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PRENATAL CARE UTILIZATION as a PREDICTOR of  
FAILURE to THRIVE

by

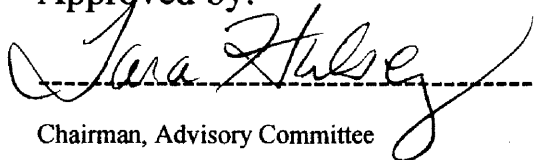
Cynthia L. Allen

A dissertation submitted to the faculty of the Medical University of South Carolina in  
partial fulfillment of the requirements for the degree of Doctor of Philosophy in the  
College of Graduate Studies

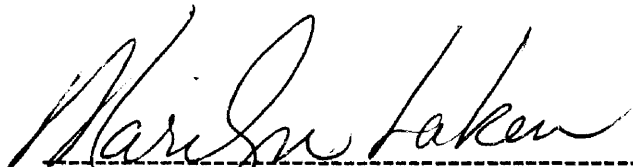
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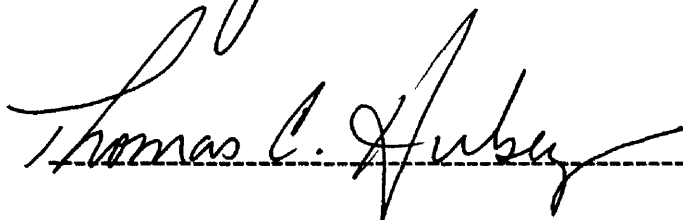
2005

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Chairman, Advisory Committee

  
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## DEDICATION

I dedicate this work to my family and daughter, Katelyn. I appreciate their immense encouragement and support in my life. Their love was a rainbow full of hope and joy during this scholarly endeavor. I thank my mother and father for being the wind beneath my wings. I am grateful for Katelyn's love and sweet nature that was endless during my studies; our play was a composite of doctoral studies and coloring during her early childhood years. I cherish her bookmarks given to me with a big hug. I wish for her to always strive for her dreams and goals in life.

I thank the Dean, Dr. Gail Stuart, and faculty at the College of Nursing for sharing their knowledge and excitement while preparing me for a lifetime of intellectual inquiry in scholarship, clinical practice, and research. As a final point, I dedicate this work as a branch of the embracing words and messages received from The Very Reverend John B. Burwell.

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## ABSTRACT

This case-control study used an academic health sciences center sample to examine differences in prenatal care utilization (defined by the number of prenatal care visits and gestational age at entry into prenatal care) between failure to thrive infants and healthy infants; and test prenatal care utilization as a predictor of failure to thrive. This study described maternal bonding characteristics (prenatal care utilization, infant length of hospital stay, feeding method, frequency of call/visits, and discharge teaching) of hospitalized failure to thrive infants. Using the Medical University of South Carolina Perinatal Information System, Keane System, and Practice Partner databases, a study sample (N=222) was obtained from mothers who received prenatal care service, delivered their child at MUSC, and obtained pediatric health services through the university network during 2001-2004.

The conceptual model used to guide this study was Barnard and Eyres' (1979) Child Health Assessment Model; an ecological model based on the assumption that the mother, infant and environment are all in interaction. Failure to thrive often results from dysfunctional maternal-infant interactions triggered by interference. The maternal health seeking behavior of prenatal care use was utilized as a proxy for maternal-fetal/infant attachment. Maternal variables examined in this study were: adequacy of prenatal care utilization, education, age, parity, and pregnancy interval. The environmental variable was marital status and child variables were intrauterine growth and gender. Cases and controls were matched 1 to 1 in terms of age, race, and insurance status.

Preliminary data analyses found that prenatal care utilization, based on the number of prenatal care visits and gestational age at entry into care, and gender were independently associated with failure to thrive. There were no significant differences in adequate/less than adequate prenatal care utilization, maternal age, education, parity, pregnancy interval, and intrauterine growth between cases and controls. The odds for females developing failure to thrive were 1.834 times higher than for males ( $p = 0.027$ ); prenatal care utilization was not a predictor of failure to thrive when controlling for confounding variables ( $p = 0.502$ ). Using the Child Health Assessment Model only 2.5% of the variance of the predictive independent variables were explained.

## **Chapter 1**

### **Introduction**

The health of mothers, infants and children serves as worldwide indicators of a nation's health and predictors of the health of future generations (DHHS, 2001). *Healthy People 2010* aims at increasing quality and years of healthy life in addition to eliminating health disparities (DHHS, 2001). In young children, growth is a marker of health status and well being (Black, Hutchenson, Dubowitz, & Bererson-Howard, 1994; Wright, 2000). A significant public health concern that affects nations and all races is failure to thrive. The term failure to thrive (FTT) means insufficient nutrition impairing growth generally in the first 2-3 years of life (Kessler, 1999). The prevalence of failure to thrive is between 5 percent and 10 percent in both urban and rural settings; accounting for 3 – 5 percent of admissions to university-based children's hospitals (Kessler & Dawson, 1999). Causation of failure to thrive is often attributed to pathophysiologic disease states, insufficient emotional / physical nurturing, feeding behaviors, undernutrition, and environmental conditions (Drewett, Kasese-Hara, & Wright, 2003; Shah, 2002; Steward, Ryan-Wenger, & Boyne, 2003). The various consequences of failure to thrive are associated with deficits in developmental milestones, decreased immunologic resistance, reduced physical activity, long-term impairments in cognitive development, poor academic performance, and socio-affective capability (Boddy, Skuse, & Andrews, 2000; Kelleher, et al., 1993; Kessler & Dawson, 1999; Lobo, Barnard, & Coombs, 1992; Lopez & Schumann, 1997).

The transactional model of development is structurally important in understanding the role and interplay of causative factors in failure to thrive. This perspective acknowledges the

multiple factors that interact over time resulting in the development of impaired growth (Casey, 1987; Steward & Garvin, 1997). Three interacting subsystems: the parent, the child, and their ecological and emotional context are components of this theory. A salient dimension of this phenomenon is a dysfunctional maternal-child interaction (Allen, 2002). The emotional context of a parent-child interaction is often related to parenting behaviors. Giblin, Poland, Waller, and Ager (1988) examined the relationship between maternal characteristics, family resources, and receipt of prenatal care with parenting behaviors in a neonatal intensive care unit; findings suggested that a lack of prenatal care is associated with deficits in parenting. Various aspects of parenting are often a focus of failure to thrive research (Jolley, 2003); however, little is known about the prenatal care use of mothers of failure to thrive infants. This study examined differences in prenatal care utilization (based on the number of prenatal visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants during 2001-2004 in an academic health sciences center. In addition, the researcher tested prenatal care utilization as a predictor of failure to thrive while controlling for confounding variables and described maternal bonding characteristics of infants who were hospitalized for failure to thrive.

Maternal-fetal attachment (MFA) is associated with a child's healthy growth and development (Muller, 1994). The foundation of the maternal-child relationship often originates in utero as maternal attachment is evidenced by maternal behaviors (Carson & Virden, 1984). Prenatal maternal attachment behaviors, inclusive of the utilization of prenatal care and various components of prenatal care services, are suggested to have an association with the theoretical process of maternal-fetal bonding and often precede maternal-infant attachment (Davis & Akridge, 1987; Rubin, 1984). According to Alexander and Kotelchuck (2001), adequacy of

prenatal care utilization may be conceptually viewed as a proxy indicator of health-enhancing maternal attitudes and behaviors. Rubin (1984) theoretically conceptualizes the maternal health-seeking behavior of prenatal care as a proxy for maternal-fetal and subsequent maternal-infant attachments in that it often promotes a woman's relationship with her unborn child. Research suggests that troubled attachments (either prenatal or postnatal) often precede the development of dysfunctional maternal-child relationships (Bates & Bayles, 1988). More research is needed examining prenatal effects on subsequent maternal behaviors and child health outcomes (Alexander & Kotelchuck, 2001). This study examined differences in prenatal care utilization between failure to thrive infants and healthy infants during 2001-2004; as well as tested prenatal care utilization as a predictor of failure to thrive and described maternal bonding characteristics of infants who were hospitalized for failure to thrive.

### **Attachment**

The theoretical concept of attachment is well reported in the study of parent-child relationships and failure to thrive (Ward, Brazelton, & Wust, 1999); the three central concepts in attachment theory were originally derived from Bowlby's reference of security, internal working model, and sensitivity. These concepts are often integrated into prenatal care services and preparation for childbirth as an expectant woman seeks to provide healthy behaviors through clinical evaluation of the pregnancy, mental representations about the fetal/infant relationship that lead to secure working models, and interpreting the fetal cues/child's signals accurately (Davis & Akridge, 1987). Rubin (1984) postulates that maternal-fetal attachment evolves at various stages of gestation and may require the entire pregnancy to completely develop.

Various components of the prenatal care visit are suggested to have a positive impact on the process of maternal-fetal attachment. According to Fletcher and Evans (1983) women expressed a positive feeling toward their fetuses after viewing the ultrasound of their fetus during the first and early second trimester. Maternal awareness and attachment behaviors are also associated with fetal kick counts and auscultation of fetal heart tones (Carson & Virden, 1984; Solchany & Barnard, 2001). The maternal health seeking behavior of prenatal care utilization remains an area of understudied research in pediatric failure to thrive. This study used the maternal health seeking behavior of prenatal care utilization (defined by the number of prenatal visits and the gestational age at entry into prenatal care) as a proxy for maternal-fetal attachment and subsequent maternal-infant relationships impacting the infant's health status during the first year of life.

### **Prenatal Care**

Aspects of prenatal care have evolved over centuries. In the early 1900s providers focused on early detection of preeclampsia while services to date incorporate the following components: (a) education concerning nutrition, hygiene, good health habits, and infant care; (b) community programs to improve living and working conditions; (c) fetal growth, heart tones, ultrasound, and physical examination to evaluate the woman's health (Merkatz & Thompson, 1990). In the mid-1980's the Institute of Medicine promoted prenatal care enrollment as a national policy to reduce adverse pregnancy outcomes. The perspective that prenatal care is essential to the promotion of healthy pregnancy outcomes for both mother and child is established at the provider, community, and governmental levels. Adequacy of prenatal care utilization is often categorized based on the number of prenatal care visits, month/trimester prenatal care began, and gestational age at delivery. Consensus among researchers suggests that prenatal care is

associated with improved birth/infant outcomes (Hulsey, Patrick, Alexander, & Ebling, 1991; Lu & Halfon, 2003; Merkatz & Thompson, 1990). A grounded theory study conducted by Sword (2003) found that taking care of self emerged as a central phenomenon that explained prenatal care usage behavior. Several studies have examined the relationship between prenatal care utilization and subsequent pediatric care utilization, well child care, and immunizations (Kogan, Alexander, Jack, & Allen, 1998; De & Bhattacharya, 2002); however, the association between prenatal care utilization and subsequent failure to thrive in infancy remains understudied. This study provided empirical data to better understand the relationship between prenatal care utilization as a predictor of pediatric failure to thrive.

### **Significance of the Research Study**

This study used an academic health sciences center representative sample consisting of failure to thrive infants and healthy infants less than 1 year of age (derived from the Medical University of South Carolina Perinatal Information Systems, Keane System, and Practice Partners databases) to examine differences in prenatal care utilization between failure to thrive infants and healthy infants; and test prenatal care utilization as a predictor of failure to thrive, while controlling for confounding variables. Derived from inpatient failure to thrive cases, this study also described maternal bonding characteristics of hospitalized failure to thrive infants. Main study variables were selected, guided by a conceptual framework, based on findings of an association between each variable and failure to thrive. The Perinatal Information Systems (PINS) contained the following maternal and child variables of interest: maternal sociodemographic characteristics (prenatal care utilization, age, race, parity, pregnancy interval, educational attainment, insurance, and marital status), and child characteristics (age, intrauterine growth, and gender). The Keane System (inpatient and outpatient database)



contained the following variables of interest: diagnosis of failure to thrive, gender, insurance coverage, and age. Practice Partners (outpatient pediatric primary care database) provided cases of failure to thrive and matched control subjects (based on well child examinations exclusive of chronic illnesses) according to age, race, and insurance status.

This study was important to nursing and society in that understanding the relationship of maternal investment in prenatal care and failure to thrive may lead to the refinement of risk assessment and care protocols for maternal-child health services in an effort to reduce health disparities. If mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are subsequently more likely to have failure to thrive infants after controlling for confounding variables, efforts to promote prenatal care as a maternal health seeking behavior that fosters maternal-fetal/infant attachment will be important for nursing to target high risk populations at risk for failure to thrive.

### **Conceptual Framework**

In review of the literature, transactional models that depict an emphasis on the psychosocial factors representing dysfunctional behaviors or interactions are salient theoretical frameworks of failure to thrive (Kessler & Dawson, 1999; Steward & Garvin, 1997). Barnard and Eyres' (1979) ecological model, referred to as The Child Health Assessment Model, provided a paradigm for this study that was interactional in nature consisting of 3 overlapping components: mother, child/infant, and environment. Overlapping these components forms an intersection, also referred to as the interaction, where all the factors are reciprocal in nature.

Pediatric failure to thrive is suggested to result from dysfunctional interactions that are triggered by interference. A breakdown in the interactive system, referred to as an interference, may originate from the mother, child, or environment creating an interruption in the adaptive

process (Sumner & Spietz, 1994). Various behavioral characteristics are observable in maternal-infant interactions. When an infant and mother do not interact in a playful or attentive manner, the interaction may become distressful to both involved. This pattern of dysfunctional socialization becomes evident as feeding and teaching interactions (directly or indirectly) effect the child's growth and development (Kessler & Dawson, 1999; Steward, Moser, & Ryan-Wenger, 2001; Sumner & Spietz, 1994). Of significance, the development of the mother-child relationship is suggested to begin in utero. Maternal health behaviors, such as prenatal care utilization, may be contextually viewed as a positive maternal relationship with her unborn child (Rubin, 1984; Solchany & Barnard, 2001). Cranley (1981) reports maternal-fetal attachment as the extent to which an expectant mother engages in behavior(s) that represent an affiliation and interaction with her unborn child.

Barnard and Eyres' (1979) framework established a conceptual perspective for investigating the maternal-infant interaction with respect to the maternal health seeking behavior (prenatal care utilization) and subsequent failure to thrive; in addition, guided the descriptive assessment of maternal bonding characteristics of infants who were hospitalized for failure to thrive. The Child Health Assessment Model provided a foundation for understanding failure to thrive during the first year of life (refer to Figure 1); variables included in this study are highlighted in bold on the conceptual framework. Research in pediatric mental health, based on a relationship perspective, suggests further inquiry of maternal-infant attachment measured by maternal health behaviors (Solchany & Barnard, 2001). This variable was incorporated in this study's model as a maternal characteristic (prenatal care utilization).

## Conceptual Definitions

The following terms are conceptually defined for utilization in this research study.

*Mother:* Sociodemographic characteristics, psycho-social assets, health status, maternal health seeking behaviors, coping and adaptation style (Sumner & Spietz, 1994).

*Environment:* Inanimate (physical characteristics), animate (siblings, other humans) and supporting factors that are provided by the family (Sumner & Spietz, 1994).

*Infant:* The infant's unique physical characteristics.

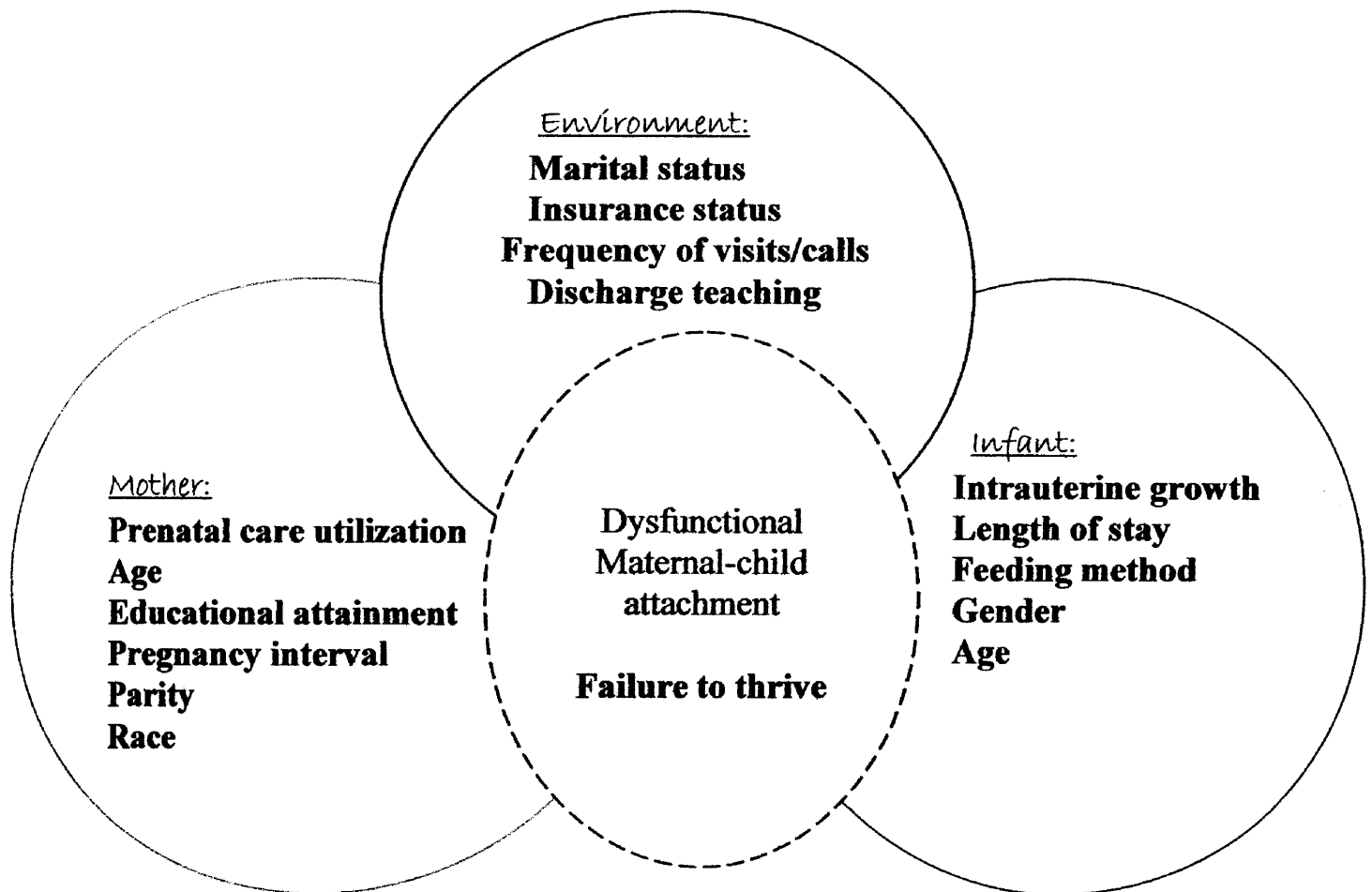


Figure 1. Components of the Child Health Assessment Model, central overlap denotes interaction

## **Assumptions of Conceptual Framework**

The Child Health Assessment Model is based on the following assumptions: (a) successful interactions depend upon the maternal-child dyad's ability to adapt to one another, (b) mothers and children have responsibilities to engage in reciprocal interactions (c) children provide cues and mothers have the responsibilities to provide opportunities for growth and development, (d) each reacts to the other adapting their behavior to accommodate and/or modify the other's behavior (e) adaptation is reciprocal in nature and healthy outcomes result from positive interactions, and (f) a breakdown in the interactive system, referred to as an interference, may originate from the mother, child, or environment creating an interruption in the adaptive process (Sumner & Spietz, 1994).

Adaptive patterns between the mother and infant are contextual and change over time relative to the infant's developmental capabilities. Maternal-infant relationship dynamics are suggested to develop in utero through maternal-fetal attachment behaviors (Davis & Akridge, 1987; Rubin, 1984; Solchany & Barnard, 2001). The maternal health seeking behavior of prenatal care utilization is suggested to promote maternal-fetal and subsequent maternal-infant attachment (Beal, 1991; Cranley, 1981; Davis & Akridge, 1987; Solchany & Barnard, 2001).

## **Conceptual Model and Analysis of Literature Review**

In selecting a conceptual framework to direct this study, Barnard and Eyres' (1979) model was identified as having an interactional dimension that incorporated existing knowledge regarding risk factors identified as having a significant association with pediatric failure to thrive (Barnard & Eyres, 1979; Davis & Akridge, 1987; Lobo, Barnard, & Coombs, 1992; Solchany & Barnard, 2001). The constructs of *mother*, *infant / child*, and *environment* derived

from Barnard and Eyres' (1979) framework in addition to a synthesis of the review of the literature guided this research.

*Mother:* Characteristics of the mother are defined by Barnard and Eyres as psycho-social assets, sociodemographic characteristics, and attachment behaviors. Maternal health behaviors - making plans, preparing for birth, and prenatal care utilization- are foundational for healthy attachments in that the activities focus on connecting with the unborn child (Solchany & Barnard, 2001). Parent-infant/child attachment is an important element of favorable growth and development outcomes in childhood; supportive and adaptive interactions foster resilience (Poulsen, 1993). Policy issues related to fostering resilience in children are suggested to incorporate resources that enhance parenting skills and enhanced mother-child interactions. Important aspects of early intervention programs link at-risk children and families to community resources and services that build resilience in infants and young children. The maternal health seeking behavior of obtaining prenatal care services often provides an environment to nurture maternal-fetal and subsequent maternal-child attachment. Adequacy of prenatal care utilization was utilized as a proxy for measuring the maternal-infant attachment/interaction aspects of Barnard and Eyres' theoretical model in this study. The utilization of prenatal care exemplified the provision of growth-fostering situations that contribute to the dynamics of the maternal-infant relationship.

According to Alexander and colleagues, improvements in entry and utilization of prenatal care have occurred over the last 2 decades (Alexander, Kogan, & Nabukera, 2002). The percentage of women receiving prenatal care services has increased significantly -an increase from approximately 33 percent to 50 percent of the population- in the United States between 1981 and 1995 (Kogan, Martin, Alexander, et al., 1998). Yet, racial disparities in prenatal care

persist as the proportion of black women (7.3 %) not having adequate prenatal care remains nearly 2.3 times that of whites (3.2%) (Aday, 2001). Maternal age, race, and educational level are sociodemographic characteristics examined in attachment, prenatal care, and failure to thrive literature.

Research suggests that expectant women who are of high medical risk, inclusive of extremes in childbearing age, often avoid attachment to infants who may not survive (Campbell & Taylor, 1979). A review of failure to thrive literature reports that most case-controlled studies have found no differences in maternal age, marital status, stress or parenting attitudes (Casey, 1987). However, differences in maternal age are associated with utilization of prenatal care and pregnancy outcomes. According to Kogan and colleagues (1998) the odds ratio of intensive prenatal care utilization, based on the Adequacy of Prenatal Care Utilization Index, for maternal age less  $\leq 17$  years and  $\geq 35$  years is 0.89 and 1.13; respectively (based on a reference group of singleton births to unmarried Caucasian mothers 18-34 years of age with less than 12 years of education). The same prenatal care measures from 1995 data suggest that teenagers have a 33.1 percent adequate use versus 44.5 percent use of prenatal care for adults greater than 18 years of age (Kogan et al., 1998). Maternal age is also well reported in the literature as risk factors for low birth weight and adverse pregnancy/birth outcomes (Lu & Halfon, 2003). As such, maternal age was examined for independent associations between failure to thrive infants and healthy infants; maternal age was accounted for as a potential confounder when studying prenatal care utilization (case control design with one to one matching on race, insurance status, and infant's age) as a predictor of failure to thrive in infancy.

Researchers cite that further analysis is required to understand the contribution of maternal educational attainment associated with failure to thrive. Deficits in educational attainment,

employment, and socioeconomic status often contribute to the at-risk aspects of pediatric failure to thrive and cognitive development (Metallinos-Katsaras & Gorman, 1999; Chatoor, Surles, Ganiban, Beker, Paez, & Kerzner, 2004). Chatoor and colleagues (2004) found that higher maternal educational and socioeconomic levels were correlated with early childhood Mental Developmental Index scores. These sociodemographic characteristics, in addition to the psychosocial factor of the maternal-child interaction, explained more of the variance in cognitive development than nutritional status.

Barnard (1980) reports that higher Nursing Child Assessment Feeding and Teaching Scale scores are often associated with higher levels of maternal educational attainment. Kelleher and colleagues (1993) cite the relative risk ratios (RR) of perinatal characteristics in the Infant Health and Development Program cohort pertaining to maternal education; college graduates RR is 2.12 in comparison to 1.00 and 1.51 for some college and high school graduates; respectively. The confounding effect of educational attainment and prenatal care utilization in relationship to maternal and child health outcomes is well reported in the literature. Hence, educational level was examined for its independent association with infant health status and was accounted for as a potential confounding variable when examining prenatal care utilization as a predictor of failure to thrive.

Lastly, the maternal characteristics of parity and pregnancy interval were inclusive in the construct of mother in this study. Casey (1987) cites that there is no significant difference between families with failure to thrive children and control groups based on number of family members, birth order/index child, or measures of environmental stressors. However, differences often exist in prenatal care utilization and birth outcomes in relation to parity and pregnancy

interval (Berhane & Dietz, 1999). With relationship to child health outcomes, parity and pregnancy interval were examined for independent associations with pediatric failure to thrive.

*Environment:* Environmental constructs of Barnard and Eyres' model are conceptualized as the inanimate and animate characteristics in which the child resides. According to Kessler and Dawson (1999), unidirectional models have been replaced by transactional models in that behaviors interact with responses from the environment to create subsequent behaviors. When the maternal-child interaction occurs in an environment which is unsupportive or dysfunctional, opportunity for optimal growth is lacking (Lobo et al, 1992). Environmental conditions -such as poverty and single family units- are shown to be powerful determinants of the cognitive development and behavior of children (Duncan, Brooks-Gunn, & Klebanov, 1994). Due to the detrimental impact that pediatric undernutrition has on brain development, social policy implications are directed the following: (a) increasing the accessibility to federal food programs, (b) promoting breastfeeding, and (c) reducing poverty (Tanner & Finn-Stevenson, 2002). Failure to thrive is seen in all socioeconomic strata; however, the incidence is especially high among urban and rural families living in poverty (Bithoney, Dubowitz, & Egan, 1992). One of the pervasive effects of poverty is to inhibit a mother's parenting role (Bradley, Whiteside, Mundfro, Casey, Kelleher, & Pope, 1994). Parenting has often been a central focus in examining infants and children who fail to thrive.

Giblin, Poland, Waller, and Ager (1988) examined the association of maternal characteristics, family resources, and receipt of prenatal care with parenting behaviors reporting that the no-prenatal-care group was suggested more likely to display less favorable bonding. According to Casey (1987) separation in the mother's relationship with the father was cited as significant correlate with failure to thrive. Child neglect becomes evident as feelings of



depression, powerlessness, anger, substance abuse, disorganization and feelings of alienation develop. The operational components of environment factors for this study were derived from marital status and insurance status. Marital status was examined independently in association between failure to thrive infants and healthy infants; it was accounted for as potential confounder when studying prenatal care utilization as a predictor of failure to thrive. This study also described maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who were hospitalized for failure to thrive.

*Infant:* Infant characteristics are inclusive in Barnard and Eyres' (1979) model; when considering causation, it is unlikely that maternal and infant/child factors are individually responsible for the development of failure to thrive. Various risk factors (e.g., low birth weight, prematurity, and intrauterine growth, race, and gender) are suggested to correlate with failure to thrive (Berhane & Dietz, 1999; Kelleher, et al., 1993; Sherry, 1999). The potential confounding effects of intrauterine growth are important to consider when studying predictors of failure to thrive in infancy. This case control study (matched on age, race, and insurance status) examined differences in prenatal care utilization between failure to thrive infants healthy infants as well as tested prenatal care utilization as a predictor of failure to thrive, while controlling for confounding variables of infant age and gender.

This study included Barnard and Eyres' identified constructs of maternal, infant, and environmental factors. The variables included in maternal characteristics were prenatal care utilization, maternal age and education, parity, and pregnancy interval. Marital status, insurance status, frequency of visits/calls, and discharge teaching are included under the construct of environment. Infant characteristics of intrauterine growth, length of stay, feeding method,

gender, and age were incorporated into the study design methodology and data analyses. The maternal-infant interaction, with respect to maternal health seeking behaviors/attachment, and subsequent dysfunction contributing to failure to thrive were examine under the maternal characteristic construct of this study in relation to the outcome variables. The preceding variables were selected based on the Child Health Assessment Model with support from review of the literature. However, adequacy of prenatal care utilization (based on the number of prenatal visits and the gestational age at entry into prenatal care) has not been examined as a predictor of subsequent failure to thrive in infancy while accounting for confounding effects among the variables included in this study. This study merged two academic health sciences center data systems with an outpatient primary care database to test prenatal care utilization as a predictor of failure to thrive among infants, while accounting for maternal characteristics, environmental factors, and infant characteristics. A descriptive component was utilized to assess maternal bonding characteristics among hospitalized failure to thrive infants.

### **Research Questions**

The specific aims of this research were to examine differences in prenatal care utilization between failure to thrive infants and healthy infants, test prenatal care utilization as a predictor of failure to thrive, and describe maternal bonding characteristics of hospitalized failure to thrive infants. This study utilized the Perinatal Information System, Keane System, and Practice Partners databases from the Medical University of South Carolina in Charleston to test the following research questions:

1. Are there differences in prenatal care utilization (based on the number of prenatal visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants?

2. Is prenatal care utilization a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders?
3. What are the maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who are hospitalized for failure to thrive?

### **Hypotheses**

The hypotheses were as follows: Mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are significantly more likely to have failure to thrive infants than healthy infants. Inadequate prenatal care use is a predictor of subsequent failure to thrive. Mothers who receive less than adequate prenatal care demonstrate less than favorable bonding behaviors with their infants who are hospitalized for failure to thrive.

## **Chapter 2**

### **Review of Literature**

An ecological model developed by Barnard and Eyres (1979) guided this review of the literature. Failure to thrive (FTT) is a diagnosis given to infants and children, generally during the first 2-3 years of life, who lose weight or fail to gain weight in accordance with standardized growth charts. The dimensions of this phenomenon are multifaceted and interactional. Failure to thrive is given meaning by its complexity and contributing factors; attributes of the mother, infant, and/or environment create interference in the maternal-infant relationship. This dysfunctional relationship leads to a reciprocal problem that ultimately results in nutritional and nurturing deficiencies. Further research on failure to thrive is needed to examine the association between a woman's attachment to her fetus and subsequent behaviors toward her infant. Barnard and Eyres' (1979) conceptual framework is an effective midrange transactional model of causation that guided the analysis of prenatal care utilization as a predictor of failure to thrive; a paradigm for examining prenatal care utilization as a proxy for maternal-infant attachment and health-enhancing maternal behaviors. Variables selected for this study were derived from the constructs of mother, infant, and environment. Literature in support of these study variables will be addressed in this review. The outcome variable (failure to thrive) is reviewed first, followed by the construct 'maternal characteristics', which includes the main study variable prenatal care utilization. This leads to discussion of the constructs 'infant characteristics' and 'environmental factors'. A summary concludes the literature review.

## **Failure to Thrive**

The importance of adequate growth has been widely recognized. According to Wright (2000), growth acts as a proxy for well being in early life. The term *failure to thrive* is traditionally used to describe children, generally less than 3 years of age, with weights below the 5<sup>th</sup> percentile (gestation corrected age and gender) and children who experience significant failure to gain weight over time (deceleration of two or more standard deviations in 6 months or less) based on the National Center for Health Statistics growth grid (Casey, 1992; Shah, 2002; Steward, Ryan-Wenger, Boyne, 2003; Ward, Brazelton, & Wust, 1999; Wright & Talbot, 1996). This phenomenon was first referenced in 1897 by L. Emmett Holt who equated infantile wasting conditions with circumstances and malnutrition; in 1915, Henry Dwight Chaplin associated emotional deprivation with growth failure among children in foundling homes (Kessler & Dawson, 1999). In 1941, Bakwin suggested that loneliness may be fatal for young infants; leading to a socialization policy of infant handling and stimulation that reduced infant morbidity and mortality rates (Jolley, 2003). By the 1960's, the psychosocial aspects of failure to thrive were recognized as an entry in the American Psychiatric Association's Diagnostic and Statistical Manual (DSM-III) classifying the maternal deprivation syndrome component of this disorder as a "reactive attachment disorder" (Schwartz, 2000).

In 1968, the perspective of undernutrition and public policy became evident through Hunger USA. The policy responded to millions of American citizens who reportedly experience hunger. Policy implications arose from empirical outcomes that link nutritional status with behavior, growth, and cognitive function. According to Kessler and Dawson (1999), undernutrition exacts a stiff toll in relation to health status and educational readiness. Studies indicate that failure to thrive in infancy is

associated with adverse intellectual outcomes that are of significant concern at a population level (Corbett & Drewett, 2004). Thus, from the perspective of public policy where billions of dollars are invested annually in the educational system of children, keeping infants and children healthy are extremely important.

Clinical categories often dichotomize failure to thrive along an organic versus nonorganic axis; however, a paradigm that embraces complexity is needed in the process of risk analysis. Organic failure to thrive (OFTT) is the result of a major disease process or organ dysfunction (e.g., chronic diseases, persistent infectious diseases, neurological impairment, metabolic and endocrine abnormalities) accounting for approximately 5 percent of failure to thrive cases (Reilly, Skuse, Wolke, & Stevenson, 1999; Sherry, 1999; Sullivan et al., 2002; Wells, 2002). Persistent failure to thrive combined with a history of hospitalizations are often indicators of a chronic underlying disease state (Kamath et al., 2003). Nonorganic failure to thrive (NFTT) is more common in the United States than OFTT; the term implies insufficient emotional/physical nurturing without specific pathophysiological abnormality. Causes of NFTT have been attributed to several theories, including emotional deprivation, dysfunctional maternal-child relationships, parenting styles, underfeeding, neglect and abuse (Kessler & Dawson, 1999; Jolley, 2003; Stein, Kessler, & Hubbard, 2002; Sumner & Spietz, 1994).

Drotar and Robinson (1999) cite the importance of continuing research concerning the psychosocial aspects of this phenomenon due to the high prevalence rate of failure to thrive, significant psychological and medical comorbidity, difficulties and expenses in clinical management, risk for long term and psychological impairments (p. 77). Variables examined in failure to thrive studies can be classified in three general categories: maternal variables (inclusive of the maternal-child interaction; also known as the psychosocial variable), infant/child variables, and environmental

variables. This study examined differences of prenatal care utilization (defined by the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants; in addition to, tested prenatal care utilization as a predictor of failure to thrive when sociodemographic characteristics (age, education, parity, and pregnancy interval), environmental (marital status), and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders using a case-control design matched by infant's age, race, and insurance status from an academic health sciences center sample during 2001-2004. In addition, this research described maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who were hospitalized for failure to thrive.

### **Maternal Characteristics of Failure to Thrive**

This section of the literature review will focus on the measure of maternal characteristics among infants who fail to thrive. Historically maternal characteristics were cited as causation for the development of nonorganic failure to thrive (Barbero & Shaheen, 1967; Drotar & Robinson, 1999; Steward & Garvin, 1997; Wright, 2000). Failure to thrive (classified with or without organic etiology) was often associated with some type of psychological disorder - inclusion of abuse and neglect, marital discord, maternal depression and anxiety, mental retardation, personality and thought disorders, suicide, and addiction- that limit the mother's ability to provide care for her child (Benoit, et al., 1989; Shapiro, Fraiberg, & Adelson, 1976; Sumner & Spietz, 1994). A composite of research measures utilized to assess psychosocial factors of failure to thrive include the following domains: (a) child's psychological status measured by cognitive development, social and affective responsiveness, and behavior during feedings, (b) parent-child relationships measured through teaching and feeding scales rating the

maternal-child interaction, and (c) family environment assessment by the stimulation provided to the child and family structure, resources, stress, relationships, and parental beliefs concerning failure to thrive (Barnard, 1980; Casey, Bradley, & Wortham, 1984; Chatoor, Dickson, Schaefer, & Egan, 1985; Drotar & Robinson, 1999). Several studies support the hypothesis that pediatric failure to thrive is often associated with psychological dysfunction in the family; yet warrants further investigation as the specific factors of this relationship remains unclear (Benoit et al., 1989; Schwartz, 2000).

Researchers suggest that parental depression, especially in the primary caregiver, is a risk factor for pediatric undernutrition (Stein, Kessler, & Hubbard, 2002); however, concurrence is not found within the review of literature. According to a population-based cohort study, Drewett and colleagues (2004) found that high depression scores during the postpartum period were not associated with a higher prevalence of failure to thrive. These findings concur with Steward and Garvin's (1997) results that most case-control studies find no differences among healthy mothers and mothers of failure to thrive infants in regards to life stresses, psychopathology or perceived social support. A prospective study that examined the relation of neonatal sucking to later feeding, postnatal growth, maternal postpartum depression, and feeding practices (Ramsay, Gisel, McCusker, Bellavance, & Platt, 2002) also found that maternal depression did not affect feeding practices, infant feeding abilities nor growth. This contemporary review of literature supports the hypothesis that the significance of maternal postpartum depression in association with failure to thrive may not be as strongly correlated as suggested in previous studies.

Based on a maternal perspective, trends in parent-infant interaction, parents' psychosocial assets, partner involvement in child care, and stress level are suggested to contribute to the development of



failure to thrive (Lobo, Barnard, & Coombs, 1992). Infant growth outcomes improve as parental perceptions of competency and child adaptability increase. According to Lopez (1997), the perceptions of the parent are more significant than the parent's perceived stress level. The component of maternal stress is a significant factor in the dysfunctional parent-child interaction (Lobo et al., 1992). Mothers of nonorganic failure to thrive infants report a significantly higher stress score, unstable lifestyles categorized further by frequent changes in their lives, and less social support. Research suggests that a short pregnancy interval is associated with faltering weight (Berhane & Dietz, 1999). This case-control study tested prenatal care utilization as a predictor of failure to thrive, while accounting for the potential confounding effects of pregnancy interval, maternal age, and marital status.

Several studies note differences in maternal educational level, experiences and perceptions of their own childhood, and relationship issues (Bithoney & Newberger, 1987; Steward & Garvin, 1997). Although these studies found mother's of nonorganic failure to thrive infants to have lower educational levels and greater conflict-driven partnerships, these differences and the focus on maternal factors were not distinct enough to explain the development of this disorder. Risk factors and outcomes for failure to thrive in low birthweight, preterm infants found that there were no differences between failure to thrive and non-failure to thrive infants with respect to the following maternal characteristics: intelligence level, mental health, knowledge of child development, and concerns about development (Kelleher, et al., 1993). Pollitt and Eichler (1976) conducted a case-control study (19 failure to thrive children and 19 healthy controls matched on age, gender, and race based on inclusion criteria of singleton, birth weight at least 2500 grams, gestational age 36 weeks or greater, no physical abnormalities/birth complication, and maternal height 154 cm or greater); findings suggested that the failure to thrive group had a

lower per capita income, lower mean maternal education, and greater feeding difficulties.

Kelleher and colleagues (1993) reported maternal education attainment beyond college graduate (RR = 2.12, 95% CI = 1.16 - 2.73) and maternal height < 62.5 inches (RR = 1.78, 95% CI = 1.16 - 2.73) as significant risk factors for failure to thrive. Stier and colleagues (1993) found that young maternal age (<18 years) was not associated significantly with an outcome of poor growth. This study incorporated maternal age and educational attainment as maternal characteristics to examine differences in prenatal care utilization between failure to thrive infants and healthy infants.

Psychosocial stressors that often result in pediatric failure to thrive are attributed to a combination of factors inclusive of the following: parental psychology, socioeconomic stress, lack of social support, infant/child temperament or individual factors, and inappropriate parental feeding practices (Kessler & Dawson, 1999). Parental attitudes and beliefs with regard to healthy eating/dietary intake of infants and children are important factors in the development of failure to thrive (Wells, 2002). Nutritional deficits often stem from problematic breastfeeding or weaning processes; suggested causes of failure to thrive are often attributed to both maternal feeding practices and infant readiness (Schmitt & Mauro, 1989; Skuse, 1993; Stein, Kessler, & Hubbard, 2002; Sumner & Spietz, 1994). However, feeding problems are inherent in childhood due to the integration of multiple systems inclusive of the following: physical development, temperament, psychosocial development and food preferences (Black, Cureton, & Berenson-Howard, 1999; Drotar & Robinson, 1999). Undernutrition and malnutrition are well recognized attributes in the etiology of failure to thrive; however, nutritional status as a causation alone for impaired growth is difficult to determine; in that, nutrition covaries with a number of other variables that may confound the association of a child's growth and development. Skuse (1993)

emphasizes that psychosocial, behavioral and parent-infant interaction factors are all implicated in infant feeding. Ward and colleagues (1999) cited the importance of relationship constructs in distinguishing between failure to thrive infants and healthy infants. This study focused on the maternal-infant relationship through the construct of attachment and maternal health seeking behavior (prenatal care utilization) in relationship to failure to thrive.

### **Attachment**

Attachment is defined as an affectionate relationship that emerges over time from a history of maternal-infant interactions (Stroufe & Waters, 1977; Carson, Sampson, & Stroufe, 2003). Attachment studies of infants/children with failure to thrive are well reported in the literature (Brinich, Drotar, & Brinich, 1989; Crittenden, 1987; Feldman, Keren, Gross-Rozval, & Tyano, 2004; Sumner & Spietz, 1994; Valenzuela, 1990; Ward, Kessler, & Altman, 1993). Early childhood regulatory difficulties -either feeding or behavioral- are suggested to be related to the quality of the maternal caregiving relationship (Benoit, 2000; Chatoor, et al., 2004). Research supports the hypothesis that failure to thrive is associated with disorganized attachment between the maternal-infant dyad as well as consequences from disruptions in past maternal attachment relationships resulting from trauma or loss (Ward, Lee, & Lipper, 2000). According to Carlson and colleagues (2003), findings support the perspective of attachment as a biologically guided adaptation and dyadic regulatory pattern created through transactional maternal-infant processes over time (p. 367). Barnard and Solchany (2001) cite the importance of child development in the context of relationships and emphasize the significance of the Advisory Committee on Services for Families with Infants and Toddlers 1994 statement noting that maternal-child relationships are critical for providing infants/toddlers with support,

engagement, continuity, and emotional nourishment required for healthy development and attachment.

Based on the perspective of attachment theory, maternal-infant attachment is viewed as products of actual interactions and experiences. Building the foundation for attachment through activities that focus on connecting with the unborn child is an essential component of healthy maternal-infant relationships (Barnard & Solchany, 2001). Maternal-fetal attachment is suggested to correlate and precede maternal-infant attachment relationships (Carson & Virden, 1984; Cranley, 1992). A significant element of becoming a mother, a recently advocated term to replace maternal role attainment, is attributed to the development of a secure attachment to the infant (Mercer, 1985; Mercer, 2004). Studies that examine history pertaining to the earliest mother-infant interactions may provide critical information in the development of failure to thrive (Ward, Brazelton, & Wust, 1999). This case-control study provided an understanding of the significance of the maternal health-seeking behavior of prenatal care utilization in relationship to the development of dysfunctional maternal-child attachment relationships that consequentially lead to an infant's faltering growth.

A central premise in attachment theory pertains to the universal need for human contact especially in early development as emotional and physical survival depends on the maternal-child dyadic relationship (Bowlby, 1982; Carlson, Sampson, Stroufe, 2003). Theoretical issues and research on maternal bonding and attachment are well document in the literature (Beal, 1991; Campbell & Taylor, 1979; Muller, 1994). A mother's attachment to her infant/child is reported to form the basis for her involvement in the socialization of the infant/child; this attachment is suggested to begin in pregnancy as a product of dynamic psychological and physiological events (Cranley, 1981, p. 281). Attachment relationships, suggested to evolve

over time, are identified as the first response system to develop in an individual based on a behavioral systems model (Lobo, 1995). The consequences of not acquiring this task in infancy is suggested to be related to impaired infant patterns of behavioral and emotional regulation with subsequent long term effects on quality of life (Dawson & Kessler, 1999).

Researchers support the universality of attachment and infant patterns (secure, avoidant, and resistant attachment) across cultures unrestricted to caregiving arrangement (Carlson, Sampson, & Sroufe, 2003). Researchers suggest that insecurely attached infant with failure to thrive demonstrate a decrease competence in addition to an increased stress-related rigidity and number of hospitalizations compared to securely attached infants with failure to thrive (Brinich, Drotar, & Brinich, 1989). Aspects of attachment relationships and their implications for later physical, behavioral, social, emotional, and cognitive development is an area of further exploration. This study continued to build upon and acquired new knowledge by measuring the association between prenatal care utilization (theoretical proxy for maternal attachment relationship behavior) and subsequent failure to thrive in infancy.

Davis and Akridge (1987) studied the effects of intervention between 32 and 37 week's gestation on maternal-infant attachment behaviors in the early postpartum period. Prenatal intervention consisted of demonstrating fetal position (through abdominal palpation inclusive of picture drawings), recording maternal behavior that the woman believed had an effect on fetal activity, and noting the fetal response to abdominal massage. Analysis of data found that maternal-fetal attachment developed spontaneously among the women studied; fetal cues/fetal movement increased maternal awareness of her fetus and assisted her to perceive the effect of her action(s) on fetal environment. Rubin (1984) defined prenatal care as a maternal healthy attachment behavior; contextually viewed as a maternal relationship with her unborn child.

This study focused on prenatal care utilization (a theoretical proxy for maternal attachment) as a predictor for subsequent failure to thrive during infancy.

According to Carlson and colleagues (2003), additional research is needed concerning the basic foundational processes that underlie the structure and alteration in attachment relationships. Implications for future research in the area of failure to thrive are suggested to focus on prevention and early identification of the maternal-infant/child dyad at risk. When positive experiences and interactions occur in a supportive environment, the infant will have the opportunity to achieve optimal growth and development (Kumar, Robson, Smith, 1984; Lobo, et al., 1992). Secure attachment relationships in infancy are suggested to foster positive adaptation responses, increase resistance to stress, and promote resilience (Allen, 2004; Pianta, Engeland, & Sroufe, 1990; Poulsen, 1993). Aspects of building resilience in infants and children advocate prenatal care services (Poulsen, 1993). Areas of further failure to thrive research advocate examining the intrauterine experience of the fetus; in addition to, the association between a woman's attachment to her fetus and subsequent behaviors toward her infant (Cranley, 1981). As such, aims of this study were to examine differences in prenatal care utilization -conceptualized as a healthy maternal behavior in the context of attachment relationships- between failure to thrive infants and healthy infants; in addition, to test prenatal care utilization as a predictor of failure to thrive, while accounting for confounders. A descriptive design assessed maternal bonding characteristics of infants who were hospitalized for failure to thrive.

### **Prenatal Care Utilization**

Women's health issues, maternal characteristics, and maternal health behaviors -such as prenatal care attainment- are integrally tied to child health outcome. Prenatal care utilization

may be categorized as a maternal health behavior, a maternal psychosocial characteristic, or an environmental component (Merkatz & Thompson, 1990). Content of prenatal care encompasses the detection, treatment, and prevention of adverse maternal-fetal/infant outcomes; in addition to, interventions that address psychosocial stress, unhealthy behaviors, and adverse socioeconomic conditions (Alexander & Kotelchuck, 2001; Mathews, Menacker, & MacDorman, 2002; Merkatz & Thompson, 1990; Weberling, Forgays, Crain-Thoreson, & Hyman, 2003). A life-course perspective, a theoretical framework that emphasizes the importance of various sensitive developmental periods in utero or early life during which future health outcomes are programmed, conceptualizes prenatal care as a protective factor in child health outcomes (Kotelchuck, 2003; Lu & Halfon, 2003). Illness indices outcomes often occur as a result of more risk factors and less protective factors across the life span. This study contributed to existing knowledge by examining whether the association between the patterns of health care use exhibited during the prenatal period may be indicative of subsequent failure to thrive during infancy.

According to Alexander and Kotelchuck (2001), adequacy of prenatal care may be “conceptualized as a proxy indicator of myriad health-enhancing maternal attitudes and behaviors in addition to being a measure of the prenatal care received” (p. 310). A review and comparison of prenatal care utilization indices is well-reported in the literature (Alexander & Kotelchuck, 1996). This study assigned women to categories of prenatal care utilization based on the modified Institute of Medicine index (also referred to as the modified Kessner index); a frequently cited measure of prenatal care utilization in the scientific literature. This quantitative measurement of adequacy of prenatal care contains the following categories: adequate, intermediate, inadequate, none, and unknown (Bell & Zimmerman, 2003). Adequate use of

prenatal care is derived based on a number of visits for gestational age at delivery that meets or exceeds the American College of Obstetrics and Gynecology standards. An inadequate number of visits are defined as less than 50% of adequate criterion. This study examined differences in prenatal care utilization between failure to thrive infants and healthy infants; and tested prenatal care utilization as a predictor of failure to thrive while accounting for these confounding variables.

Utilization of prenatal care services are well reported in the literature (Alexander & Cornely, 1987; Alexander, Kogan, & Nabukera, 2002; D'Ascoli, Alexander, Petersen, & Kogan, 1997; Erci, 2003; Martin, et al., 2003). According to the 2002 data on United States births, 83.7 percent of women received prenatal care during the first trimester of pregnancy. Research suggests unwantedness of pregnancy and barriers (e.g., SES, education level, age, race, marital status, and geographical location) as factors that are often associated with the lack of prenatal care use (Aday, 2001; Hulsey, 2001; Bucher et. al., 1997). Beneficial maternal and child health outcomes are reported among studies of women who receive prenatal care (Alexander & Kotelchuck, 2001; Hulsey, Patrick, Alexander, & Ebling, 1991; Hueston, Gilbert, Davis, & Sturgill, 2003; Mathews, Menacker, & MacDorman, 2002; Mullings & Wali, 2001). Prenatal care is reported to decrease adverse pregnancy outcomes for women of all ages beyond 25 years old independent of ethnicity, length of gestation, or formal educational attainment (Hoyert, 1996). The potential confounding effects of maternal age, race, marital status, and educational level were controlled for in this study when examining prenatal care utilization as a predictor of failure to thrive.

Recent studies indicate that children are more likely to receive immunizations and well-child care if their mother received antenatal care and higher education (De & Bhattacharya, 2002).



Kogan, et al. (1998) examined the association between adequacy of prenatal care utilization and subsequent pediatric care; findings suggest that children whose mothers received less than adequate prenatal care utilization had significantly fewer well child examinations, even after controlling for income, insurance coverage, content of care, wantedness of child, site of care, and maternal characteristics. Hence, investigations pertaining to prenatal care utilization and subsequent infant health outcomes are fruitful areas of further research. This study that examined infant health outcomes is important to nursing and public health sectors in that prenatal care utilization may predict subsequent development of pediatric growth failure. The significance of findings from this study may support the early intervention needs of children at risk for underutilization of health care services and growth and developmental delays due to inadequate prenatal care utilization. This study contributed to the existing body of knowledge by incorporating parity, pregnancy interval, maternal age, race, and educational attainment in the investigation of differences in prenatal care utilization between failure to thrive infants and healthy infants during 2001-2004.

### **Infant Attributes of Failure to Thrive**

In considering causation, it is unlikely that maternal and infant factors are individually responsible for the development of this disorder. A maladaptive, reciprocal interaction between mother and infant has been shown to result in an impaired nutritional intake with subsequent development of nonorganic failure to thrive (Bithoney & Newberger, 1987). Kessler and Dawson (1999) reported that the major risk factor (dysfunctional maternal-infant/child interaction) in the development of failure to thrive has not been found to fluctuate based on the child's age. Infants contribute to their own growth with behaviors and characteristics they exhibit. When the behavioral characteristics unique to failure to thrive infants are present before

the development of the syndrome, these characteristics may have a significant contribution to the development of the maladaptive maternal-infant interaction. Retrospective studies concerning the growth patterns of failure to thrive reveal that the onset of faltering growth is usually within weeks of birth, and 50 percent of the cases met the diagnostic criteria by the age of 6 months (Wright & Talbot, 1996). Kotelchuck and Newberger (1983) examined ecological stress factors in the etiology of failure to thrive using a case-control structured interview design (n=42); findings suggested that the majority of cases (71%) were found among children less than 12 months of age. This case-control study matched subjects by infant's age (in addition to, race and insurance) to examine differences in prenatal care use and between failure to thrive infants and healthy infants.

Pollitt and Eichler (1976) reported various physical and social characteristics of infants / children that directly contribute to their malnutrition and growth failure. Observational studies indicate that nonorganic failure to thrive infants are often viewed by their caregivers as behaviorally difficult; infant characteristics of apathy, unusual watchfulness, diminished vocalization, lack of cuddliness, aversion to touch and indifference to separation from caregiver are reported (Steward & Garvin, 1997; Sumner & Spietz, 1994; Feldman, Keren, Gross-Rozval, & Tyano, 2004). Steward and colleagues (2001) found that failure to thrive infants often display poor cues and ambiguous signals toward their mother during a feeding interaction. These findings are consistent with previous studies that reported nonorganic failure to thrive infants to demonstrate lower behavior reactivity (Bithoney, Dubowitz, & Egan, 1992).

While unique behavioral characteristics of nonorganic failure to thrive infants may be significant to the development of this disorder, the specific contribution remains unknown (Bithoney, Van Sciver, Foster, Corso, & Tentindo, 1995). Researchers postulate that behavioral reactivity of an

infant is often influenced by the mother's behavior. An example of this occurs when an infant is confronted by a depressed mother, the infant exhibits a depressed vagal tone and is less behaviorally reactive (Steward, Moser, & Ryan-Wenger, 2001). Consensus among researchers suggests that behavioral and feeding problems are significant attributes of failing growth; however, additional studies are needed to identify the fetal aspects and mechanisms by which various medical, social and behavioral problems cause failure to thrive. This study examined the association between prenatal care use and subsequent failure to thrive guided by Barnard and Eyres' (1979) Child Health Assessment Model.

According to Sturm and Gahagan (1999) infant/child temperament, cultural practices, and biological risk factors often interact synergistically to produce failure to thrive. Racial differences in growth potential are largely attributed to environmental adequacies versus genetic factors (Berhane & Dietz, 1999); as such, the World Health Organization advocates the 1977 National Center for Health Statistics growth charts as international references. The influence of race will also be controlled for in this study in that African Americans are reported to have a higher rate for low height-for-age and low weight-for-height than any other racial or ethnic group (Sherry, 1999).

Herman-Staab (1992) conducted a retrospective analysis of the Special Supplemental Nutrition Program for Women, Infants and Children (23 failure to thrive subjects and a comparison cohort of 69 randomly selected non-failure to thrive) concluding that failure to thrive was more common among male children (78% versus 49%,  $p < 0.03$ ) and children who were breastfed (41% versus 7%,  $p < 0.05$ ). This research examined the independent association of gender on infant health outcome as well as described maternal bonding behaviors (prenatal

care utilization, infant length of stay, feeding method, frequency of calls/visits, and discharge teaching) of infants who were hospitalized for failure to thrive.

The association between biological vulnerability factors (birthweight and intrauterine growth) may be precursors to the development of infantile growth failure. Low birth weight is often a common medical characteristic associated with inadequate growth (Sherry, 1999). According to Steward and colleagues (2001) full term infants who subsequently developed failure to thrive presented with significantly lower birth weights (2,959 grams) than control infants (3,364 grams). Kelleher and colleagues (1993) conducted a three-year prospective case-control study reporting the following: (1) less than a third of low birth weight, preterm infants diagnosed with a chronic condition (e.g., cerebral palsy, bronchopulmonary dysplasia, and congenital heart disease) developed failure to thrive, (2) mothers of failure to thrive infants reported a poorer health status of their infants measured by the Stein Total Health Score ( $p < 0.003$ ) and RAND General Health Rating Score ( $p < .0001$ ), and (3) failure to thrive infants were more likely to be small for gestational age at birth and demonstrated deficits in neurodevelopmental examinations at 40 weeks gestation-corrected age. With respect to an infant's nutritional status, Steward (2001) advocates the inclusion of intrauterine growth as a variable when examining factors associated with the development of failure to thrive. As such, this study tested prenatal care utilization as a predictor of failure to thrive while controlling for the potential confounding effect of intrauterine growth.

### **Environmental Factors of Failure to Thrive**

The Child Health Assessment Model emphasizes the interaction between mother-infant and environmental factors as important risk assessment components in the development of failure to thrive. According to Casey (1999), "the quality of the early home environment generally

predicts long-term child status better than do early child biological characteristics” (p. 525). Cultural factors such as meal-time expectations and food related behaviors are often measured using the Home Observation for the Measurement of the Environment (HOME) inventory. This tool (comprised of 45 binary-choice items with subsets of parental responsiveness, acceptance of the child, organization of the environment, play materials, parental environmental, and variety of stimulation) is designed to assess the quality of stimulation and support available to a child in their home environment (Kessler & Dawson, 1999). Casey, Bradley, and Wortham (1984) reported that based on the HOME inventory, nonorganic failure to thrive infants had less-organized physical environments and mothers who provided less emotional responsiveness. Based on a prospective study that examined the cognitive development of children (infancy through 6 years of age) in poverty with normal growth and those with failure to thrive, researchers found that failure to thrive children had lower cognitive scores than healthy children; a child-centered home environment and small family size was associated with a better cognitive performance (Mackner, Black, & Starr, 2003). This study included parity and marital status while examining prenatal care use as a predictor of failure to thrive in an attempt to capture siblings/family size as a potential confounding variable.

Peterson and Chen (1990) examined patterns of medical characteristics and the presence of social/psychosocial problems stratified by OFTT, NFTT, mixed FTT, and normal growth. Based on a case series of 1,275 children, low birth weight and prematurity were more common among OFTT and mixed FTT groups. The proportion of OFTT children living in a household with less than 100 percent of the poverty cutoff was 29 percent versus an approximated 50 percent or more in the remaining groups. Mothers who suffer from the stress related to poverty often have little energy to provide for the nutritional needs of their children. The home

environment and relationship between the parent and child are suboptimal across multiple ethnic groups in association with poverty (Slack, Holl, McDaniel, Yoo, & Bolger, 2004). Previous research has found that failure to thrive children are more predominantly white, middle class in comparison to children with other pediatric social illnesses (Newberger, Reed, Daniel, Hyde, & Kotelchuck, 1977). However, all margins of socioeconomic status (SES) are attributes associated with FTT; cautioning a causal relationship of quantifying SES as a predictor of faltering growth among children (Braveman et al., 2001; Kessler & Dawson, 1999). This study incorporated insurance status as a variable within the environmental construct of the Child Health Assessment Model and a component in the methodology of matched cases and control subjects.

A prominent longstanding attribute of nonorganic failure to thrive is equated with emotional deprivation. This encompasses the various aspects of isolation, maternal deprivation, environmental deprivation, impaired maternal-infant relationship and neglect (Kessler & Dawson, 1999). Maternal attachment, sensitivity to her infant cues, alleviation of the infant's distress and provision of growth-fostering situations contribute to the dynamics of the maternal-infant relationship. Various environmental factors attributed to maternal characteristics (e.g., education, poverty, unemployment, abuse and neglect, mental/emotional problems, drug use, and type of parental support) often influence the dynamics of the maternal-child relationship (Crais, 1999; Kim-Cohen, Moffitt, Caspi, & Taylor; 2004).

Lobo, Barnard, and Coombs (1992) conducted a prospective case-control study to describe the social aspects of failure to thrive children admitted for hospitalization and identify differences in parent-infant interaction between organic failure to thrive and nonorganic failure to thrive and control subjects less than 12 months of age. Findings suggested that mothers in the failure to thrive

group had the following: lower psychosocial asset scores, earlier average developmental expectations, higher stress scores, more relocation and marital problems. These factors may indicate that mothers of failure to thrive infants may be less able to provide an optimal environment for their child (Lobo, et al., 1992). Kotelchuck and Newberger (1983) conducted a case-control study (42 hospitalized FTT children between 12-48 months of age and 42 healthy children matched on age, gender, and race) exploring the significance of ecological stress in the etiology of failure to thrive through structure interviews. Based on the following study variables (family structure, social class, number and cause of mother-child separation, child centered problems, family and neighborhood support, maternal stress, and health index), the following three factor distinguished failure to thrive families from inpatient controls: the mother's perception of a sickly child, a lack of family support and neighborhood isolation, and a larger discrepancy in parental education.

Research suggests that abusive and neglectful parents have less frequent and lower quality interactions with their children in comparison to non-maltreating parents and child abuse is often associated with inadequate growth (Garner, Panpanich, & Logan, 1999; Kessler & Dawson, 1999; Slack, Holl, Yoo, & Bolger, 2004). Exploring aspects of a parenting skills and maternal bonding behaviors are important in that an infant's/child's well-being is often related to the parenting process. Parenting behaviors are often influenced by prenatal drug use, parental involvement, and use of prenatal care (Giblin, Poland, Waller, Ager, 1988). This study assessed maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who were hospitalized for failure to thrive. Exploring the significance of these factors may lead to new knowledge and avenues for further exploration in the areas of maternal-child health, maternal-infant attachment relationships, and pediatric failure to thrive.

## Summary

Based on a vast review of literature pertaining to this phenomenon, little is known about the prenatal care use of the mothers of failure to thrive infants. The maternal variable of prenatal care was reported by Kelleher and colleagues (1993) who conducted a three year prospective case-control study of low birthweight, preterm failure to thrive infants finding no differences in use of prenatal care -defined by percent none or 3<sup>rd</sup> trimester- between failure to thrive and non-failure to thrive infants (10.6 versus 7.9; respectively). Recommendations for further research to determine the relevance of these findings among normal birth weight infants who develop failure to thrive are suggested. Herman-Staab (1992) conducted a retrospective analysis of records of the Special Supplemental Nutritional Program for Women, Infants, and Children (WIC); the study found that there were no differences in trimester prenatal care initiation. According to Drotar & Robinson (1999), more research is needed concerning the psychosocial aspects of failure to thrive to assist with preventative measures and clinical management. This study investigated differences in prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants in an academic health sciences center during 2001- 2004. This research tested prenatal care utilization as a predictor of failure to thrive while controlling for confounding variables and described maternal bonding characteristics of infants who were hospitalized for failure to thrive. Findings from this proposal may encourage providers to inquire of prenatal care use during child healthcare services, as an indicator of maternal-child attachment and predictor of failure to thrive. As the dimensions of failure to thrive are multifaceted and interactive, including attachment constructs in the assessment of failure to thrive infants will provide opportunities for mothers to receive supportive therapy interventions. The importance



of this study will be used to guide implications for practice, primary prevention and early intervention programs; risk analysis that incorporates a multifaceted approach may benefit from including prenatal health care as a means of promoting child development and maternal-child attachment that ultimately fosters positive reciprocal interactions toward wellbeing.

## Chapter 3

### Methodology

This chapter presents the definitions of the study terms, research design, study setting and sample, data collection protocol, instrumentation, management of data, and data analysis plan.

#### Operational Definitions

The following terms are operationally defined for their use in this research study:

**Failure to Thrive:** defined in terms of the International Classification of Disease 9<sup>th</sup> Revision, Clinical Modification (ICD-9-CM) diagnostic billing code 783.41 “failure to thrive, failure to gain weight in childhood” (Practice Management Information Corporation, 2004). This outcome variable will be studied as a nominal variable derived from hospitalized and ambulatory failure to thrive diagnoses. This study variable will be coded as “case\_id”.

**Well children:** defined in terms of well infant/child examinations based on a diagnosis code of V20.2 “health supervision of infant/child; routine infant health check”. This nominal variable will be coded as “control\_id” within the control group for outpatient health care services.

**Maternal sociodemographic characteristics-** age ( $\leq 19$  years, 20-34 years,  $\geq 35$  years, and unknown), educational attainment ( $< 12$  years,  $\geq 12$  years, and unknown), Race (Black, White, Hispanic, Other), parity (1 or 2,  $\geq 3$ , and unknown), pregnancy interval ( $< 12$  months,  $\geq 12$  months, unknown). These study variables will be coded as “matage”, “educat”, “matrace”, “parityc”, and “pregnancy interval”, as respectively defined.

**Prenatal Care Utilization:** the maternal health care seeking behavior variable examining utilization of prenatal care will be derived from the modified Institute of Medicine (M-IOM / M-Kessner) index. This index defines the standard for an adequate number of prenatal care visits according to the recommendations of the American College of Obstetrics and Gynecology. Attributes of the M-IOM index are as follows: adequate start of care between 1-3 months, adequate number of visits at 40 weeks is 9, missing category, and no care category. The modified Kessner is referenced from the original Institute of Medicine index that accounts for adequacy of prenatal care (while adjusting for gestational age at delivery) the month in which care is initiated, the number of prenatal care visits, and the type of obstetric service provided. Classification of “adequate” utilization of prenatal care requires the following: (a) a first trimester initiation of care, (b) a specific number of prenatal care visits for gestational age at delivery, and (c) delivery by a private obstetrical service. Late initiation of care or fewer visits for the gestational age at delivery results in a classification of either “intermediate” or inadequate prenatal care use (Alexander & Kotelchuck, 1996, p. 409). Modifications incorporate deleting the requirement of delivery in a private obstetric service and accounting for missing data. This study variable measuring prenatal care utilization will be coded as “mkessner” in that data will be assigned to the following categories: “adequate”, “intermediate”, “inadequate”, “none”, and “unknown” based on the M-Kessner index. Adequacy of prenatal care use will be further recoded into a dichotomous variable labeled “pnc” delineating adequate prenatal care utilization (yes) and less than adequate prenatal care utilization (no). This variable will define less than adequate prenatal care utilization based on the following M-Kessner coding values: (a) intermediate (b) inadequate, or (c) none.

**Infant characteristics:** intrauterine growth categorized as follows: large for gestational age (LGA), appropriate for gestational age (AGA), and small for gestational age (SGA); infant length of hospital stay (full-days) to be calculated from chart review based on number of hospital days excluding data of admission and date of discharge, feeding method (breastfed, bottled formula, bottled breast milk, and other), age (days), and gender (male or female). These study variables will be coded as “IUG”, “LOS”, “feedings”, “age”, and “gender”; as respectively defined.

**Environmental factors:** insurance status (Private, Self pay or indigent, Medicaid, and unknown), and marital status (Married, Unmarried, and unknown), frequency of visits/calls by mother during Week 1 and last week (Frequent: almost daily maternal contact; Irregular: 1-3 maternal visits/calls per week; Infrequent: mother does not visit/call or difficulty in contacting her is recorded), and discharge teaching (Favorable: mother shows progress attaining child care skills as evidenced by appropriate questions and/or verbalized understanding of discharge teaching; Neutral: task correctly performed with attainment of minimum skills and/or minimal interest expressed; Unfavorable: expressed lack of interest in child care and failure to learn skills). These study variables will be coded as “insurance”, “marital status”, “frequency of visits”, and “discharge teaching”; as respectively defined above.

### **Research Design**

This study utilized a case-control retrospective design to examine differences in prenatal care utilization between failure-to-thrive infants and healthy infant; this study also incorporated a descriptive design to describe maternal bonding characteristics of infants who were

hospitalized for failure to thrive. This study was guided by Barnard and Eyres (1979)

conceptual framework (refer to Figure 1; located on page 8). The purposes of this study were:

1. To examine the differences of prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants.
2. Test prenatal care utilization as a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders.
3. To describe maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who are hospitalized for failure to thrive.

### **Setting**

This study utilized the Medical University of South Carolina (MUSC) information services resources. MUSC is a 596-bed (plus 50 neonatal and 24 bassinets) Level I Trauma Center; the Medical Center consisting of four major hospital facilities- Medical University Hospital, MUSC Children's Hospital, Storm Eye Institute, and the Institute of Psychiatry. MUSC rates among one of the nation's best hospitals with a range of specialized care services; *Child* magazine rates it the best children's hospital in the Southeast. Over the past six years, MUSC has consecutively received the National Research Corporation's Consumer Choice Award.

The Medical Center is fully licensed by the South Carolina Department of Health and Environmental Control and accredited by Joint Commission on Accreditation of Healthcare Organizations. As South Carolina's premier health care center, MUSC receives statewide

referrals through consortium hospitals, satellite clinics, and an extensive network of referring physicians; the facility has managed care contracts with major commercial payers. Statistics for fiscal year 2004 are as follows: average daily census rate is 470; annual number of admissions is 29,368; number of births 2,131; number of outpatient visits 630,000; number of inpatient surgical procedures 11,032; and number of outpatient surgical procedure 7,151.

This study utilized two of MUSC's electronic medical record systems, the Keane System and Practice Partners, in addition to MUSC's Perinatal Information System database. MUSC implemented the Keane System in 1989; this system provides applications for medical records, hospital billing, inpatient and outpatient registration, medical record coding, and report writing for historical database. In 1992, MUSC incorporated Practice Partners -a product of Physician Micro Systems, Inc.- to interface with scheduling, registration, labs and hospital repository systems. This is an outpatient electronic medical record system with capabilities of storing and retrieving patient demographics and clinical data (e.g., progress notes, immunizations, laboratory, radiology, medication profile, specific studies, and consults). The system enters approximately 56,000 visits per year from 28 specialty and primary care clinics (e.g., Internal Medicine, OB/GYN, Family Practice, Pediatrics, etc.).

The following information is given to provide a composite of quality assurance information pertaining to the data bases that were used in this research.

*Keane System:* Data from a medical record is coded in the Keane System by knowledgeable certified coders within 4 days from hospital discharge. Under MUSC bylaws, a print out is generated for the attending physician to sign off verifying the correct diagnosis and procedure sheet. Quality assurance measures of the Keane System are as follows: (a) interfaces with a 3M incoder, (b) quarterly internal quality review, (c) quarterly certified external consultant, and (d)

review from the Office of Inspector General through the Federal Government over the past four years. This system contains a current master patient index with an error rate of - 0.11.

*Practice Partners:* Practice Partners quality assurance measures are implemented by nursing chart audit, ambulatory quality improvement, and compliance officers. The system is fully accredited by JCAHO; data entry is reviewed and signed off by the attending physician within 28 days of service. The Medical University's Health Information Management System Coordinator is responsible for quality assurance monitoring and verification of accurate coding.

*Perinatal Information System:* The Perinatal Information Systems (PINS) quality assurance measures are in compliance with the Medical University of South Carolina.

### **Study Sample**

All infants less than 1 year of age born at MUSC who received inpatient medical care at the Medical University of South Carolina Medical Center or outpatient medical care through University Medical Associates primary care settings with a diagnosis of failure to thrive (ICD-9 coding 783.41) were eligible for inclusion as "cases". The "controls" were derived from the University Medical Associates provider network upon receiving outpatient services on a yearly basis without medical illness diagnoses. Failure to thrive infants and control infants were matched on a 1 to 1 basis in terms of race, age (within  $\pm$  3 months), and socioeconomic status (based on insurance coverage). Identifiable data were derived from four single-year birth cohorts to provide data on a 12 month follow period.

*Inclusion criteria.* Infants less than 1 year old whose mothers received prenatal care at MUSC, reside in Charleston County and were singleton deliveries at MUSC between July 1, 2000 - July 1, 2001; July 2, 2001 - July 1, 2002; July 2, 2002 - July 1, 2003; July 2, 2003 - July 1, 2004. During the first year of life, case subjects received the ICD-9 code 783.41 (failure to

thrive, failure to gain weight) accessed by either Keane System or Practice Partners; control subjects were retrieved through Practice Partners through the ICD-9 code of V20.2 (health supervision of infant/child; routine infant health check) and were required to have received outpatient medical services at MUSC during the first year of life without diagnoses of chronic illness. The mothers of cases or control subjects must have received prenatal care at MUSC, reside in Charleston County, and delivered a singleton that was discharged from MUSC.

*Sample size.* Based on the proportion of cases that lack prenatal care use with an odds ratio of 2.0 alpha level of 0.05 and beta level of 0.20, representing a power of 80% to detect a two fold increase to 32% that cases might have received less than adequate prenatal care utilization, a sample size of 105 in each group was calculated as follows:

(a)  $p_0$  : Proportion of controls who lack prenatal care use = 0.163 {derived from the U.S. data of births year 2002, 83.7% of women received prenatal care during the 1<sup>st</sup> trimester}

(b)  $p_1$  : Proportion of cases who lack prenatal care use = 0.326

$$(p_0)(OR) = (0.163)(2.0)$$

(c)  $q_1$  :  $1 - p_1$

(d)  $q_0$ :  $1 - p_0$

$$n \text{ (each group)} = \frac{(p_0 q_0 + p_1 q_1)(Z_{1-\alpha/2} + Z_{1-\beta})^2}{(p_1 - p_0)}$$

$$n = \frac{[(0.163)(0.837) + (0.326)(0.674)][1.96 + 0.84]^2}{(0.326 - 0.163)^2}$$

$$= 105$$



Consultation with Dr. Thomas C. Hulsey was obtained with regard to sampling; n = 111 for each group was advised for this case-control study and utilized. Sampling for the descriptive design was based on the total available population (inpatient failure to thrive infants) from the case-control study.

### **Data Collection Protocol**

Data were derived from the Medial University of South Carolina Perinatal Information System, Keane System, and Practice Partners databanks. Analysis of data was based on various statistical formulations which describe the differences among variables in that some of the research variables consist of count data and others continuous data; chi-square testing were used to analyze independent association and if a significant association was identified the variable was placed in a binary logistic regression equation. The protocol for data collection followed the specified procedures:

- (a) Permission to conduct this study as exempt research was obtained from the dissertation advisory committee and Institutional Review Board at MUSC.
- (b) Data were derived from the following databases at Medial University of South Carolina with the specified years:
  - (i) Perinatal Information System from 1997-2004.
  - (ii) Keane System and Practice Partners from 1/1/2000 - 12/13/2004.
- (c) Selection criteria for the study subjects were based upon the following inclusion and exclusion criteria. The inclusion criteria consist of the following: maternal Charleston County residency, prenatal care use at MUSC, delivery of singleton live birth at MUSC, infant's age less than 1 year; inpatient diagnosis code of 783.41, outpatient diagnosis code of 783.41

or V20.2. Exclusion criteria consist of: maternal residency outside of Charleston County, prenatal care and delivery services not obtained through MUSC, infants with chronic medical illness who receive outpatient services through MUSC provider network, children beyond 1 year of age, and health care obtained outside of MUSC's network.

- (d) De-identified data were contained in the Statistical Package for the Social Sciences (SPSS) format for the variables requested in the preceding operational definition section of this study.
- (e) Study variables were extracted from MUSC's Keane System, Practice Partners, and Perinatal Information Systems to perform secondary data analysis as outlined in Table 3-1. Missing data, specific to prenatal care utilization, was obtained from chart review by Cindy Allen, Ph.D. (c), R.N., F.N.P. through electronic retrieval or hard copy records.
- (f) Through a retrospective chart review data were recorded on Appendix A and entered into SPSS. Variables of prenatal care use, infant length of stay, frequency of visits/calls, feeding, and discharge teaching were directly recorded from the chart by the primary investigator. Accuracy of data collection was obtained by reviewing the record once entries are recorded prior to closing the record. Chart records were reviewed in the Medical Record room designated area at MUSC or via electronic access.
- (g) Databases were merged with a matching case-control identifier to a working file, cleaned, and analyzed using SPSS software. Cases of missing data were

excluded only from computations where the missing data variable prohibits analysis.

- (h) Data contained in the working file were secured by the investigator with password accessibility and maintained 5 years beyond the completion of final dissertation defense.
- (i) **Data Management:** Data were entered and cleaned in the SPSS statistical software computer program. Descriptive statistics and frequency distributions were generated for each study variable. Data were then be recoded and categorized according to operational definitions. Frequencies were obtained from this reformatted data to ensure accuracy. Hard copies were kept in a file with notation of: file name, variable name, recoding categories indicating system missing data. This record keeping assisted the investigator to justifying any concerns with data analysis/findings. Statistical consultation was provided by Dr. Thomas C. Hulsey and Dr. Yvonne Michel from the Medical University of South Carolina.

### **Instrumentation**

The tools used in this study to examine prenatal care difference between failure to thrive infants and healthy infants (in addition to quantify the relationship between prenatal care utilization and consequential failure to thrive in infancy) and describe maternal bonding characteristics of hospitalized failure to thrive infants were derived from the Medical University of South Carolina Perinatal Information System, Keane System, and Practice Partners databases. These instruments contained the research variables as discussed under the operational definition section of this proposal. The modified Kessner index was utilized as a

measurement tool to assign women to categories of prenatal care utilization; also from this adequacy of prenatal care utilization measurement a dichotomous prenatal care variable was derived. Verifying accuracy of the modified Kessner was performed in this study as variables for month of care and number of visits were inclusive in the database. No adjustments were made concerning measurement error with the Modified Kessner as based on information provided data was calculated and entered correctly. The measurement and information source of each study variable are presented in Table 1.

Table 1. Study Variable Names, Measurement, and Information Source.

Study Variable	Variable Scale	Information Source
Maternal age	Nominally scaled	PINS
Education attainment	Categorical scaled	PINS
Insurance status	Nominally scaled	PINS
Marital status	Categorical scaled	PINS
Race	Nominally scaled	PINS
Pregnancy Interval	Interval ratio scaled	PINS
Parity	Nominally scaled	PINS
Prenatal care index	Ordinal scaled	PINS
Intrauterine growth	Categorical scaled	PINS
Child's age	Interval scaled	Keane, Practice Partners
Gender	Nominally scaled	Keane, Practice Partners
Length of Hospital Stay	Interval scaled	Chart review
Feedings	Categorical	Chart review
Frequency of visits/calls	Categorical	Chart review
Discharge teaching	Categorical	Chart review
Failure to thrive	Nominally scaled	Keane, Practice Partners
Well child exam	Nominally scaled	Practice Partners

### **Plan for Data Analysis**

Data analysis consisted of descriptive findings, *t* tests, chi-square analysis, odds ratios, and binary logistic regression. Data were analyzed by performing *T* test or chi-square test between the cases and controls on an item by item basis. *T* test for independent samples was applied to

data where the underlying scale was ordinal/interval and chi-square was applied to the study variables where the underlying scale was nominal / categorical. Nonparametric statistics were performed if the distribution of data were not normal. To examine prenatal care utilization as a predictor of failure to thrive, logistic regression was utilized to isolate the effects of differences in prenatal care use on failure to thrive infants and healthy infants, while simultaneously controlling for the remaining independent variables.

### **Summary**

In summary, the purposes of this research study were as follows: (1) to examine differences in prenatal care utilization between failure to thrive infants and healthy infants in an academic health sciences center during 2001-2004, (2) to test prenatal care utilization as a predictor of failure to thrive while accounting for confounding variables, (3) to describe maternal bonding characteristics of infants who are hospitalized for failure to thrive. Variable were measured by the Medical University of South Carolina Perinatal Information System, Keane System, and Practice Partners databases. Study sample size was 222 (n=111 FTT cases and n=111 healthy controls) and should have been adequate to effectively detect differences in prenatal care utilization between failure to thrive infants and healthy infants based on power analysis (alpha set at 0.05 and beta set at 0.20). Data were analyzed using a series of parametric / non-parametric Chi-square analyses, Mann-Whitney U tests, and binary logistic regression.

## **Chapter 4**

### **RESULTS**

The specific aims of the study were: 1) to examine the differences of prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants, 2) to test prenatal care utilization as a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders, 3) to describe maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who are hospitalized for failure to thrive. This chapter will present the results of each research question tested in this study.

#### **Sample Characteristics**

The study sample (N=222) consisted of infants less than 1 year old during 1/1/2000 – 12/13/2004. The cases (n =111) were selected from the available 114 infants diagnosed with failure to thrive. In this study, 78.4 percent of the cases were outpatient failure to thrive infants and 21.6 percent were inpatient cases. Healthy outpatient infant controls (n = 111) were diagnosed with a well child examination exclusive of chronic disease. Subjects were matched on a 1 to 1 basis in terms of age, race and insurance. Forty-five percent of the study sample was less than 3 months old; equal numbers of females and males existed with the majority classified

as appropriate for gestational age (76.1%). The majority of the infant's mothers were unmarried Black women (77.1% and 68.5%; respectively) between 20-34 years old who received Medicaid (67.7%) and adequate prenatal care utilization (55.7%); 46.8 percent experienced 1-2 prior deliveries. Descriptive statistics for each group are listed in Table 2.

Characteristic	Failure to Thrive Infants (n=111)	Matched Healthy Infants (n=111)
Infant's gender		
Female	58.0%	42.0%
Male	42.0%	58.0%
Intrauterine growth		
Large for gestational age	9.9%	10.8%
Appropriate for gestational age	72.1%	80.2%
Small for gestational age	18.0%	9.0%
Modified Kessner index:		
Adequate prenatal care use	57.7%	52.3%
Intermediate prenatal care use	14.4%	26.1%
Inadequate prenatal care use	24.3%	18.9%
No prenatal care	3.6%	0.0%
Unknown	0.0%	2.7%
Prenatal care use:		
Adequate	56.8%	52.3%
Less than adequate	43.2%	45.0%
Unknown	0.0%	2.7%
Marital status		
Married	27.0%	18.0%
Unmarried	73.0%	78.4%
Maternal age		
≤ 19 years old	18.9%	27.0%
20-34 years old	71.2%	64.9%
≥ 35 years old	9.9%	8.1%
Maternal education		
<12 years	27.9%	14.4%
≥ 12 years	29.7%	20.7%
Unknown	42.3%	64.9%

<b>Table 2 –continued.</b>		
Parity		
Zero	41.4%	42.3%
1 or 2	47.7%	45.9%
3 or more	10.8%	11.7%
Pregnancy interval		
< 12 months	3.6%	1.8%
≥ 12 months	38.7%	43.2%
Missing data	57.7%	55.0%

### **Differences of Prenatal Care Utilization between FTT Infants and Healthy Infants**

To answer the first research question (Are there differences in prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and health infants?), a series of Chi-square analyses were executed. The study hypothesis stated that mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are significantly more likely to have failure to thrive infants than healthy infants. The maternal sociodemographic variable of prenatal care use was analyzed based on the modified Kessner index as well as a dichotomous prenatal care variable.

*Prenatal Care Utilization.* According to the modified Kessner index (refer to Table 3 and Figure 2), prenatal care utilization among mothers whose infants were diagnosed with failure to thrive was as follows: (a) 57.7 percent received adequate prenatal care, (b) 14.4 percent received intermediate prenatal care, (c) 24.3 percent received inadequate prenatal care, and (d) 3.6 percent received no prenatal care. Mothers with healthy infants received the following modified Kessner classifications: (a) 52.3 percent received adequate prenatal care, (b) 26.1 percent received intermediate prenatal care, (c) 18.9 percent received inadequate prenatal care, and (d) 2.7 percent were unknown.

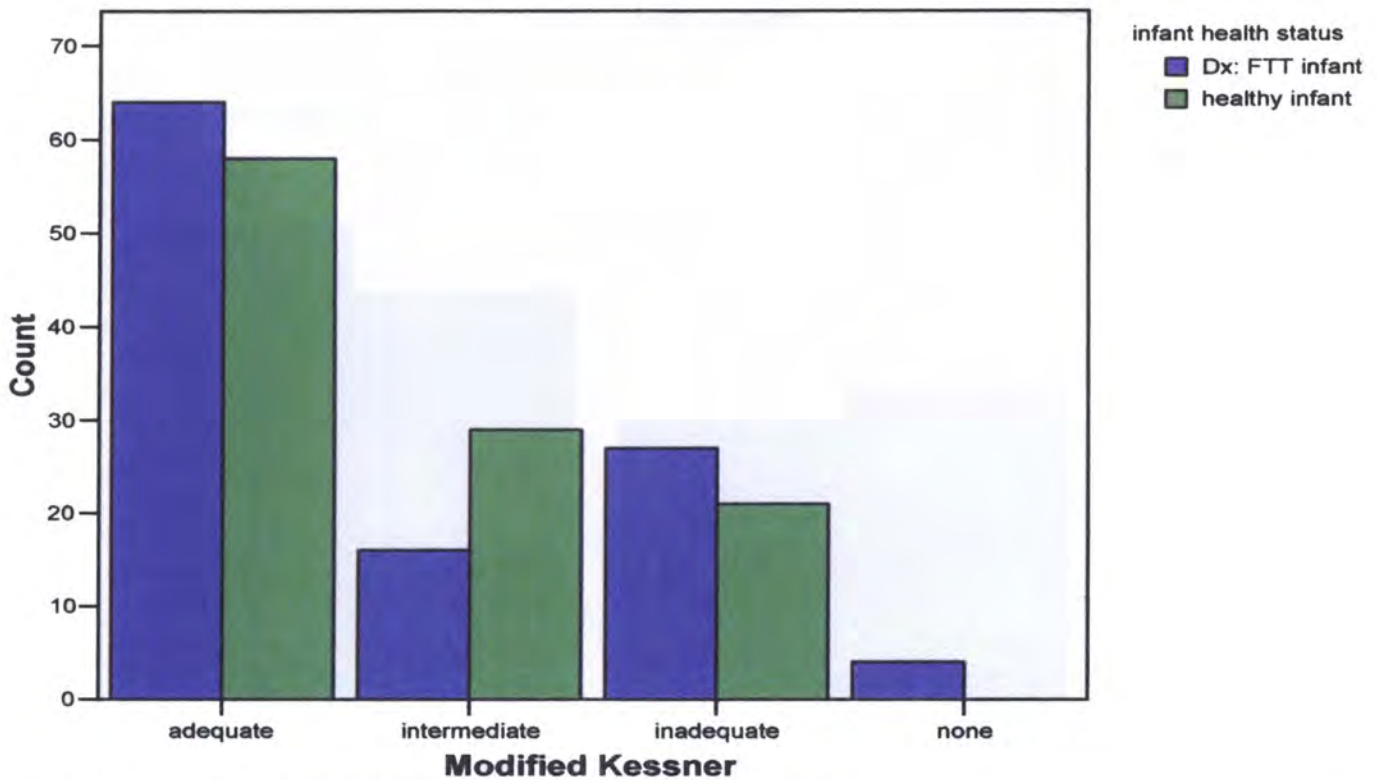


There was a significant difference in prenatal care utilization -based on the number of prenatal care visits and the gestational age at entry into prenatal care measure by the modified Kessner index- between cases and controls (Chi-square 8.761, df = 3, p value = 0.033). With 2 cells having an expected count < 5 and data not normally distributed, nonparametric testing on a dichotomous prenatal care utilization variable was performed.

**Table 3. Crosstabulation of Modified Kessner and Infant Health Status**

		Infant Health Status		Total	
		FTT Infant	Healthy Infant		
Modified Kessner	Adequate	Count	64	58	122
		% within infant health status	57.7%	52.3%	55.0%
	Intermediate	Count	16	29	45
		% within infant health status	14.4%	26.1%	20.3%
	Inadequate	Count	27	21	48
		% within infant health status	24.3%	18.9%	21.6%
	None	Count	4	0	4
		% within infant health status	3.6%	.0%	1.8%
	Unknown	Count	0	3	3
		% within infant health status	.0%	2.7%	1.4%
	Total	Count	111	111	222
		% within infant health status	100.0%	100.0%	100.0%

### Bar Chart



**Figure 2. Histogram of Modified Kessner and infant health status**

Data analysis was performed using a dichotomous classification of prenatal care utilization. From this data, 64 case subjects received adequate prenatal care and 47 case subjects received less than adequate prenatal care (refer to Table 4). Among the controls, 58 subjects received adequate prenatal care and 50 subjects received less than adequate prenatal care. From this data, there were no significant differences in prenatal care utilization between failure to thrive infants and healthy infants (Fisher’s Exact test p value = 0.588). The histogram of adequate versus less than adequate prenatal care use among cases and controls is found in Figure 3; statistical output of Chi-square analysis is listed in Table 5. Data analysis did not incorporate missing data.

**Table 4. Crosstabulation of Prenatal Care (PNC) Use and Infant Health Status**

		Infant Health Status		Total
		FTT infant	Healthy infant	
PNC use	Adequate	64	58	122
	Less than adequate	47	50	97
Total		111	108	219

## Bar Chart

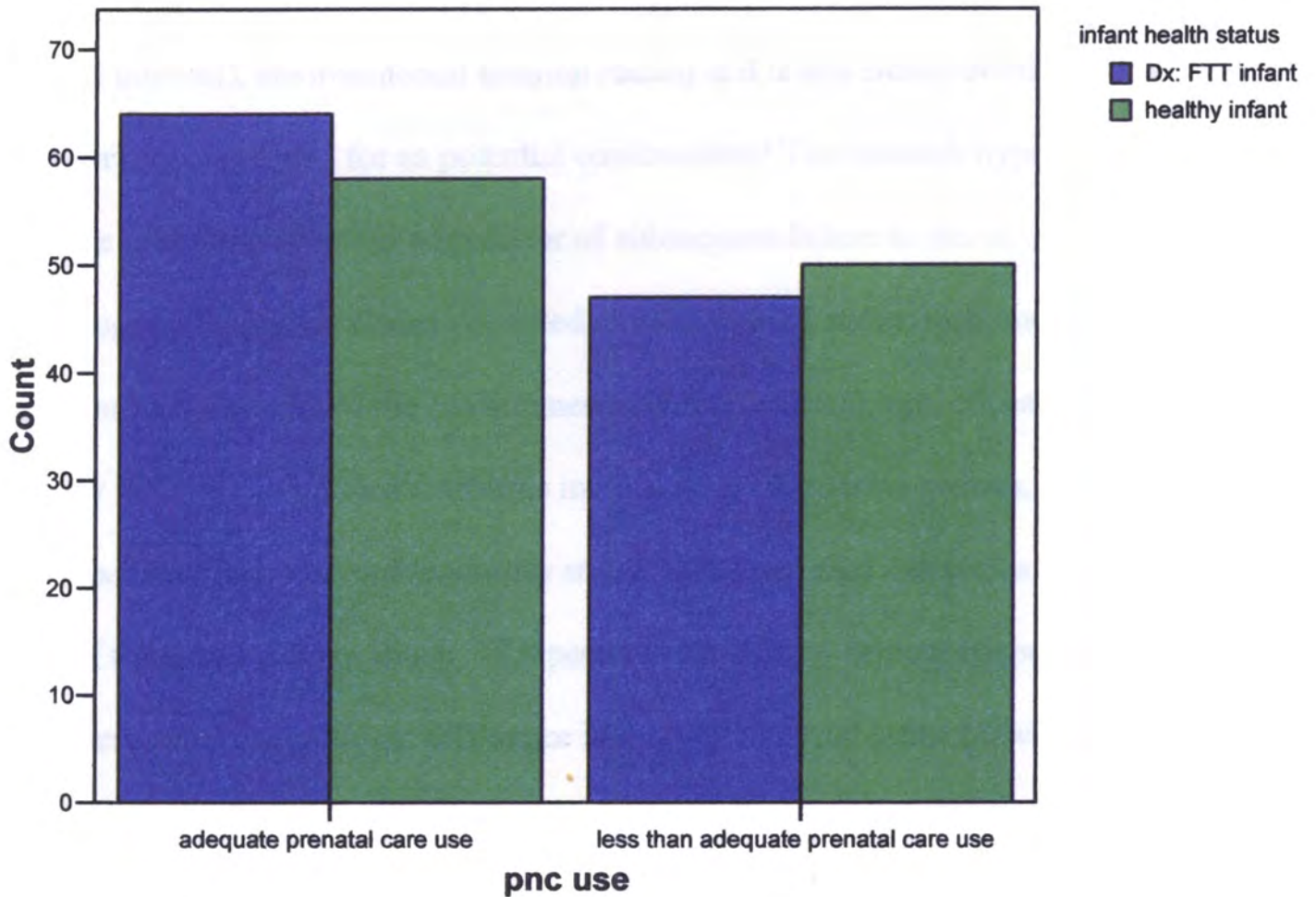


Figure 3. Histogram of dichotomous prenatal care variable and infant health status.

Table 5. Chi-Square Tests of Dichotomous Prenatal Care Use and Infant Health Status

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.347(a)	1	.556		
Continuity Correction(a)	.205	1	.651		
Likelihood Ratio	.347	1	.556		
Fisher's Exact Test				.588	.325
Linear-by-Linear Association	.345	1	.557		
N of Valid Cases	219				

(a) 0 cells (.0%) have expected count less than 5. The minimum expected count is 47.84.

## Second Hypotheses Testing

The second research question was: Is prenatal care utilization a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders? The research hypothesis stated that inadequate prenatal care use is a predictor of subsequent failure to thrive. Maternal sociodemographic characteristics consisted of race, marital status, insurance (preceding two variables are a composite of the environmental characteristics), age, education, parity, and pregnancy interval. Infant characteristics include age, intrauterine growth, and gender.

*Maternal race, marital and insurance status.* Maternal race categories consisted of: 67.6 percent of the subjects were Black, 18.9 percent White, 12.6 percent Hispanic, and 0.9 percent Other. There was no significant difference in mother's marital status between cases and controls (Fisher's Exact Test p value = 0.151). The majority of women in both groups were unmarried; 73.0 percent among cases and 78.4 percent among controls (refer to Table 6). Insurance among the cases was 19.8 percent private, 12.6 percent self pay/indigent, and 67.6 percent Medicaid; controls were similar due to 1:1 matching.

**Table 6. Crosstabulation of Marital Status and Infant Health Status**

		Infant Health Status		Total
		FTT Infant	Healthy Infant	
Marital	Married	27.0%	18.0%	22.5%
	Unmarried	73.0%	78.4%	75.7%
	Unknown	.0%	3.6%	1.8%

*Maternal age and educational attainment.* There was no significant difference in maternal age among the cases and controls (Chi-square = 2.113, df = 2, p value = 0.348). Mothers aged 20-34 accounted for 71.2% of the infants diagnosed with failure to thrive, while mothers 19 years old or younger and 35 years old or greater accounted for 18.9 percent and 9.9 percent, respectively. Mothers of healthy infants between the ages of 20-34 years accounted for 64.9 percent of the study sample, mothers 19 years old or younger represented 27.0 percent and women 35 years old or greater represented 8.1 percent (refer to Table 7).

**Table 7. Maternal Age for Cases and Controls**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	≤ 19 years old				
	Cases	21	18.9	18.9	18.9
	Controls	30	27.0	27.0	27.0
	20-34 years old				
	Cases	79	71.2	71.2	90.1
	Controls	72	64.9	64.9	91.9
	≥ 35 years old				
	Cases	11	9.9	9.9	100.0
	Controls	9	8.1	8.1	100.0
Total Pairs		111	100.0	100.0	

Level of maternal education was 42.3 percent unknown for cases and 64.9 percent unknown for controls; thus only descriptive statistics were performed. Among all of the cases, 27.9

percent attained less than 12 years of education and 29.7 percent attained equal to or greater than 12 years; while 14.4 percent of the total controls attained less than 12 years of education and 20.7 percent attained equal to or greater than 12 years (refer to Table 8).

**Table 8. Maternal Educational Attainment (years) for Cases and Controls**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<12 years				
	Cases	31	27.9	48.4	48.4
	Controls	16	14.4	41.0	41.0
	≥12 years				
	Cases	33	29.7	51.6	100.0
	Controls	23	20.7	59.0	100.0
	Total				
	Cases	64	57.7	100.0	
Controls	39	35.1	100.0		
Missing	Unknown				
	Cases	47	42.3		
	Controls	72	64.9		
Total Pairs		111	100.0		

*Parity and pregnancy interval.* There was no significant difference in parity between cases and controls (Chi-square 0.089, df = 2, p value = 0.956). Parity status was similar among the 2 groups within all categories. Forty-one percent of the cases experienced no previous deliveries versus 42.3% of the controls, with 47.7 percent (parity 1 or 2) and 10.8 percent (parity 3 or more) for cases; compared to 45.9 percent and 11.7 percent respectively for controls (refer to Table 9).



**Table 9. Parity Status for Cases and Controls**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Zero				
	Cases	46	41.4	41.4	41.4
	Controls	47	42.3	42.3	42.3
	1 or 2				
	Cases	53	47.7	47.7	89.2
	Controls	51	45.9	45.9	88.3
	3 or more				
	Cases	12	10.8	10.8	100.0
	Controls	13	11.7	11.7	100.0
Total Pairs		111	100.0	100.0	

Among the controls, pregnancy intervals were recorded on 51 of the 65 women ranging from 158 to 7815 days. Pregnancy interval data was available on 47 of the 65 case mothers, number of days ranged from 324 to 6214. Among the cases and controls, the majority experienced a greater than or equal to 12 months pregnancy interval (38.7% and 43.2% respectively); a pregnancy interval less than 12 months was reported in 3.6 percent of the cases and 1.8 percent of the controls. Due to the nature of the study variable with respect to parity, for all women in this study (regardless of parity) missing data was 57.7 percent for cases and 55.0 percent for controls. Nulliparous women accounted for approximated 40 percent (41% cases and 42.3% controls); as such the percentage of missing data (pregnancy interval) that existed was assumed to be related to the first-time mothers who would not pertain to this measurement. Missing data in both groups (cases and controls) was eliminated from Chi-square analysis after confirming

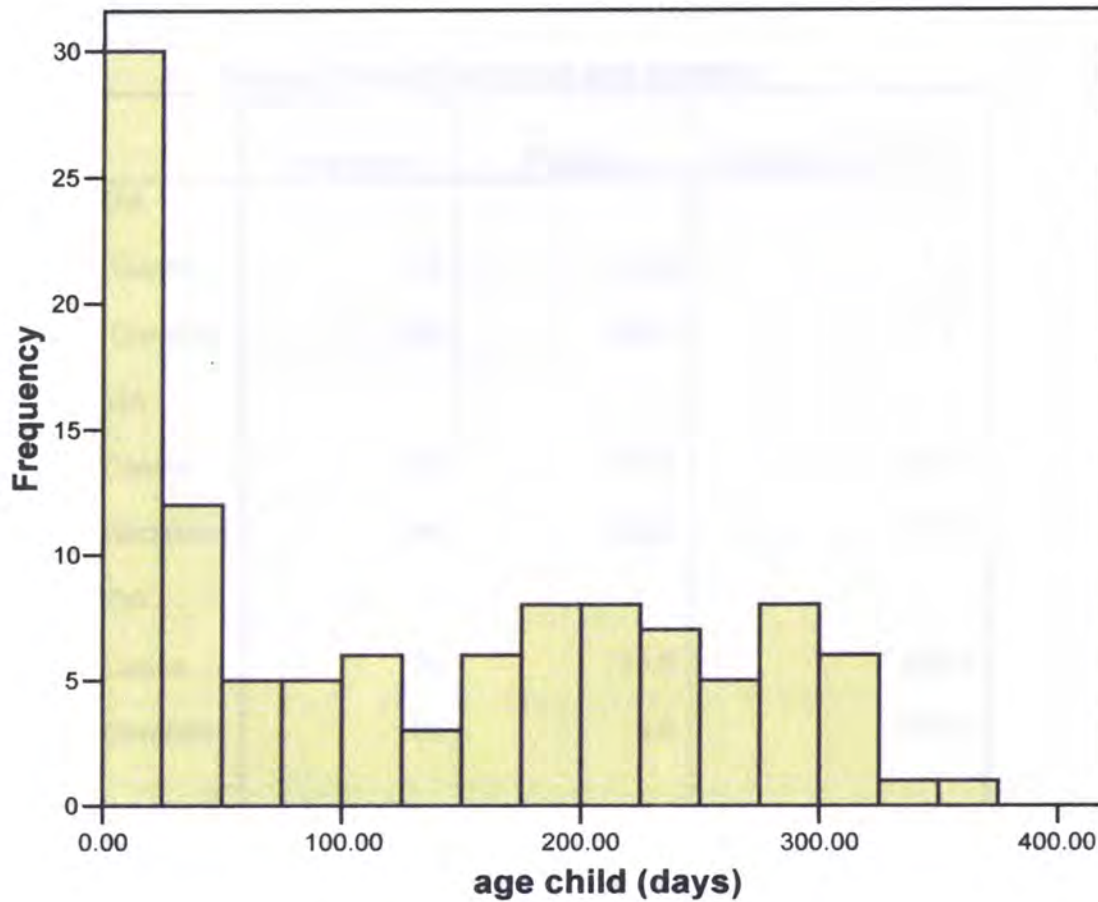
the missing were random. There was no significant difference between pregnancy interval (missing / non-missing) between cases and controls (Fishers' Exact Test p value = 0.787). In addition to no significant difference in pregnancy interval (missing and non-missing) between adequate prenatal care use and less than adequate prenatal care use (Fisher's Exact Test p value= 1.000).

Excluding nulliparous women from data analysis with regards to pregnancy interval, this study found (based on 95 subjects) that there was no significant difference in pregnancy interval (less than 12 months / 12 months or greater) between adequate and less than adequate prenatal care use (Fishers Exact test p value= 0.400). This study found no significant difference in pregnancy interval (less than 12 months / 12 months or greater) between cases and controls (Fisher's Exact test p value =0.426). The odds ratio for pregnancy interval [Exp(B) = 0.448] did not reveal an increase in the likelihood of developing failure to thrive (95% Confidence interval 0.078- 2.569; p value = 0.367)

*Infant characteristics.* Among the cases and controls, age ranged from birth to 365 days; a bimodal value of 14 and 16 existed with a median of 118 days (refer to Figure 4); similarity was due to 1:1 matching on infant's age.



## Histogram of child's age among cases and controls



**Figure 4. Age of the case-control study sample (N=222).**

There was a significant difference in gender between cases and controls (Fisher Exact Test  $p$  value = 0.032). Fifty-eight percent of the infants diagnosed with failure to thrive were females and 42 percent were males. There were no significant differences in intrauterine growth between failure to thrive infants and healthy infants (Chi-square = 3.856,  $df = 2$ ,  $p$  value = 0.145). Among the total cases, 9.9 percent were large for gestational, 72.1 percent were appropriate for gestational age, and 18.0 percent were small for gestational age according to the Brenner growth classification (refer to Table 10). Infant gender among the controls consisted of 42 percent females and 58 percent males; 10.8 percent were large for gestational age, 80.2

were appropriate for gestational age, and 9.0 percent were classified as small for gestational age.

**Table 10. Brenner Growth for cases and controls**

		Frequency	Percent	Cumulative Percent
Valid	LGA			
	Cases	11	9.9	9.9
	Controls	12	10.8	10.8
	AGA			
	Cases	80	72.1	82.0
	Controls	89	80.2	91.0
	SGA			
	Cases	20	18.0	100.0
	Controls	10	9.0	100.0

### **Binary Logistic Regression**

*Binary logistic regression.* To analyze the second research question (Is prenatal care utilization a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders), binary logistic regression was performed. Through data pre-analysis screening, it was found that maternal education and pregnancy interval had greater than 10 percent missing information. These independent variables were excluded from the logistic regression analysis. Due to

matching of case and control subjects on race, insurance status, and infant's age, these independent variables were also excluded from logistic regression analysis. The remaining independent variables (gender and prenatal care utilization) were entered into the equation simultaneously. Dependent variable coding was as follows: failure to thrive infant = 0 and healthy infant = 1. The Cox and Snell R squared value quantified the proportion of the variance explained in the model; the variance explained in this analysis was only 2.5 percent. Regression coefficients are presented in Table 11.

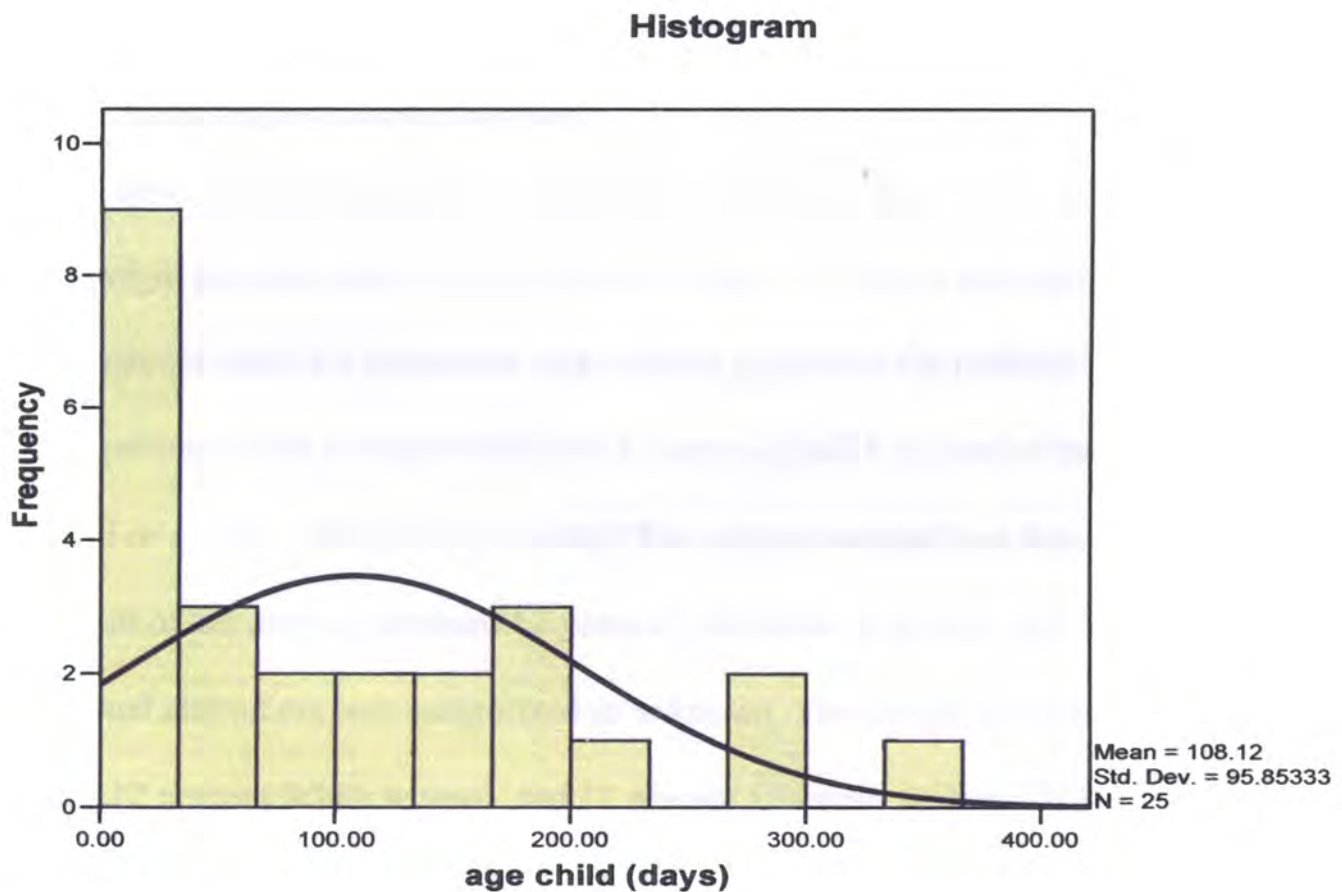
The odds for females developing failure to thrive were 1.834 [Exp(B) = 1.834] times higher than for males ( p value = 0.027, 95% Confidence interval 1.072 - 3.135). The odds ratio for mKessner [Exp(B) = 0.900] which was coded from 0 = adequate to 3 = none did not reveal an increase in the likelihood of developing failure to thrive. Thus, prenatal care utilization was not a significant predictor of failure to thrive when controlling for confounding variables (p value = 0.502, 95% Confidence interval 0.661-1.224).

**Table 11. Regression Coefficients**

	<i>B</i>	<i>Wald</i>	<i>df</i>	<i>p</i>	Odds Ratio
Gender	.606	4.905	1	.027	1.834
mKessner	-.105	.450	1	.502	.900
Constant	-.256	1.328	1	.249	.774

## Description of Maternal Bonding Characteristics of Failure to Thrive Infants

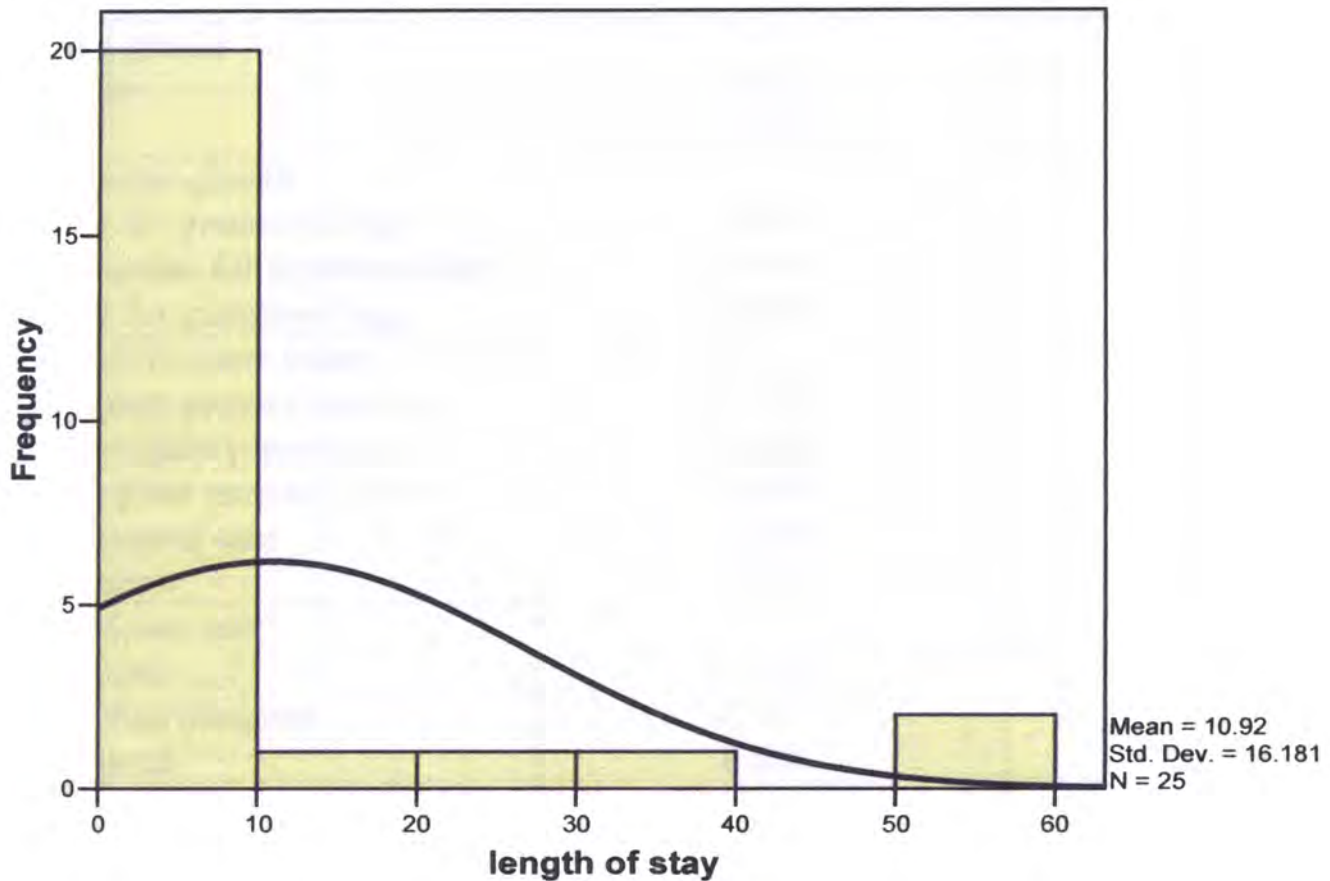
The third aim of this research was to describe maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits/calls, and discharge teaching) of infants who were hospitalized for failure to thrive. Descriptive statistics will be presented followed by data analyses. The sample (N=25) consisted of 15 females and 10 males between the ages of 9 – 342 days old (refer to Figure 5) that were hospitalized for failure to thrive. Length of hospital stay ranged from 1 – 60 days with the majority (80%) discharge within the first week (refer to Figure 6).



**Figure 5.** Age of the descriptive study sample (N=25)



## Histogram



**Figure 6. Infant length of hospital stay (days)**

A composite of descriptive statistics are outline in Table 12. Based on intrauterine growth, eight percent were large for gestational age, 72 percent appropriate for gestational age, and 20 percent small for gestational age. Sixteen percent of the mothers were 19 years of age or less, 76 percent of the mothers were 20-34 years old, and 8 percent of the mothers were 35 years old or greater. Thirty-two percent of the mothers attained less than 12 years of education, 40 percent of the mothers attained 12 years of education or greater, and 28 percent of maternal educational attainment was categorized as unknown. The sample consisted of 76 percent Black women, 12 percent White women, and 12 percent Hispanic women. Of the 25 mothers, 3 were married (12 %) and 22 were unmarried (88 %); insurance status was as follows: 24 percent private, 16 percent self pay / indigent, and 60 percent Medicaid.

**Table 12. Overview of the Study Variables Descriptive Statistics, Case-control and Descriptive Study Failure to Thrive Infants**

Characteristic	Inpatient and Outpatient Failure to Thrive Infants (n=111)	Hospitalized/Inpatient Failure to Thrive Infants (n=25)
Infant's gender		
Female	58%	60%
Male	42%	40%
Intrauterine growth		
Large for gestational age	9.9%	8.0%
Appropriate for gestational age	72.1%	72.0%
Small for gestational age	18.0%	20.0%
Modified Kessner index:		
Adequate prenatal care use	57.7%	52.0%
Intermediate prenatal care use	14.4%	16.0%
Inadequate prenatal care use	24.3%	24.0%
No prenatal care	3.6%	8.0%
Unknown	0.0%	0.0%
Prenatal care use:		
Adequate	56.8%	52.0%
Less than adequate	43.2%	48.0%
Unknown	0.0%	0.0%
Marital status		
Married	27.0%	12.0%
Unmarried	73.0%	88.0%
Maternal age		
≤ 19 years old	18.9%	16.0%
20-34 years old	71.2%	76.0%
≥ 35 years old	9.9%	8.0%
Maternal education		
<12 years	27.9%	32.0%
≥ 12 years	29.7%	40.0%
Unknown	42.3%	28.0%
Parity		
Zero	41.4%	32.0%
1 or 2	47.7%	56.0%
3 or more	10.8%	12.0%
Pregnancy Interval		
Less than 12 months	3.6%	8.0%
Greater than/equal 12 months	38.7%	36.0%
Missing data	57.7%	56.0%

*Maternal bonding behaviors.* There were no statistical differences in prenatal care utilization (adequate / less than adequate) between patient classification (inpatient / outpatient) of failure to thrive cases based on the case-control study (n=111) and descriptive study (n=25) (Fisher's exact test 0.491). Among the 25 infants who were hospitalized for failure to thrive, 52 percent received adequate prenatal care and 48 percent received less than adequate prenatal care. From the 12 subjects that received less than adequate prenatal care, frequencies of categories based on the modified Kessner index were as follows: 4 classified as intermediate, 6 classified as inadequate, and 2 classified as none (see Table 13).

**Table 13. Frequency and Percent of Modified Kessner Index, Failure to Thrive Infants (N=25)**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Adequate	13	52.0	52.0	52.0
Intermediate	4	16.0	16.0	68.0
Inadequate	6	24.0	24.0	92.0
None	2	8.0	8.0	100.0
Total	25	100.0	100.0	

Due to the presence of extreme outliers within the feeding method, infant length of stay, and frequency of visits/calls categories (see table 14), nonparametric statistical parameters were used. There were no significant difference between prenatal care use and infant length of stay (Mann-Whitney U test 74.5, p value = 0.85) or infant's age (Mann-Whitney U test 67.0, p value = 0.55). The majority (92%) of the infants were fed formula with the remaining 8 percent equally grouped between breastfeeding and other feeding methods. There was no significant difference between prenatal care use and feeding method (Chi-square 2.355, df = 2, p value = 0.308).

Eighty-four percent of the mothers visited or called frequently (measurement defined as almost daily contact) with 8 percent representing both categories of having irregular (1-3 calls / visits per week) and infrequent (does not call / visit) contact with their infant per week. Due to small number of subjects in the irregular and frequent groups, they were collapsed to 1 non-frequent category; there was no significant difference between prenatal care use and frequency of visits / calls (Fisher's Exact test p value = 1.000). Discharge teaching was 80% favorable and 20% unfavorable among the total 25 subjects. Based on this data, there was no significant difference between prenatal care use and discharge teaching (Chi-square 0.361, df = 1, p value= 0.645).

Table 14. Percent of Study Variable, Hospitalized Failure to Thrive Infants (N = 25)	
Study Variable	Percent
Prenatal Care Utilization	
Adequate	52.0%
Less than adequate	48.0%
Feeding Method	
Breastfed	4.0%
Bottle fed (breast milk)	0.0%
Bottle fed (formula)	92.0%
Other	4.0%
Length of stay (days)	
Less than 3 days	36.0%
4-7 days	44.0%
8-33 days	12.0%
34-60 days	8.0%
Frequency of visits / calls by mother	
Frequent (almost daily contact)	84.0%
Irregular ( 1-3 times per week)	8.0%
Infrequent (does not/difficult to contact)	8.0%
Discharge Teaching	
Favorable	80.0%
Neutral	0.0%
Unfavorable	20.0%



## **Chapter 5**

### **Summary and Conclusions**

#### **Conclusions and Interpretations**

This study used an academic health sciences center sample to test prenatal care utilization as a predictor of failure to thrive, while accounting for maternal sociodemographic, environmental, and infant characteristics. The specific aims of the study were: 1) to examine the differences of prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) between failure to thrive infants and healthy infants, 2) to test prenatal care utilization as a predictor of failure to thrive when maternal sociodemographic characteristics (age, educational attainment, parity, and pregnancy interval), environmental (marital status) and infant characteristics (intrauterine growth and gender) are accounted for as potential confounders, and 3) to describe maternal bonding characteristics (prenatal care use, infant length of hospital stay, feeding method, frequency of visits / calls, and discharge teaching) of infants who were hospitalized for failure to thrive.

Identifying indicators that may predispose infants to subsequently developing failure to thrive are important health issues. The etiology of failure to thrive is often diverse and should be viewed as a result of numerous factors or interaction of factors. Based on this study design, it was not feasible to incorporate every variable that may influence failure to thrive; however, an attempt was made to include variables that were: 1) significant to the population studied, 2) reported as having an association with failure to thrive in historical and/or contemporary

research studies, and 3) beneficial in answering the research questions. Inclusion of additional environmental variables was limited due to the methodology and availability of variables in the data bases.

Preliminary analysis of prenatal care utilization suggested that the Modified Kessner index was independently associated with infant health status (failure to thrive infant versus healthy infant). Given the study hypothesis and lack of normally distributed data, nonparametric testing of a dichotomous prenatal care utilization variable found that there were no significant differences in prenatal care utilization between cases and controls. Since there were no statistical significance differences in the adequacy of prenatal care utilization between failure to thrive infants and healthy infants, the null hypothesis was not rejected at the alpha .05 level of significance, concluding that the data did not support the study hypothesis that mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are significantly more likely to have failure to thrive infants than healthy infants.

Through pre-analysis screening it was found that both prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) and gender were independently associated with failure to thrive. However, when controlling for confounding variables, statistical significance was no longer significant for the Modified Kessner index measuring the adequacy of prenatal care utilization. Gender remained a predictor of failure to thrive. Given that prenatal care utilization did not remain significant, the null hypothesis was not rejected at alpha .05 level of significance; concluding that the data did not support the study hypothesis that prenatal care use would predict failure to thrive.

From this study, additional findings suggested that there were no significant differences between prenatal care use and infant length of stay, feeding methods, frequency of visits / calls,

or discharge teaching for infants who were hospitalized for failure to thrive. The interpretation and summary of findings of this research study are derived from maternal sociodemographic, environmental, and infant characteristics of failure to thrive.

The study sample was based upon mothers who resided in Charleston County, delivered a live birth and received pediatric medical services at the Medical University of South Carolina. The majority of the sample was multiparous unmarried Black women between 20-34 years old who received Medicaid and adequate prenatal care. Given that failure to thrive is not considered a phenomenon limited to poor children, several potential confounding variables were accounted for in this case-control study design. Failure to thrive cases were matched with healthy control infants in an outpatient setting. One control subject was selected for each failure to thrive case, matched on the following variables: maternal race, insurance status, and infant's age. The matching controlled for the confounding effects of these independent variables documented in the review of literature.

### **Research Variables**

*Prenatal care Utilization.* The measurement of adequacy of prenatal care utilization between failure to thrive infants and healthy infants was significantly different. Percentages for cases and controls according to categories were as follows: (a) adequate use 57.7 percent versus 52.3 percent, (b) intermediate use 14.4 percent versus 26.1 percent, (c) inadequate use 24.3 percent versus 18.9 percent, (d) no prenatal care 3.6 percent for cases, (e) unknown 2.7 percent for controls. This study found that there was an independent association between prenatal care use (based on the Modified Kessner index) and infant health status (failure to thrive infant versus healthy infant). By logistic regression analysis, prenatal care utilization was not a significant factor that predicted failure to thrive when controlling for confounding variables.

This study found that there were no significant differences in prenatal care utilization (based on adequate prenatal care use and less than adequate prenatal care use) between cases and controls. Among the cases, 56.8 percent received adequate prenatal care utilization while 43.2 percent received less than adequate. Fifty-two percent of the controls received adequate prenatal care utilization, 45 percent received less than adequate, and 2.7 percent remained unknown. The results of a 2-sided Fisher's Exact test found no statistical differences in prenatal care use between cases and controls ( $p=0.588$ ). This finding concurs with previous studies that measured prenatal care use among mothers with failure to thrive infants (Altemeier et al., 1985; Herman-Staab, 1992; Kelleher et al., 1993). Herman- Staab (1992) found that there was no association between trimester prenatal care began and nonorganic failure to thrive (inclusion criteria for case & controls were as follows: WIC program from birth to 12-24 months; birth date between 1983-1986, gestational age at birth 36 weeks or greater, birthweight above 25<sup>th</sup> percentile, and absence of chronic/episodic disease). Kelleher and colleagues (1993) conducted a three year prospective case-control study of low birth weight, preterm failure to thrive infants finding no differences in use of prenatal care (defined by percent none or 3<sup>rd</sup> trimester) between failure to thrive and non-failure to thrive infants. Limited research is reported on pregnancy experience, with respect to the maternal health seeking behavior of prenatal care use, among mothers with failure to thrive infants; findings from this study will contribute to the existing body of pediatric failure to thrive research.

According to the 2002 U.S. birth data (Martin et al, 2003), 78.4 percent of South Carolinian woman begin care in the first trimester versus 4.7 percent receive late (prenatal care beginning in the 3<sup>rd</sup> trimester) or no care. Racial differences exist as 82.5 percent white women receive prenatal care in the first trimester compared to 70.3 percent for black women. Late or no care is

higher among black women (7.1%) versus white women (3.4%). Based on the 2002 U.S. live birth data (Martin et al., 2003), timing of prenatal care utilization (receiving prenatal care in the 1<sup>st</sup> trimester) has gradually improved by 10 percent over the past decade (83.7% for all races in 2002 versus 75.8% for all races in 1990).

Although the month that prenatal care began is a useful measurement of timing, adequacy measurements of prenatal care use are beneficial to determine appropriateness of care in that these indices take into account the number of prenatal care visits and/or gestational age at delivery. In 2002, prenatal care utilization in the U.S. for all races was as follows: 31.9% intensive use, 42.8% adequate, 14.0% intermediate use, and 11.3% inadequate use (Martin et al., 2003). This academic health sciences center study found the sample's adequacy of prenatal care (55.7%) was below the U.S. vital statistics rate of at least adequate use (74.6%).

This comparison was made based on this studies measurement of adequacy of prenatal care use through the Modified Kessner index and the 2002 data on U.S. births utilizes the Adequacy of Prenatal Care Utilization (APNCU) Index. The preceding indices have the following comparable attributes: basis for standard (ACOG), adequate start of care (1-3 months), adequate number of visits at 40 weeks (9), separate missing and no care categories, and no risk modifications. The APNCU has an intensive visit category whereas the modified Kessner does not; however, when grouping the categories to report the percentage of mothers who received at least adequate this component was not problematic.

*Maternal age and marital status.* The majority of mothers among cases and controls were between the ages of 20-34 years old (71.2 % versus 64.9%). Maternal age 19 years or younger was 18.9 percent for cases and 27.0 percent for controls; while women 35 years old or greater accounted for 9.9 percent of the cases and 8.1 percent of controls. Based on this data, there

were no statistical significant differences in maternal age between failure to thrive infants and healthy infants ( $p=0.348$ ). This finding is in concurrence with previous studies (Kotelchuck & Newberger, 1983; Stier et al., 1993). In a retrospective case-control study ( $N=438$ ) researchers (Stier et al., 1993) found that children of younger mothers (18 years or less at birth) were not significantly more likely to experience failure to thrive than were children born to mothers who were older than 18 years ( $RR=1.67$ , 95% CI 0.75-3.73). Concurrence is found in a nine-month prospective study that limited subjects to premature infant who had low birth weight (Kelleher et al., 1993) suggesting that maternal age was not a significant factor in the development of failure to thrive; mean maternal age was 24.5 for mothers of failure to thrive infants ( $N=180$ ) versus 24.9 for mothers of non-failure to thrive infants ( $N=591$ ).

This study found no significant differences in marital status between cases and controls. The majority of women in both groups were unmarried (73% cases versus 78.4% controls); this finding concurs with the majority of births to unmarried women by race in the United States in addition to previous failure to thrive research. Based on the recent vital statistics (Martin et al., 2003), births to unmarried mothers among all ages and race is 34 percent (28.5% for Whites and 68.2% for Blacks, and 43.5% Hispanic). The birth rate for unmarried women has essentially remained stable since 1995; a wide variability exists based on race (black and white) and Hispanic origin. Kotelchuck and Newberger (1983) found no significant differences between infantile failure to thrive cases and healthy controls in regards to age of parents, martial status, duration of marriage, family size, and index of birth order. This study concurs with researchers who support that martial status has not been shown to have an independent association with failure to thrive (Casey, 1987; Kelleher et al., 1993; Mitchell et al., 1980).

*Maternal race and insurance status.* The effect of race and insurance status (in addition to child's age) could not be statistically tested due to the matched case-control design. The majority of this study sample consisted of Medicaid subjects (67.6%), private insurance and self-pay/indigent subjects were within a 0.072 margin of each other (19.8% and 12.6%, respectively). In this study, most of the women were Black (68.5%); 18.9 percent were White women, 12.6 percent were Hispanic, and 0.9 percent were Other. The predominant black race among cases and controls is not an unusual finding given the geographical location and setting. However, it is important to interpret these descriptive findings with caution in that failure to thrive does not limit itself to poverty or ethnic subgroups.

In 2002, the birth rate among Whites was 13.5 live births per 1,000 women aged 15-44 years versus 15.7 for blacks (a decrease from year 2000 of 13.9 and 17.0 for respective groups). With regards to prenatal care, according to Aday (2001) ethnic disparities persist in that the percent of black (7.3%) and Hispanic (6.2%) women not having adequate prenatal care remains two times that of whites (3.2%). Hulseley (2001) found that black ethnicity was reported as a predictor of late/no prenatal care. This study accounted for ethnic differences black, white, and Hispanic subgroups for prenatal care utilization and infant health outcomes in that subjects were matched on a 1 to 1 basis in terms of maternal race.

*Maternal educational attainment.* Previous research suggests that lower educational status and conflict-driven partnerships are attributes of mothers with failure to thrive infants (Bithoney & Newberger, 1987; Steward & Garvin, 1997); yet these differences are not distinct enough to explain the development of this disorder. This study found that the level of maternal education was unknown for 42.3 percent of the cases and 64.9 percent of the controls. Due to this missing data, statistical differences were not calculated. However, descriptive statistics found that

among the cases 27.9 percent attained less than 12 years of education and 29.7 percent attained high school degrees and higher education. Compared to 14.4 percent of the controls having attained less than a high school education and 20.7 percent achieving 12 years of education or greater. These findings are similar to Kelleher and colleagues (1993) research that found maternal educational attainment at the college level a significant risk factor for failure to thrive (RR=2.12). However, Pollitt and Eichler (1976) reported that based on a case control study (matched on age, gender, and race) findings suggested that the failure to thrive group had a lower mean maternal education. Herman-Staab (1992) found no differences in maternal educational level between nonorganic failure to thrive cases and healthy controls.

*Parity and pregnancy interval.* This study found no significant difference in parity between mothers of the failure to thrive and healthy infants less than one year old. This finding concurs with previous reports that examined the relationship of parity and birth order finding no significant differences between cases and controls (Kotelchuck & Newberger, 1983; Herman-Staab, 1992). This study found that 4 case mothers (3.6%) experienced a pregnancy interval of less than 12 months versus 2 control mothers (1.8%). Among failure to thrive infants, 43 mothers (38.7%) reported a pregnancy interval of greater than or equal to 12 months versus 48 mothers (43.2%) of healthy infants. This study found no statistical significant difference between pregnancy interval and infant health status.

*Child characteristics.* This study found that 78.4 percent of the failure to thrive cases were classified as an outpatient and 21.6 percent were inpatient cases; Krugman and Dubowitz (2003) report that hospitalization of failure to thrive is rarely required. Given that the majority of infants were younger than 3 months old, severity of failure to thrive as well as concerns for safety may have attributed to this study hospitalization rate. In this study, limiting the inclusion



criteria for age less than 12 months allowed for a more homogeneous subject population based on age. This study concurs with researchers who have found that failure to thrive is predominantly a syndrome of early infancy (Kotelchuck & Newberger, 1983; Skuse, Reilly, & Wolke, 1994; Wright, 2000; Jolley, 2003).

This study sample consisted of a bimodal distribution of age (14 and 16 days) with a median value of 118 days (16.8 weeks). The median value of 16.8 weeks for infant age concurs with existing research. A prospective case-control study conducted by Lobo, Barnard, and Coombs (1992) reported child's age as follows: 16.2 weeks for failure to thrive, 23.5 weeks for protein calorie malnutrition, 20.8 weeks for nonorganic failure to thrive, and 8.6 weeks for organic failure to thrive.

This research gathered information of intrauterine growth based on the Brenner growth classification system in that birthweight as a sole indicator is often not sensitive enough to identify intrauterine growth retardation in full-term infants (Steward, 2001; Jolley, 2003). Examining the measurement of body proportionality at birth is suggested to provide an aspect of vulnerability for infant growth failure that may not be accounted for based on birthweight. This study found no significant difference in intrauterine growth between cases and controls. The majority (N=222) of subjects were categorized as appropriate for gestational age (76.1 %); 72.1 percent for cases compared to 80.2 percent for controls. Eighteen percent of the failure to thrive infants were small for gestational age compared to 9 percent for healthy infants. This study sample concurs with the prevalence rate of intrauterine growth retardation (IUGR) in the US (8.6%); infants categorized as having IUGR are also referred to as small for gestation age (Jolley, 2003). Comorbid conditions associated with IUGR may contribute to pediatric undernutrition and growth failure as a result of increased caloric needs. In review of the

literature, no comparison studies were found to compare the results of intrauterine growth and failure to thrive in infancy as birthweight / gestational age were predominantly reported.

According to the National Vital Statistics Report, gender ratio has remained comparatively stable over the past 50 years; there were 1,048 live male births for every 1,000 female live births in 2002 (Martin et al., 2003). Difficulties exist in comparing study findings of gender as an indicator of failure to thrive, among both historical and contemporary studies, due to differences in demographic variables and research methodology. This study found that the failure to thrive sample consisted of 58 percent female infants. Among the cases, 64 subjects were females and 47 were males. Whereas, the healthy control group consisted of 47 females and 64 males. There were significant differences in gender between failure to thrive infants and healthy infants. These findings concur with smaller studies (Lobo et al., 1992) that reported female gender a predominant finding of failure to thrive infants (10 females and 2 males). However, a larger epidemiologic study (N=312) by Mitchell and colleagues (1980) found more female failure to thrive children; yet, the results were not statistically significant. The researchers suggested that the rationale for these findings were suggested to be that males recovered both weight and height parameters faster than females during early childhood years.

Altemeier and colleagues (1985) prospective study found that infant gender did not correlate with nonorganic failure to thrive. Kelleher and colleagues (1993) found no differences between groups for gender (52% males for FTT versus 47.9% non-FTT) among low birth weight, preterm infants. A structured interview case-control study (consisted of 84 subjects with 71% less than 12 months of age, 83% predominantly white with 67% of the families not receiving federally funded medical assistance) found a greater proportion of males as a feature of failure to thrive infants (Kotelchuck & Newberger, 1983). Herman-Staab's (1992) case-control study

derived from 39 percent Caucasian and 61 percent Other (95% Black, 4% Hispanic, and 1% Indochinese), 23 nonorganic failure to thrive, and 69 healthy control infants less than 24 months found that case infants were more likely to be male and to have been breast-fed than control infants.

*Maternal bonding behaviors.* This study found that among 25 infants hospitalized for failure to thrive, there were no significant differences in maternal bonding behaviors (as evidenced by prenatal care use, infant length of stay, feeding method, frequency of calls/ visits, and discharge teaching). Maternal sociodemographic characteristics were similar to the larger study sample with the majority consisting of unmarried (88%), black (76%) women between the ages of 20-34 years that received Medicaid (60%) and adequate prenatal care (52%).

This study found no statistically significant differences between prenatal care use and length of stay or infant's age. Based on the 25 hospitalized infants less than 12 months of age, 52 percent received adequate prenatal care. Of interest, this result is less than the larger study sample (n=111) utilization measure of prenatal care (56.8 % received adequate prenatal care) for failure to thrive infants suggesting that adequate prenatal care may be a protective factor for reducing the occurrence of hospitalization among failure to thrive infants. However, Chi-square analysis found no statistical differences in prenatal care utilization (adequate / less than adequate) between patient classification (inpatient / outpatient) of failure to thrive infants (Fisher's exact test p value = 0.491).

This study did not find the method of feeding to be associated with hospitalized failure to thrive infants less than 12 months of age. The majority (92%) of infants was formula fed upon admission and throughout their hospital stay; there were no significant differences between prenatal care use and feeding method. Failure to gain weight in the exclusively breastfed infant

is often a perplexing case; the benefits of breastfeeding may be noted in this study as only 4 percent of the infants who failed to thrive were breastfed. Given that 23 out of 25 infants were formula fed the sample was considered homogenous with respect to feeding method. An additional benefit derived from this sample is that interpretation of results among mainly formula fed infants reduced the potential of maternal (physiological) and/or infant (slower weight gain between 3-12 months) factors that may be attributed to failure to thrive breast fed infants (Stein, Kessler, & Hubbard, 2002).

This study found no significant differences between prenatal care use and frequency of visits/calls. Based on the review of literature, an unsupportive environment and maternal unresponsiveness or lack of acceptance is suggested to be a component of failure to thrive. This study found that 84 percent of the mothers visited or called frequently (recorded as almost daily contact), 8 percent had irregular contact (1-3 calls/ visits per week) and 8 percent had infrequent (does not call / visit) contact with their failing to thrive infant. These findings do not support the prominent longstanding attribute of nonorganic failure to thrive that is suggested to be equated with emotional deprivation measured by the study variable. However, caution is warranted in interpreting these results in that the quality or duration of the maternal-infant interaction was not measured given the variables / data available in review of chart records. The study variable was specific to frequency of maternal calls or visitations throughout the failure to thrive infant's hospital stay.

Growth fostering situations are suggested to contribute to the dynamics of the maternal-infant relationship; in addition to maternal adaptation style, sensitivity to infant cues, and alleviation of the infants' distress (Kessler & Dawson, 1999; Steward, 2001; Sumner & Spietz, 1994). This study examined discharge teaching as a component of maternal bonding behaviors

in relation to infants who were hospitalized for failure to thrive. Based on chart review, documentation of maternal response of discharge teaching information was 80% favorable and 20% unfavorable. Mothers received a favorable score in discharge teaching by demonstrating progress in attaining child care skills as evidenced by appropriate questions and/or verbalizing understanding of discharge teaching information. There were no mothers who received a neutral score (discharge teaching tasks were correctly performed with attainment of minimum skills and/or minimal interest expressed). However, this study found 20 percent (5 out of 25 subjects) of the cases received documentation of an unfavorable (as evidenced by the mother's expressed lack of interest in child care and failure to learn skills) discharge teaching status. This study found no significant differences between prenatal care use and discharge teaching. Based on adequate prenatal care use, 11 mothers demonstrated favorable discharge teaching behaviors and 2 mothers demonstrated unfavorable discharge teaching behaviors. Less than adequate prenatal care, 9 mothers received favorable discharge teaching and 3 mothers received unfavorable discharge teaching. These findings are unreported in the review of literature and may suggest that mothers of infants hospitalized for failure to thrive demonstrate favorable maternal bonding behaviors based on the operational definitions of this study.

### **Discussion of Hypotheses**

The following discussion will be guided by a review of the study hypotheses: mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are significantly more likely to have failure to thrive infants than health infants, inadequate prenatal care use is a predictor of subsequent failure to thrive, and mothers who receive less than adequate prenatal care demonstrate less than favorable bonding behaviors with their hospitalized failure to thrive infants. Preliminary analysis of prenatal care utilization suggested

that there was a significant difference in prenatal care use (measuring the adequacy of prenatal care utilization from ordinal data) between failure to thrive infants and healthy infants.

Statistical analyses that accommodated the study hypothesis and data that were not normally distributed found no statistical significance differences in the adequacy of prenatal care utilization between cases and controls failing to reject the null hypothesis at the alpha .05 level of significance. In conclusion, this study found that the data did not support the study hypothesis that mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) are significantly more likely to have failure to thrive infants than healthy infants.

Binary logistic regression further validated the finding that adequacy of prenatal care use was not an indicator of failure to thrive. Initially, pre-analysis screening found that both prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care; modified Kessner) and gender were independently associated with failure to thrive. Controlling for the effects of these confounding variables in relation to the dependent variable (failure to thrive infant versus healthy infant) revealed that the statistical significance was no longer significant for prenatal care utilization (Modified Kessner); however, gender remained a predictor of failure to thrive. This study also concluded that mothers who receive less than adequate prenatal care did not demonstrate less than favorable bonding behaviors with their hospitalized failure to thrive infant.

### **Limitations**

Strengths of this research were related to case-control methodology that reduced Berkson's bias. Obtaining a healthy control subject from an outpatient primary care facility was

performed to investigate the effects of the study variables. The selection of healthy, outpatient control subjects matched on age, race, and insurance status strengthened the value of this report.

Limitations of this study may be related to the inability determine underlying, chronic disease states that may consequentially lead to failure to thrive. Given that the ICD-9 classification for failure to thrive (revised in 2001) does not distinguish organic FTT (OFTT), nonorganic FTT (NFTT), and mixed FTT categories, this study did not differentiate these clinical conditions. However, classifications issues have been addressed in previous research studies. Kelleher and colleagues (1993) conducted a prospective cohort study that incorporated clinician coding of FTT into three categories. Clinical descriptions of failure to thrive coded as organic (OFTT) resulted directly from the presence of physical disease. Nonorganic FTT (NFTT) was coded in the absence of a known specific biological disease state; mixed FTT was a coded when both OFTT and NFTT were contributing factors to a child's faltering growth. Based on this previous research, results were as follows: 12 percent were coded as organic FTT, 16 percent were coded as mixed, and 72 percent were coded as nonorganic FTT or unknown. Nearly half (48%) of the NFTT cases and 65 percent of the OFTT/ mixed cases were diagnosed before 12 months of age. This study was derived from a single failure to thrive diagnostic / billing code during 2001-2004; this unspecified classification of the condition should not have limited the interpretation of findings.

Additional limitations to be considered, prenatal care utilization may be considered both an intervention and an indicator of maternal health seeking behavior, signifying a set of personal beliefs and activities related to pregnancy and the value of health care (Alexander & Cornely, 1987). The effects of prenatal care utilization may indicate its benefits or reflect differences in maternal characteristics according to self-selected groups. According to Alexander and Cornely

(1987), variations in prenatal care utilization may be attributed to the following aspects: accessibility, availability, and perceived desirability. Based on this study's conceptual model and operation definition, prenatal care utilization was not found to be an indicator of failure to thrive. Aspects of the theoretical framework, implications for nursing, and recommendations are further addressed in this research.

### **Theoretical Framework**

Failure to thrive is a complex phenomenon that is suggested to occur as a result of the interaction of multiple factors (Kessler & Dawson, 1999; Jolley, 2003; Steward, 2001). A salient dimension of failure to thrive is a dysfunctional maternal-infant interaction that may be attributed to maternal, infant, or environmental factors. The Child Health Assessment Model is a widely recognized theoretical framework that is used to guide failure to thrive research. This model established a conceptual perspective for investigating the maternal-infant interaction with respect to the maternal health seeking behavior (prenatal care utilization) and subsequent failure to thrive in infancy; in addition, guided the descriptive assessment of maternal bonding characteristics of infants who were hospitalized for failure to thrive.

Barnard and Eyres (1979) model is an appropriate model to guide failure to thrive research, but not for non-observational studies. The theory that adequacy of prenatal care utilization would subsequently predict failure to thrive was not supported in this study based on the operational definitions and study design. The perspective that failure to thrive in infancy may result from a maternally induced breakdown of maternal-infant bond formation is well reported in the review of literature; however, measuring the interaction through the variables of this study did not capture this effect. Based on the Cox and Snell R squared value (2.5%), 97.5 percent of the predictive independent variables of failure to thrive remained unaccounted for



based on the study variables. This large percentage may have been a result of the limited access of measuring maternal, infant, and environmental characteristics of failure to thrive through secondary data analysis methodology. Although this study found differences in prenatal care utilization (based on the number of prenatal care visits and the gestational age at entry into prenatal care) and gender, these differences and the effect on infant health status were not distinct enough to explain the development of failure to thrive.

The descriptive components of this study did not report that prenatal care utilization was associated with specific maternal bonding behaviors of infants who were hospitalized for failure to thrive. Incorporating a more qualitative aspect of maternal bonding in addition to the study variables may provide a more holistic, interactional framework in future studies. Including maternal and infant variables that measure the quality of attachment relationships may contribute to a better fitting model in future studies guided by Barnard and Eyres' (1979) theoretical model. Capturing an interactional aspect of maternal-infant bonding and attachment through observational studies may provide better model fit indices. Previous research that examined various aspects of parenting bonding (touching the child, commenting favorably on the child's appearance / health / behavior, feeding with sensitivity, and asking appropriate questions) found that lack of prenatal care was associated with deficits in parenting (Giblin, et al., 1988). Incorporating these aspects into this study may provide a more robust model.

Model fit indices and variances may be enhanced by including both quantitative and qualitative methodology that examines the association of prenatal care and maternal-infant attachment relationships that subsequently lead to failure to thrive. Future studies examining differences in prenatal care utilization should also incorporate the methodology of structural equation modeling that includes the number of hospitalizations for failure to thrive infants.

As the dimensions of failure to thrive are multifaceted and interactive, including attachment constructs in the assessment of failure to thrive infants provided a holistic framework. Theory building that incorporated the context of maternal-fetal/infant attachment constructs was an important aspect of failure to thrive research. This study that examined maternal health behaviors, such as the measurement of adequacy of prenatal care utilization, as a proxy indicator of maternal-infant attachment among failure to thrive infants and healthy infants provided a foundation for future research and theory testing.

### **Implications for Nursing**

This study was important to nursing and society in that understanding the relationship of maternal investment in prenatal care and failure to thrive may lead to the refinement of risk assessment and care protocols for maternal-child health services in an effort to reduce health disparities. If mothers who sought less than adequate prenatal care (late entry into care and inadequate number of visits) were found to be subsequently more likely to have failure to thrive infants after controlling for confounding variables, efforts to promote prenatal care as a maternal health seeking behavior that fosters maternal-fetal/infant attachment would be of importance for nursing to target high risk populations at risk for failure to thrive. This study found that there were differences in prenatal care utilization between failure to thrive infants and healthy infants; however, prenatal care utilization was not found to be a predictor of failure to thrive after controlling for confounding effects of other risk factors.

Based on this study, mothers who received at least adequate prenatal care were considerably below the national results (55.7% versus 74.6%). Measures to address inadequate prenatal care use are of great importance. Martin and colleagues (2003) report that there have been modest improvements in the percent of women with inadequate prenatal care since 2001 (decline from

11.6 % to 11.3%). The benefits of prenatal care are well reported in the review of literature. Hulseley and colleagues (1991) found that prenatal care is strongly associated with improved pregnancy outcomes with trends consistent across maternal risk and utilization categories. Further replication studies are needed for examining the benefits of prenatal care use in relation to failure to thrive.

This research provides direction for future studies that examine maternal health seeking behaviors (adequacy of prenatal care use) as a proxy for attachment in pediatric failure to thrive. Theoretical frameworks need to be constructed to provide a foundation for rigorous data analysis and findings. Groundwork for a theoretical model that explore prenatal care use and failure to thrive needs to capture variables that focus on the ecological nature of growth failure during infancy and early childhood (< 18 months of age) in the home setting through a structured interview case-control design. Future research should expand upon the quality of interactions among maternal bonding, nutritional intake and the care-giving environment (Chatoor et al, 2004; Solchany & Barnard, 2001; Steward, 2001). Identifying at risk groups and risk factors for growth failure are important in limiting the physical and cognitive sequelae of failure to thrive. Researchers suggest that various psychological factors (problematic and conflictual maternal-child feeding and play interactions) often contribute to a lower cognitive development in young children (Chatoor et al., 2004). The adverse intellectual outcomes are significant from a maternal-child and societal perspective.

The investigation of differences in prenatal care utilization between failure to thrive infants and healthy infants remains an understudied area; additional studies are needed to further examine the effects and interactions among variables. The significance of findings from this study were not statistically significant (when controlling for confounding variables) to support

the early intervention needs of infants at risk for growth and developmental delays due to inadequate prenatal care utilization. However, the clinical significance of results may be of importance.

### **Recommendations**

The following topics are suggested as areas of future research in pediatric failure to thrive. Inclusive of measuring adequacy of prenatal care, developing and testing a tool that measures the quality of care and content provided (newborn care, infant feeding, growth and development) would be of interest in pediatric failure to thrive research. Williams and Pinnington (2003) found that knowledge of national infant feeding and weaning guidelines was limited suggesting that recommendations were not widely understood / being recognized. These factors may have an impact on the advice provided to parents that consequentially lead to pediatric undernutrition and failure to thrive. Including a variable that measures if the mother/family perceives that health care providers are “listening and acknowledging their concerns” is suggested as an important factor among families of failure to thrive children. Thomlinson (2002) found that that nurses and doctors who listened and acknowledged that they trusted the family were respected and valued by caregivers. Signifying the importance of cultural competency in an era of health disparities, health care providers need to be attentive to the impact of their verbal /nonverbal behaviors on families.

This study included a feeding method in the descriptive aspect of maternal bonding characteristics. However, incorporating more specific measurements of infant feeding (having the mother/caregiver complete a feeding questionnaire) and feeding / teaching scales (measured through the Nursing Child Assessment Feeding Scales and the Nursing Child Assessment Teaching Scales) may be of value in replication studies (Sumner & Spietz, 1994). Researchers

have found that inefficient feeding is a factor that is suggested to predict postnatal growth (Ramsay et al., 2002). Drewett and colleagues (2003) found that mothers of failure to thrive infants fed the child as much or more than controls (inclusive of reporting no differences in the energy density of foods consumed); however, failure to thrive children had a greater tendency to refuse/reject the offered food and fed themselves significantly less often than non-failure to thrive children.

Failure to thrive research that incorporates measurement of maternal health seeking behaviors, such as prenatal care utilization, as a proxy for maternal-infant attachment should consider analytical models that incorporating touch patterns and prenatal care use. Researchers found that proximity and touch are disturbed in children who fail to thrive (Feldman, Keren, Gross-Rozval, Tyano, 2004); fundamental maternal-child relationship difficulties were related to the findings that reduced maternal touch, unintentional, and negative touch were correlated with similar touch patterns of the child. Feldman and colleagues (2004) study found that touch patterns may serve as risk indicators of potential failure to thrive; reinforcing the significance of the reciprocal nature of the maternal-child interaction and detrimental outcome of dysfunctional attachments.

This affirmative link between positive touch in the regulation of physiological growth and development during infancy is consistent with Chatoor's (2004) findings that mother and child play is suggested to be related to efficacious feeding. Methodology that incorporates patterns of proximity and touch (such as: play interaction, proximity, touch patterns, dyad's response to touch, and gaze pattern) in the home environment and/or office setting in addition to narrative information of prenatal care utilization and maternal attachment relationships between failure to thrive infants and healthy infants may be fruitful areas of research (Black, Cureton, &

Berenson-Howard, 1999). Examining a child's touch of mother and maternal touch are both important aspects to include when evaluation the maternal-child relationship. A child's capacity for intimacy is suggested to develop in within the reciprocal regulation of closeness in the maternal-child relationship (Carlson, Sampson, & Stroufe, 2003).

Lastly, measuring the effect of unwanted pregnancy in a replication study (matched on child's age, race, gender, and insurance status) would be of interest given the large percentage of women who received less than adequate prenatal care. Based on a study of familial characteristics of failure to thrive, Kotelchuck and Newberger (1983) found no significant differences emerged between cases and controls in response to questions about the mother's pregnancy (prematurity, feelings of physical condition during pregnancy, and wantedness of child); however adequacy of prenatal care was not a component of the study design. Specification of wanted child (no/ambivalent/yes) is an important factor to examine in relation to timing of prenatal care. Hulsey (2001) reported that unwanted pregnancy was found to be a predictor of late/no prenatal care. In summary, the implications for academia, practice, and research based on the above discussion of recommendations provide an ecological, interactional framework for the exploration of factors that may effect (directly or indirectly) growth failure in infancy.

### **Summary**

This case-control study has examined differences in prenatal care utilization between failure to thrive infants and healthy infants less than 12 months of age and tested prenatal care use as a predictor of failure to thrive. This research has described maternal bonding behaviors of infants who were hospitalized for failure to thrive. Using a conceptual model from Barnard and Eyres (1979), maternal sociodemographic characteristics (prenatal care utilization, age, education,

parity, and pregnancy interval), and environmental factors (marital status), and infant characteristics (intrauterine growth and gender) were included in the study and accounted for as potential confounding variables. The study was conducted using the Medical University of South Carolina Perinatal Information System, Keane System, and Practice Partners databases from 1997-2004 and 2000-2004; respectively.

Prenatal care utilization was not found to be a predictor of failure to thrive after controlling for confounding effects of other risk factors. Gender was found to be significantly associated with failure to thrive after controlling for study variables. The odds for females developing failure to thrive were 1.834 times higher than for males. In summary, maternal child health advocates recommend adequate prenatal care use. Preliminary data from this study found that prenatal care utilization may be associated with infant health status (failure to thrive infant / healthy infant); however, further data analyses did not provide statistical evidence that this variable was a strong predictor of failure to thrive.

<b>Data Collection Form: Prenatal Care Utilization as a Predictor of Failure to Thrive</b>		
<b>Identifier Number:</b>		
<b>Date:</b>		
<b>Primary Investigator:</b>		
<b>Study Variable:</b>	<b>Findings:</b>	
<b>Prenatal Care Use</b>		
Yes = adequate		
No = less than adequate		
mkessner (as listed in data base)		
<b>Length of stay (days)</b>		
Number of days		
Unknown		
<b>Feeding method</b>		
Breastfed		
Bottle fed (breast milk)		
Bottle fed (formula)		
Other		
<b>Frequency of visits/calls by mother</b>		
	Week One	Last week
Frequent (almost daily contact)		
Irregular (1-3 per week)		
Infrequent (does not/difficulty to contact)		
<b>Discharge Teaching</b>		
Favorable		
Neutral		
Unfavorable		



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