggest that gas is the result rather than the cause of crying. Such findings may explain why, in the present study, mothers of colicky infants reported an increase in gas during crying periods.

Demographic and Descriptive Variables

When entered in regression analyses mother's and father's age, occupation, race, mother's times pregnant, birth order, mother's use of drugs in labor and delivery, father's work hours, baby's sex, birthweight, gestational age, and feeding method failed to add significantly to the prediction of total CASS scores collected 6 weeks after birth. Although mother's education was correlated with colic scores,

only father's education reached the significance level ($p < .01$) set for entry into the regression model. Perhaps, the significant correlation between mother's and father's education prevented mother's education from reaching significance. The intercorrelation among variables is also a likely explanation as to why parents' occupational status failed to reach significance.

The finding that father's, but not mother's, educational level was related to colic may, at first glance, seem enigmatic. However, such results might be explained by the thought that father's education may be a better estimate of the mother's potential educational level than the mother's actual level of education. Such a hypothesis is lent credibility by the moderate correlation found between parents' educational levels as well as the suggestion that women usually find it more difficult than men to pursue their education. Marriage, children, and traditional role assignments may delay or end a woman's educational aspirations (Friedan, 1963).

Father's Education

Although previous research has not investigated the relationship between father's education and colic, mother's education has been found to be related to colic. Paradise (1966) found mothers of colicky infants to be highly intelligent and well-educated. Although a chi-square analysis in the present study produced nonsignificant results, a higher proportion of infants of semiprofessional and professional parents were assigned to the moderate and severe colic groups than infants of parents in other occupational categories. Such findings could have several possible explanations.

Paradise (1966) suggested that the higher incidence of colic among the more intelligent or well-educated could be the result of better reporting of colic symptoms rather than an actual difference in incidence. However, such an explanation is less likely for the present study sample in that all subjects used the same system of reporting, whereas Paradise urged mothers "to report promptly by telephone to the author any unexplained crying or colic" (p. 124). A second explanation could be that more educated parents have higher expectations or less tolerance for infant crying (Hollingshead & Redlich, 1958). Thinking themselves to be intelligent and perceptive individuals, they could feel more frustrated by crying which they are unable to ameliorate. Such frustration could magnify their perceptions of the problem or actually perpetuate crying as a result of inconsistent handling and the communication of stress to infants (Bakwin, 1956; Stewart et al., 1954). A third explanation for the relationship between parent education and colic could be that well-educated and intelligent parents give birth to intelligent infants who are frustrated by their immaturity (Meyer, 1958). The possibility that their motor development is not keeping pace with their intellectual development could explain the moderate relationship that was found between colic and the temperamental characteristic of Frustration to Limitations. This is not to hypothesize that an infant must be colicky to be intelligent, but that colic, in some infants, could be caused or perpetuated by a frustrated mental precocity. The testing of such a hypothesis, however, must await the construction of valid measures of neonatal temperament and intelligence.

Birth Order

Some authors have written that colic is more common among first-born children (Bakwin, 1956; Rambar, 1956; Spock, 1944); however, they provided no evidence for their assumptions. The results of the present study support the findings of researchers (Illingworth, 1954; Meyer & Thaler, 1971; Paradise, 1966; Taylor, 1957) who have failed to find significant differences in the occurrence of colic due to birth order.

Although birth order was not a significant predictor of colic scores, first-borns did have higher 6-week CASS scores than second-borns. Although such a difference could be due to sampling error, the possibility remains that birth order could have some influence on the occurrence or perpetuation of colic.

The traditional explanation for colic in first-born infants has been that inexperienced mothers transmit their tension and anxiety to the infant, thereby causing or perpetuating the cycle of colic (Bakwin, 1956; Bruce, 1961; Rambar, 1956; Spock, 1944). This suggestion was not supported by the present study, for, although maternal postpartum state anxiety was found to have a weak, but significant, relationship to colic, first-time mothers were not found to be more anxious than experienced mothers.

A final speculation regarding the slightly larger number of colicky first-borns is based on the relationship found between mother's milk consumption and 6-week infant soothability scores. As previously mentioned, the more milk consumed by the lactating mother, the less soothable her infant was at 6 weeks of age. Keeping this finding in mind, the weak but significant negative correlation between mother's

postpartum milk consumption and parity may suggest an alternative explanation for the slightly larger number of colicky first-born infants. The greater milk consumption by primiparas may place their infants at a higher risk for developing colic as a result of cow's milk protein intolerance (Jakobsson & Lindberg, 1978, 1983). Again, such an explanation must be considered with caution as the relationship between cow's milk and colic demands further study. Also, although there were slightly more colicky first-borns than second-borns in the study, a significant relationship between birth order and colic was not established.

Race

Although race did not emerge as a significant predictor of colic when placed in a regression analysis, a chi-square analysis did suggest that severe colic occurred less frequently in nonwhite infants. While previous research (Paradise, 1966) has suggested that race is not a factor in the emergence of colic, any interpretations of the results of the present study must remain tentative due to the small number of nonwhite subjects in the sample.

Parent Variables

Several researchers have suggested that infantile colic is related to factors within the infant's environment. These factors have usually taken the form of environmental tension, particularly stemming from the mother. The present study investigated the relationship between colic and parents' prenatal and postnatal state and trait anxiety, mother's first postpartum week fatigue, and maternal

support at 6 weeks after birth. Although mother's prenatal and postnatal state anxiety were found to be related to colic, these variables explained only a small percentage of the variance in total CASS scores.

Prebirth Parent Variables

Prebirth anxiety. Most of the research citing anxiety as a cause of colic has focused on postnatal anxiety; however, a few researchers (Lakin, 1957; Paradise, 1966) have suggested that anxiety experienced during pregnancy could be effecting changes within the mother which could contribute to neonatal irritability and colic after birth. The results of the present study suggest that if third trimester anxiety has any relationship with such infant behaviors, it is minimal. Neither maternal trait anxiety nor paternal state or trait anxiety were found to be predictive of colic. Maternal third trimester state anxiety did enter the regression equation ($p < .01$), but it explained only an additional 5% of the variance in colic scores when father's education was in the model, and it was eliminated from the model when parent postbirth variables were introduced. Therefore, the results of this study do not support the contention that prebirth anxiety plays a major role in explaining colic. Research investigating the relationship between prenatal anxiety and the specific behavioral outcome of infantile colic has not been forthcoming. However, Chisholm et al. (1978) reported significant correlations between maternal second trimester blood pressure, a correlate of stress, and neonatal irritability and lability of states. Such results suggest that anxiety measures collected at different points during pregnancy could prove more fruitful for future research.

Maternal Pregnancy Research Inventory. The maternal Pregnancy Research Inventory (PRI) was completed by mothers during the third trimester of pregnancy in an attempt to collect additional measures of prebirth maternal emotionality. Mother's Fears for Herself, Desire for Pregnancy, Fears for her Baby, Dependency, Irritability, Maternal Feelings, and Depression and Withdrawal were not found to be predictors of infantile colic, when father's education and parents' prenatal state anxiety were controlled for in the analysis. Such results support the finding that third trimester emotionality has little to do with infantile colic. However, again, such measures, collected at different junctures in pregnancy, might alter the non-significant results encountered in the present study.

Postbirth Parent Variables

Parent postbirth variables emerged as more powerful predictors of colic than prebirth variables. When they were entered into regression analyses, they eliminated all prebirth variables from the model. Although maternal first postpartum week state anxiety and maternal support at 6 weeks were related to colic, mother's first postpartum week fatigue emerged as the strongest parent predictor of colic, explaining 14% of the variance when father's education and neonatal irritability were included in the model.

Postbirth anxiety. Neither father's first postpartum week state or trait anxiety nor mother's trait anxiety contributed to the prediction of colic; however, mother's first postpartum week state anxiety replaced her prenatal state anxiety in the model. The finding that father's postpartum state anxiety was not significantly correlated

with infantile colic could be explained by the fact that, in most cases, the mother was the infant's primary caregiver and, therefore, had more contact with the infant.

Because some infants developed colic during the first postpartum week, the possibility existed that the relationship between maternal postpartum state anxiety and colic was being confounded by the onset of infant crying prior to the mother's completion of first postpartum week forms. Therefore, the variable CFC (Control for Crying) was entered into the regression model to control for such an effect. Even with CFC in the model, however, mother's postpartum state anxiety continued to reach significance. Such results have several possible explanations.

First, maternal postpartum anxiety may be a predictor of infantile colic. Such an explanation has been assumed, but not verified, by many authors (Bakwin, 1956; Bonar, 1935; Breslow, 1957; Carey, 1968; Cobb, 1956; Harley, 1969; Levine, 1956; Meyer, 1958; Rambar, 1956; Taylor, 1957; Weiland et al., 1957; Wessel et al., 1954). In a more systematic study, Paradise (1966) failed to uncover a relationship between maternal psychoemotional factors and colic. However, Paradise's use of the MMPI, an instrument designed to measure abnormal personality traits, was probably not tapping the same type of maternal factors as the State-Trait Anxiety Inventory (STAI), which was used in the present study. The use of the STAI as a measure of maternal anxiety appears to have been an appropriate choice, in that the differentiation between state and trait anxiety made by Spielberger et al. (1970) seemed to be supported by the finding that only state anxiety met the criterion level of .01 for entry into the regression models. Paradise's

inability to find an association between mother's psychological make-up and colic could be equated with the lack of a relationship found between the more stable trait anxiety measured in the present study, and the emergence of infantile colic. Such results suggest that if a relationship exists between anxiety and colic, it exists between the less stable state anxiety and not the more stable traits of a mother's personality as has been suggested by some authors (Breslow, 1957; Carey, 1968; Taylor, 1957).

A second possible explanation for the significant relationship found between mother's postpartum state anxiety and colic is that the CFC variable could have been an inadequate control in that it relied upon mothers' memories for dating the onset of their infants' crying. The small amount of variance explained in colic scores after the entrance of CFC in the model could still, therefore, be explained by the onset of colic prior to mothers' completion of anxiety forms. This has been a criticism of several of the studies reporting relationships between colic and maternal anxiety (Breslow, 1957; Stewart et al., 1954; Taylor, 1957).

Whether or not either of the above explanations is adequate in explaining the findings of the present study, it must be stressed that the variance accounted for by maternal state anxiety was small, as it was for all predictor variables. Therefore, even if maternal state anxiety has some value in the prediction of colic, it is likely to be minimal.

Maternal fatigue. While the literature has neglected to investigate the relationship between mother's fatigue and colic, fatigue was felt to be a worthwhile variable to investigate as several mothers

in the pilot study commented that the most difficult adjustment to parenthood was "sleep deprivation."

Mother's first postpartum week fatigue emerged as the most important predictor of infantile colic scores collected 6 weeks after birth. Explaining approximately 14% of the variance in the dependent variable, it reduced the variance explained by mother's first postpartum week state anxiety to only 4%. Such an occurrence could be explained by the correlation between the two variables, suggesting that mother's fatigue could be a major component of her first postpartum week state anxiety.

Just as it was hypothesized that the onset of infant crying, prior to completeion of first week forms, may have confounded the relationship between anxiety and colic, the possibility existed that maternal fatigue was also being confounded by infant crying, the variable it was attempting to predict. Therefore, the variable CFC was placed in a regression equation to control for the possibility of such effects. While CFC failed to reach significance in the regression analysis, the possibility still exists that the CFC variable was not an adequate control and that the maternal fatigue variable was still being confounded by infant crying. Therefore, based on the results of the present study, it is difficult to determine whether increased crying influenced the mother's fatigue or whether the mother's fatigue created enough environmental stress to cause or perpetuate the cycle of infant crying. Another possibility is that mothers reporting more fatigue were less tolerant of infant crying due to their physical exhaustion.

The difficulty in collecting maternal fatigue and anxiety data after birth, but prior to increased infant crying, creates problems

in obtaining measures of unconfounded relationships between such maternal and infant factors. Future studies should attempt to collect maternal factors as soon after birth as possible; preferably, before the mother leaves the hospital or increases contact with her newborn infant.

Maternal support. Pearson product moment correlation coefficients indicated that mother's actual support and support by father were not related to colic scores, whereas mother's perception of support was. Such a finding suggests that the mother's actual support system is less important than her perception of it in the prediction of infantile colic.

Mother's perception of support was found to be related to colic scores, but it failed to maintain a consistent position in subsequent regression analyses. When mother's first postpartum week state anxiety entered the regression equation first, mother's perception of support failed to reach significance. When both mother's first postpartum week state anxiety and mother's perception of support were placed in a regression equation together, neither maintained significance as a result of their relationship with each other.

This relationship between mother's perception of support and colic corresponds with previous research (Carey, 1968) to a degree. However, although a relationship seems to exist, the present study did not find maternal perception of support to be the greatest predictor of colic, as Carey had suggested. This finding could have several explanations. First, the Maternal Support Questionnaire (MSQ), used in the present study, has not been subjected to tests of its psychometric properties. Although, in the pilot study, mothers

claimed that the MSQ accurately assessed their support networks, an instrument subjected to more objective tests of reliability and validity might better reflect the kinds of support that are most important to the new mother.

A second explanation for the weak relationship found between support and colic could be that the sixth postpartum week was not the most appropriate time to administer the MSQ. Pleshette et al. (1956) demonstrated a need for emotional support for primiparas, especially during the first trimester of pregnancy. Williamson and Egeland (1981) emphasized the importance of social support for couples during late pregnancy and the early postpartum period. It is also worth noting that the only study to investigate the relationship between support and colic (Carey, 1968) reported a relationship between the pregnant woman's expectations of support after the baby was born and the development of colic. The relationship between support and colic deserves further study.

Infant Variables

First Postpartum Week

MABI dimensions. The dimensions of Neonatal Interactive Processes, Motoric Processes, State Control, and Physiological Response to Stress, as measured by the MABI, were not found to contribute significantly to the prediction of colic scores. However, the dimension of State Control did replace mother's first postpartum week state anxiety in a model where neither met the .01 criterion level for significance. This result suggests that neonatal state control may still be a variable worthy of further investigation.

Pearson product moment correlation coefficients were computed between the MABI state item (Item 15) and total CASS scores for the four MYRATE groups with the thought that the relationship between neonatal state and colic may be dependent upon the infant's 6-week colic rating. Although none of the correlations were significant, a pattern emerged suggesting that more colicky infants are either "very sleepy," or "awake a lot of the time and quiet," during the first postpartum week, whereas infants with lower 6-week colic scores cried more during the first week after birth.

These findings become less enigmatic when one considers the finding that moderately and severely colicky infants are less variable in their ages for the onset and disappearance of increased crying. Perhaps, the stronger correlation between neonatal state and 6-week colic ratings for infants in the no colic group reflects a stability of temperament from birth through 6 weeks of age. And, perhaps, whatever it is that causes colic interrupts this stability in more colicky infants. A second explanation is that infants who are very sleepy and quiet during the first postpartum week may seem more colicky because caregivers have developed expectations for their infants which are challenged at 2 to 3 weeks of age when infants begin to go through a "normal developmental phase" characterized by increased crying. More research is needed to determine further whether these relationships actually exist, and if so, what mechanisms may be responsible for such associations.

Neonatal irritability. Neonatal irritability was found to be significantly and positively correlated with 6-week colic scores. It entered a regression equation, which included father's education and

mother's fatigue, replacing mother's first postpartum week state anxiety in the model. Although it appears that irritability in the first week is related to colic at 6 weeks of age, the association is weak with neonatal irritability explaining only 5% of the variation in colic scores.

The relationship between neonatal irritability and infantile colic was further investigated through the computation of Pearson product moment correlation coefficients between neonatal irritability and colic for each of the four MYRATE colic groups. Although all correlations were nonsignificant, a pattern, similar to the one evidenced by the relationship between the MABI neonatal state item and colic for the four MYRATE groups, emerged. While the correlations between neonatal irritability and colic for moderately and severely colicky infants were negative and close to zero, the correlations for infants in the no and mild colic groups were positive and approached significance. A larger sample size for each colic group may have resulted in some of these correlations reaching significance ($p < .01$).

If a relationship between neonatal irritability and 6-week colic does exist for less, but not more, colicky infants, the mechanism is probably similar to that operating in the hypothesized relationship between neonatal state and infantile colic, discussed in the previous section. Again, more research is needed to investigate these relationships.

Three- and Eight-month Temperament

The temperamental characteristics of Rhythmicity, Mood, Distractibility, Duration of Orienting, and Frustration to Limitations,

measured 3 months after birth, were found to be significantly correlated with 6-week colic scores. More colicky infants were found to be less rhythmic, more variable in mood, less distractible, have shorter durations of orienting, and demonstrate more frustration to their limitations at 3 months of age than infants who had been less colicky. The correlations between colic and Rhythmicity and Mood correspond to findings of previous researchers (Licamele et al., n.d.; Huttunen & Nyman, 1982); however, the temperament characteristics of Distractibility and Duration of Orienting have not been previously found to be of importance in predicting colic. Although Huttunen and Nyman's finding that colicky infants are more intense than noncolicky infants was not supported by data from Carey's Revised Infant Temperament Questionnaire (RITQ), mothers of colicky infants rated their infants as being less adaptable, more variable in mood, and more intense than did mothers of noncolicky infants.

As has been suggested by previous researchers and authors (Benjamin, 1961; Carey, 1968; Korner, 1971; Levine, 1956; Meyer, 1958), colicky infants in the present study were not found to have lower thresholds to sensory stimulation. Perhaps, sensory threshold, as measured by Carey's RITQ, is not reflecting the type of stimulation that is most upsetting to the colicky infant. Carey's variable is a measure of threshold to external stimulation. Perhaps, the variable of interest should be threshold to internal stimuli, such as internal discomfort or frustration due to motor immaturity. The finding that at 3, but not 8, months of age colicky infants are less distractible than noncolicky infants could be viewed as offering support for this hypothesis. Perhaps, colicky infants are less distracted by external

stimuli becuase internal stimuli are too intense. This could also explain why the Duration of Orienting for colicky infants is shorter than that for those who are not colicky. At 8 months of age, when infants are less focused on internal stimuli and motor skills have improved, Distractibility and Duration of Orienting were no longer significantly correlated with colic.

The negative correlation between Rhythmicity, as measured by Carey's Rhythmicity subscale and Bates's Unpredictability factor, and colic could also be a symptom of colic rather than an unbiased indicator of temperament. The condition of colic could be what is interrupting the rhythmicity of colicky infants. Perhaps, it is not the infants who are irregular, but the caregivers who are unable to identify the infant's patterns due to havoc created by colicky crying. Colicky crying can easily confuse the infant's signals, making it difficult for caregivers to distinguish between cries from hunger, fatigue, pain, and so forth. That Rhythmicity is no longer an associated temperamental characteristic at 8 months of age, when colic has ceased, adds support for this line of reasoning.

The only temperament characteristics correlated with infantile colic that were found to be stable from 3 to 8 months of age were Mood and Frustration to Limitations. Although it is not difficult to hypothesize as to why a colicky infant might display more negative mood than a noncolicky infant, it is a little harder to explain the continuation of mood differences into the eighth month of life. Perhaps, the moderate correlation between Mood and Frustration to Limitations lends a clue to the perpetuation of more variable mood among once-colicky infants. It seems safe to assume that infants who

are more easily frustrated are more likely to exhibit symptoms of negative mood. Another possible explanation for the correlation beween Mood and Frustration to Limitations, however, could be that these two temperamental characteristics are not conceptually distinct.

The significant correlation between Frustration to Limitations and colic lends credibility to Meyer's (1958) suggestion that colic results from a frustrating immaturity which limits the infant's activity. In hypothesizing as to why some infants may be more frustrated by their immaturity than others, it might be valuable to investigate the role of intellectual development. An infant need not be colicky to be intelligent; however, it may be that a degree of intellectual precocity, which is out of pace with motor development, could be frustrating enough to create colic symptoms. The relationship between parents' level of education and colic lends some support for this hypothesis. More research is needed.

Summary and Conclusions

Birth order, feeding method, parents' age, race, father's work hours, birthweight, gestational age, mother's use of drugs in labor and delivery, and infant's gender were not significantly related to infantile colic. The lack of a relationship between colic and birth order is of special interest and supports the findings of the most recent research. Such replication should discourage the perpetuation of misinformation about inexperienced mothers causing colic in their first-born children. The common assumption that breast-fed infants are immune to colic is also challenged by this research. Mothers of colicky bottle-fed infants should be reassured that their decision

not to breast-feed is not responsible for the onset of colic in their infants.

The lack of a relationship between feeding method and colic should not act to dismiss infant diet as a factor in the onset of colic. Although the present study did not support research reporting a relationship between colic and allergy or family history of allergy, the existence of allergic colic has been well-established in previous studies. Therefore, it is not the existence of allergic colic that is in question, merely the frequency of its occurrence. A differentiation must be made between allergic colic and colic resulting from other, yet to be understood, factors. While the colic symptoms in some infants will resolve upon the elimination of cow's milk products from the diets of the bottle-fed infant or nursing mother, such a therapy does nothing to alleviate the apparent distress in a large number of colicky infants. More systematic studies are needed to investigate further the cause and extent of allergic colic.

Some researchers and authors have referred to colic as a maturational phenomenon experienced by all infants. The present study supports the hypothesis that most infants go through a period of increased crying, beginning around 2 weeks of age and subsiding around 3 months of age. However, several additional findings suggest that although this developmental phase may accentuate the symptoms of colic, colic appears to exhibit defining characteristics which distinguish it from this "developmentally appropriate behavior." First, the mean ages for onset and disappearance of increased crying were similar for colicky and noncolicky infants; however, the variability of these ages decreased as the severity of colic increased. The uniform age

parameters found for more colicky infants suggest that colic may be a symptom of a condition or phenomenon unique unto itself. Second, colicky infants differed from noncolicky infants in terms of periodicity of crying. Most infants were found to cry more during the later afternoon and evening hours, but the crying of more colicky infants invaded other hours of the day as well. Third, although neonatal irritability evidenced a weak but significant positive relationship with colic, this relationship differed for infants in the varying colic groups. Although these findings are far from established, they suggest that colicky infants may actually cry less than noncolicky infants immediately after birth. More research is needed to investigate the behavior of colicky infants during the first few weeks of life. Finally, the present research supports the well-known fact that some infants cry more than others. Even if the first 3 months serve a developmental purpose for all infants, the question still remains: "Why do some infants cry more than others?" The isolation of variables capable of differentiating among infants of varying degrees of soothability is a first step in answering this question.

The present study identified several etiological factors associated with infantile colic; however, these variables failed to explain but a small percentage of the variance in the dependent variable. The best set of predictors of infantile colic, selected by stepwise regression analyses, included the demographic variable of father's education, the parent variable of mother's postpartum fatigue, and the infant variable of neonatal irritability. Together, however, these variables accounted for only 27% of the variance in 6-week CASS scores. Therefore, while the results of this study suggest that irritable

newborns having fathers with more education and mothers reporting more postbirth fatigue are more likely to be colicky at 6 weeks of age than are less irritable newborns having fathers with less education and mothers reporting less fatigue, such relationships could very well be eliminated with the introduction of other, yet to be investigated, variables. For example, further investigation into the neonate's behavior immediately after birth might support the pattern, emerging from analyses in the present study, suggesting that the value of neonatal irritability as a predictor of colic may be dependent upon whether or not the infant becomes colicky in the subsequent weeks.

While several infant temperamental characteristics were found to be related to 6-week colic scores, they were not entered into regression analyses because they were assessed after the collection of colic data. Infants who were more colicky at 6 weeks of age were found to be less rhythmic, less distractible, more variable in mood, more frustrated by their limitations, and to have shorter durations of orienting at 3 months of age than less colicky infants. Although none of these relationships were surprising, the failure of Threshold to Stimulation to correlate with colic was unexpected. Several researchers have reported such a relationship and have explained it by suggesting that some infants may become colicky because of their inability to shut out disturbing stimuli. This hypothesis may still be worth investigating, however, as it is possible that sensory threshold, as measured by Carey's RITQ, was not reflecting the type of stimulation that is most disturbing to colicky infants. Perhaps, threshold to internal stimuli, such as internal discomfort or frustration due to motor immaturity, would be more appropriate variables for investigation.

The finding that most infants experience a great deal of gas, but colicky infants experience more associated discomfort, could be viewed as supporting this hypothesis.

Because the experience of colic could have been confounding the results of temperament assessment at 3 months of age, temperament measures were readministered at 8 months of age. Mood and Frustration to Limitations were the only characteristics to remain stable over the 5-month period of time. The significant correlation between Frustration to Limitations and colic supports the speculation that colic could be partly due to a frustrated mental precocity in the infant. Although such a suggestion must be viewed with caution due to the correlational nature of the relationship, it is a viable hypothesis for future research. The finding that colic began to subside at the same time that infants' motor skills improve lends credibility to this hypothesis. Also, the value of father's education as a predictor of colic might lie in its possible relationship with infant intellectual precocity. A study of the relationship between infant intellectual and motor development and infantile colic is warranted.

In summary, the variables identified by this study as being the most predictive of, or highly correlated with, colic were mother's postpartum fatigue, father's education, neonatal irritability, and several temperamental characteristics of the infant. These variables represent factors of the infant's internal environment, external environment, or both which can cause or influence colic.

Maternal fatigue is a factor in the infant's external environment which most likely acts to perpetuate the cycle of infant crying. Other types of environmental stress, such as maternal anxiety or lack

of support, also probably have the same effect. The fact that these parent psychosocial and emotional factors were not assessed prior to the onset of increased crying in all cases, however, makes it impossible to evaluate them as etiologies of colic.

External environmental factors, such as the parent variables discussed above, most likely act to perpetuate colic, whereas factors originating within the infant or resulting from an interaction between innate and experiential factors are more likely to be implicated in its etiology. The organic dysfunction of allergic colic has already been discussed. Although this study did not uncover a relationship between allergy and colic, colicky infants were thought, by mothers, to experience more gas pains than noncolicky infants. It is unlikely that all colicky infants are suffering from undiagnosed allergies; however, the apparent discomfort of colicky infants cannot be dismissed. If most babies have gas, why do only some infants experience associated discomfort? Perhaps, something akin to pain threshold can be responsible for this variability. Again, the present study was unable to investigate this question.

The interaction between an infant's temperament and his or her external environment may influence the display of colic symptoms. The finding that the relationship between frustration to limitations and colic remained significant from 3 to 8 months of age could be thought of as supporting researchers who have speculated that some infants may develop colic symptoms as a result of being frustrated by their immaturity. If this were the case, the question still arises: "Why are some infants more frustrated than others?" Although the present study was not equipped to investigate this question, the

relationship between father's education and colic might provide some clues. As previously suggested, if father's education is correlated with infant intelligence, perhaps, some infants are more frustrated due to the lack of synchrony between their motoric and intellectual development. Such speculations must be viewed with extreme caution until they are addressed and confirmed by future investigations.

Although several factors related to colic have been identified, the small amount of variance explained in colic scores suggests that the most crucial variables have yet to be recognized. Or, perhaps, more valid measures of these suggested associated factors, and of colic itself, could result in a better understanding of infantile colic. The construction of instruments capable of assessing neonatal temperament and intelligence, during the first few weeks of life, would aid in understanding the relationships among father's education level, infant frustration to limitations, and infantile colic. The variables identified by the present research should, therefore, not be dismissed as insignificant, but considered in terms of why they might bear any relationship to colic at all.

Limitations of the Study

1. The sample for this study was recruited from a select population in that all subjects were volunteers from prepared childbirth classes. Results are, therefore, applicable for couples attending such classes and cannot be generalized to the population as a whole.

2. The present study attempted to achieve methodological improvements in the study of colic. However, the reliability and validity of all instruments were not established for the study sample. Further refinement of measures of colic and independent variables might have resulted in stronger relationships.

3. Although several temperamental characteristics of infants were found to be related to infantile colic, the correlational nature of the analyses prohibited interpretations of causation. Measurement of temperamental characteristics during the neonatal period could provide greater insight into the value of temperament in the prediction of colic. The ability to evaluate temperament during the early neonatal period could also contribute to a better understanding of the nature of infantile colic, hence, to improved therapeutic approaches.

4. Although an attempt was made to collect data on several parent psychosocial and emotional factors prior to the onset of colic, the attempt was not uniformly successful. Because colic began as early as the first week in some infants, the measures of parental anxiety could easily have been confounded. Future research should attempt to collect parent measures as soon after birth as possible, preferably, before the mother has left the hospital and had an opportunity to interact with her newborn.

5. The relationship between maternal prenatal anxiety and infantile colic could be better investigated by assessing anxiety at several junctures throughout pregnancy, rather than only during

the third trimester. Perhaps, a critical period exists during which the effects of maternal anxiety are most pronounced.

Recommendations for Future Research

1. Although the present study has identified some variables which appear to be associated with colic, the small amount of variance accounted for in colic scores suggests a need to search for other variables of possible import. In-depth case studies involving infant and parent observations from pregnancy through the third and fourth postpartum months might shed light on additional variables worthy of further investigation.

2. Maternal fatigue and neonatal irritability, two variables found to be most predictive of colic, deserve additional study. Perhaps, the predictive value of neonatal irritability and maternal fatigue could be increased through methodological improvements. Both variables were measured by single item responses. Development of longer and more sophisticated measures may find that it is not the variables but the measures which are in need of revision.

3. The pattern which emerged when correlations between neonatal irritability and colic were computed for each colic group deserves further attention. The possibility that colicky infants cry less than noncolicky infants during the first few weeks of life is enigmatic. Such correlations, of course, could be due to chance, especially considering their failure to reach significance.

However, replication of such results would be intriguing and offer much food for thought in the understanding of infantile colic.

4. An investigation into the relationship between colic and intellectual development could provide a better understanding of the relationship found between father's education, the infant temperamental characteristic of Frustration to Limitations, and infantile colic. The construction of instruments capable of assessing temperament and intellectual development during the early neonatal period could be the first step in exploring this relationship.

APPENDIX A
INFORMED CONSENT

Infant Research Project

This study focuses on the behavior and temperament of your soon-to-be-born child. Being that nobody will know your baby like you will, you will be requested to complete a series of questionnaires pertaining to your infant's behavior. During the first week after your baby's birth, the mother will be requested to complete a modified version of Brazelton's Neonatal Behavioral Assessment Scale (MABI). This original scale is a highly respected instrument for the assessment of infant behavior. Although the original Brazelton Scale is usually administered by trained testers, mothers have been found to be quite objective in assessing their own infants' behavior. Through administering this simple instrument to your baby you should gain knowledge about many of the behaviors that your baby is and is not yet capable of. When your baby is 6 weeks old, you will be asked to complete a very brief questionnaire concerning your baby's behavior on five consecutive days. It is appreciated that parents of small babies are very busy; therefore, questionnaires have been designed so that each can be completed in 3-5 minutes. When your infant is 3 months old, you will be asked to complete a few questionnaires on your baby's temperament. Parents who have completed these questionnaires have described them as being informative and fun.

In addition to the questionnaires concerning your baby's behavior, you will be requested to complete a few forms pertaining to your own adjustment to parenthood (whether this is your first, second, third . . . child). After all, who is in a better position to provide information about parents' feelings during this eventful time than parents themselves?

You will be given all forms and questionnaires at the beginning of the study. Being that you are sure to be busy during the first few months of your baby's life, the investigator will telephone you or send you postcards at various points during the study to remind you to complete and return forms. You will be provided with self-addressed stamped envelopes for the purpose of returning these forms to the investigator.

Although you will not be compensated monetarily for your participation in this study, you will receive a small infant toy which can be used when administering the MABI to your baby. It is hoped that a more important compensation for your time and effort will be the increased knowledge you will gain about your infant, as well as the knowledge that you will be contributing to our understanding of infant

behavior. All interested participants will be provided with a summary of the results of this study.

There are no risks involved in your participation in this study, and you are free to withdraw your cooperation at any time. Your names will be replaced with a code number to ensure anonymity. Your rights to privacy will be protected to the extent provided by law.

We have read and understand the procedure described above. We agree to participate in the study and we have received a copy of this description.

_____	_____	_____
Mother	Father	Date

_____	_____
Principal Investigator	Date

Marilyn W. McAuliffe
1706 S.W. 77 Terrace
Gainesville, Florida 32607
372-8351

APPENDIX B
DEMOGRAPHIC SHEET I

Code No._____

Names_____ Date_____

Address_____ Phone_____

Marital Status (circle one): Married Unmarried

Mother

Age_____ Date of Birth_____

Race (circle one): White Black Oriental Other_____

What is the highest grade of school that you have completed (circle one)?

Grade School	High School	College	Graduate School
1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	1 2 3 4

Have you had any other schooling?

____No Months Years

____Yes_____ _____
(Kind?) (How Long?)

Occupation:_____

Are you presently employed? Yes No

Do you plan on working outside the home after the baby is born? Yes No

If yes, how soon after the baby is born?_____

Do you want to work? Yes No

Father

Age_____ Date of Birth_____

Race (circle one): White Black Oriental Other_____

What is the highest grade of school that you have completed (circle one)?

Grade School	High School	College	Graduate School
1 2 3 4 5 6 7 8	9 10 11 12	1 2 3 4	1 2 3 4

Have you had any other schooling?

____No Months Years

____Yes_____ _____
(Kind?) (How Long?)

Occupation: _____

Are you presently employed? Yes No

If yes, do you plan on taking any time off when the baby is born? Yes No

If yes, how much time do you plan on taking off? _____

Is your employer agreeable to your taking time off? Yes No

What time do you leave for work? _____ Return home? _____

Will you be living with the baby's mother when the child is born? Yes No

If yes, about how many hours per week will you be out of the home and away from your family? _____

Family

How many children do you presently have? _____

Please complete information on other children:

Sex	Birthdate	Present Age	Breast-fed or Bottle?	Medical or Physical Problems
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

New Baby

When is the baby's expected date of birth? _____

Where do you expect the baby to be delivered? (Please give name of hospital, etc.) _____

Who is your obstetrician? _____

Do you plan on nursing the baby? Yes No

If yes, for how long? _____

Do you plan on having anyone help with the new baby? Yes No

If yes, who? _____

For how long? _____

Thank you for your time and cooperation!

APPENDIX C
DEMOGRAPHIC SHEET II

Date _____ Code No. _____

Labor and Delivery Information

What was the expected date of your baby's birth? _____

What was the actual date of your baby's birth? _____

What was the approximate length of your labor? _____ hours

Did you receive any drugs during labor to ease pain or discomfort?

Yes No

If yes, please place a check mark next to the drug(s) you received?

____ Demerol (tranquilizer)

____ Epidural (spinal anesthetic)

____ General Anesthesia

____ Other (please specify) _____

Did you try to go through labor without the use of drugs? Yes No

Did the drugs give you much relief? Yes No

Are you glad that you decided to receive drugs? Yes No

If you did not receive drugs during labor, do you wish you had? Yes No

Did you have a cesarean delivery? Yes No

Was your labor induced? Yes No

Did the baby receive a laboyer bath? Yes No

Did you have any labor or delivery complications? Yes No

If yes, what complications did you have? _____

_____

Infant Information

Baby's sex: Male Female Birthweight: ____ pounds ____ ounces

Length at birth: _____ inches

Apgar at 1 minute after birth: _____

Apgar at 5 minutes after birth: _____

Did your baby have any medical complications during labor or after birth? Yes No

If yes, what complications did your baby have? _____

_____

How is your baby's health now? _____

Mother

How are you feeding your baby (circle one)? breast bottle both

If you are nursing your baby, how soon after birth did your baby nurse? _____ hours

Was your first attempt to nurse your baby a satisfying experience for you? Yes No For your baby? Yes No

How tired do you feel now (circle one): Extremely tired, very tired, a little tired, not very tired, not tired at all

Additional Comments

THANK YOU!

CONGRATULATIONS!

APPENDIX D
PREGNANCY RESEARCH INVENTORY (PRI)

Code No. _____

In the following questions, we would like to know about some of your feelings about pregnancy and labor. It is important that you answer all questions. After each statement, please check the answer that best describes your feelings. There are no right or wrong answers; we only want to find what the experiences of women are.

1. Most women go through labor without much difficulty.
   Strongly agree____ Mildly agree____ Mildly disagree____
   Strongly disagree____.

2. Before pregnancy, I had been looking forward to having a baby.
   Strongly agree____ Mildly agree____ Mildly disagree ____
   Strongly disagree____.

3. I would like to have my mother or some older woman help me take care of my baby.
   Strongly agree____ Mildly agree____ Mildly disagree____
   Strongly disagree____.

4. Some people may think it's silly to have superstitions during pregnancy, but I find that I have them.
   Often____ Occasionally____ Rarely____ Never____.

5. I'm easily upset since pregnancy.
   Frequently____ Occasionally____ Rarely____ Never____.

6. I would like to have:
   1 child____ 2 children____ 3 children____ 4 children____
   5 children____ 6 children____ more than six children____.

7. I've lost interest in things during pregnancy.
   Very much____ Somewhat____ A little____ Not at all____.

8. If she would only admit it, every pregnant woman is scared and worried.
   Strongly agree____ Mildly agree____ Mildly disagree____
   Strongly disagree____.

9. When I first found out that I was pregnant, I was:
Delighted____ Happy____ Just accepted it--was neither happy nor unhappy____ Somewhat unhappy____ Extremely unhappy____.

10. Taking care of a small baby is something that no woman should be expected to do all by herself.
Strong agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

11. The baby can be harmed if the mother gets upset during pregnancy.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

12. I have felt that my pregnancy is long and tiresome.
Frequently____ Occasionally____ Rarely____ Never____.

13. I stopped playing with dolls when I was:
6 years or less____ 7 or 8 years old____ 9 or 10 years old____ 11 or 12 years old____ 13 years of more____.

14. Since becoming pregnant, I've been discouraged.
Very much____ Somewhat____ A little____ Not at all____.

15. I worry about having a great deal of pain during childbirth.
Frequently____ Occasionally____ Rarely____ Never____.

16. I would like to have:
A boy____ A girl____ It makes no difference____.

17. It's unpleasant to be alone when pregnant.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

18. I am afraid that my baby may be ugly or unattractive.
Frequently____ Occasionally____ Rarely____ Never____.

19. I've been less patient with family and friends during pregnancy.
Very much____ Somewhat____ A little____ Not at all____.

20. I would consider my motherly feelings as:
Very motherly____ Above average____ Average____ Less than average___ Not motherly____.

21. I have been happy and cheerful during pregnancy.
Frequently____ Occasionally____ Rarely____ Never____.

22. Any pregnant woman dreads delivery.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

23. I did not want to have a baby at this time.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

24. It would be comforting to know that you could turn to your mother or some older woman for help in making decisions.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____ .

25. Any pregnant woman is concerned whether her baby will be normal.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

26. I've been more short-tempered since I've been pregnant.
Very much____ Somewhat____ A little____ Not at all____.

27. Before I was married, I hoped to have:
No children____ 1 child____ 2 children____ 3 children____
4 children____ 5 children____ 6 children____ more than
6 children____.

28. I don't like being with people during pregnancy.
Frequently____ Occasionally____ Rarely____ Never____.

29. If I had the choice, while delivering the baby, I would prefer to be:
"Out"____ Awake, but have drugs that would ease the pain___
Completely awake and not use drugs____.

30. Before I became pregnant, we were hoping to have a baby.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

31. No matter how much a young mother knows, she still should have her mother or some older woman around.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

32. I worry that I may lose my baby.
Frequently____ Occasionally____ Rarely____ Never____.

33. I've been hard to get along with during pregnancy.
Frequently____ Occasionally____ Rarely____ Never____.

34. When I was a little girl:
I wanted to take care of babies and young children whenever possible____. I liked taking care of babies and young children sometimes____. I was indifferent about taking care of younger children. I thought younger children were a nuisance____.

35. Since becoming pregnant, I've felt dull and indifferent.
Very much____ Somewhat____ A little____ Not at all____.

36. I believe that most women make too much fuss about the difficulties of childbirth.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

37. I sometimes wish that I weren't going to have this baby.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

38. A pregnant woman needs lots of consideration from her family.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

39. I worry that my baby may be injured while being born.
Frequently____ Occasionally____ Rarely____ Never____.

40. I've been tense and edgy since pregnancy.
Very much____ Somewhat____ A little____ Not at all____.

41. I would like it best if my baby were with me in the hospital all the time.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

42. I've felt very calm and peaceful during pregnancy.
Very much____ Somewhat____ A little____ Not at all____.

43. I worry that I'll have a hard time during delivery.
Frequently____ Occasionally____ Rarely____ Never____.

44. I tried to keep from becoming pregnant.
True____ False____.

45. There is nothing worse for a young mother than being alone while going through her first experience with a baby.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

46. I worry about my baby being weak or sickly.
Frequently____ Occasionally____ Rarely____ Never____.

47. I've been restless and uneasy during pregnancy.
Very much____ Somewhat____ A little____ Not at all____.

48. When you first began to menstruate, how did you feel about it? (Check one or more)
Proud____ Pleased____ Just accepted it____ Unhappy____
Frightened____ Angry or rebellious____ Disgusted____.

49. Since becoming pregnant, I've been unhappy and in low spirits.
Very much____ Somewhat____ A little____ Not at all____.

50. I worry that having a baby will make me less attractive.
Frequently____ Occasionally____ Rarely____ Never____.

51. This was the wrong time for me to have a baby because of: (Check all reasons that apply to you). My health____ Money problems____ Housing problems____ I did not want to leave my work____ My husband or family does not approve____ I have enough children____ I'm not ready to settle down____ It interferes with other plans____ None of the above____.

52. Most women need more time than they are given to rest up after having a baby.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

53. I have been worried that my baby may be born dead.
Frequently____ Occasionally____ Rarely____ Never____.

54. I've felt cross since I've been pregnant.
Frequently____ Occasionally____ Rarely____ Never____.

55. Whenever I see a pretty baby:
I wish for one of my own____ I feel like taking it up in my arms____ I am interested, but just look____ I am not interested____ I think babies are a nuisance____.

56. I've just felt like doing nothing since pregnancy.
Frequently____ Occasionally____ Rarely____ Never____.

57. I worry that pregnancy and childbirth will ruin my health.
Frequently____ Occasionally____ Rarely____ Never____.

58. Any pregnant woman would like to have her mother near her.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

59. I worry that my baby may be mentally retarded.
Frequently____ Occasionally____ Rarely____ Never____.

60. I've been moody during pregnancy.
Frequently____ Occasionally____ Rarely____ Never____.

61. If I had a choice, I would like:
To have someone care for the baby for me____ To have someone care for the baby most of the time____ To have someone care for the baby a lot of the time____ To have someone care for the baby sometimes____ To take care of the baby all by myself____.

62. Since becoming pregnant, I've been miserable.
Frequently____ Occasionally____ Rarely____ Never____.

63. It's natural for a woman to worry that she might die during childbirth.
Strongly agree____ Mildly agree____ Mildly disagree____ Strongly disagree____.

64. Women should have more help with the job of raising children.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

65. A woman should be very careful about what she does during pregnancy for fear the baby may be hurt.
Strongly agree____ Mildly agree____ Mildly disagree____
Strongly disagree____.

66. I have enjoyed pregnancy.
Very much____ Somewhat____ A little____ Not at all____.

67. I think that breast-feeding a baby is:
Unpleasant____ Painful____ Embarrassing____ A nuisance____
Neither pleasant nor unpleasant____ Relaxing____ Somewhat enjoyable____ Very enjoyable____.

68. Since I've been pregnant, I've had crying spells.
Frequently____ Occasionally____ Rarely____ Never____.

APPENDIX E
MATERNAL SUPPORT QUESTIONNAIRE (MSQ)

Code No. _____

Directions: Please circle the response that BEST answers each question. It is important that you answer all questions.

1. Do you have access to a car?
   a) Always or almost always
   b) Usually
   c) Sometimes
   d) Infrequently
   e) Never or almost never

2. Do you have access to a telephone?
   a) Always or almost always
   b) Usually
   c) Sometimes
   d) Infrequently
   e) Never or almost never

3. How difficult is it for you to get out and do what you need to do?
   a) Always or almost always difficult
   b) Usually difficult
   c) Sometimes difficult
   d) Usually easy
   e) Always or almost always easy

4. How many adult relatives live around your area (close enough to visit on a daily basis)?
   a) None
   b) 1 or 2
   c) 3 to 5
   d) 6 to 10
   e) more than 10

5. How many adult relatives who live around your area can you count on in times of real need?
   a) None
   b) 1 or 2
   c) 3 to 5
   d) 6 to 10
   e) More than 10

6. How many friends live around your area?
   a) More than 10
   b) 6 to 10
   c) 3 to 5
   d) 1 or 2
   e) None

7. How many friends who live around your area can you count on in times of real need?
   a) None
   b) 1 or 2
   c) 3 to 5
   d) 6 to 10
   e) More than 10

8. How many days per week do you get together with relatives or friends?
   a) Every day
   b) 5 or 6 days per week
   c) 3 or 4 days per week
   d) 1 or 2 days per week
   e) Less than 1 day per week

9. Are you satisfied with the number of days per week you are able to get together with relatives or friends?
   a) Always or almost always satisfied
   b) Usually satisifed
   c) Sometimes satisfied
   d) Usually unsatisfied
   e) Always or almost always unsatisfied

10. Does your present situation provide you with enough support?
    a) Always or almost always
    b) Usually
    c) Sometimes
    d) Rarely
    e) Never or almost never

11. Do you feel overwhelmed with household tasks and children? How often do you feel this way?
    a) Never or almost never
    b) Infrequently
    c) Sometimes
    d) Often
    e) Always or almost always

12. How many days per week do you get away by yourself to do something you would like to do?
    a) Every day
    b) 5 or 6 days per week
    c) 3 or 4 days per week
    d) 1 or 2 days per week
    e) Less than 1 day per week

13. Are you happy with the number of days per week that you are able to get away by yourself to do something you would like to do?
    a) Always or almost always happy
    b) Usually happy
    c) Sometimes happy
    d) Usually unhappy
    e) Always or almost always unhappy.

14. On the whole, how happy would you describe your present living situation?
    a) Extremely happy
    b) Somewhat happy
    c) Indifferent
    d) Somewhat unhappy
    e) Very unhappy

15. Is your baby's father happy about the baby?
    a) Very happy
    b) Somewhat happy
    c) Indifferent
    d) Somewhat unhappy
    e) Very unhappy

(Answer questions 16-22 only if you and the baby's father are presently living together.)

16. When your baby's father is home, does he help you care for the baby?
    a) Always or almost always
    b) Usually
    c) Sometimes
    d) Rarely
    e) Never or almost never

17. When he is home, does the baby's father feed the baby?
    a) Does not apply--nursing baby
    b) Never or almost never
    c) Rarely
    d) Sometimes
    e) Usually
    f) Always or almost always

18. When he is home, does the baby's father diaper the baby?
    a) Always or almost always
    b) Usually
    c) Sometimes
    d) Rarely
    e) Never or almost never

19. When he is home, does the baby's father get up at night for the baby?
    a) Always or almost always
    b) Usually
    c) Sometimes
    d) Rarely
    e) Never or almost never

20. Does the baby's father make the formula and wash the baby's bottles?
    a) Always or almost always
    b) Usually
    c) Sometimes
    d) Rarely
    e) Never or almost never
    f) Does not apply--nursing baby

21. How satisfied are you with the help you get from your baby's father?
    a) Extremely satisfied ("Couldn't be happier!")
    b) Very satisfied
    c) Somewhat satisfied
    d) Somewhat unsatisfied
    e) Very unsatisfied

22. How would you rate your present relationship with your baby's father?
    a) Excellent
    b) Very satisfactory
    c) Somewhat satisfactory
    d) Somewhat unsatisfactory
    e) Very unsatisfactory

23. How much help did you have with the baby when you first had the baby?
    a) None
    b) Very little
    c) Some
    d) A lot
    e) A great deal ("All that I needed!")

24. How satisfied were you with the amount of help you had with the baby when you first had the baby?
    a) Extremely satisfied
    b) Very satisfied
    c) Somewhat satisfied
    d) Somewhat unsatisfied
    e) Very unsatisfied

Please check both sides of paper to make sure that you have answered all 24 questions.

Thank you for your time and cooperation!

APPENDIX F
CONSENT FORM (PILOT STUDY)

This study focuses mainly on infant behavior. Being that nobody knows your baby like you do, you will be requested to complete a very brief questionnaire concerning your infant's behavior on five consecutive days. It is appreciated that parents of small babies are very busy; therefore, the questionnaire has been designed to that it can be completed in 3-5 minutes. You will be provided with a self-addressed stamped envelope for the purpose of returning these forms to the investigator.

You will also be requested to complete a questionnaire concerning your feelings of support since having the baby. After all, who is in a better position to provide information about mothers' feelings during this eventful time than mothers themselves?

In addition to completing these questionnaires, your opinions will be sought as to how these forms can be improved for future use with other mothers.

Although you will not be compensated monetarily for your participation in this study, it is hoped that the knowledge that you will be contributing to our understanding of infant behavior will be ample compensation.

There are no risks involved in your participation in this study, and you are free to withdraw your cooperation at any time. Your name will be replaced with a code number to ensure anonymity. Your rights to privacy will be protected to the extent provided by law.

I have read and understand the procedure described above. I agree to participate in the study and I have received a copy of this description.

_____ _____
Mother Date

_____ _____
Witness Date

_____ _____
Investigator Date

Marilyn W. McAuliffe
1706 S.W. 77 Terrace
Gainesville, Florida 32607
372-8351

APPENDIX G
INTERVIEW SCHEDULE

Code No. _____

Directions: Please answer the following questions as carefully and completely as possible. Please keep in mind that the purpose of the questions is to get a better picture of your baby's behavior during the first three months of his or her life. Please feel free to make comments whenever you feel that it would make your response more understandable. PLEASE BE AS ACCURATE AND COMPLETE AS POSSIBLE WHEN ANSWERING THESE QUESTIONS. Thank you again!

1. Was there much unsoothable OR unexplainable crying in the first three months of your baby's life?
(Unsoothable: fussed, whined, cried after being fed, changed, etc. Couldn't be made completely happy or content.)

   a. a great deal b. some c. a little d. not much e. none

2. Please give a description of your baby's crying behavior during the first three months of life. This is the MOST IMPORTANT ITEM on this form, so an extra sheet of paper has been enclosed so that you will have plenty of room to include everything you can remember about your baby's crying behavior. (More information for answering this question is provided on extra page.)

3. Has your baby's crying behavior remained the same since birth?
   YES NO

   If your baby has fussy periods, when did they begin? ____ days after birth

   When did your baby's fussing seem to be at its worst? ____ days after birth

   Has your baby's fussing seemed to subside? Yes No Somewhat
   If yes or somewhat, how old was your baby when it began to subside? ____ weeks old

4. What did you feel was the CAUSE of most of your baby's crying or fussing during the first three months of life?

5. Did you ever consult your pediatrician about your baby's crying or fussiness? Yes No

   If yes, what did your pediatrician tell you? Were you given any suggestions for calming your baby?

   Who is your pediatrician?

6. Have you ever noticed that anything you ate or drank seemed to influence your baby's behavior? Yes No

   If yes, what?

   How many ounces of milk do you usually drink each day? ___ ounces
   How many ounces of milk did you drink during pregnancy? ___ ounces/day
   Do you eat dairy products each day? Yes No

7. Is there any allergy in your family? Yes No
   If yes, who and to what?

8. Have any of your other children had "colic"? Yes No
   If yes, which child? (e.g., 1st, 2nd, 3rd, etc.)

9. Had you heard of the term "colic" prior to this study? Yes No
   If yes, what did you think "colic" was?

   Do you have any emotional reactions to the term "colic"? (e.g., Would you be defensive if you were told you child was colicky? Explain.)

THANK YOU ONCE AGAIN!! I REALLY APPRECIATE THE TIME YOU HAVE TAKEN FROM YOUR BUSY SCHEDULE. I HOPE OUR RESULTS WILL HAVE MADE IT ALL WORTHWHILE!

(PLEASE REMEMBER TO ANSWER QUESTION #2 BELOW. PLEASE FEEL FREE TO USE ADDITIONAL PAPER.)

Directions: Please give a description of your baby's crying behavior during the first three months of life. Please include information on the following aspects of your baby's fussing: Time of day, length of fussy periods, number of times fussy periods would occur each day AND number of days each week (approximately, of course), whether your baby would scream or just whimper, whether or not your baby appeared to be in some kind of discomfort or not, how fussing changed with age, the relationship fussing MAY have had to feeding, how often your baby would sleep (day and night) and ANY OTHER INFORMATION THAT YOU FEEL WOULD HELP ME GET TO KNOW YOUR BABY BETTER.
(Note: I really appreciate your effort on this question. Thanks!)

APPENDIX H
MOTHERS' ASSESSMENT OF THE BEHAVIOR OF HER INFANT (MABI)

Code No. _____

Directions: Because a mother knows her baby better than just about anyone else, we would like you to give us your impressions of your baby by circling your answer to these questions. They will help us understand newborn babies and how they behave in different situations. In order to answer these questions you might want to watch your baby for a while and try playing some of the games with him or her. For example, in order to answer Question No. 9, we ask you to shake a rattle to the side of your baby's face to see if he turns to look at the rattle.

1. When you play with your baby s/he is often
   a. sleepy
   b. alert
   c. upset

2. How would you describe your baby?
   a. fairly attractive
   b. quite attractive
   c. very attractive

3. How much do you have to stimulate your baby to get her or him to look at you?
   a. not very much
   b. a fair amount
   c. a lot

4. When your baby is upset, what does he do to quiet himself?
   a. brings his hand to his mouth
   b. sucks with nothing in his mouth
   c. looks at you

5. Try talking to your baby holding your face about one foot away from her face and then slowly move your face to one side and then to the other as you continue talking. When you do this your baby
   a. doesn't look at you
   b. becomes quiet and looks at you
   c. follows your face to each side with her head and eyes
   d. follows your face with her head and eyes, up and down and to each side

6. Now try the same thing, only move your face without talking. When you do this your baby
   a. doesn't look at you
   b. becomes quiet
   c. follows your face with his head and eyes
   d. follows your face with his head and eyes, up and down and to each side

7. Try talking to your baby from one side of her head and then from the other. When you do this she
   a. has no reaction or she blinks
   b. becomes quiet
   c. turns her eyes and head to your voice once or twice
   d. turns her eyes and head to your voice more than two times

8. Now try holding a colorful toy or some shiny object in front of your baby's face and then move it slowly to each side of his head and then up and down in front of his face. When you do this he
   a. doesn't look at the toy
   b. becomes quiet and looks at toy
   c. follows the toy you are moving with his head and eyes
   d. follows the toy you are moving with his head and eyes, up and down and to each side

9. Try shaking a rattle on one side of your baby's head and then on the other side. When you do this she
   a. has no reaction or she blinks
   b. becomes quiet
   c. turns her eyes and head to the rattle once or twice
   d. turns her eyes and head to the rattle more than two times

10. When you did the above things with your baby, he usually
    a. paid little attention to you or the toy
    b. had short periods of watching you or the toy
    c. watched you or the toy for a fairly long time
    d. paid attention most of the time

11. How does your baby feel when you handle or hold her?
    a. limp like a rag doll
    b. limp some of the time
    c. relaxed but firm
    d. very tense

12. When your baby moves his arms, the movements are
    a. jerky most of the time
    b. jerky some of the time
    c. smooth some of the time
    d. smooth most of the time

13. When you pick up your baby and hold her in a rocking position
    a. she often swings her arms and kicks her legs and squirms a lot
    b. she's like a sack of meal in your arms
    c. she relaxes and nestles her head in the crook of your arms
    d. she moves her face toward you and reaches her hands out to grab your clothing

14. When your baby is crying very hard
    a. nothing seems to quiet him
    b. only a pacifier will quiet him
    c. holding and rocking him will quiet him
    d. talking to him and holding your hand on his stomach quiets him

15. How would you describe your baby most of the time?
    a. very sleepy
    b. awake a lot of the time and quiet
    c. cries occasionally but is easily quieted
    d. cries a lot and is difficult to quiet

16. Please circle those activities which upset your baby.
    a. changing her diaper
    b. undressing or dressing her
    c. putting her back in her bassinet
    d. lying her on her stomach

17. How active is your baby?
    a. not very active
    b. somewhat active
    c. quite active
    d. very active

18. How often does your baby tremble when s/he's warmly dressed?
    a. not very often
    b. occasionally
    c. fairly often
    d. very often

19. How would you describe your baby's color changes?
    a. she rarely changes color
    b. she changes to blue around her mouth when uncovered and to red when crying but only for a minute
    c. she changes color when she's uncovered or crying but changes back to her natural color when she's covered up or comfortable
    d. she seems to get blue or red very often but will get her natural color back after you've been holding her for a while

20. How are your baby's mood swings--how often do they occur and how quickly do they change?
    a. s/he sleeps most of the time and hardly ever cries
    b. s/he is quiet much of the time
    c. s/he goes back and forth from being quiet to crying fairly often
    d. s/he often changes from being sleepy or quiet to crying and then back again--s/he changes mood often and very quickly

21. When your baby is crying, how successful is she at quieting herself?
    a. she cannot quiet herself
    b. she makes several attempts to quiet herself but is usually unsuccessful
    c. she has many brief successes at quieting herself
    d. she often quiets herself for long periods of time

22. How would you describe your baby's hand-to-mouth activity?
    a. he makes no attempt to bring his hands to his mouth
    b. he often brings his hand next to his mouth
    c. he sometimes puts his fist or fingers in his mouth
    d. he sometimes sucks on his fist or fingers for as long as 15 seconds at a time

23. How many times has your baby looked like s/he was smiling at you? _____

APPENDIX I
INFANT CHARACTERISTICS QUESTIONNAIRE (ICQ)

1. How easy or difficult is it for you to calm or soothe your baby when he/she is upset?

1	2	3	4	5	6	7
very easy			about average			difficult

2. How easy or difficult is it for you to predict when your baby will go to sleep and wake up?

1	2	3	4	5	6	7
very easy			about average			difficult

3. How easy or difficult is it for you to predict when your baby will become hungry?

1	2	3	4	5	6	7
very easy			about average			difficult

4. How easy or difficult is it for you to know what's bothering your baby when he/she cries or fusses?

1	2	3	4	5	6	7
very easy			about average			difficult

5. How many times per day, on the average, does your baby get fussy and irritable--for either short or long periods of time?

1	2	3	4	6	6	7
never	1-2 times per day	3-4 times per day	5-6 times per day	7-9 times per day	10-14 times per day	more than 15

6. How much does your baby cry and fuss in general?

1	2	3	4	5	6	7
very little; much less than the average baby			average amount; about as much as the average baby			a lot; much more than the average baby

7. How did your baby respond to his/her first bath?

1	2	3	4	5	6	7
very well--baby loved it			neither liked nor disliked it			terribly--didn't like it

8. How did your baby respond to his/her first solid food?

1	2	3	4	5	6	7
very favorably--liked it immediately			neither liked nor disliked it			very negatively--did not like it at all

9. How does your baby typically respond to a new person?

1	2	3	4	5	6	7
almost always responds favorably			responds favorably about half the time			almost always responds negatively at first

10. How does your baby typically respond to being in a new place?

1	2	3	4	5	6	7
almost always responds favorably			responds favorably about half the time			almost always responds negatively at first

11. How well does your baby adapt to things (such as in items 7-10) eventually?

1	2	3	4	5	6	7
very well, always likes it eventually			ends up liking it about half the time			almost always dislikes it in the end

12. How easily does your infant get upset?

1	2	3	4	5	6	7
very hard to upset--even by things that upset most babies			about average			very easily upset by things that wouldn't bother most babies

13. When your baby gets upset (e.g., before feeding, during diapering, etc.) how vigorously or loudly does he/she cry and fuss?

1	2	3	4	5	6	7
very mild intensity or loudness			moderate intensity or loudness			very loud or intense, really cuts loose

14. How does your baby react when you are dressing him/her?

1	2	3	4	5	6	7
very well--likes it			about average--doesn't mind it			doesn't like it at all

15. How active is your baby in general?

1	2	3	4	5	6	7
very calm and quiet			average			very active and vigorous

16. How much does your baby smile and make happy sounds?

1	2	3	4	5	6	7
a great deal, much more than most infants			an average amount			very little, much less than most infants

17. What kind of mood is your baby generally in?

1	2	3	4	5	6	7
very happy and cheerful			neither serious nor cheerful			serious

18. How much does your baby enjoy playing little games with you?

1	2	3	4	5	6	7
a great deal, really loves it			about average			very little, doesn't like it very much

19. How much does your baby want to be held?

1	2	3	4	5	6	7
wants to be free most of the time			sometimes wants to be held; sometimes not			a great deal--wants to be held almost all the time

20. How does your baby respond to disruptions and changes in the everyday routine, such as when you go to church or a meeting, on trips, etc.?

1	2	3	4	5	6	7
very favorably doesn't get upset			about average			very unfavorably gets quite upset

21. How easy is it for you to predict when your baby will need a diaper change?

1	2	3	4	5	6	7
very easy			about average			very difficult

22. How changeable is your baby's mood?

1	2	3	4	5	6	7
changes seldom, and changes slowly when he/she does change			about average			changes often and rapidly

23. How excited does your baby become when people play with or talk to him/her?

1	2	3	4	5	6	7
very excited			about average			not at all

24. Please rate the overall degree of difficulty your baby would present for the average mother.

1	2	3	4	5	6	7
super easy			ordinary, some problems			highly difficult to deal with

Experimental Items

A. On the average, how much attention does your baby require, other than for caregiving (feeding, diaper changes, etc.)?

1	2	3	4	5	6	7
very little--much less than average			average amount			a lot--much more than the average baby

B. When left alone, your baby plays well by him/herself.

1	2	3	4	5	6	7
almost always			about half the time			almost never--won't play by self

C. How does your baby react to being confined (as in a carseat, infant seat, playpen, etc.)?

1	2	3	4	5	6	7
very well--likes it			minds a little or protests once in a while			doesn't like it at all

D. How much does your baby cuddle and snuggle when held?

1	2	3	4	5	6	7
a great deal--almost every time			average-sometimes does and sometimes does not			very little; seldom cuddles

APPENDIX J
COLIC AND SOOTHABILITY SCALE (CASS)

Infant Behavior Scale Code No. _____

Baby's Sex_____ Baby's Birthdate_____

Baby's Present Age_____ Date of Ratings _____

Directions: Five rating forms are enclosed. One should be completed at the end of each day during your baby's sixth week of life (42-49 days old). If you miss a day from this period, please do not try to recall how your baby behaved on the missed day. Instead, observe your baby's behavior one day longer than requested and simply record the date for this rating. If your child is ill during this time and is not demonstrating his or her typical behavior, you should wait until the child has recovered before completing the forms. Please be sure to indicate the dates on which the ratings were made.

Using the enclosed rating scales, please circle the response that BEST answers each question. There are no good or bad answers, only responses that best describe your child's behavior on a particular day.

RESPONSES DEALING WITH INFANT CRYING AND FUSSING SHOULD INCLUDE ONLY THAT CRYING THAT IS UNEXPLAINABLE OR UNSOOTHABLE.

In other words, only crying or fussing that persists after all of the baby's needs (e.g., hunger, fatigue, wet diaper, too hot, too cold, need for physical comfort such as holding, cuddling, etc.) have been attended to should be the criteria for answering each question.

Keeping forms in a place where you will not forget them (such as on the nightstand or refrigerator) is suggested, as it is important that forms be filled out on the specified days.

Additional Rating Information:

1. These forms should be completed by the MOTHER and should not be discussed with any other person until completed. (It is not unusual for the father's perceptions of his infant's behavior to be different from the mother's perceptions.)

2. Base your ratings on your child's usual behavior for each day. (If there has been a change in routine which has influenced your baby's behavior for a particular day, note this in the comment section.)

3. Rate each question independently. Do not purposely attempt to present a consistent picture of your baby.

4. Use extreme ratings where appropriate. Avoid rating only near the middle of the scale.

5. Please rate every item.

6. Rate each item quickly.

THANK YOU FOR YOUR TIME AND COOPERATION!!

Day_____ Date _____ Code No. _____

INFANT BEHAVIOR SCALE

1.	Did your baby fuss during feedings today?	Always or almost always	Frequently	Sometimes	Rarely	Never or almost never
2.	During what time of the day did most of your baby's fussing or crying occur?	Midnight-6 a.m.	6 a.m.-12 Noon	12 Noon-6 p.m.	6 p.m.-Midnight	Any time of day
3.	During your baby's fussing or crying periods, did she draw knees up against her abdomen as if there were abdominal pain or cramps?	Never or almost never	Rarely	Sometimes	Frequently	Always or almost always
4.	How long did your baby's unsoothable fussing or crying periods usually last?	0-5 minutes	5-15 minutes	15-30 minutes	30-60 minutes	Over 60 minutes
5.	Did your baby's fussing or crying continue regardless of who held him?	Always or almost always	Frequently	Sometimes	Rarely	Never or almost never
6.	Did your baby pass much gas during crying periods?	Always or almost always	Frequently	Sometimes	Rarely	Never or almost never
7.	Were there long periods of fussing, crying or screaming for which no satisfactory solution could be found?	Always or almost always	Frequently	Sometimes	Rarely	Never or almost never
8.	Did your baby fuss or cry shortly after feedings?	Never or almost never	Rarely	Sometimes	Frequently	Always or almost always

9.	How would you best describe the intensity of your baby's crying?	Screaming	Strong crying	Crying crying	Mild	Slight fussing
10.	Throughout the day, did your baby appear tense rather than relaxed?	Always or almost always	Frequently	Sometimes	Rarely	Never or almost never
11.	How many times did your baby's unsoothable crying or fussing periods occur?	Rarely cried	1-2 times	3 times	4 times	More than 4 times
12.	Did your baby appear hungry shortly (less than 90 minutes) after feedings?	Never or almost never	Rarely	Sometimes	Frequently	Always or almost always

Comments:

APPENDIX K
CRY SCALE

Directions: In the space provided, record the number of the description that best describes your baby's behavior today.

Number	Description
1.....	Whenever the baby cried, an explanation could easily be found. When the cause of crying was attended to, the baby stopped crying.
2.....	There were periods of unexplained crying or fussiness. However, these episodes were mild and brief (lasting less than 3 minutes each time).
3.....	There were frequent or long periods of unexplained crying or fussiness (totaling less than 3 hours). Holding, rocking, feeding, burping, changing, etc. resulted in only occasional, partial, or temporary relief.
4.....	There were long periods of fussiness, crying, or screaming (totaling 3 or more hours) for which no satisfactory solution could be found.

TODAY, DESCRIPTION NUMBER _____ BEST DESCRIBES MY BABY.

Comments:

THANK YOU!!

APPENDIX L
DESCRIPTIVE STATISTICS FOR VARIABLES

Descriptive Statistics for Demographic and Descriptive Variables

Variable	N	M	SD	Min.	Max.
Father's Education (yrs.)	161	15.03	2.70	10	21
Mother's Education (yrs.)	163	14.22	2.27	9	20
Father's Age	161	29.33	5.57	18	63
Mother's Age	163	26.52	4.28	18	38
Birth Order	131	1.43	0.78	1	5
Birthweight (ounces)	156	125.51	15.91	83	168
Gestational Age	151	242.63	10.29	211	272
No. of Hours Father Away (per week)	152	47.37	17.38	0	99
Times Pregnant	131	1.66	1.00	1	5

Descriptive Statistics for Pregnancy Research Inventory (PRI) Subscales

Scale	M	SD	Min.	Max.
Fear for Self	2.02	0.44	1.20	3.30
Desire for Pregnancy	1.49	0.49	1.00	3.00
Dependency	2.89	0.46	1.86	4.00
Fear for Baby	2.25	0.48	1.20	3.70
Irritability	2.34	0.57	1.00	3.80
Maternal Feelings	2.26	0.38	1.30	3.50
Depression	1.92	0.46	1.00	3.40

Note. N = 161.

Descriptive Statistics for Mother's Prenatal and Postpartum, State and Trait, Anxiety

Anxiety	N	M	SD	Min.	Max.
Prenatal State	161	35.72	8.69	20	59
Prenatal Trait	155	36.62	8.79	20	57
Postpartum State:					
Week 1	151	32.72	9.97	20	66
Week 6	148	30.16	7.99	20	58
Week 12	141	29.31	7.95	20	54
Postpartum Trait:					
Week 1	150	34.01	8.94	20	62
Week 6	148	32.65	7.98	20	61
Week 12	141	31.91	7.48	20	55

Descriptive Statistics for Father's Prental and Postnatal, State and Trait, Anxiety

Anxiety	N	M	SD	Min.	Max.
Prenatal State	157	35.02	9.16	20	67
Prenatal Trait	153	32.92	7.86	20	63
Postpartum State:					
Week 1	146	32.57	8.20	20	56
Week 6	141	30.94	8.25	20	61
Week 12	130	32.00	8.82	20	65
Postpartum Trait:					
Week 1	146	31.94	7.40	20	57
Week 6	141	31.28	8.00	20	63
Week 12	129	31.72	8.69	20	70

Descriptive Statistics for MABI Neonatal Variables

Variable	N	M	SD	Min.	Max.
Neonatal Irritability (MABI Item 16)	150	1.54	0.75	1	5
Interactive Processes	147	2.14	0.45	1	3
Motoric Processes	150	1.93	0.25	1	2
State Control	151	2.07	0.33	1	3
Physiological Response to Stress	149	1.91	0.28	1	2

Descriptive Statistics for Maternal Fatigue and Support

Variable	N	M	SD	Min.	Max.
Fatigue	155	3.08	1.05	1.00	5.00
Actual Support	150	3.24	0.51	2.20	4.71
Father's Support	146	3.17	0.92	1.33	5.00
Perception of Support	150	3.77	0.44	2.33	4.83

Descriptive Statistics for RITQ Scales

Scale	3 Months				8 Months			
	M	SD	Min.	Max.	M	SD	Min.	Max.
Activity	16.72	2.72	9.39	23.00	18.53	2.23	11.92	23.62
Rhythmicity	10.32	3.04	4.60	18.75	9.12	2.55	3.92	15.00
Approach	8.06	3.03	3.22	19.33	9.51	3.03	4.36	20.00
Adaptability	7.81	2.20	3.50	12.83	7.81	2.11	4.36	14.36
Intensity	12.33	3.25	5.44	22.80	14.04	2.34	8.40	20.30
Mood	10.36	2.50	5.30	16.44	10.95	2.62	7.00	20.00
Persistence	10.93	2.78	5.57	20.17	10.59	2.27	5.75	16.75
Distractibility	8.39	1.73	4.89	13.30	8.91	1.88	4.33	13.10
Threshold	15.94	4.41	4.00	27.33	14.60	3.79	5.22	23.30

Note. 3 Months: *N* = 140. 8 Months: *N* = 104.

Descriptive Statistics for ICQ Factors

Factors	3 Months				8 Months			
	M	SD	Min.	Max.	M	SD	Min.	Max.
Fussy-Difficult	2.90	0.82	1.17	5.33	2.79	0.91	1.33	6.00
Unadaptable	2.20	0.98	1.00	5.50	2.40	0.95	1.00	5.50
Dull	3.00	0.63	1.00	5.00	3.21	0.64	1.33	5.00
Unpredictable	2.53	0.83	1.00	5.00	2.69	0.86	1.00	5.33

Note. 3 Months: N = 141. 8 Months: N = 105.

Descriptive Statistics for IBQ Dimensions

Dimensions	3 Months				8 Months			
	M	SD	Min.	Max.	M	SD	Min.	Max.
Activity Level	3.87	0.77	2.12	5.94				
Frustration to Limitations	3.51	0.69	1.89	5.33	3.33	0.46	2.48	4.56
Duration of Orienting	4.01	1.08	1.44	6.90	4.04	1.06	1.54	6.62
Smiling and Laughter	4.61	0.95	2.36	6.57				
Fear	2.46	0.70	1.07	5.00	2.70	0.70	1.00	5.00

Note. 3 Months: N = 138. 8 Months: N = 103.

Descriptive Statistics for Dependent Variables

Variable	N	M	SD	Min.	Max.
CASS	147	22.66	5.03	12.60	37.80
CS	146	1.74	0.57	1.00	3.40
MYRATE	133	2.16	0.95	1.00	4.00
MRCOLIC	139	4.05	1.05	1.00	5.00
RATECRY	130	3.09	1.25	1.00	5.00
GCSM	123	1.85	0.82	1.00	4.00
GCSF	111	1.81	0.77	1.00	4.00

Descriptive Statistics for CASS Subscales

Subscales	M	SD	Min.	Max.
Frequency	4.46	1.41	2	8
Physical Symptoms	6.52	1.92	3	12
Feeding Behavior	5.23	1.40	3	9
Soothability	4.21	1.67	2	8
Time of Day	3.59	0.73	1	5
Duration	1.81	0.77	1	5
Intensity	2.57	0.88	1	5

Note. *N* = 147.

APPENDIX M
INTERCORRELATION MATRICES OF VARIABLES

M-1

Intercorrelation Matrix of CASS Subscales

	FRE[a]	PHY[b]	FEE[c]	SOO[d]	TOD[e]	DUR[f]	INT[g]
FRE	---	.462**	.590**	.418**	-.014	.310**	.374**
PHY		---	.592**	.462**	.001	.307*	.364**
FEE			---	.488**	-.032	.349**	.308**
SOO				---	.046	.508**	.488**
TOD					---	-.032	.136
DUR						---	.394**
INT							---

Note. N = 147.

[a]FRE = Frequency. [b]PHY = Physical Symptoms. [c]FEE = Feeding Behavior. [d]SOO = Soothability. [e]TOD = Time of Day. [f]DUR = Duration. [g]INT = Intensity.

*$p < .001$. **$p < .0001$.

M-2

Intercorrelation Matrix of Demographic and Descriptive Variables

	EDF[a]	EDM[b]	AGM[c]	AGF[d]	TP[e]	BO[f]	FWH[g]	BW[h]	GA[i]
EDF	---	.555*** (161)[j]	.317*** (161)	.264** (161)	-.024 (130)	-.076 (130)	.021 (152)	-.077 (154)	-.143 (149)
EDM		---	.380*** (163)	.117 (161)	-.115 (131)	-.081* (131)	.011 (152)	-.020 (156)	-.079 (151)
AGM			---	.571*** (161)	.464*** (131)	.450*** (131)	.116 (152)	.164 (156)	.010 (151)
AGF				---	.172 (130)	.182 (130)	-.023 (152)	.087 (154)	-.008 (149)
TP					---	.801*** (131)	.036 (125)	.204 (130)	.039 (128)
BO						---	.093 (125)	.262* (130)	.041 (128)
FWH							---	.099 (147)	.045 (142)
BW								---	.297** (151)
GA									---

[a]EDF = Father's Education. [b]EDM = Mother's Education. [c]AGM = Mother's Age. [d]AGF = Father's Age. [e]TP = Times Pregnant. [f]BO = Birth Order. [g]FWH = Father's Work Hours. [h]BW = Birthweight. [i]GA = Gestational Age. [j]Sample Size *N*.

*$p < .01$. **$p < .001$. ***$p < .0001$.

M-3

Intercorrelation Matrix of Mother's and Father's Prenatal State and Trait Anxiety

	EDF[a]	SM-P[b]	TM-P[c]	SF-P[d]	TF-P[e]
EDF	---	-.255* (159)[f]	-.133 (154)	-.062 (156)	.010 (152)
SM-P		---	.668*** (155)	.263** (157)	.026* (153)
TM-P			---	.303*** (152)	.303** (151)
SF-P				---	.707*** (153)
TF-P					---

[a]Father's Education. [b]Mother's Prenatal State Anxiety. [c]Mother's Prenatal Trait Anxiety. [d]Father's Prenatal State Anxiety. [e]Father's Prental Trait Anxiety. [f]Sample Size N.

*$p < .01$. **$p < .001$. ***$p < .0001$.

M-4

Intercorrelation Matrix of the Pregnancy Research Inventory (PRI) Scales

	EDF[a]	SM-P[b]	SF-P[c]	FS[d]	DP[e]	DE[f]	FB[g]	IT[h]	MF[i]	DW[j]
EDF	---	-.255* (159)[k]	-.062 (156)	-.170 (159)	-.150 (159)	-.163 (159)	-.003 (159)	-.119 (159)	-.104 (159)	-.134 (159)
SM-P		---	.263** (157)	.509*** (161)	.314*** (161)	.278** (161)	.291** (161)	.501*** (161)	.176 (161)	.524*** (161)
SF-P			---	.275** (157)	.101 (157)	.189 (157)	.137 (157)	.257* (157)	.048 (157)	.241 (157)
FS				---	.169 (161)	.381*** (161)	.496*** (161)	.370*** (161)	.155 (161)	.398*** (161)
DP					---	.087 (161)	.025 (161)	.332*** (161)	.182 (161)	.332*** (161)
DE						---	.241* (161)	.170 (161)	.139 (161)	.152 (161)
FB							---	.285** (161)	-.083 (161)	.295*** (161)
IT								---	.056 (161)	.793*** (161)
MF									---	.065 (161)
DW										---

[a]EDF = Father's Education. [b]SM-P = Mother's Prenatal State Anxiety. [c]SF-P = Father's Prenatal State Anxiety. [d]FS = Fears for Self. [e]DF = Desire for Pregnancy. [f]DP = Dependency. [g]FB = Fears for Baby. [h]IT = Irritability and Tension. [i]MF = Maternal Feelings. [j]DW = Depression and Withdrawal. [k]Sample Size N.

*$p < .01$. **$p < .001$. ***$p < .0001$.

M-5

Intercorrelation Matrix of Mother's and Father's First Postpartum Week State and Trait Anxiety

	EDF[a]	SM-P[b]	SM-1[c]	TM-1[d]	SF-1[e]	TF-1[f]
EDF	---	-.255* (159)[g]	-.151 (149)	-.028 (149)	-.102 (145)	.098 (145)
SM-P		---	.368*** (150)	.484*** (149)	.196 (146)	.090 (146)
SM-1			---	.742*** (150)	.296** (146)	.217* (146)
TM-1				---	.294** (146)	.253* (146)
SF-1					---	.603*** (146)
TF-1						---

[a]EDF = Father's Education. [b]SM-P = Mother's Prenatal State Anxiety. [c]SM-1 = Mother's Postpartum State Anxiety. [d]TM-1 = Mother's Postpartum Trait Anxiety. [e]SF-1 = Father's Postpartum State Anxiety. [f]TF-1 = Father's Postpartum Trait Anxiety. [g]Sample Size *N*.

*$p < .01$. **$p < .001$. ***$p < .0001$.

M-6

INTERCORRELATION MATRIX OF SEVERAL PARENT AND INFANT VARIABLES

	EDF[a]	SM-1[b]	FAT[c]	PS[d]	AS[e]	FS[f]	D1[g]	D2[h]	D3[i]	D4[j]	NI[k]
EDF	---	-.151 (149)[1]	-.128 (153)	-.027 (148)	.044 (148)	.110 (145)	.016 (145)	.046 (148)	.033 (149)	.112 (147)	.073 (148)
SM-1		---	-.383** (150)	-.385** (149)	-.165 (144)	-.054 (140)	.091 (145)	.013 (147)	.150 (148)	.064 (148)	.173 (147)
FAT			---	.273* (147)	.154 (147)	-.060 (143)	-.101 (146)	-.031 (149)	-.054 (150)	-.088 (148)	-.073 (149)
PS				---	.432**	.128	-.076 (141)	-.104 (143)	-.091 (144)	-.124 (142)	-.201 (143)
AS					---	.756**	-.051 (141)	.005 (143)	-.026 (144)	-.116 (142)	.005 (143)
FS						---	.619 (137)	.108 (139)	-.066 (140)	-.119 (138)	.099 (139)
D1							---	-.033 (145)	.109 (145)	.048 (144)	.173 (145)
D2								---	.060 (150)	.083 (149)	.050 (150)
D3									---	.065 (149)	.083 (150)
D4										---	.034 (149)

[a]EDF = Father's Education. [b]SM-1 = Mother's Postpartum State Anxiety. [c]FAT = Mother's Fatigue. [d]PS = Perception of Support. [e]AS = Actual Support. [f]FS = Father's Support. [g]D1 = MABI Interactive Processes. [h]D2 = MABI Motoric Processes. [i]D3 = MABI State Control. [j]D4 = MABI Physiological Response to Stress. [k]NI = MABI Neonatal Irritability. [l]Sample Size *N*.

*$p < .01$. **$p < .0001$.

M-7

Intercorrelation Matrix of RITQ Subscales

	ACT	ACT8	RHY	RHY8	APP	APP8	ADA	ADA8
ACT	---	.463	.002	.008	.227*	.167	.099	.111
ACT8		---	.196	.057	.080	.106	-.017	.177
RHY			---	.335	.180	.265*	.133	.327**
RHY8				---	.117	.275*	.132	.307
APP					---	.470***	.635***	.443***
APP8						---	.384***	.630***
ADA							---	.413***
ADA8								---
INT								
INT8								
MOO								
MOO8								
PER								
PER8								
DIS								
DIS8								
THR								
THR8								

Note 1. Key (3-month subscales): ACT = Activity, RHY = Rhythmicity, APP = Approach, ADA = Adaptability, INT = Intensity, MOO = Mood, PER = Persistence, DIS = Distractibility, THR = Threshold.

Note 2. An 8 is placed after label to indicate 8-month subscale.

Note 3. $N = 140$, $N = 104$, $N = 99$ for correlations between 3-month correlations, 8-month correlations, and 3- and 8-month correlations, respectively.

*$p < .01$. **$p < .001$. ***$p < .0001$.

M-7 (Extended)

INT	INT8	MOO	MOO8	PER	PER8	DIS	DIS8	THR	THR8
.358***	.319	-.088	.008	.003	.030	-.072	.085	.247	.210
.213	.389***	.135	.217	-.082	.030	.017	-.052	.177	.168
-.150	.184	.196	.222	.009	.059	.154	.102	.034	.093
-.121	.165	.150	.431***	.011	.096	.183	.304*	-.012	.105
.429***	.277*	.368***	.260*	.194	.167	.353***	.279*	.249*	.194
-.015	.272*	.293*	.542***	.107	.077	.251	.334**	.087	.386***
.297**	.172	.325***	.203	.063	.159	.321***	.245	.256*	.192
.159	.436***	.265*	.340**	-.035	.083	.220	.263*	.134	.451***
---	.332**	-.104	-.226	-.033	-.014	-.071	-.055	.477***	.246
	---	.029	.149	-.054	.169	-.007	.045	.165	.316*
		---	.454***	.127	.107	.333***	.129	-.008	-.035
			---	.211	.127	.214	.280*	-.015	.098
				---	.414***	.072	.034	-.020	-.012
					---	.029	.019	-.017	.080
						---	.429***	.021	.056
							---	-.051	.024
								---	.480***

M-8

Intercorrelation Matrix of ICQ Factors

	FD	FD8	UNA	UNA8	DUL	DUL8	UNP	UNP8
FD	---	.667***	.195	.191	.267*	.231	.317***	.219
FD8		---	.156	.328**	.250	.347**	.273*	.386***
UNA			---	.493***	.302**	.111	.169	-.085
UNA8				---	.235	.281*	.059	.072
DUL					---	.390***	.093	.093
DUL8						---	.177	.227
UNP							---	.328**
UNP8								---

Note 1. Key (3-month factors): FD = Fussy-Difficult, UNA = Unpredictable, DUL = Dull, UNP = Unpredictable.

Note 2. An 8 is placed after factor label to indicate 8-month factor.

Note 3. N = 140, N = 105, N = 101 for correlations between 3-month factors, 8-month factors, and 3- and 8-month factors, respectively.

*p < .01. **p < .001. ***p < .0001.

M-9

Intercorrelation Matrix of IBQ Dimensions

	AL	FL	FL8	DO	DO8	SL	F	F8
AL	---	.181	-.060	.216*	.226	.380***	.191	.004
FL		---	.388***	-.239*	-.030	-.219*	.318***	.164
FL8			---	-.164	-.065	-.056	.292*	.467***
DO				---	.401***	.515***	.028	.070
DO8					---	.434***	.101	.026
SL						---	.028	.097
F							---	.352**
F8								---

Note 1. Key (3-month dimensions): AL = Activity Level, FL = Frustration to Limitations, DO = Duration of Orienting, SL = Smiling and Laughter, F = Fear.

Note 2. An 8 is placed after dimension label to indicate 8-month dimension.

Note 3. N = 138, N = 103, N = 96 for correlations between 3-month dimensions, 8-month dimensions, and 3- and 8-month dimensions, respectively.

*p < .01. **p < .001. ***p < .0001.

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Marilyn Wiegand McAuliffe received her Bachelor of Science degree from Northwestern University where she majored in speech education and minored in English. After graduating in 1976, she spent 2 years in the classroom teaching fourth through eighth grades. She earned her Master of Science degree, in 1978, in educational administration and supervision, at Barry University, Miami, Florida. During her 5 years at the University of Florida, Marilyn functioned as a seminar leader for an undergraduate course in Human Growth and Development, Research Assistant, and Teaching Assistant in research and statistics. She was the instructor for an undergraduate-graduate course in Testing and Measurement and worked for 6 months on the developmental research team at Shands Hospital, where she took part in research and intervention with premature infants. Her future plans include the continuation of research inspired by the present study.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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