CHILD-RELATED PARENTING STRESS AND MATERNAL RESPONSIVITY IN MOTHERS OF CHILDREN WITH INTRAVENTRICULAR HEMORRHAGE

By

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TABLE OF CONTENTS

| ACKNOWLEDGMENTS | .................................................. | ii |
| ABSTRACT | .................................................. | vi |
| CHAPTER 1: LITERATURE REVIEW | .................................................. | 1 |
| Introduction | .................................................. | 1 |
| Overview: Intraventricular Hemorrhage in Infancy | .................................................. | 2 |
| Intervention Programs | .................................................. | 10 |
| Maternal Responsivity | .................................................. | 21 |
| Gaps in Maternal Responsivity Research on Mothers of Children with Disabilities | .................................................. | 33 |
| Parenting Stress | .................................................. | 36 |
| Impact of Demographic Variables | .................................................. | 43 |
| Focus of the Current Investigation | .................................................. | 51 |
| Hypotheses | .................................................. | 52 |
| CHAPTER 2: METHODS | .................................................. | 53 |
| Subjects | .................................................. | 53 |
| Measures | .................................................. | 59 |
| Planned Analyses | .................................................. | 68 |
| CHAPTER 3: RESULTS | .................................................. | 70 |
| Brief Overview of Analyses | .................................................. | 70 |
| Distribution of Variables | .................................................. | 70 |
| Evaluation of Hypotheses | .................................................. | 75 |
| Correlations | .................................................. | 99 |
| CHAPTER 4: DISCUSSION | .................................................. | 102 |
| Summary of Results | .................................................. | 104 |
| Reviewing the Interpretive Context of the Central Variables | .................................................. | 106 |
| Explicating the Link Between Maternal Responsivity and Child-Related Parenting Stress | .................................................. | 112 |
| Demographic Influences on Responsivity | .................................................. | 118 |
| Child's Neonatal Medical Condition: Unique Relationship to Responsivity | .................................................. | 134 |
| Strengths and Limitations of the Current Investigation | .................................................. | 143 |
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Children born prematurely with fragile medical conditions, such as intraventricular hemorrhage, are at high risk for developmental disabilities. Early intervention programs designed to enhance developmental potential often train parents to perform activities at home. The effectiveness of such activities likely depends upon parental responsivity, the ability to interpret child signals with accuracy and to adapt approaches to a child's developmental pace and needs.

Child-related parenting stress may compromise responsivity and reduce quality of interactions with youngsters. However, little is known about the relationship between child-related parenting stress and responsivity in parents that are challenged by demographic disadvantage in addition to the stresses of raising children with severe...
medical and developmental difficulties. From an early intervention point of view, it is important to investigate the variables that affect responsivity, a parental resource upon which interventionists depend or try to enhance when they incorporate parents into service delivery plans.

This investigation explored relationships between maternal responsivity and child-related parenting stress in a sample of mothers of 2-year-olds with intraventricular hemorrhage. Severity of child neonatal medical condition and demographic factors were controlled in a demographically and ethnically diverse sample. Correlations revealed that lower maternal responsivity was associated with higher child-related parenting stress, maternal age, social support, and maternal race, though measurement issues preclude cultural interpretations. In hierarchical regression analyses, child-related parenting stress explained little variance beyond that explained by medical and demographic variables. A curvilinear relationship was detected between maternal responsivity and severity of medical condition. Finally, maternal responsivity was not predicted by number of children or number of adults living in the household when severity of medical condition was controlled.
CHAPTER 1
LITERATURE REVIEW

Introduction

Maternal responsivity has long been regarded as important for children's healthy socioemotional development. While maternal responsivity greatly enhances interactions between healthy children and their caregivers, it plays a more critical role in interactions with young children born prematurely with fragile medical conditions who are at risk for developmental disabilities (Saylor, 1991). Early intervention programs often aim to enhance responsivity or implicitly rely on responsivity skills when they teach parents to perform activities at home to promote their children's development.

This study investigated maternal responsivity in mothers of young children with intraventricular hemorrhage (IVH), a form of brain damage common in premature, low birth weight infants. Maternal responsivity may be compromised by medical complications in a child with disabilities, the stresses of demographic disadvantage, and stress-producing qualities of the child him or herself. The current study explored relationships between maternal responsivity and such stresses in a sample of children at risk that was demographically and ethnically diverse.
Overview: Intraventricular Hemorrhage in Infancy

Intraventricular hemorrhage and associated medical problems have many effects upon the infant, and consequently, upon his or her caregivers. In this section, several topics pertinent to children who experienced IVH in the neonatal period are presented. IVH is defined, its classification scheme is described, and the impact of the birth of a child with IVH and associated medical complications upon the family is briefly discussed. Obstacles to accurate prediction of developmental outcome in these children are addressed, and the degree of their developmental plasticity is highlighted.

IVH Definition and Classification

Infants born weighing less than 1,500 grams are at increased risk for intraventricular hemorrhage (IVH), a direct insult to the central nervous system that is common among premature infants (Saylor, Levkoff, & Elksnin, 1989). Occurring within hours of birth, intraventricular hemorrhages produce abnormal bleeding from cranial capillaries, the extent of which is associated with degree of neurological damage (Volpe, 1981). Such injury is also referred to as intracranial hemorrhage (ICH). Extent of IVH may be determined by ultrasonograms or computed tomographic (CT) scans (Landry, Schmidt, & Richardson, 1989). An IVH grading system devised by Papile and colleagues (Papile, Burstein, & Burstein, & Koffler, 1978). Grade I (isolated
subepidermal hemorrhage) and Grade II (IVH without ventricular dilation) represent mild bleeds, Grade III (IVH with ventricular dilation) represents a moderate bleed, and Grade IV (IVH with parenchymal involvement) represents a severe bleed.

Intraventricular hemorrhage frequently co-occurs with other perinatal difficulties, such as hydrocephalus, seizures, respiratory distress syndrome and bronchopulmonary dysplasia, retinopathy of prematurity, and cerebral palsy (Saylor, 1991). Hydrocephalus is an enlargement of the ventricular systems in the brain due to increased pressure from cerebrospinal fluid (Rourke, Bakker, Fisk, & Strang, 1983). Retinopathy of prematurity is a common cause of blindness in premature infants (Vohr & Garcia-Coll, 1988). Respiratory distress syndrome (RDS) results from immature lung development in the premature infant and is associated with intrauterine growth retardation (Vohr & Garcia-Coll, 1988). RDS may develop into bronchopulmonary dysplasia (BPD), a more chronic form of lung injury. RDS and BPD often necessitate mechanical ventilation to supplement oxygen intake (Vohr & Garcia-Coll, 1988). Secondary effects of BPD beyond the perinatal period include failure to thrive, poor weight gain, recurrent lung infections, and neurological sequelae (Vohr & Garcia-Coll, 1988). Clearly, the child who experiences IVH in the perinatal period is often subject to many other serious medical complications.
**Family Adjustment**

The birth of a child with a fragile medical condition represents a crisis for the family that imposes dramatic coping demands (Farran, Metzger, & Sparling, 1986; Saylor et al., 1989). Parents of IVH infants, like other parents of premature technology-assisted infants, face numerous adjustments. The trauma of medical complications surrounding the child's birth and early weeks in the neonatal intensive care unit generate concerns about the child's future health. Families of premature infants who experience IVH frequently endure an extended hospitalization period of the infant after delivery, and are bombarded by contacts from multiple service agencies (Odom & Chandler, 1990; Saylor et al., 1989). They commonly experience significant disruption of routines and changes in division of family responsibilities. In addition, these families must deal with their emotional reactions to the arrival of a child with intimidating medical needs and unknown physical and cognitive limitations (Collins-Moore, 1984; Farran et al., 1986; Odom & Chandler, 1990).

As a child who experienced IVH continues to grow, the family continues to adapt to the demands of the child's particular condition. Children may have cerebral palsy, which imposes motor and movement deficits that interfere with the use of arms, hands, legs, and mouth, and complicates speaking and eating. Children who experience
orthopedic and/or sensory impairments may require special equipment and corrective surgeries. They may experience learning problems and developmental delays and may be mentally retarded.

**Predicting Developmental Outcome**

There exists general informal agreement within the medical community that intraventricular hemorrhage presents developmental risk to the infant. A national survey of neonatologists and pediatricians revealed that there is at least general prognostic agreement among physicians regarding outcome (Siperstein, Wolraich, & Reed, 1991). The physicians in the survey expected Grade I bleeds to be associated with slight impairments and Grade IV bleeds to be associated with severe developmental impairments. Expected severe impairments included sensory and motor deficits, moderate to severe retardation, and potential need for residential care (Siperstein et al., 1991).

Severe medical complications have been associated with increased incidence of developmental delay and/or disability (Landry, Chapieski, Fletcher, & Denson, 1988; Landry et al., 1984; Papile, Munsick-Bruno, & Schaefer, 1983). However, prediction of outcome for a given child or sample is difficult to achieve. Data regarding the long term outcome for infants born with IVH are controversial and contradictory (Siperstein et al., 1991; Sostek, Smith, Katz, & Grant, 1987). Studies report conflicting results
concerning long-term cognitive and motor effects (Bendersky & Lewis, 1990; Bozynski, Nelson, & Rosati-Skertich, 1984; Papile et al., 1983; Sostek et al., 1987; Williamson et al., 1983). Disparate percentages of IVH infants become classified as developmentally delayed in outcome studies of high-risk samples from the IVH population.

Imprecision in predicting outcome is attributable to many causes. These include mixtures of medical complications among infants with IVH, use of general developmental measures, lack of long-term follow-up, and the influence of social/environmental factors. These problems are elaborated below.

Medical complications. Variation in the occurrence and co-occurrence of medical complications results in medical and developmental heterogeneity in the group of premature infants as a whole. This heterogeneity compounds difficulties predicting outcome (Landry, et al., 1988; Aylward, Verhulst, & Bell, 1989). Medical complications such as respiratory distress syndrome, bronchopulmonary dysplasia, and progressive hydrocephalus, described above, often co-occur and complicate the medical stability of infants with intraventricular hemorrhage (Vohr & Garcia-Coll, 1988). Landry and her colleagues (Landry et al., 1988; Landry et al., 1984) have identified differences in performance between infants and toddlers who experienced different combinations and varying severity of perinatal
medical complications. These researchers have even recommended that data from infants with different combinations of medical complications be analyzed separately when developmental progress is the variable of interest.

**Developmental measures.** A second reason for lack of predictability in outcome is that most follow-up studies of children with intraventricular or intracranial hemorrhage have relied upon global developmental measures that may not reveal subtle cognitive, motor, and perceptual-motor patterns of development. For instance, Selzer, Lindgren, and Blackman (1992) assessed a group of children with neonatal intracranial hemorrhage, who did not manifest obvious impairments in infancy. The children obtained significantly lower scores on specific perceptual-motor and memory measures at five years of age than a control group of children without perinatal or medical problems. Global developmental measures may not be sensitive enough to detect impairments in children of young chronological ages.

**Follow-up periods.** Third, short follow-up periods have contributed to variation in developmental findings. Short follow-up periods do not permit examination of change over time. Relatively recent studies have found that impairments emerged several years after the occurrence of severe perinatal medical events (Landry et al., 1988; Selzer et al., 1991). Landry and her colleagues found more impairment in certain groups of IVH infants at three years of age than
were evident at age two (Landry et al., 1988). On the other hand, Aylward and colleagues (Aylward et al., 1989) found correlations of decreasing magnitude between perinatal medical variables and child intellectual, motor, and neurological performance as children grew older. Hence, variance in length of follow-up is another variable that complicates comparison of findings across studies in the IVH outcome literature.

**Environmental influences.** Fourth, failure to appropriately control or examine the impact of social/environmental variables has been cited frequently as an important problem in research on children at medical and developmental risk (Lewis & Bendersky, 1989; Selzer et al., 1992). Evidence from some studies suggests that social factors may be even more predictive of developmental progress than medical variables among high-risk, low birth weight infants (Aylward et al., 1989). This is particularly important since the occurrence of IVH is confounded with social class. The highest incidence of IVH occurs in low birth weight infants, who are more likely to be born into families that are disadvantaged (Shonkoff, 1982).

Environmental variables are particularly important to incorporate into investigations, given their relative significance. Schraeder (1986) found that mother-rated developmental level of low birth weight infants was predicted by characteristics of the home environment and
SES. She found that minimal additional variance was explained by perinatal medical variables. Aylward et al. (1989) investigated the cognitive, motor, and neurological performance of children born with perinatal complications, including IVH, up to 36 months. They found that cognitive performance at 3 years of age was more strongly associated with a creative measure of socioeconomic status than with any of the perinatal variables measured. Their socioeconomic measure included such variables as parental education, presence of a phone in the home, involvement of a male with the family, and freedom from public financial assistance. Research reports such as this support the hypothesis of Sostek and her colleagues (Sostek et al., 1987) that a large amount of the variance in long-term outcome in high-risk infants may not be solely explicable by perinatal medical factors.

**Plasticity in Development**

The above research, taken together, suggests that neonatal medical factors alone cannot predict outcome in children with IVH. There is a degree of developmental plasticity in these infants, upon which early intervention programs attempt to capitalize. Comprehensive interventions with multiple specific curriculums have been designed to promote developmental progress in premature infants. Developmental plasticity is hypothesized to be greatly affected by the social environment, of which the infant's
caretakers are a central component. Many intervention programs utilize the most prominent persons in the child's life—the parents or primary caregivers—as interventionists by educating and training them to perform intervention techniques at home. In the next section, interventions are addressed and the role of parents in these programs is emphasized.

**Intervention Programs**

**Types of Interventions**

The challenges faced by families of children born premature and/or with fragile medical conditions have inspired the development of many intervention programs. Wolke (1987) classified interventions into five categories, based upon theoretical underpinnings and ultimate goals. Programs may address 1) optimal infant stimulation levels, 2) parent-infant bonding, 3) maternal coping with premature delivery, 4) improving infant/caregiver interaction by helping parents read infant cues, and 5) facilitation of development of infants with identified developmental problems. Programs in these classifications may overlap in their goals.

The current investigation is primarily concerned with the fourth type of intervention, enhancement of maternal responsivity to child cues. It is also indirectly concerned with the fifth category of intervention, facilitation of developmental progress in infants and young children, in
that responsivity of the caregiver may play an important role in promoting developmental progress. Of central interest in the current investigation are the skills parents and primary caregivers bring to or learn in programs that enlist them as providers of intervention services to their own children.

Involvement of Parents in Early Intervention

Many early intervention programs teach parents a curriculum of exercises or skills to use in interactions with their children at home. Two examples of parent curriculums are the "Partners" and "Early Partners" programs (Sparling et al., 1991), first used in the Infant Health and Development Program (IHDP). The IHDP was an eight-site randomized trial designed to test the efficacy of an early intervention program for low birth weight premature infants. Programs may combine center-based treatment and home-based interventions, as did the IHDP (Ramey et al., 1992), or rely exclusively upon home visits. For example, Barrera, Kitching, Cunningham, Doucet, and Rosenbaum (1990) describe a home visit intervention program that provided parent training in problem solving and in child development.

When programs provide guidelines for interaction or teach parents to perform certain behaviors, the success of these interventions depends to an unknown extent upon the ability of the parents to implement the skills they learn. It is likely that adherence to the treatment plan and
regularity of performance of the skills that are taught affects the impact of the program. However, it is also probable that quality of parental performance of the skills affects the value of the service as well.

Examples of Interventions

Below, five selected intervention programs and results are briefly described, in which parents were trained in techniques to enhance development in their infants and young children who were born prematurely. These programs either required or directly taught parents to respond appropriately and sensitively to their children's needs. The intervention programs and their results are presented to provide specific examples of parental involvement in intervention programs. In each program, skills that parents either already possessed or acquired through training may have played a role in the eventual impact of the intervention.

Vermont Intervention Program for Low Birth Weight Infants. In a longitudinal follow-up study ranging seven years, Achenbach, Phares, Howell, Rauh, and Nurcombe (1990) demonstrated cognitive benefits for low birth weight infants exposed to parent-focused early intervention. These infants were of higher mean birth weight (2,250 grams) than the typical IVH infant (1,500 grams or less) and were free of severe neurologic insults that frequently characterize IVH infants. Their three-month intervention, called the Mother-Infant Transaction Program (MITP), was based on the concept
of the transactional nature of development (Sameroff & Chandler, 1975; Fiese & Sameroff, 1989).

The program consisted of seven daily sessions performed by an intensive care nurse during the week before the infant's discharge from the hospital. The MITP program also included four home sessions at 3, 14, 30, and 90 days post-discharge. The program goals were to help each mother read her baby accurately, appreciate her baby's temperamental characteristics, and respond appropriately to her baby's cues. It was hypothesized that increasing the mothers' facility with their infants would reduce the risk of developmental delay.

Results of the seven-year follow-up study (including 88% of original subjects) indicated significantly higher cognitive performance for children in the intervention group versus no-treatment control and normal birth weight groups. This group difference, controlling for SES, illustrated a progressive divergence in test scores that first became evident at age three (as measured by other age-appropriate instruments) (Rauh, Achenbach, Nurcombe, Howell, & Teti, 1988).

Due to the inclusion of a control group, these striking long-term differences can be attributed to the intervention. Indirect effects of the program may have accrued because the mothers continued to apply the skills in which they were briefly instructed, and/or were inspired to pursue
additional development-enhancing experiences for their children as the years passed. The differences are profound and of clinical as well as statistical significance.

The thrust of the intervention was promotion of the parents' ability to respond sensitively to their children. While parental performance of the skills taught was not measured, maternal responsivity was the intended manipulated variable and is the presumed direct or indirect cause of group differences. In the next study, parent-child interaction was considered critical to differences between intervention and control groups.

Gainesville premature infant study. Resnick, Armstrong, and Carter (1988) studied the developmental progress of 41 high-risk premature infants treated at Shands Hospital at the University of Florida. While these subjects were of higher average birth weight (approximately 2,000 grams) than many IVH children (1,500 grams or less), more than half had experienced common medical complications associated with prematurity, such as respiratory distress syndrome, and required mechanical ventilation.

Infants who were randomly assigned to the treatment condition received developmental interventions in the NICU. Mothers in the treatment group also received home visits from nurses who modeled language, cognitive, social and muscular exercises, and play activities for them to perform. The control group of mothers and infants received standard
social services and physical and occupational therapy with appropriate referrals as needed. In addition to 6- and 12-month infant developmental assessments, parent-child play interactions were measured.

At 12 months, main effects of treatment were observed. Infant cognitive scores were higher and parent-child interactions were of higher quality in the intervention group. However, further analyses revealed that parent-child interaction styles were related to cognitive performance regardless of group assignment. These compelling results suggested that receipt of routine or enhanced treatment was less strongly associated with developmental progress than were the interaction styles of the participating parents and infants. Intervention assignment was less influential than the quality of interaction between the members of the dyads in that sample. The conclusion of the authors was that high-quality parent-child interaction--reflecting a broad set of skills that were not directly taught in that study--was probably the most influential factor in the observed cognitive gains in those premature infants.

Infant Health and Development Program (IHDP). Ramey et al. (1992) reported the results of a comprehensive three-year early intervention program for low birth weight infants. This eight-site randomized trial assigned children from nearly one thousand families to standard care (N=608) or to a comprehensive treatment program (N=377) that was
designed to enhance infant cognitive, behavioral, and health status. The treatment program included home visits, in which parents were taught to implement the Early Partners program (Sparling et al., 1991). The treatment program also included child development center-based delivery of early intervention services, and parent support groups.

The overall results indicated that the group of children who received and whose families received the comprehensive treatment package obtained an average intellectual quotient in the normal range. The average quotient of the control group fell at the upper end of the borderline intellectual functioning category. The overall average difference in IQ score between the treatment and control groups was 6 points.

Overall, the scores of the children in the treatment group increased with level of family participation in the total program. It is noteworthy that differences did not appear until the three-year follow-up. Although the treatment and control groups were balanced for birth weight, birth weight was still a predictor of cognitive scores within the treatment group. Infants with lower birth weights obtained lower intellectual scores. Infants weighing less than 1500 grams did not demonstrate benefit from treatment through increases in intellectual scores relative to infants of higher birth weight (Ramey et al., 1990).
Ramey and his colleagues tested the efficacy of the entire comprehensive package, so the relative efficacy of each component is unknown. The impact of the "Partners" component, which depended upon parents to implement the techniques they were taught, could not be assessed. While the unique effect of the "Partners" program is unknown and the quality of implementation by the parents was not measured, it can still be said that parental service delivery was one component of a program that yielded success for children commensurate with the degree of participation by their parents.

While overall results of the IHDP are encouraging, the limited benefit demonstrated by infants of very low birth weights is a reminder of the more intense impairments those infants experience, and perhaps greater intervention needs in those families. The impact of and participation in the "Partners" curriculums, as mentioned above, were not separately evaluated. It is unclear what factors might influence the helpfulness of that program for families of children with severe impairments.

**Early Intervention Research Institute (EIRI): Two Age-at-Start Studies.** Casto, Saylor, Immel, and Huntington (1991) reported the three-year results of the South Carolina IVH study. South Carolina was one location of a multi-site early intervention study of premature infants. This group of children had considerably lower average birth weight
(approximately 1150 grams) than children in the IHDP intervention (approximately 1800 grams). Sixty-four children with IVH were randomized to begin either "early" intervention, consisting of intensive motor intervention services starting at three months adjusted age followed by a comprehensive developmental program, or "delayed" intervention, consisting of a full developmental program beginning at 12 months adjusted age. Parents were taught to implement exercises and activities modeled by a professional therapist.

Results of the 12-, 24-, and 36-month assessments that controlled for severity of medical condition revealed no significant differences between the groups that received early or delayed intervention. Groups were equivalent on family measures, parent-child interaction, and developmental measures (Casto et al., 1991). Examination of some of the nonsignificant differences revealed trends that suggested the early intervention group may have experienced more parenting stress. Saylor (1991) suspected that the early intervention directed specifically toward motor facilitation may not be beneficial to this population at that early stage of the infants' lives. Furthermore, the early intervention may not have been as helpful given the comparatively low birth weight of the infants in this investigation compared to others, such as the IHDP.
A parallel EIRI investigation was carried out in Salt Lake City, Utah, with a separate sample of IVH infants. The 58 infants in that study were also randomly assigned to "early" or "delayed" intervention beginning at different ages, as in the South Carolina study. The Utah children, whose average birth weight was approximately 1400 grams, were evaluated at 18-, 30-, 48-, and 54-month follow-up assessments. Results of that investigation (Casto et al., 1991) also revealed no significant differences between the early and delayed intervention groups on family measures, parent-child interaction, or developmental measures. In contrast to the South Carolina data, there was a non-significant trend toward lower parenting stress in the early intervention group.

These EIRI interventions depended, in large part, upon the ability of parents to carry out intervention activities that were modeled by professionals. Performance of parent-delivered activities may have affected the efficacy of the overall intervention. Parent-child interaction was measured directly in these investigations, but it did not differ between the "early" and "delayed" intervention groups. The degree to which specific guidance in interaction styles might have enhanced parental performance of the curriculum skills or had an impact on the outcome of these investigations is uncertain.
Two generalizations are apparent from these studies. One is that early intervention programs often include parent involvement. Second, intervention programs have lower success rates with lighter (less than 1500 grams), more medically-compromised infants. The child with IVH exemplifies high-risk for developmental disability, and may not as readily benefit from early intervention. For children such as these, it is critical to learn what can increase the effectiveness of early intervention programs. Individual treatment programs might be enhanced by availability of information about factors that support or limit parental ability to interact with these challenging infants and children, and to maximally utilize the specialized instruction they are provided.

Summary

Parents of children with IVH and other difficulties are often given a major role in providing early intervention services to their own children. It is an intuitively-appealing hypothesis that the effect of a parent-delivered intervention may in large part depend on whether and how well the parents are able to apply the necessary skills. The ability of the parent to be maximally sensitive to the child's needs may be paramount, whether these skills are directly taught by the interventionist or not. Quality of parental involvement in early intervention activities may ultimately affect the cost-effectiveness of those programs.
Of central interest in the current investigation is the role of parental involvement in the facilitation of developmental progress in compromised infants and children. One aspect of parental or caregiver behavior with infants and young children is known as "responsivity." In the following section, literature about responsivity is introduced and its critical importance in the lives of young children is addressed. This section precedes subsequent sections that address factors that affect responsivity, the central focus of this investigation.

Maternal Responsivity

Maternal or caregiver responsivity has been considered so important a factor in the lives of young children that copious amounts of literature have been written about this subject. The ability of caregivers to sensitively respond to their children's needs is considered a central cornerstone in the developmental of young children (Bowlby, 1969; Brazelton & Als, 1979; Maccoby, 1980). Responsivity has also been considered particularly important in the lives of young children at risk for developmental disabilities (Greenspan, 1989). In this section, the concept of responsivity as it is popularly defined is introduced. The importance of this construct for premature and medically-fragile populations is emphasized, impediments to responsivity are presented, and measurement of the construct of responsivity is addressed.
This investigation focused on maternal parenting variables. While fathers are significant parenting influences and play an important role in child development (Maccoby, 1980; Phares, 1992), there exists a preponderance of evidence that mothers are the primary caretakers of children with chronic or even transient illnesses (Drotar, Crawford, & Bush, 1984; Hauenstein, 1990). Hence, discussion of responsivity from here forward will pertain to maternal responsivity.

The Construct of Responsivity

There is a long tradition of conviction among researchers across many schools of thought that maternal behavior greatly influences behavioral reactions of young children, thus influencing children's abilities and resources to deal adaptively with their environments. Responsiveness, a specific quality of maternal behavior during interaction with her child, has been demonstrated to influence child development in positive ways across many domains (Ainsworth, Bell, & Stayton, 1971; Bowlby, 1969; Cichetti, 1987; Maccoby, 1980).

Ainsworth and her colleagues (Ainsworth, Blehar, Waters, & Wall, 1978) defined responsivity (also referred to as "sensitivity") as a caretaker's contingent and appropriate responses to child signals based on consistent perception and accurate interpretation of those signals. Dyadic interactions that are marked by relatedness,
synchrony, and response-contingent stimulation are associated with secure attachment and healthy emotional development in the early infant stages (Isabella and Belsky, 1991; Isabella, Belsky, & von Eye, 1989). Teaching mothers to interact more synchronously with their young children has resulted in decreased maternal parenting stress, increased child compliance rates, and heightened mutual affection between mother and child (Eisenstadt, Eyberg, McNeil, Newcomb, & Funderburk, 1993). Quality of maternal interaction clearly impacts upon many important aspects of child development.

Maternal responsivity is particularly important for young children with fragile medical conditions or developmental disabilities. Given variability in developmental progress rates in high-risk populations, the potential impact of maternal stimulation and interaction assumes great importance. Appropriate maternal stimulation has been linked with rates of infant language development (Landry et al., 1989), attention regulation (Bakeman & Adamson, 1984), and exploration of the environment (Landry, Chapieski, & Schmidt, 1986). These are developmental areas in which progress is particularly difficult for many children who are at risk for developmental disabilities to achieve.
Impediments to Optimal Responsivity

Many factors impede appropriate maternal responsivity in mothers of children with fragile medical conditions or developmental disabilities. Infants born prematurely with medical and developmental risk factors may exhibit ambiguous behavioral cues that are difficult for mothers to interpret. Such communication difficulties may reduce the likelihood of appropriate or accurate maternal responding (Kasari & Farran, 1984; Kasari, Farran, & Harber, 1984). Interactions as basic as feeding and bathing may be complicated in such infants and children. Their styles of interacting may not reinforce maternal responses that normally facilitate developmental progress (Saylor, 1991). Crnic, Ragozin, Greenberg, Robinson, and Basham (1983) observed interaction patterns between mothers and preterm infants that appeared unsatisfying to both members of the dyads.

Child disabilities may impede mother-child interaction by restricting the child's ability to engage the caregiver and by heightening caregiver discomfort (Bailey & Wolery, 1992). Towle, Farran, and Comfort (1988) emphasize that interactions between young children at risk for developmental disabilities and their mothers may differ substantially from interactions between healthy children and their mothers. Rosenberg and Robinson (1988) summarize the literature as follows: compared to healthy peers, children with developmental disabilities are less active, less
initiating and less responsive in interactions with their mothers, and do not provide as many cues to promote affective exchange and accurate communication.

**Measurement of Maternal Responsivity**

Investigation of maternal responsivity patterns requires specialized instrumentation. Many systems have evolved with which to measure parent-child or mother-child interactions (Ainsworth et al., 1971; Blount et al., 1989; Bradley, 1989; Eyberg & Robinson, 1983). Several systems have been designed specifically to measure interactions between caretakers and children with disabilities (Allen, Affleck, McQueeny, & McGrade, 1982; Farran, Kasari, Yoder, Harber, Huntington, & Comfort-Smith, 1987; Greenspan, 1989; Kogan, 1980; Mahoney, Powell, & Finger, 1986). Development of unique measurement systems has been inspired by the premise that parenting patterns demonstrated by families of healthy children do not provide an appropriate comparison standard for families of children with developmental difficulties (Farran, Clark, & Ray, 1990). While measurement systems can be applied to maternal or paternal caretakers, the following discussion pertains to the use of measurement systems to describe interactions between mothers and their children.

Many criteria may be employed to differentiate behavioral measurement systems. Towle et al. (1988) emphasize three criteria: derivation of the scale
(theoretical versus empirical), breadth of focus (broad versus specific), and type of coding (behavioral count versus global ratings). A related classification scheme labels measurement systems as "molar" versus "molecular" (Rosenberg & Robinson, 1988). Another classification criterion pertains to the object of observation—individual members of the dyad or the dyad as a unit. These classification criteria are considered in turn below, along with instruments that exemplify these overlapping characteristics.

**Derivation of the scale.** Scales can be classified as theoretical or empirical in their derivation. For scales that are theoretically based, the generalizability of findings rests in large part upon the intended meaning of the measure compared to others. Theoretically-derived scales may vary widely in the content they intend to capture. For instance, the Parent Behavior Progression scale (Bromwich, 1981) was created to measure behaviors related to bonding and attachment. Hence, one section of this scale measures behaviors thought to reflect establishment of an affective base that promotes attachment. In contrast, the perspective behind the Parent/Caregiver Involvement Scale (P/CIS) (Farran, Kasari, Comfort, & Jay, 1986) is cognitive-behavioral. The P/CIS purports to measure parental behaviors that foster cognitive growth and self-esteem in the child.
Mother-child interaction instruments that are empirically-based usually measure specific behaviors delineated by detailed definitions. The occurrence and co-occurrence of dyadic and individual behaviors is then analyzed. For instance, the Greenspan-Lieberman Observation System (GLOS) (Greenspan & Lieberman, 1980; Greenspan & Poisson, 1983) collects highly detailed observations of 98 child and caregiver behaviors. These behaviors may be analyzed for complex interaction patterns or grouped into categories of positive and negative verbal and non-verbal behaviors (Lewis & Lee-Painter, 1974).

**Breadth of focus.** This dimension pertains to the narrowness or breadth of the units used to observe the construct. Instruments that purport to capture the overall quality of an interaction, in an abstract and relatively subjective sense, are global and their focus is described as broad. Instruments that do not presuppose the meaning of a given behavior tend to measure individual, small units of behavior. The focus of such instruments is described as specific (Towle et al., 1988).

**Types of coding.** Global ratings or behavioral counts are also characteristics that differentiate scales. Global ratings represent qualitative judgments about the behaviors observed, such as intensity, magnitude, or acceptability of the observed behaviors (Cone & Foster, 1982). Behavioral counts result in tallies of certain types of highly-defined
behaviors, yielding frequency values. This coding approach may facilitate calculation of duration of certain behaviors (Cone & Foster, 1982).

**Molecular versus molar.** Combination of two of the differentiating criteria mentioned above creates another classification scheme for mother-child interaction instruments. Measurement systems may be classified as "molar" or "molecular" based on breadth of focus and type of coding (Rosenberg & Robinson, 1988). Molar rating systems combine broad focus with global ratings, and in effect condense classes of behavior. Examples of molar systems are the Maternal Behavior Rating Scale (Mahoney, Powell, & Finger, 1986) and the Parent/Caregiver Involvement Scale (Farran et al., 1986). Both include qualitative behavior ratings on five-point scales that are summed to yield a few broad descriptive scores. Molecular rating systems combine specific focus with behavioral counts. Examples of molecular rating systems are the Interpersonal Behavior Constructs System (Kogan, 1980; Kogan & Gordon, 1975), which records specific behaviors at regular 40-second time intervals, and the Greenspan-Lieberman scales (Greenspan & Lieberman, 1980; Greenspan & Poisson, 1983) mentioned above.

**Individual or dyadic focus.** While some systems focus on the behavior of both members of the mother-child dyad, other systems focus primarily upon the mother. These approaches have different advantages. Systems that measure
the behavior of both members of the dyad provide interactional data that reflect the reciprocal nature of interaction. For instance, Francis and Jones (1984) measured quality of dyadic interaction in terms of "co-action," in which mother and child are engaged in the same activity, and "alternation," in which mother and child take turns exchanging verbally or behaviorally in an interaction. Measurement systems that focus on maternal behavior highlight specific strengths and weaknesses in parenting skills. Such detail can be used to tailor individualized intervention efforts (Farran et al., 1990; Rosenberg & Robinson, 1988).

Scale characteristics may be more or less useful for observation of mothers of children with disabilities. Global ratings may be more useful than behavioral counts for capturing the interactions between children with developmental disabilities and their mothers (Rosenberg & Robinson, 1988). Global ratings of responsiveness can, in some instances, preserve qualitative information that quantitative systems may not. In addition, behavioral count systems often underestimate maternal responsivity by reflecting low levels of child engagement (Rosenberg & Robinson, 1988).

The following example illustrates that behavioral count ratings can be misleading when applied to mothers of children with developmental disabilities. Mothers of
children with cognitive impairment may promote high-quality interactions by responding contingently to their children's initiations. Yet such responsive mothers could earn low quantitative scores of responsivity because their children emitted few cues and behaviors to which to respond (Eheart, 1982). This very concern prompted Brooks-Gunn and Lewis (1984) to control for overall production rates of maternal and child behavior when calculating maternal responsivity scores.

Rating systems with maternal focus are useful for rating interactions between children with developmental disabilities and their caretakers. In such dyads, the "burden of maintaining exchange" falls more heavily upon the caretaker (Rosenberg & Robinson, 1988, p. 164). Certain interactive behaviors may be more meaningful when performed by mothers of children with developmental disabilities than by mothers of healthy children. For instance, during interaction with a child who is motorically-restricted, maternal positioning of the infant or young child is critical to mutually-pleasing interactions.

The Parent/Caregiver Involvement Scale. Measurement systems that intend to describe interaction between mothers and their children with developmental disabilities meaningfully must take into account the special characteristics of such children. Among the caregiver-child interaction scales recommended for use with children with
developmental disabilities, the Parent/Caregiver Involvement Scale (P/CIS) is one of the more promising (Saylor, 1991). It employs global ratings and focuses on maternal behavior.

The P/CIS was developed on the premise that adult caregivers are "mediators of experience" for the child, and that "the pace and sequence of the mediation should be smooth and seamless to allow optimal growth." (Farran, et al., 1990, p. 240). Two of its scales, the Quality Scale and the Appropriateness Scale, were created to operationalize the qualities of "smoothness" and "seamlessness."

The Appropriateness Scale contains items designed to measure the extent to which the caregiver's style adapts to the developmental pace of the child (Farran et al., 1990). The Quality Scale contains items designed to measure the intensity with which the parental interactions were carried out. The descriptors "smooth" and "seamless," therefore, characterize parental interactive behaviors that are performed with intensity appropriate to the child's preference level, and that are timed appropriately to the child's developmental readiness, not anticipating nor lagging behind his/her abilities.

While the Quality Scale measures an important aspect of maternal interaction, the Appropriateness Scale taps aspects of maternal behavior that may have the greatest impact upon facilitation of developmental progress, as measured in early
intervention programs. The Appropriateness scale focuses on maternal behaviors that foster initiative in the child's play, facilitate his or her physical interaction with the environment, allow for independence in play, present achievable challenges, and help maintain the child's interest level. These items are considered particularly relevant to the child's learning potential and cognitive development.

**Summary**

Several aspects of maternal responsivity have been considered here. Appropriate responsivity is a factor upon which the effectiveness of parent-based intervention programs likely depend. This construct is crucial to the development of young children. Factors that limit or impede responsivity are important to identify.

Two broad factors known to affect maternal responsivity are *child-related parenting stress* and *demographic disadvantage*. The influence of these factors upon maternal responsivity is the central focus of this investigation. However, integration of the literature pertaining to these variables is impeded by several factors. There are gaps in the literature in areas of great importance to early interventionists. These gaps are highlighted in detail below.
Gaps in Maternal Responsivity Research on Mothers of Children with Disabilities

Demographic disadvantages and child-related parenting stress are two general factors that have great theoretical relevance to maternal responsivity. However, variables that represent these factors have been combined infrequently in investigations of mothers of young children with fragile medical conditions. The literature on responsiveness in mothers of such children is demographically constrained. More information is available about intact families from relatively secure economic backgrounds, and most often in samples dominated by subjects of majority ethnic background. Below, descriptions of a few investigations that illustrate these gaps are presented.

Lojkasek, Goldberg, Marcovitch and MacGregor (1990) found that older motherhood and higher socioeconomic status (SES) were associated with higher maternal responsivity in a sample of mothers of children with Down Syndrome, neurological impairment, and developmental delay of unknown origin. However, this finding emerged from a sample in which the majority of mothers were married, Caucasian, and from high SES backgrounds. In another study of mothers of at-risk infants, Helm, Comfort, Bailey, & Simeonsson (1990) compared two samples of mothers. One sample was composed of older, high SES mothers, 80% of whom were Caucasian and/or married. The other sample was composed of predominantly single adolescent mothers, only 40% of whom were Caucasian
and/or married. Their results, which controlled for race, indicated that adolescent mothers were rated lower in responsivity to their at-risk infants than older mothers. However, the margin of difference may not have been clinically significant, and results are confounded by SES, which was lower in the younger, minority sample.

Parenting stress is infrequently included as another variable of study in investigations of maternal responsivity in these families. Demographic factors are commonly included in responsivity studies, but the relative influence of demographic factors and child-related stress upon maternal responsivity is unknown. Taken together, few investigations have considered maternal responsivity and parenting stress in families of children with severe neonatal impairments in demographically diverse samples.

Comparison of findings across responsivity studies is hampered by wide variability in and vague definitions of the disabilities of the children assessed. Sample descriptions vary in level of detail, and often include vague categorizations of the children's impairments in broad terms such as "developmentally delayed," "handicapped," and "disabled." In measuring maternal responsivity to vaguely-defined samples of children, it is difficult to isolate the characteristics of the children to whom the mothers were responding.
Summary

Little is known about the relationship between maternal responsivity and maternal parenting stress in families that are challenged by demographic disadvantages in addition to the stresses of raising children with severe medical and developmental difficulties. This constitutes an unsettling gap in the literature. From an early intervention point of view, it is important to investigate the variables that affect maternal responsivity, a parental resource upon which interventionists depend when they incorporate parents into their service delivery plans. It is essential to gain a fuller understanding of how the stressful qualities of children with developmental disabilities may be related to maternal responsivity.

In the following sections, what is currently known about the effects of parenting stress and demographic factors upon maternal responsivity is presented. Parenting stress is addressed first. Variations in stress levels in families of children with disabilities is discussed, followed by presentation of models of parenting stress and research findings that highlight the contribution of child characteristics to parenting. Finally, existing research on child-related parenting stress and maternal responsivity and the limits of those research findings are presented.
Parenting Stress

Variation Among Families of Children with Disabilities

The mere presence of a child with cognitive and physical disabilities in a family does not in and of itself predict stress levels or adaptation. While much literature suggests that parents of children with disabilities and chronic illnesses experience more stress on the average than mothers of healthy children (Beckman, 1983; Hanson & Hanline, 1990; Hauenstein, 1990; Kazak, 1986), other literature suggests that the relationship between raising a child with disabilities and the experience of parenting stress is not clear cut. Considerable variance has been noted in adaptation (Hauenstein, 1990) and few parents of children with disabilities and chronic illnesses experience significant psychological maladjustment (Wallander et al., 1989a). Specific aspects of caring for a child with disabilities must be identified in order to explain variations from family to family, caretaker to caretaker (Wallander, Pitt, & Mellins, 1991).

Several models of parenting stress facilitate identification of the interacting and specific factors that contribute to stress in a family. These models attempt to capture the "big picture" as well as facilitate closer scrutiny of individual variables. Webster-Stratton (1990) described the viewpoint of parenting stress research as a "wide-angle lens" (p.302). This metaphor describes the
integration of the myriad factors within and external to the family put forth in parenting stress models. Below, several parenting stress models are described.

**Parenting Stress Models**

The parenting stress models of Belsky, Mash and Johnston, Webster-Stratton, and Wallander and his colleagues, and Abidin are briefly presented next. Each model delineates separable sources of stress and postulates modes of interaction. This selection does not intend to represent the literature as a whole, but merely to highlight the important and interactive role of child characteristics in the context of other sources of stress in a parent's life.

Belsky (1984) posited that parental functioning is multiply determined, and is influenced by three broad determinants: a) the parent's personal psychological resources (including individual characteristics and resources influenced by family of origin), b) the child's individual characteristics, and c) contextual support. He hypothesized that positive elements in one area can buffer deficits in another.

Mash and Johnston (1990) elaborated the intricate interconnectedness of child characteristics with parental and environmental variables. Child characteristics and environmental conditions are presumed to have direct effects on parent-child interactive stress. In addition, child and
environmental variables have indirect impact on parent-child interactive stress through their influence upon the psychological adjustment and behavior of the parent. Parental characteristics, such as cognitions, attributions, and expectations, are viewed as mediators of the effects of child and environment. Finally, reciprocal influences abound in the system. Parent-child interactive stress in turn affects child characteristics, parent characteristics, and environmental conditions.

Webster-Stratton (1990) posited a model of parenting stress composed of the above elements categorized according to a slightly different scheme. In her conceptual model, she considers child characteristics, inter-parental/marital conditions, and extra-familial conditions as the main categories of additive stressors. The impact of these stress sources are mediated by the parent's psychological well-being, and family and social/community support.

Wallander and his colleagues have proposed a theoretical model intended to explain adaptation of parents of children with disabilities and chronic illnesses (Wallander et al., 1989a; Wallander et al., 1989b). Their model classifies features of the child, parent, or environment as risk or resistance factors. Adaptation risk factors include child disability/disease characteristics, parental strain related to child care, and psychosocial stress. These risk factors are posited to be mediated by
resistance factors, such as intra-personal strengths, social-ecological factors, and coping styles or strategies. Indirect effects are also posited in this model. While theirs is not specifically a "parenting stress" model, it bears similarity to the above models in considering the unique contribution of child characteristics in parenting.

Richard Abidin's (1990) model of parenting stress integrates the previous work of many researchers, drawing upon the concepts of temperament, cognitive appraisal, and life stress. The Parenting Stress Index (Abidin, 1983; Abidin, 1990), Abidin's popular parental self-report instrument, reflects his theory that parenting stress results from convergence of stress from several sources: 1) the temperament-related characteristics of one's child, 2) parent personality and satisfaction in the parenting role, and 3) accumulation of life events. Abidin's model emphasizes the role of subjective parental judgment in the experience of parenting stress.

As is illustrated in the models described above, most theories of parenting stress conceptualize the child as an individual and unique source of stress that is embedded in an interactive dyadic or family context. While the role and meaning of a child's personality and behavioral characteristics cannot be fully appreciated outside his or her social and environmental context (Bronfenbrenner, 1979; Kazak, 1989; Sameroff & Chandler, 1975), efforts to focus
specifically on such child characteristics are worthy, especially in early stages of research with a population. Children with IVH have been understudied, often excluded from research samples due to the severity of their impairments.

Research also supports the value of focusing specifically on stress-producing child characteristics, as they appear to have relevance to maternal responsivity. Child characteristics that have been related to parenting stress include both objective and perceived qualities of the children. For instance, parental perception of a child's degree of attachment or demonstration of affection can greatly impact a parent's competence and comfort in the parenting role (Hoppes & Harris, 1990; Rodrigue, Morgan, & Geffken, 1990). Parental perception of child temperament and behavioral disposition can be a potent source of parental stress (Abidin, 1990). Attributions made by parents regarding the motivations and causes for their child's behavior can augment parenting stress (Bugental, Mantyla, & Lewis, 1989) and exacerbate problems in parent-child relationships.

The current investigation focused on the stress generated specifically by child characteristics, in order to clarify one aspect of the total mother-child interaction picture. One of the parenting stress models described above has a unique feature that assisted the current investigation
in its aims. Abidin's model has a corresponding psychometric instrument, developed directly from the model, that facilitates measurement of stress-producing child personality and behavioral characteristics.

Abidin's Parenting Stress Index (Abidin, 1990) is a parental self-report instrument that highlights the perception/appraisal component of parenting stress. It divides stress factors into two main sources: child-related and parent-related stress. The Abidin model assumes that child-related stress represents a combination of actual child characteristics and parental perception of those characteristics (Abidin, 1990). In rating child-related stress, parents reveal their subjective appraisals of the intensity and disruptiveness of their children's behavior, and the extent to which child characteristics deviate from their expectations and hopes. Innocenti, Huh, and Boyce (1991) found that PSI Child Domain scores in a large sample of children with various handicaps were higher than those of the PSI normative sample. In particular, parental ratings of child distractibility items strongly differentiated the two samples.

The variable of primary interest in the current study is the ability of a mother to respond with optimal sensitivity to her child's needs. Abidin's model provides a ready means by which to measure child characteristics that could increase parental stress, as distinct from other
sources of stress. The PSI Child Domain Scale provides a succinct measure of parental perception of child characteristics to facilitate measurement of their association to maternal responsivity.

**Constraints of Parenting Stress Findings**

The following findings illustrate gaps in the parenting stress literature relevant to early interventionists. Studies inform about the relationship between parenting stress and maternal responsivity, but not in samples of mothers characterized by ethnic diversity, social disadvantage, or economic hardship. Those are often characteristics of the environments into which premature infants at risk for disabilities are born.

Hanson and Hanline (1990) found that levels of parenting stress did not differ between groups of Caucasian children with Down syndrome, hearing impairments, or neurological impairments in a three-year longitudinal study. Adaptive behavior, but not cognitive developmental level, was negatively correlated with the PSI. While revealing an interesting finding, their study offered no information about African-American mothers and their children facing the stresses of adaptation to disability. In a large sample of families of children with developmental disabilities from varied SES backgrounds, higher parenting stress was predicted by lower marital adjustment (Trute, 1990). However, this finding emerged from a sample in which 80% of
parents were married, and did not address the concerns of single parents. In two investigations of children with developmental disabilities (Down Syndrome, cerebral palsy, spina bifida, neurological impairment, and hearing impairment), parenting stress was linked to high caregiving demands (Beckman, 1983) and lower social support (Hanson & Hanline, 1990). However, these samples were almost exclusively intact, Caucasian, high SES families.

Summary

The parenting stress literature provides many findings about the experiences of parents of children who have developmental disabilities. However, we know more about parenting stress and its potential link to maternal responsivity in samples that have more resources with which to face the challenge of raising a child with disabilities and/or chronic medical needs. In the next section, the demographic variables that are neglected in the parenting stress/maternal responsivity literature pertaining to families of children with disabilities are considered. Findings are presented about the relationship of demographics to maternal parenting, which illustrate the importance of their inclusion in studies of maternal responsivity to high-risk children.

Impact of Demographic Variables

Maternal age, education, marital status, social support, and income have been associated with quality of
home environments, levels of parenting stress, and maternal responsivity. These variables represent the "contextual" sources of stress denoted in Belsky's parenting model as important determinants of parenting quality (Belsky, 1984), and social-ecological factors in the model of adaptation posited by Wallander and his colleagues (Wallander et al., 1989a; Wallander et al., 1989b). Such demographic contextual variables may compromise optimal parenting. The literature is peppered with findings regarding the association of maternal age, education, marital status, social support, and income with parenting behavior. These variables frequently co-occur, and are confounded in many studies. Below is a brief summary of findings that highlight these confounds or present results of better-controlled investigations.

Maternal Age

In studies of relatively healthy infants, younger maternal age has emerged as a parenting risk factor, but confounds between age and other variables leaves its unique impact unclear. For instance, adolescent mothers have been rated as less sensitive and less responsive in interactions with their infants (Culp, Culp, Osofsky, & Osofsky, 1991), but age and ethnicity were confounded in that investigation. Young adolescent mothers reported less child development knowledge and more punitive attitudes about child-rearing than older mothers studied by Reis (1989). However, the
ethnic balance of each age group was not detailed. Another research team (Stevens & Duffield, 1986) found age to be positively correlated with more positive parenting skills, higher verbal responsivity, and lower punitiveness in African-American women, during their interactions with infants 12-30 months of age. But other variables related to maternal age were not controlled.

A few studies have attempted to avoid these confounds. In an ethnically-balanced sample of teen parents, parental age most frequently predicted maternal involvement and optimal parenting environment, even within a restricted age range (Reis & Herz, 1987). In a sample of primarily African-American teen mothers, an association between maternal problem-solving skills and optimal mother-child interaction was evident when age was controlled, but not when education and SES were controlled (Panzarine, 1989). Findings such as these illustrate the necessity of examining maternal age in the context of other demographic variables as well.

**Maternal Education**

Maternal education is often associated with maternal age, and is controlled in many investigations of maternal behavior. Controlling for education often makes associations between maternal performance and other constructs disappear (Garcia-Coll, Hoffman, Van Houten, & Oh, 1987; Panzarine, 1988). Maternal education has been
associated with child-rearing attitudes and styles. Longer duration of education has been associated with more positive perinatal child-rearing attitudes (Seymore, Frothingham, MacMillian, & DuRant, 1990), and with more positive post-partum outcomes (Dunst, Vance, & Cooper, 1986). Stevens (1988) found that education was positively associated with quality of the child-rearing environments provided by Caucasian adult mothers. Stevens (1988) did not find significant correlations between education and quality of the child-rearing environments in the African-American teen and adult groups he studied, most likely due to the low variance in educational status among mothers in that sample.

Maternal educational level has also been implicated in general child adjustment. In a study of children with chronic physical disorders who were between the ages of 4 and 16, lower maternal education was consistently related to poorer social and behavioral adjustment of the children, even after other family resources were taken into consideration (Wallander et al., 1989a).

**Maternal Marital Status**

In addition to maternal age and education, maternal marital status has been a focus of attention in parenting studies. Although single motherhood is a known risk factor, few studies of maternal responsivity have examined single mothers. Evidence of association between single motherhood and stress reveals its importance and potential relationship
to responsivity in the context of other demographic variables.

In a seminal investigation of mothers of children with handicaps, Beckman (1983) found that single mothers reported more stress than married mothers. Zareski (1983) found that single mothers with premature children reported significantly higher parenting stress levels than married mothers of premature children. Mothers of premature children fell into the highest stress percentile group of the study, highlighting the deleterious effects of this combination of life stresses. Webster-Stratton (1989) found that single mothers of healthy children perceived themselves as significantly more stressed, reported more child behavior problems, and were rated as more critical and controlling during standardized observations of interaction with their children than married mothers. The differences between single and married women in Webster-Stratton's (1989) sample held whether the married women perceived their marriages as distressful or supportive. While single motherhood does not preclude effective parenting, stresses that accompany single motherhood may compromise a mother's ability to respond with optimal sensitivity to her child (Barrat, Roach, & Colbert, 1991; Belsky, 1984; Forgatch, Patterson & Skinner, 1988; Hetherington, Cox, & Cox, 1982; Maccoby, 1980; Wallerstein & Kelly, 1980).
Maternal Social Support

Social support has also been implicated in parenting performance. Social support from different sources has been related to differential parenting experiences and infant outcomes in families of high-risk premature infants (Crnic, Greenberg, & Slough, 1986). Networks of multiple caretakers have been hypothesized to buffer socioemotional development of infants (Frodi, Grolnick, Bridges, & Berko, 1990). In samples of Caucasian adult mothers and African-American teen mothers, social support from extended family members has been associated with more skillful parenting (Stevens, 1988). Larger size of family (i.e., number of members with whom the adolescent mother currently resides) has been associated with higher levels of social support in a sample of adolescent mothers (Kissman, & Shapiro, 1990).

Unger and Wanderman (1988) found that family support was positively correlated with quality of the home environment provided by teenage mothers in a sample that was predominantly African-American and single. In the same sample, support from the babies' fathers was positively correlated with the sensitivity displayed by the teen mothers during interactions with their infants. This study illustrates that, regardless of the source, presence of social support may potentiate positive outcomes. Social support has been implicated in levels of stress and in successful adaptation of intact families of children with
physical handicaps and chronic illnesses (Kazak & Marvin, 1984; Kazak, 1986; Hauenstein, 1990).

Maternal Income

Finally, the high volume of literature focused on low SES populations attests to the psychosocial significance of this variable. A conglomeration of disadvantages is often associated with limited income. In Bronfenbrenner's social ecological model (Bronfenbrenner, 1979), economic status of the family profoundly affects the microsystem and mesosystem in which a child develops and in which parents lead their personal and child-rearing lives. The financial burdens of medical care, therapy, special equipment, lost work time, special residential needs, and other costs add to the psychological burden of raising a child with chronic illness or disability (Butler, McManus, & Newachek, 1986; Seligman & Darling, 1989). Low-income living is often associated with more crowded living quarters, insufficient resources for meeting basic needs and emergency demands, and stressful effects of chronic anxiety and helplessness (Maccoby, 1980). Inclusion of an income measure is essential in studies that intend to fill a demographic gap between the two literatures of maternal responsivity and parenting stress in mothers of children with disabilities and fragile medical conditions.

Additional Demographic Variables

Three additional demographic variables may affect maternal responsivity, but in undetermined ways. Race,
number of children in the home of the target child, and number of additional adults in the household may influence expression of maternal responsivity. However, potential direction of effects is difficult to predict from the literature.

Differences in responsivity scores between women of different races may reflect cultural differences in mother-child interaction styles. Number of additional children in the home could potentially promote or limit maternal responsivity. Additional children could drain a mother of needed energy, or represent sources of previous beneficial child-rearing experience. Lastly, number of additional adults in the home may promote or curtail maternal responsivity. While the presence of additional adults might enhance maternal responsivity through social support and relief of stress by redistribution of daily demands, additional adults may play a role in limiting a mother's developing ability to read her child's cues if she is but one of many adults establishing physical care and social interaction routines. The impact of maternal race, additional children, and additional adults in the home is uncertain and cannot be predicted with confidence. However, the impact of these variables on maternal responsivity is important to examine and document.
Focus of the Current Investigation

The current investigation examined the association between maternal responsivity and child-related parenting stress in mothers of children born prematurely with fragile medical conditions who were at risk for developmental disabilities. This investigation examined this relationship with a large, demographically-diverse sample of children and children, controlling for extent of demographic hardship, and controlling for severity of medical condition of the child subjects.

The following questions were asked: Is child-related parenting stress associated with lower maternal responsivity? Does the accumulation of demographic risk factors bear association to lowered maternal responsivity? Do specific stress-producing characteristics of the child with IVH account for variance in maternal responsivity, above and beyond the effects of severity of the child's medical condition and demographic risk factors? How are maternal race, number of additional children, and number of additional adults in the home related to maternal responsivity? Does the relationship of maternal responsivity with race and number of child and adults change after child's original medical condition is considered? The following five hypotheses were tested.
Hypotheses

#1: Maternal report of high child-related parenting stress would be associated with lower ratings of responsivity in mothers during play interactions with their children with medical and developmental disabilities.

#2: The more demographic risk factors that impinge upon a given mother, the lower would be her level of responsivity to her child with medical and developmental disabilities.

#3: The stress-producing qualities a mother perceives in her medically-fragile child with developmental disabilities accounts for variance in her responsivity to that child, above and beyond the effects of demographic challenges and child's neonatal medical condition.

#4: Maternal race, number of children, and number of adults in the home would be significantly associated with levels of maternal responsivity in an unpredicted direction.

#5: Maternal race, number of children, and number of adults in the home would be significantly associated with levels of maternal responsivity, above and beyond the effects of the child's neonatal medical condition.
CHAPTER 2
METHODS

Subjects

Source of Data

The data for this investigation were gathered through the Early Intervention Research Institute (EIRI) of Utah State University. Beginning in October 1985, EIRI was established through a grant awarded to Utah State University from the United States Department of Education to launch a series of multi-site investigations of children at risk for developmental disabilities (Utah State University, 1985). The EIRI studies span 19 sites across the United States. Data collection methods were designed to be compatible in core variables, measures, and assessment intervals in order to facilitate comparisons between sites and promote combination of databases for subsequent analysis.

All of the data collected by the EIRI Longitudinal Studies of Effects and Costs of Early Intervention with Handicapped Children are considered part of the public domain and are available to outside researchers who wish to study relevant issues in this population. Two EIRI samples were selected for the present investigation. Salt Lake City, Utah (EIRI Project #5) and Charleston, South Carolina (EIRI Project #6) were the two EIRI investigation sites that
focused on children with intraventricular hemorrhage. These two samples were combined for the purposes of the present investigation.

**General Subject Background Information**

**Prior early intervention experience.** All mothers had originally given their informed consent and granted permission for their children to participate in an early intervention study based on the Curriculum and Monitoring System (CAMS) (Casto, 1979) designed for young children with handicaps served by the Multi-Agency Project for Preschoolers. The CAMS program was designed to stimulate development in five core developmental areas: receptive language, expressive language, motor development, self-help skills, and social emotional development. Separate curriculums were devised for each of these developmental areas. The children were administered placement tests to determine their developmental levels in each domain, and individual intervention goals were set for each child. The program was implemented through twice-monthly hour-long home visits by an infant specialist who modeled and supervised maternal practice of intervention techniques.

The study in which the South Carolina and Utah children were originally enrolled was designed to explore the benefits of beginning the CAMS early intervention program at different ages. By random assignment, half the children in each sample began receiving the motor component of the CAMS
program at 3 months corrected age while the other half of each sample received standard routine care. All the infants began receiving the full CAMS program subsequently, with developmental stimulation in receptive language, expressive language, motor development, self-help skills, and social emotional development. Implementation of the full program began at 12 months of age for children in the South Carolina sample and at 18 months of age in the Utah sample.

The children who received the CAMS motor program at 3 months of age before implementation of the full CAMS program were designated as the "early intervention" group. The children who received only routine care prior to implementation of the full CAMS program were designated as the "delayed intervention" group. Results of that early intervention investigation revealed that children beginning the CAMS intervention program at different times did not significantly differ in developmental status, levels of parenting stress, or family functioning at any of the yearly evaluations in either the South Carolina or Utah sample (Casto, Saylor, Immel, & Huntington, 1991).

For the purposes of the current study, the non-significant impact of age-at-start justified the combination of the early and delayed intervention groups within the South Carolina and Utah samples. Additionally, the total South Carolina and Utah samples were combined to increase the sample size for the present investigation. The samples
were combined with two considerations in mind. First, merging the samples yielded a sample of children with intraventricular hemorrhage of unprecedented size. Second, demographic differences between these geographically and economically distinct samples added breadth to the investigation. Demographic diversity had the potential to enhance the generalizability of the findings. At the same time, common measurement of demographic variables in the two samples allowed for statistical control of this variation.

**Recruitment**

Subjects were recruited for the South Carolina and Utah samples by the same method. The original South Carolina sample was composed of 64 children with IVH and their families who were from urban and rural communities in and near Charleston. The original Utah sample was composed of 58 children with IVH and their families, 90% of whom lived in urban areas in and surrounding Salt Lake City and Ogden, Utah, while 10% lived in rural areas of Utah, Idaho, and Wyoming. All of the children in both samples were originally patients in a neonatal intensive care unit at a children's hospital or university medical center and had experienced IVH.

**Assessment Schedule**

Children in both samples were assessed at regular intervals. Assessments in the South Carolina samples were conducted when the children were 3, 12, 24, and 36 months of
age. Assessments in the Utah samples were conducted when the children were 3, 18, 30, and 42 months of age. This investigation focuses on data from the second follow-up assessment in each sample, when the South Carolina children were on the average 2 years old and the Utah children were on the average 2-1/2 years old.

**Attrition and sample selection.** Of the original Utah sample of 58 infants, 51 had complete data at the 30-month follow-up. Of the original 64 South Carolina subjects, 6 of those children had not been tested at the 24-month evaluation due to death (2) or relocation (4). Unavailability of these data reduced the South Carolina total to 58. An additional two subjects did not have complete data for the variables of interest in the current investigation, reducing the South Carolina total to 56. The number of cases with complete data sets in the combined sample was 107.

The total sample size was reduced further by omission of several children from the combined dataset due to specified selection criteria. Several children in the combined data set were multiply handicapped, challenged by combinations of profound retardation, deafness, blindness, and/or severe cerebral palsy. Where two or more of these severe impairments were present in a given child, those children's conditions seemed to present a different set of challenges to their mothers, and made the nature of dyadic
interaction sufficiently different from that of other dyads in the sample to be beyond the scope of this study. Based on the criteria of presence of two or more severe impairments (profound retardation, deafness, blindness, severe cerebral palsy), 7 South Carolina subjects and 1 Utah subject were omitted from the current investigation. Exclusion of those 8 subjects reduced the combined sample size to 99.

Demographics of the Combined Sample

Maternal demographics. The 99 mothers in the combined sample had an average age of 27 years old ($SD = 5.9$ years) when the target child was born. Sixty-four percent of the mothers were Caucasian, and 34% were African-American. The mean duration of maternal education was 12.9 years ($SD = 1.9$), ranging from eighth grade to post-graduate education. In terms of marital status, 69% of the mothers were married, 19.8% were single, 7.3% were separated and 3.1% were divorced at the 24- or 30-month-follow-up. Annual incomes at these follow-up assessments ranged from $2,500 to $75,000 ($M = 23,197, SD = 20,364$).

Child demographics. The combined sample was composed of 99 children born prematurely who experienced IVH. The mean infant birth weight was 1290 grams ($SD = 548$ grams; range 530 to 3636). In the South Carolina sample, the mean birth weight was lower ($M = 1122, SD = 389$) than the Utah sample ($M = 1456, SD = 622$). Infants were identified by
grade of severity of IVH, where grades I and II represented mild bleeds, grade III represented a moderate bleed, and grade IV represented a severe bleed. In the combined sample, 31% of the intraventricular bleeds were classified as grade I, 41.5% as grade II, 20% as grade III, and 7.5% as grade IV.

Sixty-seven percent of the children in the combined sample were Caucasian, 33% were African-American. Twenty percent of the families had no additional children in the home, 38.5% had one additional child, 19.8 had two, 10.4% had three, and 11% had between four and seven additional children in the home. Fourteen percent of the families had 1 adult in the home, 66% had 2, and 20% of the families had between 3 and 6 adults living in the home of the target child.

Measures

**Dependent Variable**

**Parent/Caregiver Involvement Scale** (P/CIS; Farran, et al., 1986). This instrument, a subscale of which served as the dependent variable in this investigation, is a behavioral rating scale of caregiver interaction with young children aged 3 to 36 months. It provides a global assessment of the amount, quality, and appropriateness of the behaviors an adult may use to foster optimal development during interaction with a child. The scale has been used for rating live interactions in the home environment and for
rating interactions videotaped in clinical settings. For the present investigation, interactions were coded from videotapes of interactions observed in the clinic.

The P/CIS consists of 11 caregiver behaviors: physical involvement, verbal involvement, responsiveness, play interaction, teaching behavior, control over child activities, directiveness, relationship among activities, positive statements, negative statements (discipline), and goal setting. For each behavior, 5-point behaviorally-anchored ratings are made on three dimensions: Amount, Quality, and Appropriateness of interaction. Those ratings are averaged across the 11 behaviors, resulting in 3 summary scores. (Quality and Appropriateness ratings were made only if a behavior received a rating higher than "1" on the Amount Scale, indicating that it was displayed with a minimum frequency to justify qualitative ratings on the other two scales.) A table that lists and describes the eleven P/CIS behaviors can be found in Appendix A.

In this study, the "Appropriateness" Scale was selected as the dependent variable. This P/CIS subscale most closely reflects the construct of maternal "responsivity" as it is popularly defined in the current literature. The Appropriateness score represents the extent to which each mother matched her behaviors to her child's developmental abilities, interest level, and motoric capacities. The items of this scale reflect qualities of synchronous
maternal responding which have been associated with harmonious interactions in mother-infant dyads (Isabella & Belsky, 1991; Isabella et al., 1989; Field, Healy, Goldstein, & Guthertz, 1990).

In order to alleviate a potential source of confusion for the reader, it is pointed out that one of the 11 behavioral items on the P/CIS is called "responsiveness." This is one of several behavioral items that are rated on Amount, Quality, and Appropriateness and contribute to the those summary scores. However, the Appropriateness scale in its entirety was selected to represent responsiveness in the current investigation, not that particular behavioral item.

Examples of Appropriateness Scale rating criteria for some the 11 behavioral items are as follows. Appropriateness of verbal involvement is rated as the extent to which maternal talk is contingent upon the child's activity or is devoted to explanation of the child's or mother's behavior relative to the child's activity. Appropriateness of play interaction is rated as the frequency with which the mother adapts toys and activities to the child's level. Appropriateness of sequencing of activities is rated as the frequency with which the mother introduces activities roughly in order from simple to complex and maintains the child's interest with change of stimuli.
Reliability of the Appropriateness Scale scores has been assessed from ratings of videotaped interactions from previous studies with handicapped children. Reliability estimates have been calculated in terms of percent agreement between raters, and in Generalizability or "G" coefficients. Both forms of reliability are presented below.

Interrater reliability for the P/CIS was calculated as percentage of exact agreement between raters for the 33 scores (11 behaviors rated on 3 dimensions). Rather than calculating interrater reliability of the three P/CIS summary scores (Amount, Quality, and Appropriateness), which represent averages over the 11 behaviors, agreement was calculated between two raters for all 33 individual item ratings. With this highly conservative calculation method and annual retraining since 1989, the most recent interrater agreement percentage is .88. This percentage reflects the level of agreement between the rater who coded the tapes in this study (E.W.) and the professional that Dr. Farran, the principal developer of the Parent/Caregiver Involvement Scale, has designated as her scoring "standard" for this instrument (P.B.). The tapes in the current investigation were coded immediately following annual retraining. Although an interrater reliability value is not available on the specific subjects in the current investigation, previous agreement supports the expectation that the tapes were coded in a reliable fashion.
Reliability of P/CIS scores were also calculated in terms of G-coefficients. G-coefficients arise from Generalizability Theory which extends classical reliability theory. Generalizability coefficients enable researchers to separate out unique sources of variance in subject scores (Shavelson, Webb, & Rowley, 1989). For instance, variance may be attributable to persons, occasions, and items. This separation of variance is conceptually analogous to the separation of sources of variance in factorial ANOVA models (Shavelson et al., 1989). The G-coefficients for the P/CIS Appropriateness Scale were computed by estimating the error attributable to subjects, raters, and the interaction of subjects and raters. According to Farran and her colleagues, the G-coefficients for the P/CIS Appropriateness Scale represent the proportion of variance accounted for by individual differences in subjects, above and beyond the proportion of error attributable to differences between raters (Farran et al., 1987). The G-coefficients for interrater and intra-rater reliabilities were .82 and .95, respectively (Comfort & Farran, 1986; Farran et al., 1987).

Farran et al. (1987) have reported validity of the P/CIS based on data from investigations that revealed that Amount, Quality, and Appropriateness of maternal interaction were significantly higher in mothers with high versus low social support (Comfort & Farran, 1986) and those from higher SES backgrounds (Farran, Comfort-Smith, & Kasari,
1985). Data reflecting other types of validity, for example, content, criterion, or construct validity, are not yet available.

Independent Variables

**Parenting Stress Index** (PSI; Abidin, 1990). The PSI is a parental self-report instrument designed to measure enduring elements of parent-child systems that contribute to stress and dysfunctional parenting. It is the most widely used and extensively-researched instrument for quantifying and describing parental stress. The PSI has been employed in investigations of a wide variety of issues, including child development, parenting, and behavior problems, and with a wide variety of populations, including children with physical and/or cognitive handicaps and chronic illnesses.

A unique feature of the PSI is its distinction between two sources of stress. The Child Domain Scale represents stress attributable to parents' perceptions of child characteristics. Child Domain subscales include adaptability, acceptability, degree of demandingness, mood, distractibility/hyperactivity, and reinforcing qualities of the child. The Parent Domain Scale, representing stress resulting from the parent's self-perception of his/her personal life, includes subscales for depression, attachment, experiences of restrictedness and sense of competence in the parenting role, social isolation, relationship with spouse, and health. The Total Stress
Score represents the accumulation of these different sources of stress.

The alpha reliability coefficients for the PSI scales are as follows: Child Domain Scale, .89; Parent Domain Scale, .93; Total Stress, .95. The alpha coefficients for Child Domain subscales range from .62 to .70, and the Parent Domain subscales from .55 to .80 (Abidin, 1990). One-year test-retest reliability coefficients in a sample of 18-month-olds are as follows: Child Domain Scale, .55; Parent Domain Scale, .70; Total Stress, .65 (Hamilton, 1980).

In this study, the Child Domain Scale was selected as an independent variable. PSI research with samples of children with handicaps (Innocenti et al., 1991; Kazak & Marvin, 1984) and mother-child synchrony research (Field et al., 1990; Isabella & Belsksy, 1991) suggested that the Child Domain Scale is more strongly associated with maternal responsivity than the Parent Domain Scale.

Medical Severity Index. This variable was constructed for the current investigation. The Medical Severity Index score represents the number of severe perinatal medical complications that are associated with neuro-developmental difficulties (Vohr & Garcia-Coll, 1988). Although specific perinatal events cannot predict specific developmental outcomes (Vohr & Garcia-Coll, 1988) and increasing evidence reflects the mediating influence of environmental variables (Minde et al., 1989; Wolke, 1991), the following variables
commonly co-occur with prematurity and have been associated with developmental impairments in premature infants (Vohr & Garcia-Coll, 1988; Wolke, 1991). The variables comprising this composite index that were available in both the Utah and South Carolina IVH data sets above were selected. The variables and their cutoffs are as follows:

1) gestational age 30 weeks or less
2) birth weight less than 1500 grams
3) grade of IVH greater than or equal to III
4) 17 or more days on ventilator
5) presence of seizure activity
6) diagnoses of respiratory distress syndrome (RDS) and bronchopulmonary dysplasia (BPD)

The Medical Severity Index score ranged from 0 to 6 depending on the number of conditions that applied to a given child in the period of hospitalization immediately after his or her birth. The cutoff for days of ventilation was dictated by the coding scheme of the Utah data. Their coders created a categorical variable to represent days of ventilation, the lowest level of which was "5-16 days on ventilation."

Demographic Risk Index. This independent measure was designed for the current investigation. The index is a global measure representing several conditions associated with less-than-optimal parental responsivity or parenting skill. The index was constructed on the assumption that the
presence of more demographic disadvantages in a given family compromises optimal parenting; that the addition of one of these five disadvantages increases cumulative risk when other risk-heightening conditions are present. The index consists of a 0-5 scale representing five conditions which may apply to a given mother. These include:

1) maternal age 20 or younger at birth of target child
2) no more than 12 years education
3) single marital status
4) low social support (one standard deviation below the current sample mean on the Family Support Scale, described below)
5) income below poverty line

The score on the Demographic Risk Index represents the number of disadvantage conditions that apply to a given mother. Estimation of poverty status for the total sample was based on family size and accompanying income limits for eligibility for Medicaid and/or other family services based on records provided by the South Carolina Department of Social Services. (Similar information was not available through the Utah Department of Family Support.)

Family Support Scale (FSS) (Dunst, Jenkins, & Trivette, 1984). This instrument was designed to assess the availability of sources of support as well as the degree to which these sources are perceived as helpful to families with young children. The FSS consists of 18 items that
represent sources of social support, both informal (e.g., parents, relatives, friends, social groups) and formal (e.g., school/day care center, professional agencies, specialized early intervention services). Each item is rated on a 0-4 scale ranging from "not helpful at all" to "extremely helpful." Test-retest reliability for the total scale was .91, the average correlation among items was .77, and average item-total correlation was .85 (Dunst et al, 1984).

The cutoff selected for the purposes of the current investigation was one standard deviation below the sample mean. In the current sample, the mean FSS score was 28.06, with a standard deviation of 10.6. These mean and standard deviation values are similar to those observed by Dunst and his colleagues (M = 31.45, SD = 11.96) in their sample of 47 families with pre-school-aged children with mental retardation, physical impairments, and developmental delays (Dunst, Trivette, Hamby, & Pollock, 1990). The criterion of one standard deviation indicated a cutoff score of 18, which classified 18% of the current sample as having "low" social support compared to the other families of children with developmental disabilities.

Planned Analyses

Maternal responsivity, represented by Appropriateness Scale of the P/CIS, was the primary dependent variable. The Medical Severity Index, the Demographic Risk Index, and PSI
Child Domain were the independent variables. Calculation of correlation matrices were planned to evaluate Hypotheses #1 and #2 concerning the relationship of the Appropriateness Scale with the PSI Child Domain and the Demographic Risk Index. Hierarchical multiple regression procedures were selected to assess the amount of variance in Appropriateness scores explained by the PSI Child Domain scores, above and beyond that accounted for by the Medical Severity Index and the Demographic Risk Index (Hypothesis #3). Hierarchical multiple regression was also selected to assess the explanatory power of number of adults in the home, number of children, and maternal race in the expression of maternal responsivity in the play situation (Hypotheses #4 and #5).
CHAPTER 3
RESULTS

Brief Overview of Analyses

First, distributions of the variables were assessed for normality and skewness. Specific correlation matrices were performed to test the first two hypotheses, and hierarchical multiple regression models were performed to test the remaining hypotheses. Modifications of one of the original models with intermediate stepwise and polynomial regression procedures were conducted. Finally, larger correlation matrices were analyzed to further describe relationships among the variables.

Distributions of Variables

Table 3.1 presents a summary of the means, standard deviations, and ranges of dependent and independent variables. In addition, the distributions of the main variables were evaluated for shape and for violations of the normality assumption.

Testing for Normality and Skew

The Kolmogorov-Smirnov (K-S) statistic for large samples was used to evaluate the normality of the distribution of the main variables (Afifi & Azen, 1979; Afifi & Clark, 1984). The K-S statistic rejects the null
### Table 3.1
Means, Standard Deviations, and Ranges of Dependent and Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Possible Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriateness Scale (P/CIS)</td>
<td>3.82</td>
<td>.74</td>
<td>2</td>
<td>5</td>
<td>1-5</td>
</tr>
<tr>
<td>Medical Severity Index</td>
<td>2.86</td>
<td>1.63</td>
<td>0</td>
<td>6</td>
<td>0-6</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>1290</td>
<td>540</td>
<td>530</td>
<td>3696</td>
<td></td>
</tr>
<tr>
<td>Gestational age (in weeks)</td>
<td>30</td>
<td>3.0</td>
<td>24</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Percentages:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1000 g</td>
<td>73%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 30 wks</td>
<td>64%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPD/RDS</td>
<td>61%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long ventilation</td>
<td>44%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seizures</td>
<td>9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IVH grade III/IV</td>
<td>26%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographic Index</td>
<td>1.65</td>
<td>1.43</td>
<td>0</td>
<td>5</td>
<td>0-5</td>
</tr>
<tr>
<td>Individual Maternal Demographic Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married (%)</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years education</td>
<td>13.0</td>
<td>2.0</td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Age at delivery</td>
<td>26.8</td>
<td>5.9</td>
<td>16</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>FSS</td>
<td>28.4</td>
<td>10.5</td>
<td>5</td>
<td>54</td>
<td>0-54</td>
</tr>
<tr>
<td>Income</td>
<td>23,500</td>
<td>20,800</td>
<td>2,500</td>
<td>75,000</td>
<td></td>
</tr>
<tr>
<td>Child Domain (PSI)</td>
<td>103.9</td>
<td>18.8</td>
<td>69</td>
<td>149</td>
<td>50-250</td>
</tr>
<tr>
<td>Additional Demographic Variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number adults</td>
<td>2.2</td>
<td>.9</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Number children</td>
<td>1.6</td>
<td>1.6</td>
<td>0</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Maternal race (% minority)</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
hypothesis of normality with large values of the statistic and small p-values. For the purposes of the current investigation, a liberal p-value of .01 was selected for rejecting the null hypothesis of normality in this exploratory study of a heterogeneous, understudied population.

In addition to the Kolmogorov-Smirnov statistic, skewness ratios were evaluated as evidence of non-normality. The skew ratio generated by SPSS was divided by the standard error of the skewness value, yielding a z-value. Values in excess or +/- 2.58 indicate significant skew, and are taken as evidence of non-normality (Tabachnik & Fidell, 1983). For this investigation, variables were considered to be in violation of the normality assumption if both the K-S and skewness values were statistically significant.

According to this criterion, the Appropriateness Scale met the normality assumption by the K-S criteria (K-S = 0.08, p < .18) and the skewness criteria (z = -1.67). The Parenting Stress Index also met the K-S criteria (K-S = 0.10, p < .02) and was not skewed (z = 1.93). The MSI, while failing to meet the K-S criteria for normality (K-S = 0.11, p < .01), was not skewed to a statistically significant degree (skewness z = -1.20). Three other independent variables, however, failed to meet the normality assumption. The distributions of these variables and modifications made
to accommodate the non-normal distributions are described below.

The Demographic Index was non-normally distributed (K-S = .18, p < .0001), with a lognormal distribution skewed to the right. In this index of six demographic hardships, coded dichotomously according to selected cutoffs, more subjects obtained a Demographic Index score of zero than any other score. The distribution of this variable was such that most of the subjects were concentrated in the lower end of the scale, representing fewer demographic hardships.

Base ten and natural logarithmic transformations, recommended for this type of distribution (Afifi & Clark, 1984; Montgomery & Peck, 1992), were performed and the transformed variables were tested for normality. However, the transformation attempts failed to normalize the distribution of this variable. Failure of transformation attempts is common for variables that do not have a single mode near the center of the distribution (Afifi & Clark, 1984). No further transformation attempts were performed.

To address the problem of non-normality, the Demographic Index was broken down into its component variables. Hence, the five variables were available to enter the planned regression equations. It was felt that their entry in continuous form would preserve more information than the dichotomizations in the former index. None of the individual demographic variables was skewed to a
significant degree (no z-scores exceeded +/- 2.58). The possibility of multicollinearity among the demographic variables was suspected. This issue is discussed below. One variable, marital status, remained dichotomously coded.

Number of adults in the home had an erratic distribution, with a mode of 2 (64%), with additional peaks at the values of 1 (15%) and 4 (10%). This distribution violated the normality assumption according to the K-S criteria (K-S = .38, p < .0001) as well as the skewness criteria (z = 6.05). Hence, number of adults was recoded as a 3-value variable representing 1, 2, or more than 2 adults in the home.

Number of additional children in the home (K-S = .26, p < .0001) was also non-normally distributed, with a lognormal distribution severely skewed to the right (z = 6.35). The most frequent number of additional children was 1 (38%), with over three-fourths of the families in the sample (79%) having 2 additional children in the home or fewer. Twenty-one percent of the families had between 3 and 7 additional children. Base ten and natural logarithmic transformations, recommended for this type of distribution, were performed and the transformed variables were tested for normality. The transformations failed to normalize the distribution of the variable, so it was converted into a categorical variable for purposes of analysis. Subjects
were coded for presence of 0, 1, or 2 or more additional children in the home.

Evaluation of Hypotheses

Hypothesis #1.

The first hypothesis that higher scores on the Child Domain of the Parenting Stress Index would be related to lower ratings on the Appropriateness Scale of the P/CIS was supported. Zero-order, Pearson correlations revealed that the PSI Child Domain was significantly and negatively associated with the Appropriateness Scale (r = -.25, p < .01). The direction of the low correlation indicated that higher PSI Child Domain scores were associated with lower Appropriateness scores. (This correlation was based on 99 observations, as are all other correlation coefficients unless otherwise specified.)

Hypothesis #2.

The modified second hypothesis was that each of the five demographic variables in the original Demographic Risk Index would be associated with the Appropriateness Scale. Each of the demographic variables were entered into a correlation matrix with Appropriateness Scale scores. Four of these variables were entered in continuous form (years of education, maternal age at delivery, income, and social support score on the Family Support Scale). The fifth demographic variable, marital status, was entered in
Correlation coefficients between four of the five demographic variables and the Appropriateness Scale were statistically significant. These correlations are summarized in Table 3.2. Positive correlations of moderate magnitude were observed between the Appropriateness Scale and income, $r = .22$, $p < .05$, and maternal age of delivery, $r = .27$, $p < .01$. A moderate negative correlation coefficient was obtained between the Appropriateness Scale and marital status, $r = -.28$, $p < .01$, indicating that higher Appropriateness scores were earned by women who were married. A low correlation coefficient was observed between the Appropriateness Scale and the Family Support Scale, $r = -.16$, $p < .05$. This correlation indicates, rather paradoxically, that mothers reporting lower helpfulness of social support were rated as more responsive on the Appropriateness Scale. The correlation coefficient between the Appropriateness Scale and years of maternal education was not statistically significant.

Examination of coefficients between variables #1 through #5 on Table 3.2 reveals that the five demographic variables were also, not surprisingly, significantly correlated with each other. For instance, maternal age was associated with education, $r = .30$, $p < .0001$, with marital status, $r = .35$, $p < .01$, and with income, $r = .35$, (For dichotomous variables, SPSS automatically calculated point-biserial correlations.)
Table 3.2

**Correlations between the Appropriateness Scale and the Demographic Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. APP</td>
<td>.27**</td>
<td>.15</td>
<td>-.28**</td>
<td>.22*</td>
<td>-.16*</td>
<td>-.29**</td>
<td>.08</td>
<td>-.04</td>
</tr>
<tr>
<td>2. M-age</td>
<td>--</td>
<td>.30***</td>
<td>-.28**</td>
<td>.35****</td>
<td>.20*</td>
<td>.00</td>
<td>.03</td>
<td>.17*</td>
</tr>
<tr>
<td>3. Educ.</td>
<td>--</td>
<td>-.27**</td>
<td>.48****</td>
<td>.31***</td>
<td>-.07</td>
<td>-.13</td>
<td>-.06</td>
<td></td>
</tr>
<tr>
<td>4. Marital</td>
<td>--</td>
<td>-.63****</td>
<td>-.12</td>
<td>.55****</td>
<td>-.09</td>
<td>-.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Income</td>
<td>--</td>
<td>2.24**</td>
<td>-.43****</td>
<td>.06</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. FSS</td>
<td>--</td>
<td>.01</td>
<td>-.04</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Race</td>
<td>--</td>
<td>-.05</td>
<td>.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Adults</td>
<td>--</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Children</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*APP = Appropriateness Scale of the Parent/Caregiver Involvement Scale; M-age = maternal age at delivery; Marital = marital status; FSS = Family Support Scale; Adults = number of adults in home; Children = number of additional children in the home.

* p < .05

** p < .01.

*** p < .001

**** p < .0001
p < .0001. Even higher in magnitude were the correlation coefficients between income and education, r = .48, p < .0001, and between income and marital status, r = .63, p < .0001. These intercorrelation patterns influenced the analysis of Hypothesis #3.

**Hypothesis #3.**

The third hypothesis, that child-related parenting stress would account for variance in maternal responsivity beyond the effects of medical and demographic challenges, was tested using hierarchical multiple regression. Severity of neonatal medical condition and the five demographic variables of the former Demographic Risk Index were planned to be entered first, followed by the PSI Child Domain.

Prior to analysis, two problems were anticipated. First, based on the high degree of intercorrelation among the demographic variables, it was expected that these would generate a high level of multicollinearity if all were entered into a regression model. Secondly, one of the independent variables—the Medical Severity Index (MSI)—appeared to have a curvilinear relationship with the dependent variable.

The following intermediate analyses were necessary before conducting the proposed hierarchical regression analysis. First, stepwise regression was employed to identify a subset of demographic variables that most parsimoniously represented demographic variance. Second,
a polynomial model was employed to address the non-linearity problem. The polynomial model identified a quadratic term to account for a curvilinear relationship among two of the variables. These modifications are described in detail below.

**Intermediate stepwise analysis.** A stepwise regression procedure was performed to select a set of non-overlapping demographic variables that accounted for the most variance in the Appropriateness Scale to limit redundancy in the model (Tabachnick & Fidell, 1983). This was done in the interest of parsimony and of limiting the number of analyses so as not to inflate the overall error rate in the investigation. The goal was to assemble a block of demographic variables that would summarily express demographic variance in a similar fashion as would have been accomplished by the former Demographic Index.

The variables entered into the stepwise regression equation included the five variables that originally comprised the Demographic Index and the three additional demographic variables--maternal race, number of adults in the home, and number of additional children. The latter three variables were added because there was no longer reason to analyze them separately from the original five. (The original reason for analyzing them separately was that they did not lend themselves to dichotomous predictions of influence based on the current literature). Inclusion of
the three additional demographic variables in the stepwise procedure allowed examination of their predictive potential along with the other five.

As can be seen in Table 3.2, maternal race was highly correlated with income ($r = -0.43, p < 0.0001$) and with marital status ($r = 0.56, p < 0.0001$). Minority ethnic status was associated with lower income and with single motherhood. Number of adults in the home was not correlated significantly with any other demographic variables. Number of additional children in the home was positively associated with maternal age ($r = 0.17, p < 0.05$) but with no other demographic variables.

Table 3.3 summarizes the results of the stepwise regression procedure. The P/CIS Appropriateness Scale was regressed in stepwise fashion on all eight demographic variables in the dataset. The procedure yielded a 3-variable solution. Maternal race, the demographic variable most highly correlated with the Appropriateness Scale, was the first variable to enter the model. Maternal age at delivery was next to enter, being the variable with the partial correlation of next highest magnitude after race was already in the model. The final variable selected by the stepwise procedure was the Family Support Scale. Maternal age, race, and helpfulness of social support were all significant predictors of the Appropriateness Scale, with probabilities less than 0.01.
Table 3.3

Intermediate Stepwise Hierarchical Regression on Demographic Variables

Dependent Variable: Appropriateness Scale 

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>Mult R</th>
<th>R²</th>
<th>Change in R²</th>
<th>Beta to enter</th>
<th>F model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MATERNAL RACE</td>
<td>.29</td>
<td>.08</td>
<td>--</td>
<td>-.29**</td>
<td>8.98**</td>
</tr>
<tr>
<td>2</td>
<td>AGE OF DELIVERY</td>
<td>.40</td>
<td>.16</td>
<td>.07**</td>
<td>.27**</td>
<td>8.93***</td>
</tr>
<tr>
<td>3</td>
<td>SOCIAL SUPPORT</td>
<td>-.46</td>
<td>.21</td>
<td>.05*</td>
<td>.24*</td>
<td>8.44****</td>
</tr>
</tbody>
</table>

* p < .05  
** p < .01  
*** p < .001  
**** p < .0001
The three demographic variables selected by the stepwise procedure are not necessarily the variables with the highest association to the Appropriateness Scale. They are, however, the three that were both related to the dependent variable and the least interrelated with each other. For instance, maternal marital status and income, both of which had higher zero-order correlations with the Appropriateness Scale than the FSS, were not selected by the stepwise procedure. This is likely because of their strong correlations with maternal age. The stepwise procedure bypassed these variables because they did not contribute unique additional variance after maternal age had entered. Hence, maternal race, maternal age at delivery, and maternal social support were selected to represent demographic variance in the proposed hierarchical model in place of the original Demographic Index.

**Intermediate analysis to correct non-linearity.** The second problem requiring modification of analysis plans for Hypothesis #3 was violation of the linearity assumption. Prior to multivariate analyses, bivariate plots of each independent variable with the Appropriateness Scale were examined in order to determine if they reflected a linear relationship. The linearity assumption was upheld for all variables except the Medical Severity Index.

Figure 3.1 depicts the bivariate plot between the MSI and the Appropriateness Scale. The plot revealed a
Figure 3.1

**Bivariate Plot of Appropriateness Scale Scores with the Medical Severity Index**

Note: Numerals in the graph represent the number of subjects at that data point. Actual MSI scores range from 0 to 6.
curvilinear relationship. Appropriateness scores did not regularly increase or decrease along with the MSI scores. The lower Appropriateness scores tended to correspond with intermediate values of the MSI, and higher Appropriateness scores tended to correspond with more extreme values (low and high) of the MSI.

In order to further evaluate the suggested curvature, multivariate residual plots were examined according to commonly recommended procedures (Pedhazur, 1982; Schlotzhauer & Littell, 1987; Snedecor & Cochran, 1980). The planned hierarchical analysis was run, using the Appropriateness Scale as the dependent variable. The independent variables, entered hierarchically, included the Medical Severity Index, the block of three demographic variables identified by the stepwise procedure, and the PSI Child Domain. The values of each independent variable were plotted against the standardized residuals from the multivariate regression line, as recommended by Schlotzhauer and Littell (1987). In that multivariate plot, a parabolic bend was still evident. The curvature indicated the need for a polynomial term to facilitate representation of the non-linear variable in a linear model.

In order to identify the polynomial term that would correct for the observed curvature, polynomial expressions of the MSI were tested. A hierarchical regression using the Appropriateness Scale as the dependent variable and
polynomial variations of the Medical Severity Index as independent variables was performed, according to commonly recommended techniques (Pedhazur, 1982; Snedecor & Cochran, 1980) to produce the most parsimonious model.

The independent variables for this intermediate analysis were the linear, second-degree (quadratic), third-degree (cubic), fourth-degree (quartic), and fifth-degree (quintic) polynomial variations of the Medical Severity Index. The polynomial terms were obtained by raising the values of the MSI to the second, third, fourth, and fifth powers. The terms were entered hierarchically in that order. Five polynomial terms were entered, numbering one less than the number of possible values of the MSI, as it is recommended that the number of polynomial terms tested equal the value one less than the number of discrete values of that independent variable (Pedhazur, 1982, p. 405). $R^2$ change values were examined in order to determine the lowest polynomial term necessary to describe the relationship between the Medical Severity Index and the Appropriateness Scale.

Table 3.4 presents the results of the polynomial hierarchical regression model. The quadratic or second-degree polynomial term (representing squared values of the MSI) accounted for a significant increase in variance in Appropriateness scores over the original MSI term ($R^2 = .15$, $R^2_{\text{change}} = .12$, $p < .001$). Higher-degree polynomial terms did
Table 3.4

**Intermediate Polynomial Regression Analysis to Correct for Curvilinearity**

<table>
<thead>
<tr>
<th>Independent Variable&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Beta</th>
<th>R&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Change in R&lt;sup&gt;2&lt;/sup&gt;</th>
<th>F Change</th>
<th>F Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI</td>
<td>.15</td>
<td>.02</td>
<td>--</td>
<td>--</td>
<td>2.17</td>
</tr>
<tr>
<td>MSI&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.27</td>
<td>.15</td>
<td>.13</td>
<td>14.20***</td>
<td>8.33***</td>
</tr>
<tr>
<td>MSI&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1.72</td>
<td>.16</td>
<td>.02</td>
<td>1.89</td>
<td>6.24***</td>
</tr>
<tr>
<td>MSI&lt;sup&gt;5&lt;/sup&gt;</td>
<td>-2.50</td>
<td>.18</td>
<td>.01</td>
<td>1.34</td>
<td>5.03***</td>
</tr>
</tbody>
</table>

<sup>a</sup> MSI = Medical Severity Index, linear term; MSI<sup>2</sup> = Medical Severity Index, quadratic expression; MSI<sup>3</sup> = Medical Severity Index, cubic term; MSI<sup>5</sup> = Medical Severity Index, quintic term. MSI<sup>4</sup>, the quartic term, not entered into equation by SPSS because Tolerance limits reached.

* p < .05
** p < .01
*** p < .001
**** p < .0001
not increase variance explained to a statistically significant degree, a finding that was not unexpected. Significant trends beyond the second-degree polynomial are rare (Pedhazur, 1982).

Hence, the quadratic term was selected for addition to the proposed hierarchical regression model to account for the curvilinear relationship between the Medical Severity Index and Appropriateness scale. It was added to the model, rather than entered in replacement of the original Medical Severity Index. All the terms up to and including the highest-interpretable polynomial term are to be retained in the final polynomial equation (Pedhazur, 1982, p. 412).

**Final testing of the hierarchical model.** Table 3.5 presents the results of the hierarchical regression model, which incorporated the results of the stepwise and polynomial analyses described above. The original MSI was entered first, followed by the MSI quadratic term. (These were entered sequentially in order to display the increase in variance explained by the addition of the quadratic term.) Next, the three demographic variables selected from the stepwise procedure were entered simultaneously in a block. Finally, the Child Domain of the Parenting Stress Index was entered last.

Block entry of the three demographic variables was chosen instead of sequential entry for the following reasons. Simultaneous entry approximated the original
### Table 3.5

**Hierarchical Regression Model on Appropriateness Scale: Incorporation of Stepwise and Polynomial Model Results**

**Dependent Variable: Appropriateness Scale**

<table>
<thead>
<tr>
<th>Independent Variable&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Beta</th>
<th>( R^2 )</th>
<th>Change in ( R^2 )</th>
<th>F Change</th>
<th>F Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI</td>
<td>-1.07*</td>
<td>.02</td>
<td>--</td>
<td>--</td>
<td>2.16</td>
</tr>
<tr>
<td>MSI&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-1.27***</td>
<td>.15</td>
<td>.13</td>
<td>14.20***</td>
<td>8.33***</td>
</tr>
<tr>
<td>Demographic Block</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSS</td>
<td>-.21*</td>
<td>.14</td>
<td>6.32***</td>
<td>7.68****</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>-.24**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-age</td>
<td>.27**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSI Child Domain</td>
<td>-.17*</td>
<td>.32</td>
<td>.02</td>
<td>3.32</td>
<td>7.11****</td>
</tr>
</tbody>
</table>

<sup>a</sup> MSI = Medical Severity Index; MSI<sup>2</sup> = Medical Severity Index squared (quadratic term); FSS = Family Support Scale; M-age = maternal age at delivery.

* \( p < .05 \)

** \( p < .01 \)

*** \( p < .001 \)

**** \( p < .0001 \)
analysis design, in which demographic variance would have been represented by one variable. Both the original and modified analysis designs achieved the objective of isolating the amount of variance attributable to the PSI Child Domain, beyond the effects of collective demographic challenge. It was not the purpose of the current investigation to describe incremental variance attributable to various demographic factors, nor to test their relative explanatory power.

While the Medical Severity Index alone was not a significant predictor of Appropriateness scores, the quadratic term (MSI²) added a significant increment to the amount of variance explained in Appropriateness scale scores, \( F (2,96) = 8.33, p < 0.001 (R^2 = .15) \). The addition of the quadratic term thus accomplished a 13% increase in variance accounted for, compared to the 2% of variance accounted for by the linear term, the Medical Severity Index, alone.

The block of three demographic variables, entered next, produced a significant increment in variance explained \( F_{\text{change}} (5,93) = 6.32, p < .001 \). This block accounted for an additional 14% of the variance in Appropriateness scores, after the curvilinear influence of medical severity was considered. The total percent of variance explained by the medical and demographic variables was 29% (\( R^2 = .29 \)).
Each of the demographic variables were significant predictors. As can be seen from the standardized beta weights in Table 3.5, the FSS was negatively associated with the Appropriateness Scale ($p < .05$), suggesting that higher Appropriateness scores were earned by mothers who reported lower satisfaction with social support. Maternal race was associated with the Appropriateness Scale, ($p < .01$). Mothers who were Caucasian tended to receive higher ratings from observers on the Appropriateness Scale than mothers who were African-American. Maternal age at delivery of the child was positively associated with Appropriateness scores ($p < .01$). Mothers who were older when their children were born earned higher Appropriateness scores than younger mothers.

Lastly, the PSI Child Domain approached but did not attain significance as a predictor of the Appropriateness Scale. The addition of the PSI Child Domain increased the total variance explained by the model to 32% ($R^2 = .32$). However, the two-percent increment was not statistically significant ($F_{\text{change}} = 3.32, p < .07$). Hence, the PSI Child Domain did not account for unique variance in the Appropriateness Scale, after the effects of medical severity and demographic variables were taken into account. The final model accounted for approximately 31% of the variance in Appropriateness scores.
Semipartial correlations. Table 3.6 presents semipartial correlations, which provide additional information about relationships between the independent variables and the Appropriateness Scale. Semipartial correlations describe relationships between the dependent variable and an independent variable after the effects of other independent variables have been removed from the independent variable. All the semipartial correlation coefficients are based on 99 observations. The semipartial correlation coefficient between the Appropriateness Scale and the PSI Child Domain when the effects of the other independent variables were partialled out was low (part r = -.16).

This semipartial correlation is exceeded in magnitude by the other independent variables in the model. The semipartial coefficients for the MSI quadratic term (part r = .27), the MSI (part r = -.23), the Family Support Scale (part r = -.21), maternal age at delivery (part r = .26), and maternal race (part r = -.24) all exceed the semipartial correlation coefficient between the PSI Child Domain and Appropriateness Scale (part r = -.16). This pattern illustrates the relatively weaker unique predictive value of the PSI Child Domain when medical and demographic variables precede it in the hierarchical regression model.

Interpretation of Quadratic Term. In polynomial regression, beta weights are not easily interpretable
### Table 3.6

**Correlations and Semipartial Correlations Between Appropriateness Scores and Independent Variables in Hierarchical Model**

<table>
<thead>
<tr>
<th>Variable</th>
<th>$r$</th>
<th>semipartial $r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Severity Index</td>
<td>.14</td>
<td>-.23</td>
</tr>
<tr>
<td>Medical Severity Index, Quadratic term</td>
<td>.24</td>
<td>.27</td>
</tr>
<tr>
<td>Family Support Scale</td>
<td>-.16</td>
<td>-.20</td>
</tr>
<tr>
<td>Maternal race</td>
<td>-.29</td>
<td>-.16</td>
</tr>
<tr>
<td>Maternal age at delivery</td>
<td>.27</td>
<td>.24</td>
</tr>
<tr>
<td>PSI Child Domain</td>
<td>-.24</td>
<td>-.16</td>
</tr>
</tbody>
</table>
(Pedhazur, 1982). Polynomial tables exist for transforming the polynomial variable back to the original scale through multiplication by constants (Snedecor & Cochran, 1980). While these calculations may be obtained, it is more useful to interpret the MSI in terms of its bivariate curvilinear relationship with the Appropriateness Scale. The plots reveal that ratings of maternal responsivity tend to be higher for mothers of infants with either few medical complications or many medical complications. Lower maternal responsivity ratings were assigned to mothers whose infants had moderate levels of the medical complications included in the index.

Post-hoc developmental analysis. In order to enhance interpretation of the final model for Hypothesis #3, an additional analysis was conducted. It could be argued that the predictive effect of the MSI merely reflected the ensuing detrimental effects of neonatal insult and medical fragility on subsequent child development. In order to estimate the relative impact of developmental level of the child in the context of medical severity, demographic hardship, and child-related parenting stress, the following additional analysis was conducted. Data from the Minnesota Child Development Inventory (MCDI) (Ireton & Thwing, 1974) was available for the 49 subjects in the South Carolina subsample. Because this developmental measure was a not administered to the two-year-olds in the Utah sample, the
supplementary analysis was limited to the South Carolina subsample.

The MCDI was added to the hierarchical multiple regression equation, described above, for the South Carolina subsample. The original Medical Severity Index was force entered first, followed by the square of the Medical Severity Index quadratic term. Next, the MCDI was entered, followed by the block of demographic variables. The Child Domain of the Parenting Stress Index was entered last.

Addition of the Minnesota Child Development Inventory (MCDI) into the hierarchical multiple regression model tested above indicated that it was not predictive of maternal responsivity. Nor did its inclusion change the overall pattern of results. The MSI and the quadratic term accounted for 19% of the variance in the South Carolina subsample, \( F(2,41) = 4.93, p < .01 \), which amounted to 5% more variance than was accounted for by these variables in the combined sample. The subsequent addition of the MCDI to the model added no significant variance, \( R^2 = .21 \), \( \Delta R^2 = 0.62, p < .43 \). The block of three demographic variables, entered next, accounted for an additional 16% of the variance in Appropriateness scores in the South Carolina subsample, after the curvilinear influence of medical severity was considered. The demographic block increased the total variance accounted for (\( R^2 = .37 \)), which was
statistically significant increment, $F_{\text{change}} (6,37) = 3.15$, $p < .05$.

Lastly, the PSI Child Domain approached but did not attain significance as a predictor of the Appropriateness Scale in the South Carolina subsample, $F_{\text{change}} (7,36) = 1.80$, $p < .19$. The total model was significant, $F (7,36) = 3.40$, $p < .01$, and accounted for 40% of the variance in maternal responsivity in the South Carolina subsample ($R^2 = .40$). The overall pattern of results was similar to that found in the combined sample, and the developmental information in the MCDI did not change this pattern.

Hypothesis #4.

The fourth hypothesis was that maternal race, number of adults in the home, and number of additional children would be associated with maternal responsivity. The stepwise regression analyses described in the previous section revealed the relationship of these three variables to maternal responsivity in relation to other five demographic indicators. Maternal race was found to be a significant predictor, as described above, and the most significant of all the eight demographic variables--both in the stepwise analysis, and also in the hierarchical analysis that controlled for severity of medical condition. Number of adults and number of additional children in the home did not emerge as significant predictors relative to race, maternal age at delivery, and social support.
The originally proposed analyses were still conducted to spotlight the explanatory power of these variables in and of themselves. Maternal race was coded as a dichotomous variable since all mothers in the final sample were either Caucasian or African American. T-tests revealed significant differences between African-American and Caucasian mothers on the Appropriateness Scale. Mothers who were Caucasian were rated significantly higher on the P/CIS Appropriateness Scale ($M = 3.95$, $SD = .69$) than mothers who were African-American ($M = 3.52$, $SD = .79$), $t(95) = -2.73$, $p < .01$.

Correlation coefficients were not statistically significant for the relationships between the Appropriateness Scale and number of adults in the home, $r = .05$, $p < .33$) and between the Appropriateness Scale and number of additional children in the home, $r = -.01$, $p < .49$. However, these variables had very irregular distributions. It was felt that the individual impact of these variables would be better represented in analyses of variance, in which the subjects were divided into groups by virtue of their values on these variables.

As described earlier, the continuous variable representing number of adults in the home was converted into a 3-level categorical variable representing the following groups: 1) one adult in the home, 2) two adults in the home, or 3) more than two adults in the home. Division into these three groupings was justified by theoretical questions of
interest, namely, differences between single parent, two-parent, and multiple-caregiver homes.

Results of the one-way analysis of variance revealed a significant relationship between number of adults in the home and Appropriateness scores, $F(2,96) = 3.55, p < .03$. Scheffe multiple comparison test of means revealed a significant difference between the Appropriateness scores of mothers who raised their children in two-adults homes ($M = 3.91, SD = .76$) compared to single-adult homes ($M = 3.36, SD = .88$). This analysis was performed without control variables.

Results of the one-way analysis of variance on the number of additional children in the home revealed no significant differences between the Appropriateness scores of mothers who had no other children besides the IVH child, one other, or two or more children in the home, $F(2,96) = .10, p < .90$. This analysis did not control for any additional variables.

**Hypothesis #5:**

The fifth hypothesis was that the three "additional" demographic variables--maternal race, number of adults, and number of additional children in the home--would predict variance in maternal responsivity beyond the effects of the child's medical condition. Answers to this question have already been supplied in previous analyses for two of the three variables.
First, the hypothesis regarding maternal race was addressed in Hypothesis #3 when it emerged as a significant predictor in the hierarchical multiple regression model, entered after the Medical Severity Index and accompanying MSI quadratic term. Second, the hypothesis regarding number of additional children was effectively answered in Hypothesis #4. Because this variable did not explain any variance in maternal responsivity in a one-way ANOVA, it was not expected to explain any more variance when entered after the highly-predictive Medical Severity Index and quadratic term. In the interest of limiting the total number of analyses conducted, this variable was not further analyzed.

Third, number of adults in the home was analyzed in a hierarchical model controlling for severity of medical condition. The Medical Severity Index was force entered first, followed by the quadratic term ($\text{MSI}^2$), followed by number of adults in the home. Approximately 15% of the households had a single caregiver, 65% had two caregivers, 20% had multiple-caregivers in the household. When number of adults was entered after the MSI and the MSI quadratic term (which, demonstrated above, accounted for 14% of the variance in Appropriateness scores), it was not a statistically significant predictor ($p < .42$) and did not add a statistically significant increment in overall variance accounted for ($R^2 = .15; F_{\text{change}} = 0.65, p < .42$).
Correlations

Finally, to represent the direct rather than relative relationships between the variables in the models tested, a correlation matrix was constructed of the dependent and main independent variables. Table 3.7 presents correlations between the Appropriateness Scale, the Medical Severity Index and its associated quadratic term, the three demographic variables selected with the stepwise procedure, and the Parenting Stress Index. (Please refer to Table 3.2 for correlation coefficients of all eight demographic variables with Appropriateness scores.)

As is evident in the Table 3.7, the Appropriateness Scale was significantly correlated with all of the independent variables with the exception of the linear form of the Medical Severity Index (original variable). This was expected given that bivariate and multivariate plots revealed that the MSI does not have a linear relationship with the Appropriateness Scale.

Conspicuously missing from this table are the numerous significant intercorrelations between demographic variables, as were present in Table 3.2. After the stepwise procedure selected the most predictive and least intercorrelated demographic variables, three demographic variables remained --maternal race, age at delivery, and social support. Age and race were not significantly correlated, nor were race and social support. The Family Support Scale and age were
Table 3.7

Correlations between the Appropriateness Scale and the Main Independent Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. APP</td>
<td>--</td>
<td>.14</td>
<td>.24**</td>
<td>-.29**</td>
<td>.27**</td>
<td>-.16*</td>
<td>-.25**</td>
</tr>
<tr>
<td>2. MSI</td>
<td>--</td>
<td>.96****</td>
<td>-.14</td>
<td>-.05</td>
<td>.02</td>
<td>-.16</td>
<td></td>
</tr>
<tr>
<td>3. MSI²</td>
<td>--</td>
<td>-.16*</td>
<td>-.00</td>
<td>.00</td>
<td>-.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Race</td>
<td>--</td>
<td>-.00</td>
<td>-.01</td>
<td>.37****</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. M-age</td>
<td>--</td>
<td>.20*</td>
<td>-.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. FSS</td>
<td>--</td>
<td>-.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. PSI-Child</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* APP = Appropriateness Scale of the Parent/Caregiver Involvement Scale; MSI = Medical Severity Index; MSI² = Medical Severity Index, quadratic term; M-age = maternal age at delivery; FSS = Family Support Scale; PSI-Child = Child Domain Score of the Parenting Stress Index.

* p < .05

** p < .01

*** p < .001

**** p < .0001
correlated in a positive direction \( (r = .20, p < .05) \), indicating that older mothers tended to report more satisfaction with social support in this sample. The strongest correlations in the model were between the MSI and its quadratic term (an expected association given that one variable is the square of the other) and between race and child-related parenting stress \( (r = .37, p < .0001) \). African-American mothers had higher PSI Child Domain scores than did Caucasian mothers.
CHAPTER 4
DISCUSSION

Early intervention programs and services frequently rely upon parents to perform development-promoting activities with their children in their own homes. The quality of performance of these activities is likely influenced by parental abilities to accurately read their children's cues and to adjust their own behavior to the child's developmental level to optimally facilitate the child's cognitive growth. Such manifestations of responsivity may be essential to the success of intervention activities prescribed for home implementation.

The current investigation sought to describe and quantify the effects of several factors upon the responsivity of mothers of children born prematurely with a form of brain damage known as intraventricular hemorrhage. Children with IVH may have a combination of cognitive limitations, sensory and motor disabilities, and chronic medical needs. Their mothers often have the primary challenge of helping them absorb as much from and interact with their environments to the fullest extent possible. The results of this study shed new light on factors that predict maternal responsivity with medically-fragile, premature
children at risk for developmental disabilities, and in the process raised questions to be addressed with further research.

The unique characteristics of this research population frame the interpretation of its findings. First, this sample of 99 premature infants is of an unprecedented size. The majority of the children in this investigation, who developed intraventricular hemorrhage in the neonatal period, weighed less than 1000 grams at birth. Rarely do researchers have the opportunity to study so many young children who begin life in such precarious medical condition. In addition, the ethnic, geographic, and general demographic diversity of this large sample is noteworthy. These characteristics set this investigation dramatically apart from others that have examined relationships among parenting variables and child development in families of children with cognitive and/or physical handicaps.

The main contributions of this study are four findings. First, the hypothesized relationship between high child-related parenting stress and low maternal responsivity was supported. Second, severity of the child's original medical condition was found to be related to maternal responsivity in an unanticipated and unique fashion. Third, medical and demographic context variables were so strongly related to maternal responsivity that they limited the additional predictive value of maternal report of stressful child
characteristics. Fourth, maternal ethnic background emerged as a variable that must be carefully addressed by appropriate instruments or experimental methods. Such efforts are necessary in order to enhance understanding and avoid misinterpretation of maternal behavior demonstrated by women of minority cultures. Before discussing interpretations of the results, the major findings of this study are summarized.

Summary of Results

The first hypothesis, which proposed that higher scores on the Child Domain Scale of the Parenting Stress Index would be related to lower ratings of maternal responsivity on the Appropriateness Score of the Parent/Caregiver Involvement Scale, was confirmed. Zero-order correlations revealed that higher Appropriateness scores were obtained by mothers who reported lower child-related parenting stress scores.

The second hypothesis, that more demographic risk factors would be associated with lower maternal responsivity, was modified from its original form. Instead, each of the demographic variables available in the sample was assessed individually for its association with maternal responsivity. Several of the demographic variables—older maternal age, married marital status, higher income, lower satisfaction with social support, and majority ethnic background—were related to higher maternal responsivity.
Pearson correlation coefficients between the demographic variables revealed that younger maternal age of delivery was strongly associated with fewer years of education, lower income, single marital status, and lower helpfulness of social support, which were also associated with each other. Ethnic minority status was associated with lower income and single marital status, but not with social support, education, or maternal age at delivery.

The three variables that had the strongest relationships with maternal responsivity and were least correlated with each other were maternal race, maternal age at delivery, and helpfulness of social support. Mothers of African-American ethnicity, or who were younger in age, or who reported more satisfaction with social support were rated as lower in responsivity by trained observers on the Parent/Caregiver Involvement Scale.

The third hypothesis, that child-related parenting stress would account for variance in maternal responsivity beyond the effects of medical and demographic challenges, was not supported. This finding emerged despite the significant zero-order Pearson correlation between child-related parenting stress and responsivity. In exploring Hypothesis #3, a curvilinear relationship was detected between the medical index and maternal responsivity.

The fourth and fifth hypotheses stated that maternal race and number of adults and children in the home would be
related to maternal responsivity in and of themselves and after controlling for severity of neonatal medical condition. The results of these analyses may be summarized as follows: a) Caucasian maternal race was predictive of higher maternal responsivity than was African-American ethnicity, and the association remained significant even when medical severity was controlled; b) number of adults in the home predicted maternal responsivity, but the relationship was no longer significant after medical severity was controlled; and c) number of children in the home was not predictive of maternal responsivity.

**Reviewing the Interpretive Context of the Central Variables**

The findings of the current investigation depend to a great extent upon the definition of the central variables. As noted in Chapter One, there is substantial variation across investigations in the way maternal responsivity and child-related parenting stress are defined and conceptualized. The present definitions of these variables are briefly reviewed here in order to set the stage for interpretation of the findings. First, the definition of maternal responsivity in the current investigation is revisited, with particular emphasis on cultural concerns, psychometrics, and measurement factors that differentiate the P/CIS from other maternal observation scales. Second, issues involving the definition of child-related parenting
stress are addressed, with attention to delineations between different manifestations of child-related stress.

**Definition of Maternal Responsivity**

Responsivity as promotion of cognitive development. The Parent/Caregiver Involvement Scale is a creative instrument that shows great promise for measuring the interactive behavior of mothers with children who have handicapping conditions. The theoretically-derived P/CIS was developed from a cognitive-behavioral perspective, and its three summary scales were designed to measure parental behaviors that foster cognitive growth and self-esteem in the child. The P/CIS Appropriateness Scale was selected to represent maternal responsivity. With this scale, mothers were rated on their abilities to foster initiative in the child's play, facilitate his or her physical interaction with the environment, allow for independence in play, present achievable challenges, and help maintain the child's interest level.

This definition of maternal responsivity was specifically selected because of the investigator's primary interest in parental factors that promote cognitive development in children with extraordinary medical and developmental challenges. Parents of children with IVH are the primary "early interventionists" who help the children interact with their environments. It was felt that the Appropriateness Scale aptly captured elements of maternal
behavior that are essential for promotion of cognitive development, as many children with IVH require substantial assistance. While other responsivity scales reveal the emotional availability of the mother, the Appropriateness Scale of the P/CIS allowed measurement of maternal interactive behaviors that could help prepare their children to learn.

Because this investigation focuses on a very specific aspect of maternal responsivity, direct comparison of the present results with those from other investigations of "responsivity" requires careful attention to two issues. Varying definitions of responsivity and the age of the children toward whom observed maternal behavior is directed must be considered. For example, investigations that define responsivity in terms of the adequacy of the general home environment (HOME; Caldwell & Bradley, 1984) employ a much broader focus than that employed in the current study. Responsivity findings based on infant feeding scales (Barnard & Bee, 1979) or en-face interactions (proximal face to face) consisting primarily of vocal and gestural exchanges between mothers and their young infants (for example, Francis & Jones, 1984) pertain to maternal responsivity at a very early stage of interactive history between a mother and her child. The P/CIS Appropriateness Scale focuses attention on cognitive growth-promoting
aspects of maternal responsivity demonstrated with children who were 2-1/2 to 3 years old.

**Noteworthy properties of the P/CIS.** The P/CIS Appropriateness Scale measures maternal behavior specifically. Responsivity pertains to the mother or caregiver rather than to dyadic behavioral or affective synchrony. The P/CIS, molar in style and based on qualitative ratings, differs from the broad class of behavioral count systems. However, it also differs from other qualitative rating scales on which "responsiveness" is but a single item. On the P/CIS Appropriateness Scale, responsiveness is the qualitative dimension on which 11 behavioral items are rated.

The structure of the P/CIS permits separate examination of frequency and qualitative information about maternal behaviors by yielding separate scores. Other scales may be purely quantitative (e.g., Brooks-Gunn & Lewis, 1984; Crnic et al., 1983), predominantly qualitative (e.g., Lojkasek et al., 1990), or blend qualitative and quantitative rating dimensions according to the vision of the scale developers (e.g., Greenspan & Poisson, 1983). The P/CIS yields separable scores and allows the consumers of the research to compare and contrast quantitative (Amount Scale) and qualitative information (Quality Scale and Appropriateness Scale) on their own. The current investigation focused on the qualitative information in the Appropriateness Scale,
the ratings of which are not influenced by frequency of maternal behaviors.

Finally, the interrater reliability for the scale was calculated as percent of exact agreement across all the individual item ratings. With this relatively conservative calculation method and recent annual retraining, the most recent interrater agreement percentage of .88 represents a respectable estimate of agreement. While current interrater agreement on the data in this study would be preferable, recent reliability estimates suggest that the tapes were coded in a reliable fashion. In conclusion, responsivity as measured in this investigation refers to a qualitative dimension of maternal behavior related to cognitive growth in developmentally-delayed children. The Appropriateness Scale is molar in style, yields quantitative ratings, and has a recent reliability estimate in an acceptable range.

**Definition of Child-Related Parenting Stress**

The Parenting Stress Index (Abidin, 1990) is a well-known measurement instrument that has been employed in many child and pediatric studies to describe and quantify maternal stress. Despite its popularity, it is important to review the definition of child-related parenting stress implied by this instrument to clarify this construct in the current investigation. In this study, the construct of child-related parenting stress is most similar to that of child temperament or personality characteristics.
The Child Domain of the Parenting Stress Index may be conceptualized as a scale of difficult child temperament, enhanced by the additional information of how tolerable the parent regards those child characteristics (Abidin, 1990). The Parenting Stress Index has been used to define stress in other studies of children with disabilities (Boyce et al., 1991; Hanson & Hanline, 1990; Kazak & Marvin, 1984; Innocenti, 1991) as well. This circumscribed definition excludes alternative definitions of child-related parenting stress, which are numerous.

Child-related parenting stress can be conceptualized in many different ways based on varying manifestations of challenge related to caring for a child with severe disabilities. For instance, even variables not labelled as "stress" in the current investigation, could be conceptualized as child-related stress. Severity of the child's medical condition and the ongoing adaptations the family must make to accommodate physical and medical needs certainly qualify as "child-related stress." Furthermore, demographic factors such as numerous children in the home and financial demands related to medical maintenance of the child also aptly constitute "child-related stress."

What constitutes child-related stress to one investigator may not be relevant to the research purposes of another. For example, in some of the adaptation research by Wallander and his colleagues (Wallander et al., 1989a), a
construct that bears semantic similarity to child-related stress is not labelled as such. Wallander and his colleagues (1989a) measured "chronic strain" of caring for a child with handicaps with a scale that quantifies a child's adaptive self-sufficiency. In a seminal study of stress in families of children with handicaps (Beckman, 1983), variables that could have been labelled as "child-related stress" by semantic criteria instead fell under the category labelled "parent problems." In that study, child-related stress experiences of negativism and overprotection toward the child were combined with (and possibly hidden among) ratings of parental mood, time demands, and social support.

These alternate conceptualizations of "child-related parenting stress" are reviewed to highlight the circumscribed definition employed in the current investigation. The definition of child-related stress was restricted to temperamental factors. The children of the IVH sample are more challenged than many other children included in responsivity studies who are healthier and from more advantageous sociocultural circumstances. The behavioral characteristics of these children, as perceived by their parents, was deemed most relevant to the dependent variable, maternal responsivity.

Explicating the Link Between Maternal Responsivity and Child-Related Parenting Stress

The hypothesized relationship between high child-related parenting stress and low maternal responsivity
Hypothesis #1 was supported in this sample of children born prematurely with IVH. Their families represented a broad demographic spectrum. This relationship between maternal responsivity and child-related parenting stress has intuitive validity. It is not surprising that mothers who would rate their children as less moody, more adaptable, moderately active, reinforcing, and not too removed from their pre-natal expectations might appear to observers to be more responsive. Such children may be easier to engage and may more positively respond during games and exercises prescribed by interventionists to be performed by parents at home.

Indeed, children with more stress-producing characteristics may be more difficult to respond to with patience and optimal sensitivity. This hypothesis is supported by literature on the characteristics of children with disabilities (Robinson & Robinson, 1988; Towle et al., 1988) which relates that children with stress-producing qualities are often observed in unsatisfying interactions with their mothers. It is equally plausible, however, that inadequate maternal interaction skills lead to increased moodiness, reduced attentiveness, and other stress-producing behaviors in children, which do not enhance dyadic exchanges.
**Cyclic Hypotheses**

While correlational evidence cannot support interpretations that imply causality, it is possible that cycles of interaction are likely responsible for the observed association. The zero-order correlation between the PSI Child Domain and the P/CIS Appropriateness Scale may reflect an interactive cycle in which unrewarding behaviors of the mother and/or the child perpetuate unrewarding responses in the other. Previous research on parent-child interaction in samples of healthy children and those with disabilities or fragile medical conditions are consistent with hypotheses of reciprocal and cyclic influences between parent and child (Hauenstein, 1990). Mothers' high ratings of stress-producing child characteristics may reflect their discouragement about interaction patterns with their developmentally-delayed children.

In a related correlational investigation, Lemanek, Stone, and Fishel (1993) found that certain patterns of compliance in children with handicaps were associated with verbal reinforcement and complexity of commands delivered by mothers. Their parent-child interaction findings shed light on possible mechanisms for the observed association between the PSI Child Domain and the P/CIS Appropriateness Scale in the current investigation. Lemanek et al. (1993) hypothesize that ineffective parenting strategies may produce noncompliance, which in turn leads the parent to
display alternative directive behaviors that may not improve the exchange.

The correspondence between the variables in the current investigation and in that of Lemanek and her colleagues (1993) allows applicability of their findings to this IVH sample. Parental delivery of simple, clear, developmentally appropriate commands and verbal reinforcement were correlated with compliance in the children with disabilities in the Lemanek et al. investigation. These parental behaviors would have been rated as highly responsive behaviors on the qualitatively-scored P/CIS Appropriateness Scale. Parental encouragement of children with attention-getting strategies that merely imposed structure was correlated with child noncompliance in the three handicapped groups and the control group in Lemanek's sample. Such structure-imposing maternal behaviors would have earned lower scores on the P/CIS Appropriateness Scale.

Note that the variables that were likely to be coded low on the Appropriateness Scale coincided with child noncompliance in Lemanek et al.'s (1993) study. Child noncompliance may indirectly link maternal responsivity and child-related stress on the PSI. Child disruptive behavior has been associated with elevated PSI scores in both the Parent and Child Domains, while improvement in child behavior has been associated with decreased PSI scores (Eyberg, Boggs, & Rodriguez, 1992; Eisenstadt, Eyberg,
These findings, taken together, support the interpretation that inappropriate parental directiveness during play interactions with children with disabilities may promote child noncompliance, which could be associated with higher child-related stress scores.

The characteristics of children with very challenging conditions, such as IVH and accompanying cerebral palsy, sensory impairments, mental limitations, and chronic medical needs may make appropriate maternal responsiveness very difficult to achieve and maintain. Cycles of stressful interactions may result. The findings of the Lemanek study further enhance interpretation of the present association between maternal responsivity and child-related parenting stress. For example, the autistic children in the Lemanek study, the most severely handicapped children in their sample, displayed more noncompliance than the mentally retarded, language impaired, and nonhandicapped children in the sample. The parents of these autistic youngsters also displayed a higher frequency of unproductive strategies in trying to elicit compliance than parents in the other child groups. They displayed more use of structure but no higher frequency of verbal instructions or cues. That is, parents of autistic children were more directive yet less instructive. These phenomena may reflect development of negative circularity in the interaction patterns between
parents and their children with particularly challenging conditions. It may be that the dyads of IVH children and their mothers, in similar fashion to the dyads of autistic children and their mothers, developed negative cycles of interaction that were reflected in limited maternal responsivity and higher ratings of child-related stress.

Interpreting the PSI Child Domain in Context

The PSI Child Domain did not bear a statistically significant relationship to maternal responsivity when other variables were controlled. The demographic variables and the curvilinear relationship between medical severity and maternal responsivity accounted for so much variance that the amount of additional variance explained by the PSI was minimal.

This finding does not necessarily imply that stressful child characteristics do not impact maternal responsivity when medical and demographic challenges are present. In families overwhelmed by the latter stresses, child characteristics such as fussiness, undesirable activity levels, displeasing physical appearance, and distractibility probably do challenge a mother's ability to continue responding in a cognitive-growth-promoting style. That the PSI approached statistical significance in the hierarchical model suggests some predictive value in the context of the other variables, but weak influence in a relative sense.
One possibility for the nonsignificance of the PSI Child Domain in the hierarchical model is that PSI items may not be sensitive enough to the unique characteristics of children with disabilities and delays (Innocenti, 1991). Because the PSI was not constructed for developmentally delayed populations, profiles from families of children with special needs may differ from the norms (Abidin, 1990). These are possible reasons why the PSI had a significant correlation with the Appropriateness Scale, but was not predictive of responsivity after the Medical Severity Index was taken into account. The Medical Severity Index may have accounted for variance in mothers' responses to their disabled children that the PSI was not sensitive enough to pick up. A direct observational measure of child behavior in the play context with mothers might have been powerful enough to predict maternal responsivity beyond the effects of medical and demographic influences, the interpretation of which follows next.

**Demographic Influences on Responsivity**

The inclusion in the current investigation of several demographic variables makes a contribution to the literature on several levels. This investigation studied a sample much broader than the geographically and ethnically-restricted groups on which much previous responsivity research is based. Secondly, inclusion of these variables permits complex examination of the relationship between responsivity
and child-related parenting stress. The findings interpreted below confirm some previously held suppositions (e.g., regarding maternal age), contradict others (e.g., regarding social support), highlight the limitations in this field in general in interpreting cultural influences on maternal behavior, and reveal that household composition must be explored in a specific fashion to reveal potential relationships between membership and maternal responsivity.

Considerations in Interpreting Racial Differences

The predictive value of maternal ethnicity in this study is evident in correlations, one-way analyses of variance, and hierarchical regressions controlling for severity of neonatal medical condition. This finding raises many compelling social and psychometric questions concerning the definition, observation, and measurement of "responsive" maternal behavior. These racial differences cannot be interpreted with confidence at this time due to limitations of the P/CIS and other instruments available to measure maternal responsivity, which may reflect cultural bias in the conceptualization of "responsivity." Cultural issues have been infrequently addressed in the maternal interaction literature to date, and many related issues of socialization and adaptive processes have not yet been highlighted in the literature. This section highlights areas of concern in maternal responsivity research that includes women of minority cultures.
Cultural issues of the P/CIS and other measures. The scale properties of the P/CIS provide an illustrative context in which to discuss the current cultural limits of theory and measurement in the field of maternal responsivity. Measurement issues such as establishment of norms, observer bias, observation setting characteristics, and scale development affect cultural comparisons. The limitations that are highlighted in regard to the P/CIS also apply to other responsivity instruments currently available, and hence, reflect the general state of psychometrics in this research area.

In the current sample, Caucasian mothers were rated by observers on the P/CIS Appropriateness Scale as more responsive on the average than African-American mothers. (Caucasian and African-American were the only ethnic groups represented in the present study.) While these differences cannot be interpreted with confidence, it is of interest that the P/CIS developers have made relatively substantial effort toward examining the cross-cultural performance of their measure compared to researchers using other responsivity scales. Many other scales were developed or employed with ethnic majority samples (Barrat et al., 1991; Brooks-Gunn & Lewis, 1984; Isabella & Belsky, 1991; Isabella, Belsky, & von Eye, 1989; Wasserman et al., 1985) or have been employed in samples whose ethnic composition was not described (Denham, Renwick, & Holt, 1991; Francis &
Early P/CIS research findings from the Carolina Abecedarian Project included 49 mother-child dyads, all but one of whom were African-American (Farran et al., 1987). Mothers of the children in that Abecedarian sample obtained lower scores on all three P/CIS dimensions of maternal behavior, including the Appropriateness Scale, compared to two other samples whose subjects were mostly Caucasian. Interpretation of racial differences in the current investigation, therefore, is limited not by lack of previous data with this instrument on mothers of minority cultures, but by lack of official normative data. It is also limited by current maternal responsivity theory, which has not been aimed at explaining manifestations of responsivity in women of minority samples.

The culturally-relevant issues of observer bias and subject discomfort must be considered as possible reasons for disparities in Appropriateness Scale ratings in the current investigation. Observers who differ in race or cultural background from the subjects they observe may interpret subject behavior against the standard of their own culture (Brislin, 1993), or the cultural viewpoint implied in the content of the instrument they are using. The potential influence of observer bias cannot be ruled out in this investigation, as the coder in the current
investigation was Caucasian. Such bias can only be controlled by balancing race of the observer across subjects. In a related vein, African-American subjects could have experienced discomfort in the data collection setting. Their behavior may be influenced by observation by investigators of other ethnic backgrounds. This problem is common in literature that compares subjects of different cultures (Garcia-Coll, 1990). While normative data, observer ethnicity, and subject experience are all issues in instrumentation, construct validity is another issue of central importance. Scales developed to measure maternal behavior but that are not prepared to interpret differences between subjects of different cultures may misrepresent dyadic exchanges, or misinterpret their meaning by applying one standard of interaction to differing peoples. Differences found in this investigation between mothers of different races must be interpreted in this light.

Construct validity and cultural issues in the field. The work of Brislin (1993) facilitates examination of cultural issues that apply to the use and development of the P/CIS and any other instrument that purports to measure maternal behavior. In naming methodological problems in multi-cultural research, Brislin (1993) discusses the distinction between etics and emics, terms that describe aspects of cultural experience. Etics refer to cultural-
general concepts that are shared across cultures, while emics are cultural-specific concepts that are not generalizable to other cultures.

Brislin (1993) illustrates the etic-emic distinction in an example involving the well-known concept of intelligence. The ability to problem-solve, that is, to arrive at an effective solution when confronted by an unfamiliar problem, is an etic aspect of intelligence shared across cultures. Emic aspects of intelligence, however, may differ. In American culture, quickness of mental operations is a desirable emic aspect of intelligence, while slow and careful deliberation before submitting answers is an emic aspect of intelligence valued in other cultures (Brislin, 1993).

A common research design error is the assumption that etic and emic expressions of the concept of study are equivalent in all the cultures represented in the investigation. Accordingly, attention to emic and etic aspects of responsivity are critical to scales purporting to measure this construct, particularly in subjects from varying cultural backgrounds. Misinterpretation of performance could lead to disparaging results that do not inform us about the dynamics of the construct in the culture at hand.

Manifestation of this methodological problem in responsivity research, for example, would be the assumption
that the appropriate demonstration of responsivity is equivalent across cultures. An etic aspect of maternal responsivity might be the desire of a caregiver to provide offspring with experiences necessary to succeed in that culture. However, emic aspects of responsivity might account for differences in experiences that caregivers of different cultures want to provide. Two societal characteristics that influence emic expressions of responsivity are socialization ideals and adaptive strategies of a culture.

**Socialization ideals and adaptive strategies.** Harrison, Wilson, Pine, Chan, and Buriel (1990) discuss cross-cultural socialization processes that reveal the danger of interpreting the observed racial differences in the present investigation in terms of "responsivity." It may be that responsivity as defined in the current literature is culturally-biased. Harrison et al. (1990) emphasize that Western ideals of socialization may not be relevant in other cultures, and may influence the expression of mother-child involvement. For instance, values of "American individualism," including achievement, independence, and self-promotion, are held in high regard in American culture. However, those values contrast sharply with those of cultures that emphasize interdependence and community membership.
Garcia-Coll (1990) reviews literature that suggests that alternative socialization ideals and beliefs may underlie differences in maternal behavior, and hence may lead to different manifestations of "responsivity." For instance, Field and Widmayer (1981) found that some African-American mothers were concerned that too much attention would spoil a child. Fajardo and Freedman (1981) found that the relatively passive and silent maternal interactive behavior of Navajo Indian mothers reflected that culture's ideal of parent-child interaction as placid synchrony. Garcia-Coll (1990) points out that race and cultural beliefs might influence a mother's developmental goals for her infant and young child. It is of little value to apply the standard of one culture to observation of another; mothers of other cultures have different values, ideals, or even pressing survival needs that may influence their caretaking behavior and prioritization of goals for their children.

In addition to socialization ideals, Harrison et al. (1990) highlight the impact of adaptive strategies employed by the people of different cultures. These may affect the expression of "maternal responsivity" as well. Such strategies include extension of the family network beyond the nuclear family (Apfel & Seitz, 1991; Flaherty, 1988; Flaherty, Facteau, & Garver, 1987; Wilson & Tolson, 1990), flexibility in assignment, performance, and definition of family roles, and biculturalism (dual maintenance of the
customs and one's original and host culture) (Harrison et al., 1990). These strategies may have bearing on maternal behavior and expressions of "responsivity."

**Summary: The P/CIS in cultural context.** With respect to the current investigation, the cross-cultural generality of findings pertaining to maternal responsivity are limited. Specifically, differences between mothers of different races cannot be interpreted with confidence due to cultural bias in theory, definition, and measurement of maternal responsivity. Complete interpretation of differences observed between Caucasian and African-American mothers in the current investigation is not possible at this time, due to cultural constraints that characterize the P/CIS and other mother-child interaction scales currently available in the field.

**The Influence of Young Maternal Age**

In addition to maternal race, maternal age was another variable that emerged in the stepwise hierarchical regression as one of the three demographic descriptors that were most predictive of maternal responsivity. It was also one of the three demographic variables that were least-overlapping with each other and with the other demographic variables in the database. By definition, therefore, maternal age is a demographic indicator that also encompasses variation attributable to other demographic variables. Correlation patterns revealed associations
between young maternal age and lower education and single marital status, and, to a lesser extent, lower helpfulness of social support and more children in the home. Clearly, young motherhood is often accompanied by other life situations that also have bearing on the manner in which a mother interacts with her child.

Factors associated with young age may contribute to its predictive value with regard to maternal responsivity. Education was limited to high school or less for 53% of the mothers, and was correlated with maternal age. It is likely, that educational attainment enhanced the correspondence between maternal age and responsivity in the hierarchical regression.

The results of this investigation are consistent with and extend the findings obtained in other studies. Many studies including adolescent subjects observed lower responsivity scores in younger subjects (Barrat et al., 1991; Culp et al., 1991; Panzarine, 1988; Reis & Herz, 1987). Helm et al. (1990) found that adolescent mothers were rated as less verbal and responsive on P/CIS scales when observed with their children who had handicaps, even when race was controlled. However, the coders' receipt of only brief training with the P/CIS in that study renders those results less credible. The P/CIS is a complex instrument that optimally requires training of longer duration. The expert coder employed in the current
The current investigation had extensive experience and training with the P/CIS. Hence, the current investigation support the results about age and responsivity using the P/CIS in a more credible fashion.

The current investigation is also consistent with the findings of Lojkasek et al. (1990), who also found that older maternal age was associated with higher maternal responsivity. Lojkasek and her colleagues defined responsivity as a combination of the degree to which mothers adequately positioned the child, used animated facial and vocal expression, vocalized in a developmentally-appropriate style, and exhibited pleasure in the interactions. However, the current investigation reinforces that finding in a sample that provides additional generalization information. The Lojkasek sample was predominantly Caucasian, unlike the current sample, and the degree of medical impairment in the children of Lojkasek's sample was not clearly described. The current investigation adds the information that younger maternal age predicts lower maternal responsiveness, even after controlling for medical severity of the children, and in a sample whose minority composition amounted to one-third.

Responsivity and Social Support: A Complex Relationship

The Family Support Scale, which asks mothers to rate the helpfulness of available sources of support, from friends and family to church, social groups, and community
resources, was negatively associated with maternal responsivity in the present study. This association held even after the predictive effect of severity of medical condition was taken into account. Paradoxically, mothers who rated the helpfulness of their social support as high were also more likely to be rated as low in responsivity.

The negative association between maternal responsivity and social support found in the current investigation is paradoxical and, at first glance, contradicts other social support findings. In other samples of mothers and their infants with special needs, positive parent-infant outcomes have been associated with amount of emotional, tangible, and informational support (Affleck, Tenne, Allen, & Gershman, 1986), intimate support from family members (Crnic, Greenbough & Slough, 1986) and friends (Boudykis, Lester, & Hoffman, 1987). The current findings also seem to contrast with previous research using the P/CIS scales. Comfort and Farran (1986) reported that levels of instrumental and emotional social support had a significant main predictive effect on maternal behavior across all three domains (Amount, Quality, and Appropriateness) of maternal behavior in a sample of handicapped children and their mothers.

One possible reason for differences between the current findings and previous research is the way in which social support was measured. The Family Support Scale measured the perception of helpfulness of different sources of social
support, rather than amounts of support sources available. Other investigations often use amount ratings. This observation raises the question of why satisfaction with social support might correlate differently with maternal responsivity than amounts of social support. This question could be addressed in investigations that compare the predictive utility of these two approaches to measuring social support.

Another possible interpretation is that mothers who are stressed by the challenges of raising a medically-fragile child gather a network of support sources whom they regard as helpful, but whose support does not have a direct relationship to parenting performance. It may be that some of the mothers in this sample experienced extreme parenting challenges due to the combination of demographic disadvantages and demands of these medically-fragile children. The relationship between low responsivity and high satisfaction with social support may merely illustrate that having satisfying support may assist coping in these mothers, but not necessarily facilitate optimal responsive parenting behavior in a specific parenting context.

The social support literature on density of social networks provides another possible explanation for the observed finding. Higher social support scores on the FSS could possibly reflect "denser" social support networks, which can be a source of stress (Kazak & Marvin, 1984;
Zarling et al., 1988). Network density is measured by the number of affiliative relationships between the providers of support to a family or person. Kazak and her colleagues (Kazak, 1986; Kazak & Marvin, 1984) found that high-density social support networks, which are common to families of children with handicaps, were associated with increased stress in mothers of infants with handicaps and disabilities. Similarly, Zarling et al. (1988) found that the more ties between the mother's support providers, the lower her sensitivity to her premature 6-month-old child.

Their findings were different for mothers of full-term children, for whom network density was associated with higher maternal sensitivity (Zarling et al., 1988).

The following hypothesis illustrates a mechanism through which dense social networks might increase stress for a mother of a premature infant. Zarling and her co-investigators hypothesized that stress may result from a network whose intercommunications magnify confusion over how to be helpful. Customs typically enacted to greet the healthy newborn may be replaced by ambivalence and leave supporters unsure of how to respond. Reactions from a interconnected network may proliferate a role identity in the new mother as one to be "felt sorry for," and reinforce a sense of helplessness in the new mother (Zarling et al., 1988). It is possible that individual sources of support could be perceived as instrumentally helpful and well-
intended, yet their collective, interactive influence could exert a stress-increasing effect.

The above hypothesis offers a possible explanation for the current finding of a negative relationship between helpfulness of social support and maternal responsivity. From a network density viewpoint, the degree of helpfulness of individual support providers may not be as influential upon maternal parental functioning as the degree of interconnectedness between support providers. This would be an avenue for future research, especially among minority families, as the network density findings mentioned above emerged from samples of Caucasian mothers. Additional research would be necessary to determine whether the higher network densities of minority families, which are more likely to be extended (Harrison et al., 1990; Garcia-Coll, 1990), would also contribute to low responsivity findings. Further research is also needed to investigate whether the network forces in mother-infant dyads that Zarling et al. (1988) hypothesized exert similar effects after the mother-child dyad has been interacting for a few years.

It is possible that the low magnitude of the correlation between social support and maternal responsivity \( r = -16 \) represents a spurious relationship. However, this variable remains statistically significant in later stepwise and hierarchical analyses. The correlation between the FSS and the Appropriateness Scale even increases slightly in
magnitude when the effects of other variables are partialled out. These findings suggest that closer attention to this variable is warranted. In summary, the association in the current investigation between low maternal responsivity and high FSS scores may reflect measurement strategies, the failure of support satisfaction to impact specific mother-child interactions, or the hidden effect of network density.

**Effect of Household Composition on Responsivity**

**Number of adults in the home.** Previous literature did not inform about the relationship between maternal responsivity and number of adults in residence in homes of children with disabilities. But the above-mentioned social support findings suggest that number of additional people in the home may not be as influential with respect to maternal responsivity as the quality of the network they (and others) form around the mother who is raising a disabled or medically-fragile child.

Mothers living in households with two or more than two caregivers were rated as equally responsive, and were rated as more responsive than mothers living in single-caregiver households. Correlation patterns suggest that this finding is not attributable to a direct relationship between number of adults in the home and any other demographic variable in the study. However, the effect of this variable diminished when severity of medical condition was controlled. While the current investigation focused on testing a hierarchical
model, future research that explored interactions could illustrate whether the effect of medical severity upon maternal responsivity varied with the number of caretakers.

**Number of children in the home.** As stated, number of children in the home did not predict maternal responsivity in this study. Lojkasek et al. (1990) also found no effect of number of children upon maternal responsivity. In the current investigation, the number of children in the home was used rather than number of blood-related siblings, in order to account for the functional strain of additional young ones in the household. It is noteworthy that the number of children in the home, in and of itself, was not associated with maternal responsivity. Future research might explore the impact of the number of additional children in the home that had disabilities, the ages of the additional children, or the roles they play in the family context. These more detailed variables may be more informative about the impact of children upon the responsivity of a mother raising a medically-fragile child.

**Child's Neonatal Medical Condition: Unique Relationship to Maternal Responsivity**

Many of the findings discussed above reflect the predictive value of variables after taking into account the influence of the Medical Severity Index, a variable that plays a complex role in this investigation. The non-linear relationship between maternal responsivity and severity of medical condition was an unexpected finding, and one that
has not been discussed (or possibly tested for) in other investigations of maternal responsivity. This compelling finding merits close examination for its potential application to early intervention efforts.

In the current investigation, a linear relationship was hypothesized and was tested first. The MSI did not have a linear relationship with maternal responsivity. That result is consistent with a result obtained by Wilfong, Saylor, and Elksnin (1991) with the IVH population. They found that medical condition, measured by grade of IVH alone, was not related to maternal responsivity (as represented by the P/CIS Quality and Appropriateness Scales). The possibility of a curvilinear relationship was not explored by Wilfong and her colleagues. But the current investigation tested for a curvilinear relationship and detected one with a medical complications index that included grade of IVH.

In the current sample using the P/CIS Appropriateness Scale, maternal responsivity did not regularly increase nor decrease with the severity of the child's medical condition. Instead, mothers in this study whose children experienced either very few or very many complications in the neonatal period earned the highest responsivity scores. The lowest responsivity ratings were obtained by mothers whose children experienced an intermediate number of medical problems. Compelling is the finding that this neonatal medical variable had such predictive influence upon maternal
behavior 24 to 30 months after the birth of a child with intraventricular hemorrhage.

Clinical Interpretation of the Curvilinear Relationship

Diagnostic ambiguity and maternal responding. One possible mechanism of the curvilinear association pertains to uncertainty about the developmental future of some children born with IVH. Some children with IVH have less severe bleeds or experience moderate accompanying neonatal medical problems. Mothers of such children who appear more "normal" than severely impaired children, face ambiguity about the child's prognosis that may postpone development of responsive maternal interaction patterns. Fewell and Gelb (1983) noted that in some families, parents of moderately impaired children may remain in a stage of denial if their child appears normal, and extend searches for second opinions in hopes of clarifying or improving developmental projections. Such preoccupations may delay initiation of a treatment plan (Fewell & Gelb, 1983). It can be hypothesized that such ambiguity also may cause some mothers to "hold off" fully engaging their young children, in hopes that medical opinion will soon pronounce the child normal or "alright." Saylor et al. (1989) also noted that ambiguity about developmental status can impede parental acceptance of findings in assessment processes. Hence, the mediating effect of ambiguity may affect mothers of IVH children with medical complications of intermediate severity.
One might hypothesize that the challenge of adjusting to ambiguous prognosis might affect mother-child relations in the earlier periods of interaction, and that mothers would settle into a responsive patterns with time. But the relationship between medical severity and maternal responsibility was observed when the children in the current investigation were between 2-1/2 and 3 years old, well into their interactive histories with their mothers. Saylor and her colleagues (1989) suggest that maintenance of maternal expectations that a young child will catch up to his or her same-age peers can lead to a prolonged period of stress characterized by difficulty accepting a child's cognitive and physical limitations that sometimes endures several years (Saylor et al., 1989).

This pattern of delayed acceptance may be more pronounced for the families of children that display subtle disabilities that become more evident as the child matures. Such children may resemble the ICH (intracranial hemorrhage) subjects investigated by Selzer et al. (1992). Those children displayed memory deficits at age 5 but were not previously identified with obvious problems. The responsivity of mothers of moderately-impaired children may differ from that of mothers of severely impaired children, who likely received a clear, early message that their children need all assistance available. The latter mothers may be more likely to engage the child fully from an early
point instead of waiting in hope for spontaneous improvement. These are conjectures that would need to be tested in research paradigms that followed mothers and related their interactive styles to their beliefs about their children's developmental promise.

**Irrelevance of child developmental status.** Because medical complications and developmental outcomes are generally correlated, one interpretation of the MSI findings might be that severity of medical condition is a reflection of the current developmental status of the child. The hypothesis that the predictive effect of medical severity actually represented the ensuing detrimental effects of neonatal insults and medical fragility on subsequent child development was explored. This post-hoc hypothesis had merit due to existing evidence that developmental level of children with disabilities may be related to responsive maternal behavior (Brooks-Gunn & Lewis, 1984; Crawley & Spiker, 1983; Francis & Jones, 1984) and play maturity of the child (Lojkasek et al., 1990; Wasserman, Allen, & Solomon, 1985). While not originally planned, this hypothesis was able to be explored due to inclusion of a developmental measure for some of the children in the large, EIRI multi-site data set.

Addition of the Minnesota Child Development Inventory (MCDI) into the hierarchical multiple regression model from the current investigation indicated that it was not
predictive of maternal responsivity. MCDI data in this age range were only available for South Carolina subjects. However, the finding that the MCDI was not significantly correlated with maternal responsivity and added no additional predictive information beyond the effect of severity of medical condition is telling.

In the more impoverished South Carolina subsample, where effects of demographic disadvantage were likely more pronounced, ratings of child developmental level did not account for any variance beyond that accounted for by medical variables, and also did not diminish the unique variance accounted for by demographic variables. This finding is all the more significant because the MCDI is a maternal measure of child development. Mothers' perceptions of the children's developmental competencies and deficiencies had virtually no association to their level of responsivity to the children.

**Measurement Considerations**

Had analyses proceeded without checking for violation of the linearity assumption, results would have declared severity of neonatal medical condition a useless variable. Considering the possibility of a non-linear relationship revealed the significance of otherwise "uninformative" data. Although these results are interesting and unique, some measurement concerns must guide their interpretation.
Two interpretation concerns involve the replicability of these findings and the consequences of extrapolating beyond the number of medical conditions represented in the MSI. Both concerns, however, are tempered by the fact that the MSI reflected a group of variables commonly associated with compromised outcomes in children born prematurely (Vohr & Garcia-Coll, 1988). Despite variation across studies, there seems to be a core of medical variables that are measured or controlled in most investigations of high-risk infants. These variables are birthweight, gestational age, length of hospitalization, grade of IVH if present, and duration of mechanical ventilation assistance. The index used in this investigation included most of those core variables, despite minor limitations by the availability and compatibility of these variables across the South Carolina and Utah sites. Replicability and extrapolation concerns are addressed in this context.

Replicability. Replicability concerns are represented by the question of whether alterations in the variables or number of variables in the index would alter the curvilinear relationship observed. It is certainly possible that the observed relationship might change were the composition of the index altered. However, the MSI includes medical variables commonly employed in studies of medically-fragile children, together with commonly-used cutoffs. While other studies might deviate from this core, substantial deviation
would represent departure from commonly recommended medical variables of concern indicated by the field at this time.

An index might contain more variables than were included in the MSI. For instance, Bendersky and Lewis' (1989, 1990) medical complications score included fourteen conditions. Clearly, however, the MSI is a more parsimonious collection of medical variables, and lends itself readily to formal investigation of the replicability question at hand. The relative predictiveness of this set of core variables compared to others could be explored in investigations that measure a high number of medical variables and compare the predictive power of different combinations of variables.

**Extrapolation.** Extrapolation is a related concern. There were six possible values of the Medical Severity Index. In the absence of additional research that tested for curvilinear relationships, one cannot be sure whether the same curvilinear relationship between child medical condition and maternal responsivity would emerge if the Medical Severity Index contained more or fewer variables, and hence had a different range. There is no statistical basis for surmising what relationship would exist between the dependent and independent variable(s) if the values for the independent variable were extended beyond the range that was actually studied (Pedhazur, 1982, p.413). It is uncertain where or if curves might be evident in plots of
the MSI versus other variables if the range of a revised Medical Severity Index were less than or in excess of six. Again, this measurement consideration is tempered by the fact that the medical variables included in the MSI reflect consensus in the field that these are highly relevant to children born with IVH. Only additional research can answer the question of whether the curvilinear findings would persist through permutations of the MSI.

In conclusion, a curvilinear relationship was detected between severity of medical condition and maternal responsivity. Maternal estimates of child developmental level had no impact upon this relationship, even though maternal perceptions of their child's development might have been expected to bear a relationship to their responsive behavior toward their children. The Medical Severity Index contained core medical variables common to many investigations of medically-fragile children, and possible explanations for the curvilinear relationship can be theoretically drawn from clinical and research findings from psychologists who have worked with children in the IVH population. The unexpected curvilinear relationship, therefore, is worth further exploration in further studies of medically-fragile children at risk for developmental disabilities.
Strengths and Limitations of the Current Study

Strengths

The strengths of this study include large size, demographic diversity, combination of previously unintegrated literatures, statistical integrity, and implications for early intervention efforts. The large size of this sample of children born prematurely, at low birth weights, and with brain damage is almost unprecedented in the literature. Given the common occurrence of intraventricular hemorrhage in premature infants, the findings here are applicable to many babies and children, rather than to a small circumscribed group.

The demographic diversity of this study also sets it apart from others that have examined interactions between children with disabilities and their mothers. Few responsibility studies have included minorities in substantial numbers, or even assessed for ethnic differences. This research broadened the ethnic scope, and the results reveal that attention to ethnic issues is necessary, lest misinterpretation and misunderstanding be perpetuated. This investigation highlighted a limitation in the field of responsibility research.

The combination in this study of child-related parenting stress, medical severity, demographic and maternal responsibility variables is a step toward filling a gap in the literature. Decades of research have informed us well about
the adjustment of majority, intact families who care for children with disabilities. However, those findings do not directly apply to disadvantaged families that differ from Caucasian middle class families in member composition, ethnicity and beliefs, financial stability, and maternal characteristics such as age and education. Even an assumption as basic as the existence of a relationship between child stress-producing characteristics and maternal responsivity is not clear cut when other stress-producing variables of living are considered first.

This investigation is characterized by statistical integrity and careful attention to the assumptions that underlie the statistical methods employed. Distributions of variables were carefully assessed, and relationships among variables, despite linear hypotheses, were not assumed to take linear form. Appropriate application of statistical analytical techniques strengthens the conclusions herein.

Lastly, the specificity with which constructs were defined enhances clear comparisons of this research with other studies. A distinct, focused manifestation of maternal responsivity was studied--specifically, those maternal behaviors that foster cognitive development in the child. These findings inform early interventionists about what variables impact a mother's ability to create a fertile learning environment within her relationship with her own child, as well as what variables may limit a mother's
ability to implement the tasks she is assigned to do with her child at home.

Limitations

This study also contains weaknesses that must be taken into account and which can be used to guide future research in this area. Such weaknesses include the complexity and cultural constraints of the instrument representing the dependent variable, and unknown replicability of the Medical Severity Index. The Parent/Caregiver Involvement Scale provides data from mothers of minority cultures, but, like other instruments, has not yet developed sufficient normative data to allow valid interpretations of cross-cultural comparisons. It may be that the molecular scales may be more informative to cross-cultural research on mother-child interaction at this point, because they describe interactions in a less subjective manner and might add protection against ethnocentric comparisons.

The complexity of the P/CIS is a factor that limits the ease of its general usage. While each item is rated on a 5-point behaviorally-anchored scale, coding also requires higher level abstractions. The coders of mother-child interaction tapes in the EIRI database are holders of doctoral degrees in psychology who have an abundance of experience and training. It is uncertain how easily and accurately coders with less experience and training would be
able to accomplish the fine discriminations mandated by the P/CIS.

The generalizability of the Medical Severity Index is another concern. While condensing much information and controlling for many medical variables simultaneously, the MSI might yield different results with variations in the number or the content of the items. Future studies attempting to replicate the findings here could answer this question.

Directions for Future Research

Research employed to interpret the findings above also suggest directions for future research or for extending the present findings. Investigations that identify and compare variables that predict the Appropriateness Scale with those that predict the Quality Scale and the Amount Scale could enhance understanding of the separate dimensions captured by the instrument. Such investigation might help early interventionists discover what variables affect performance of behaviors that a given mother needs to strengthen in order to best meet her child's needs. For example, the variables that help a mother conduct her play activities at the developmental level of her child (Appropriateness of teaching) are likely to be different from the variables that enable her to be spontaneous and flexible in her educational play (Quality of teaching). Other studies that employed the P/CIS have represented responsivity by combining of the
Quality and Appropriateness Scales (Blasco et al., 1990; Wilfong et al., 1991). The relative predictive value of that responsivity variable could also be explored.

Continuing development of the P/CIS should include efforts to expand its cultural validity. If undertaken, this work would advance understanding of manifestations of maternal responsivity in women of different cultures, from the which the whole field of maternal responsivity would benefit. Perhaps identification of the implicit emic quality of responsiveness on which the scale is constructed can guide efforts to expand its behavioral anchors and make the scale less culture-bound.

In addition, the instrument could benefit from generation of basic criterion and concurrent validity information, kappa estimates of reliability, test-retest reliability information, and more normative data from large, diverse samples. In addition, coding workshops could assist other researchers around the country in using this measure in their work, and hence extend its applicability beyond the expert coders on which it currently depends. Continuing validation and development efforts will strengthen and broaden this promising and creative scale.

Network density approaches to studying social support might be particularly fruitful for samples characterized by ethnic and social diversity. The negative association between responsivity and satisfaction with social support
from individual sources observed in this investigation is compelling. Previous research on effects of network density and parental functioning (Kazak & Marvin, 1984; Kazak, 1986; Zarling et al., 1989) suggest that the dynamics within social support systems may reveal different effects than the additive satisfaction with the support provided by each individual support source.

Finally, the findings of a curvilinear relationship between severity of child's neonatal medical condition and maternal responsivity generates interest. Replication concerns await the results of additional empirical research, which should be conducted in order to investigate the viability of the explanatory clinical hypotheses it inspires. In general, early intervention studies could also be strengthened by efforts to delineate the most parsimonious set of predictor medical variables for premature infants. With such information, investigations could be more comparable if they controlled a common, agreed-upon set of threatening medical conditions.

Conclusion

The current investigation uncovered complex relationships between variables associated with maternal responsivity in mothers of premature, medically-fragile children at risk for developmental delays. The objective was to examine the relationship between child-related parenting stress and maternal responsivity, and this
relationship was confirmed. However, it was found that stressful child characteristics were less predictive of maternal responsivity than the medical condition in which the child was born and the demographic context that colors the mother's child-rearing capacities and resources.

This investigation set out to test a seemingly obvious relationship—the link between maternal responsivity and child-related stress—in the context of other variables frequently ignored in similar studies of medically-fragile children. Results indicated that in families of children with a multitude of stressors, the link between stressful child characteristics and maternal responsivity is not straightforward. It may be that early intervention programs that focus on the mother-child relationship could bring more substantial effects by attending to the predictive factors uncovered here. Addressing maternal responses to the early medical diagnosis and following maternal adjustment as development unfolds could promote responsivity. General psychosocial coping assistance may help mothers hampered by low education and young age.

This investigation raised intriguing questions that may serve to sensitize other early intervention researchers to areas that may need more attention. This investigation set out to explore cultural concerns, and found that further instrument development will be required to reliably assess cultural differences. The results also revealed the value
of entertaining and testing non-linear relationships in order to explore relationships with more statistical complexity.

Children with intraventricular hemorrhage and accompanying medical complications constitute a unique sample of children that have been excluded from investigations more often than they have been included. They and their caretakers may have unique experiences and characteristics that require closer examination. We must continue efforts to explore variants in their experiences, pressures, and competencies so that early interventionists can help the "real" interventionists--the parents and caregivers--advance their children's growth to the fullest extent possible.
APPENDIX

SUMMARY OF APPROPRIATENESS SCALE DEFINITIONS
FOR THE PARENT/CAREGIVER INVOLVEMENT SCALE

1. PHYSICAL INVOLVEMENT: Assistance with child's posture, positioning of toys for the child.
   * How adequately the mother positions the child so that s/he can engage in interactions and learning experiences.

2. VERBAL INVOLVEMENT: provision of a verbal link between the child and the world.
   * How much the mother comments on child's activities, "embeds the child's activity in a verbal context." (Directives excluded.)

3. RESPONSIVITY: timing of response to activities.
   * Does the parent anticipate needs/seem oblivious? Respond too quickly/slowly?

4. PLAY INTERACTION: adaptation of toys to the child's developmental level and interest level.
   * Emphasis on kinds of activities. Does parent change child to fit the toy, or change toy to fit the child?

5. TEACHING BEHAVIOR: relationship of tasks to the child's developmental capabilities and interests.
   * How well do the activities the adults chooses fit the developmental status of the child? Are tasks below or above child's level?

6. CONTROL OVER CHILD'S ACTIVITIES: fit between degree of caregiver structure and child's developmental level.
   * How well the adult adapts structure provided to the level of the child. Does the parent provide too much, too little, or just enough structure given the child's capability for independent functioning?

7. DIRECTIVES (DEMANDS, COMMANDS): reasonableness of directives.
   * How reasonably the adult imposes requests. Are commands reasonable given the abilities and interest level of the child? Could the child actually do or is the child interested in doing what is being demanded?
8. RELATIONSHIP AMONG ACTIVITIES (in which caregiver was involved with the child): relationship of sequence of activities to the child's developmental level.

* Are the activities introduced from simple to complex? Is change introduced to maintain child's interest? Do the activities seem related to each other?

9. POSITIVE STATEMENTS: timing of statements.
* How contingent is the expression of positive emotion. Is it contingent and in appropriate amounts, not inappropriately excessive?

10. NEGATIVE STATEMENTS (DISCIPLINE): timing of statements.
* How contingent and realistic are the negative statements that are delivered. When negative emotion is expressed, is it contingent upon a behavior and is that discipline realistic?

11. GOAL SETTING: reasonableness of expectations for the child's behavior.
* How attainable are the goals set by the adult, given ability levels of the child. Are the challenges attainable?

REFERENCES


BIOGRAPHICAL SKETCH

Elizabeth Jeanne Onufrak, daughter of Daniel and Marion Onufrak, was born in Manhattan, New York, on June 21, 1964. She is a graduate of the Academy of the Holy Names in Albany, New York. A member of the Phi Beta Kappa honor society, Ms. Onufrak graduated magna cum laude from the University of Rochester with a Bachelor of Arts degree in psychology in May, 1986. She earned her masters degree in clinical psychology from the University of Florida in May of 1989, funded by training fellowship from the National Institute of Health. During her continuing doctoral studies at UF, Ms. Onufrak was awarded the Geoffrey Clark-Ryan Award for Excellence in Pediatric Psychology Research from the Department of Clinical and Health Psychology in May 1991. At the Medical University of South Carolina, in Charleston, Ms. Onufrak completed her pre-doctoral internship in clinical psychology during the academic year 1991-1992. There she was awarded first place in the Psychology Intern Research Paper Competition. Ms. Onufrak currently resides in Charleston, South Carolina, and is engaged to James Kermit Sheffield, Jr., who is currently completing medical school. She intends to pursue a postdoctoral fellowship in pediatric psychology after graduation.
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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