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A multivariate descriptive study of infants and toddlers who are technology dependent

Nissen, Hannah Lee, Ph.D.

The Ohio State University, 1992
A MULTIVARIATE DESCRIPTIVE STUDY OF INFANTS AND TODDLERS WHO ARE TECHNOLOGY DEPENDENT

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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*****

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1992

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CHAPTER I

INTRODUCTION

In pediatric health care, significant changes in the types of patients served and the level of care being provided have occurred in recent years. Children with more serious illnesses, significant numbers of whom are infants and toddlers, are occupying an increasing number of pediatric beds in health care facilities throughout the country, often for extended periods of time (American Academy of Pediatrics, 1986; Wilson, 1988). Furthermore, the care required by many of these children has become increasingly technical.

Medical advances have made it possible for young children with chronic and life-threatening illnesses and disabilities to survive, including infants of low birth weight and those born prematurely, children with serious diseases or congenital anomalies, and those having suffered serious injuries (Brodie, 1986; Gittler & Colton, 1987; Lopez, 1983). As a direct result of technological advances, in health care settings today, the population of young children with complex medical and technological needs is
growing steadily. It is projected that this trend will continue (Wilson, 1988).

Thus, researchers, practitioners, and parents are being presented with new challenges as they strive to advocate for and meet the diverse needs of this increasing population of young children. Haggerty (1983) has suggested that children with such chronic illnesses or conditions suffer much more from the fact of the chronicity than from the specific medical illness or condition they have. Whether these children have opportunities for learning, developing peer relations, relating in the context of a family, may all be of greater importance than the specific type of chronic disease they may have. Short-term emotional and social consequences, as well as long-term implications for development, of intense levels of care in nonnormative environments are unknown. Factors such as length of hospitalization, the nature of care required, characteristics of the physical and social environments to which the children are subjected, extent of family involvement, and characteristics of the children such as developmental functioning and temperament must receive systematic consideration. Children with complex medical needs can be classified as "at-risk" for developmental and behavioral difficulties. It is possible, however, that some children will survive and even progress, both physically and psychologically, while others will not. A combination of
health, environmental, and child-based factors is likely to be related to differential outcomes.

**Diagnoses, Conditions, and Clinical Features**

It has been estimated that 10 to 15% of the infants surviving neonatal intensive care to the point of discharge have chronic medical conditions. The diagnoses of these children encompass a wide range of diseases and medical difficulties, many of which involve impaired respiratory functioning. Various forms of technology, including oxygen, tracheostomy tubes, mechanical ventilation and other respiratory support, as well as intensive levels of nursing care or monitoring, are often necessary to sustain life, thus rendering children technology dependent (Task Force on Technology Dependent Children, 1988). The most common medical disorder of these infants is oxygen dependent bronchopulmonary dysplasia (BPD), a long-term complication of treatment for respiratory distress syndrome common in premature infants (Embon, 1991). This disorder often results in technology dependence, such as the need for assisted ventilation (Gillette, Hansen, Robinson, Kirkpatrick, & Grywalski, 1991). According to Posch (1988), in excess of 3,000 ventilator-supported children live in the United States, a significant proportion of whom have BPD. Other children requiring technological respiratory support have structural anomalies of the airway of a degree which impact
the child's ability to breathe effectively, often necessitating a tracheostomy tube, either with or without oxygen support.

Developmental delays have been commonly reported in the population of children who are medically fragile (Yu, Orgill, Lim, Bjuk, & Astbury, 1983), although the specific types and extent of these delays is variable and is dependent on health factors, as well as on the nature of the physical and social environment in which the child receives care (Delaney & Zolondick, 1991). It is often difficult to separate the effects of the child's condition from the effects of the child's environmental experiences.

Theoretical Framework

The hospitalization and long-term care of an infant in an intensive care setting is generally considered to be a stressor having significant and often far-reaching consequences. Among the reported effects of such early experiences are emotional and interactional difficulties, diminished cognitive abilities, externalization of a sense of control, and a lessened ability to cope effectively with life's events. Furthermore, young children have typically been viewed as significantly more vulnerable than older children and adolescents, given their limited cognitive and communicative abilities and dependency upon adults (Bolig &
Weddle, 1988). Even so, individual variation exists in terms of children's responses to stressful life events.

Murphy and Moriarty (1976) used the phrase "a continuum of vulnerability" to describe their observation that even in a sample of children who are typically developing, considerable variation is evident in their susceptibility to external and internal stressors. Some children develop serious and long-term difficulties, both physical and psychological, while other children seem to be strengthened and make gains developmentally (Anthony, 1974). The concept of resilience (Rutter, 1987) or stress resistance (Garmezy, 1981) has emerged as a counterpart to vulnerability. It has been defined as the "manifestation of competence in children despite exposure to stressful life circumstances or the presence of other risk factors and resulting vulnerabilities" (Pellegrini, 1990, p. 205).

Holahan and Moos (1987) have applied risk and resistance constructs to the development of a framework for predicting physical and psychological health. Risk indexes person-based factors or aspects of life circumstances which are associated with increased vulnerability to physical or psychological difficulty. Resistance or protective factors are measures of an individuals' strengths or the environmental resources relative to the maintenance of physical and psychological health despite stressful life periods.
The vulnerability/resiliency framework is based upon observations that many persons who had been subjected to severe and potentially detrimental circumstances early in life emerged with few negative consequences and became well-adjusted, contributing members of society. This framework is based upon the clinical and empirical work of Garmezy (1981), Rutter (1979), and Werner and Smith (1982). Garmezy (1981) studied a sample of children who grew up in a ghetto environment under circumstances of significant poverty and discrimination. Rutter's (1979) work focused upon individuals growing up in a poverty-stricken area of London. The Kauai Longitudinal Study (Werner & Smith, 1982; Werner, 1989) monitored the impact of a variety of biological and psychosocial risk factors, stressful life events, and protective factors on the development of a multiracial cohort of children born in 1955 and followed this cohort into their adult years.

Rutter (1979) identified a variety of risk factors which were related to later psychiatric disorder. Included were factors such as low socioeconomic status, overcrowding within the household, and care of the children by local authorities. In addition, various categories of protective factors were identified by Rutter (1979) and Garmezy (1981), influences that modify or ameliorate a person's response to an environmental hazard which predisposes the individual to maladaptive outcome. Among those factors reported are the
following: (1) personality factors such as temperament and self-esteem; (2) family cohesion and a supportive family milieu; and (3) access to external support networks.

Werner and Smith (1982) began by examining children's vulnerability—their susceptibility to negative developmental outcomes after exposure to perinatal stress, poverty, parental psychopathology, and disruption of the family unit. As the study progressed, the researchers also focused upon the roots of resiliency in those children who successfully coped with such biological and psychosocial risk factors and maintained a sense of competence and control. It was reported that when family and cultural variables have served to support development, children with perinatal complications could not be distinguished from children without such complications. Where family and environmental variables have hindered development, however, even infants without significant biological complications reportedly developed severe social and cognitive deficits over time.

A variety of characteristics in children were found to be related to resiliency, including temperament characteristics that elicited positive attention from family members and strangers alike. Resilient children were often described as "very active" (both boys and girls), "affectionate and cuddly" (girls), "good-natured and easy to deal with" (boys). At 20 months, the resilient children
were characterized by their alertness and autonomy, their tendency to seek out novel experiences, and their positive social orientation, particularly among girls. They were also more advanced in terms of communication, locomotion, and self-help skills than children who later developed serious learning and behavior problems. Furthermore, these children had the opportunity to establish a close bond with at least one caregiver from whom they received ample positive attention as infants. Additional protective factors included the availability of emotional support from peers and others in their environment as well as clear structure and predictability in the child's life (Werner & Smith, 1982; Werner, 1989). Other protective factors which emerged include gender and birth order, with female and firstborn children emerging as more resilient, and males and later-born children as more vulnerable. Werner and Smith (1982) suggest that constitutional factors, such as physiological health and temperament, impact to the greatest extent during infancy and early childhood. Furthermore, Holahan and Moos (1987) indicate that factors such as family support and availability of external supports appear to impact heavily upon young children's physical and psychological health. With increasing age, problem-solving skills, communication skills, and personality factors, such as self-esteem, appear to take on increasing importance.
Vulnerability/risk and resistance are often viewed as negative and positive poles of the same concept (Rutter, 1987). Further, the vulnerability or protective effects are evident only in combination with a risk variable. The protective effect is not in the evasion of risk but in the successful engagement with it. While risk mechanisms lead directly to disorder, protective processes operate indirectly; the effects are apparent only by virtue of interactions with risk variables (Rutter, 1987).

A continual interplay of stressful events and protective factors exists; each situation interacts with personal characteristics (Rutter, 1987). Thus an individual's health is impacted by an ever shifting balance between stressful events which increase vulnerability and protective factors which increase resilience (Anthony, 1974). As disadvantage and number of stressful life events increases, more protective factors are needed to counterbalance and ensure positive developmental outcomes (Werner, 1989). Co-occurring multiple risk factors are particularly hazardous, because their effects may be multiplicative rather than additive (Rutter, 1983). As long as the balance between stressful events and protective factors is maintained, successful coping is likely; if stressful events, however, are greater than the protective factors, even persons who might be classified as resilient
are likely to face difficulties in development and health (Werner, 1989).

Statement of the Problem

The purpose of this research project was to examine the effects of technological life support measures, intensive medical care, and long-term hospitalization resulting from illnesses/conditions affecting respiratory functioning on the development and behavior of children under 36 months of age. This study was exploratory/descriptive in nature and focused upon the developmental outcome, interactional behavior, and coping behavior of infants and toddlers who are technology dependent, those residing in home settings and in an institutional setting. Temperament and exploratory/play behavior also were studied in an effort to evaluate their impact on development and behavior. Family involvement and characteristics of the institutional/home environment were examined in order to evaluate the relationship to children's development and behavior. Finally, the influence of birth weight upon the development and behavior of young children who are technology dependent was investigated.

Significance of the Problem

Technological advances in health care delivery have made it possible for children with life threatening
conditions to survive, and the incidence of such children is increasing. Children with more serious illnesses or conditions, significant numbers of whom are preterm and low birth weight infants or infants who have congenital anomalies, are occupying an increasing number of pediatric beds in health care facilities throughout the country, often for extended periods of time. Moreover, the care required by many of these children has become increasingly technical. Growing numbers of children with such medical needs are being discharged to their home or foster home settings once medically stable, yet a significant number of technology dependent children reside in health care settings for significant portions of their early lives.

The literature related to this population of children has been limited to a few case studies and clinical observations; little empirical data exists on this emerging population of young children. Thus, both the developmental and psychosocial consequences of highly technical medical care on these children residing in either a health care or home setting are essentially unknown. Moreover, the implications for practice and further research of children's outcomes are uncertain. Information relative to the development and behavior of infants and toddlers who are technology dependent can aid professionals in better understanding the characteristics and needs of young children with medically complex conditions and thereby
assist them in improving the quality of care and services provided for these children.

Hypotheses

This research had the following hypotheses:

1. Differences in (a) developmental outcome, (b) interactional behavior, and (c) coping behavior will be evident between children who are technology dependent and reside in a home setting and those who reside and receive care in a health care facility.

2. Infants and toddlers who are technology dependent, residing in either home settings or a hospital setting, will have ratings on interactional behavior, as measured by the Interaction Rating Scales, which will be positively related to (a) developmental outcome and (b) coping behavior.

3. In children who are technology dependent, residing in both home and in hospital settings, there will be a positive relationship between coping behavior, as measured by the Early Coping Inventory, and developmental outcome.

4. Children who are technology dependent, residing in both home and hospital settings, who are categorized as being of "easy" temperament will be assessed with more optimal (a) developmental outcomes, (b) interactive behavior, and (c) coping behavior than those of other
temperament diagnostic clusters (i.e., intermediate low, difficult, intermediate high, and slow-to-warm-up).

5. Exploratory and play behavior of infants and toddlers who are technology dependent, residing in home and hospital settings, will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior.

6. The level of family involvement will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior in families with a child who is technology dependent and residing in a hospital setting.

7. The quality of the environment in which the child resides will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior in families with a child who is technology dependent and residing in the home as well as for those residing in a hospital.

8. Birth weight will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior for children who are technology dependent residing in both home and hospital settings.

9. Child-based factors (i.e., temperament, exploratory/play behavior), environmental factors (i.e., family involvement, and the quality of the
environment), and health factors (i.e., birth weight, technological support required) will interact to determine (a) developmental outcome, (b) interactive behavior, and (c) coping behavior in children who are technology dependent, residing in the home or hospital setting.

**Definition of Terms**

Following are the terms that were used in this study and their operational definitions:

**Technology dependent children**—According to the Task Force on Technology-Dependent Children (1988), a child who is technology dependent has a chronic disability, requires the routine use of a specific medical device to compensate for the loss of a life-sustaining body function, and requires daily, ongoing care or monitoring by trained caregivers. Within the scope of this study, children who are termed technology dependent require at least one of the following: 1) mechanical ventilation for at least a part of each day or 2) other device-based respiratory support, including tracheostomy tube care, suctioning, oxygen support, or continuous positive airway pressure (CPAP) (Task Force on Technology Dependent Children, 1988).

**Developmental outcome**—an assessment of the child's developmental strengths and weaknesses in five domains:
personal-social, adaptive, motor, communication, and cognitive, as measured by the Battelle Developmental Inventory (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1984).

Interactional behavior—a rating of selective aspects of both an infant's behavior and a parent's or caregiver's behavior during an unstructured face-to-face interaction, utilizing the Interaction Rating Scales (Field, 1980a).

Coping behavior—an assessment of the behaviors that enable young children to manage the routines, opportunities, challenges, and frustrations encountered in daily living, as measured by the Early Coping Inventory (Zeitlin & Williamson, 1988).

Temperament—an assessment of the child's behavioral style or the child's innate manner of reacting to and interacting with the environment, as measured by the revised Infant Temperament Questionnaire (Carey & McDevitt, 1978), or the Toddler Temperament Scale (Fullard, McDevitt, & Carey, 1984).

Exploratory/play behavior—a rating of the child's most sophisticated level of exploratory/play behavior with selected toys/objects during a solitary play period, as measured by an observational tool based upon the work of Belsky and Most (1981).

Family involvement—a rating of the level of contact families maintain with their child who is technology
dependent. Ratings used are as follows: (1) continual contact--child resides with natural/foster family; (2) daily contact or contact every other day; (3) weekly or biweekly contact; (4) irregular contact.

Institutional/home environment qualities--an observational assessment and interview focusing on selected aspects of quantity and quality of social, emotional, and cognitive support available to a young child within his/her living environment, utilizing the Home Observation for Measurement of the Environment, the Inventory for Families of Infants and Toddlers (Caldwell & Bradley, 1984).

Technological support--types of respiratory life support required; increasing levels of technological support are represented in the following order (from lowest to highest technological level): (1) oxygen delivered via a nasal canula, (2) tracheostomy tube without oxygen, (3) tracheostomy tube with oxygen, (4) tracheostomy tube with continuous positive airway pressure (CPAP), (5) tracheostomy tube with oxygen during waking hours and nocturnal mechanical ventilation, (6) tracheostomy tube with continuous positive airway pressure (CPAP) during waking hours and nocturnal mechanical ventilation, and (7) tracheostomy tube with continuous mechanical ventilation.

Socioeconomic status--a rating of social class (i.e., upper
class, upper middle class, middle class, lower middle class, and lower class) based upon ratings of parental educational and occupational levels (Hollingshead, 1958). (See Appendix A).

Summary

This study, based upon the vulnerability/resiliency framework, focused upon the emerging population of infants and toddlers who are technology dependent as a result of chronic medical conditions. Significant numbers of these children reside in health care facilities for much of their early lives. However, minimal empirical work relating to these children is currently in existence; little is known regarding the consequences for development and behavior of highly technical medical care. Information such is this is critical for health care and other professionals providing care and services to children with medically complex conditions. By better understanding the characteristics and behavior of such infants and toddlers, the quality of care and services provided may be improved and tailored to meet their unique needs. In addition, through studies such as the present one, the applicability of the vulnerability/resiliency framework to the emerging population of children who are technology dependent can be examined. Finally, this study and its findings provide
guidance for future research on children who have complex medical needs.

The study focused upon the development and behavior of infants and toddlers who are technology dependent residing in home and health care settings. The potential effects of temperament and exploratory/play behavior upon developmental outcome and behavior were also explored. Furthermore, family involvement, characteristics of the caregiving environment, and birth weight were examined in order to evaluate their relationships to children's development and behavior.
Within recent years, increasing numbers of researchers have examined the behavior and development of infants experiencing perinatal complications, particularly preterm and low birth weight infants, as well as their full-term counterparts. The majority of these studies, however, have focused upon healthy preterm and full-term infants rather than infants with severe medical complications. With the increasing sophistication of medical technology, it has become possible for infants of lower gestational ages and very low birth weights as well as infants with various congenital anomalies to survive. In many cases, though, these infants suffer severe complications and develop chronic conditions necessitating hospitalization in intensive care environments from birth, often for extended periods of time. The medical care required is typically highly technical; these children often are rendered technology dependent. Relatively little exists in the literature with regard to this emerging population of young children and their characteristics, behavior and development.
The interactions of parents and young children have been empirically examined in a variety of contexts, including face-to-face and play interactions. Both children who are typically developing and those who are following an atypical course of development have been the focus of these studies. The atypically developing infants observed, however, have been healthy preterm babies or those with limited medical complications and not infants with complex medical needs.

Coping, too, has received significant consideration in the literature, although little of this work pertains to infants and toddlers, and coping behavior as it relates to technology dependent infants and toddlers has been virtually unexplored.

Temperament has received increasing focus in the literature, particularly with young children who are following a typical course of development. In recent years, the temperamental characteristics of young children who are developing atypically have been studied by researchers, including children with Down syndrome and those who were born preterm. The preterm infants studied, however, have for the most part been relatively healthy preterms without serious medical complications and chronic conditions. Thus, the temperamental characteristics of preterm and often very low birth weight infants, as well as those with congenital
anomalies, who often require highly technical medical care, have received minimal attention in the literature to date.

Exploration and play of infants and toddlers has received increased attention in the literature with regard to children who are typically as well as atypically developing. As has been the case with temperament research, however, the exploration and play of technology dependent infants and toddlers has not yet been explored.

The families of young children who are technology dependent have received minimal attention by researchers. Existing information is based primarily upon clinical observations of health care professionals. The continued involvement of families with their children who are medically fragile appears to be variable; while some families are able and choose to maintain a high level of involvement, others maintain little direct involvement with their child.

Qualities of the environment in which a child resides and their relationship to children's development and behavior has been examined by a variety of researchers. Furthermore, the hospital environment, including the intensive care environment, has increasingly received attention in the literature, particularly the stressful and insensitive nature of this environment.

In the following sections, what is known with regard to the behavioral and developmental characteristics of both
healthy preterm and medically fragile infants, is reviewed. Secondly, an overview of the research focusing upon the interactions of parents and young children is presented. The work relating to early coping behavior is also discussed. In addition, the temperament literature is examined, followed by an overview of exploration and play during infancy. Family involvement and factors impacting continued involvement with medically fragile infants also receives attention. Finally, the literature examining the quality of home and hospital environments, including the intensive care environment, and the impact of environment on young children, is reviewed.

Consequences of Perinatal Complications

Recent estimates indicate that from 10% to 15% of children in the United States have some chronic health impairment. The majority of these children have mild illnesses and are able to live normally in their natural environments, such as home, neighborhood, and school. Approximately 1% of the population of children in the United States, however, many of who were born preterm, have severe health problems which require frequent or extended hospitalization (Khan & Battle, 1987). Furthermore, in the population of preterm infants born with birth weights of less than 1,500 grams, the incidence of conditions such as respiratory distress syndrome exceeds 50% (Korones, 1981).
Respiratory distress syndrome is a condition that encompasses a spectrum of risk ranging from mild hyaline membrane disease to severe and chronic bronchopulmonary dysplasia (Meisels, Plunkett, Pasick, Stiefel, & Roloff, 1987).

The population of infants with chronic health impairments also includes children with diseases of the airway (Taeusch, Ballard, & Avery, 1991). Respiratory distress due to partial or complete obstruction of the airway may present a serious, often life-threatening, event shortly following birth. Among such diseases is Pierre Robin syndrome, which has an incidence of one per 2000 births. This is a genetically transmitted disorder, which involves a significant narrowing of the airway, thus often requiring a tracheotomy.

Investigations involving preterm infants report that in addition to developmental delays, they appear to have a more limited repertoire of responses and are often deficient in their capacity to elicit and sustain social interaction (Brazelton, 1979), are more passive and less responsive socially (Field, 1980a), and are more difficult social partners because they are characteristically less alert, less responsive, and have poorer motor control and more irregular sleep patterns (Goldberg, 1978). Others appear to fall at the opposite end of the continuum, displaying a
hyper-responsivity to the environment (Als, Lester, & Brazelton, 1979).

The findings described, however, have been drawn from studies including samples of preterm infants with less severe medical complications than the very low birth weight infants receiving care in neonatal intensive care units today. Infants with more serious medical complications have not been studied to a great extent. When there are serious medical problems associated with the birth and postnatal course, the developmental and behavioral difficulties may be amplified (Field, Hallock, Ting, Dempsey, Dabiri & Shuman 1978).

With regard to assessing the impact of medical events on an infant, until very recently, the periods of time having received the most attention have been the very early stages of development, such as the neonatal period (Littman, 1979). More attention has been given to the study of medical complications occurring during the first month of life than at any other time during infancy. Oberklaid et al. (1991) indicate that still relatively little is known about the subsequent behavioral development of preterm infants. Because the early postnatal period has been presumed to be among the times of greatest threat to the infant, much less is known about events occurring at later ages and their effect upon the development and behavior of the child. In one study, however, Littman (1979) reported
significant relationships between medical events occurring in later infancy and developmental outcome measures. Infants with higher rates of medical complications after the neonatal period were performing less well on measures of development at 9, 18, and 24 months of age.

For preterm infants with severe chronic conditions, findings indicate that very low birth weight infants with conditions such as bronchopulmonary dysplasia are significantly developmentally delayed (Yu, Orgill, Lim, Bjuk, & Astbury, 1983). According to Lindgren, Harper, and Blackman (1986), severe respiratory distress syndrome is associated with cognitive deficits. Furthermore, significant numbers of ill preterm infants have been reported to be significantly less responsive to the environment than their full-term or well counterparts (Field et al., 1978). More recently, Gottwald and Thurman (1990) indicated that such infants, who often require complex technological medical care, were found to be less active, initiate fewer interactions, and provide less feedback to their caregivers than their healthier peers. Other findings indicate that such infants maintained less eye contact with caregivers, averted their gaze more, smiled less, used more unclear signals, and were more difficult to cuddle and console (Gottwald & Thurman, 1990).

Differences between healthy and ill preterm infants also have been reported with regard to tolerance of
stimulation. As reported by Oehler (1985), in an investigation of tactile and voice stimulation with a sample of preterm infants, different responses to stimulation were noted among those who were classified as healthy, moderately healthy, and ill. Ill infants were able to handle one stimulus at a time, either touch or voice, but voice and touch together resulted in an increase in avoidance reactions on the part of the infants. Healthy infants demonstrated more self-regulatory behaviors when exposed to voice, touch, and touch and voice combined than moderately healthy or ill infants.

The effects of several early medical complications, including respiratory distress syndrome (RDS) and bronchopulmonary dysplasia (BPD), on the intellectual and motoric development of preterm, very low birth weight infants were examined in a study by Landry, Fletcher, Zarling, Chapieski, and Francis (1984). Findings indicate that infants with respiratory distress syndrome demonstrated performance in the average range for their chronological age by 24 months. In contrast, infants with bronchopulmonary dysplasia reportedly had lower scores, which remained in the delayed range throughout the first two years.

The data relating to the BPD group was further analyzed according to length of hospitalization (greater or less than 16 weeks). The 16 week point was selected because 95% of the infants in the other diagnostic groups investigated had
been discharged to the home by 16 weeks. More infants with BPD had longer periods of hospitalization relative to the other infant groups, consistent with the severity of their illness. Infants with BPD who had been hospitalized longer than 16 weeks, despite similar birth weights and gestational ages to those infants having BPD with shorter hospitalizations, had mental and motor scores on the Bayley Scales of Infant Development below 80 at every age, with minimal change in scores over time. Those infants with BPD hospitalized less than 16 weeks had scores in the average range, although standard deviations were large. Over time, this group of infants showed improvement in Bayley scores (Landry et al., 1984).

An investigation by Meisels, Plunkett, Pasick, Stiefel, and Roloff (1987) was designed to study the differential effects of chronicity and severity of respiratory illness on the cognitive development of preterm infants. Three preterm risk groups were established: high risk infants were those who had the most chronic and severe respiratory illness, defined by resolution of respiratory illness of more than three weeks, and hospitalization of more than two months. Infants of moderate risk were those who displayed moderate chronicity and severity, defined by resolution of respiratory illness within three weeks, and one to two months of hospitalization. The low risk group of preterm infants included those defined as health preterms without
respiratory illness who were hospitalized for less than one month. The results indicate that preterm infants with long-term hospitalizations and chronic respiratory illness, such as bronchopulmonary dysplasia, demonstrate delayed cognitive and sensorimotor development in the second year of life. Performances on the Bayley Mental Development Index and the Uzgiris-Hunt Scales demonstrate highly significant differences between the high-risk group and the moderate- and low-risk groups.

Clinical observations of infants and toddlers who experience lengthy hospitalizations due to medically complex conditions provide descriptions of behavioral qualities often demonstrated. These include: social and exploratory passivity; an inhibited perception of the ability to move beyond immediate physical space (e.g., reaching for a toy requiring a slight stretch from a stable sitting position); a narrow range of affective expression that may be limited to irritability or, on the other end of the continuum, to the consistently jovial behavior that is reinforced by the staff; distractibility; disinterest in fine motor tasks that require eye-hand coordination, and preference for a limited repertoire of gross motor actions that allow the child to wave, bang, shake, and mouth toys while visually scanning the surroundings; and persistent mouthing of toys, (particularly notable in infants and toddlers with tracheostomies) (Goldberger, 1988a).
In summary, relatively little is known about the development and behavior of preterm, very low birth weight infants or infants afflicted with respiratory anomalies, both of whom often have medically complex conditions. Respiratory distress syndrome is a common consequence of preterm birth and very low birth weight. Among the studies of children having conditions affecting respiratory functioning, such as bronchopulmonary dysplasia, reports indicate significant developmental delays are common, both motoric and cognitive, as are interactional difficulties, and decreased tolerance of stimulation. Studies of children having structural deformities of the airway, as in the case of Pierre Robin syndrome, are limited, therefore little is known regarding the effects of their condition upon their development and behavior.

Parent-Infant Interaction

Early parent-infant interactions provide a foundation for the development of communication patterns during infancy. In the first few months of life, signals such as smiling, gazing and gaze averting, and vocalizations such as cooing or fussing become a part of the infant's conversational repertoire. Various factors appear to facilitate the development of this conversational repertoire, including early opportunities for interaction, the ability to interpret the infant's communication signals,
and contingent responsiveness to those signals by the infant's interactive partner (Field, 1979).

According to Field (1987), interaction disturbances are more likely to be found in infants who are developing atypically, such as preterm infants. Studies of parent-preterm infant interaction suggest that the preterm infant is generally less organized, less alert, and less responsive than full-term counterparts (Field, 1977). Analyses of their behavior during face-to-face interactions indicated that preterm infants engaged in more head and gaze aversion and were less vocal (Field, 1980a). In addition, frequent fussing and squirming during interaction were characteristic behaviors (Field, 1979). Interactions characterized by these behaviors have been described as being disturbed or dysfunctional, while harmonious interactions with a social partner describe the infant as appearing attentive and content.

Gaze behavior during early social interactions has been found to be related in a curvilinear fashion to the amount of stimulation for both full-term and preterm infants. Low levels and high levels of stimulation are associated with high levels of gaze aversion, and moderate levels of stimulation are associated with lower levels of gaze aversion. The preterm infants were observed to gaze avert more than the full-term infants, however. It has been suggested that, for preterm infants, their sensory and
aversion thresholds are different than those of term infants. Further, the range of stimulation to which such at-risk infants will attend and respond may be narrower (Field, 1981).

The effects of medical status on early parent-infant interaction were examined in a study of full-term infants, healthy preterms, sick preterms, and infants of diabetic mothers (DiVitto & Goldberg, 1979). Results showed that the more ill the child, the less likely the child was to be alert and responsive to stimulation and the less able the child was to give clear distress signals. While the full-term babies became less irritable and more alert after ten days at home, the three other groups became more irritable, and alertness improved only in the infants of diabetic mothers. Thus, parents of preterm infants, especially those with medical complications, were likely to experience difficulty in interacting with their babies. The evidence indicated that early interactions are affected by preterm birth and medical condition, as well as associated stresses including prolonged hospitalization and limited opportunities for interaction with parents.

Investigators have reported that the mothers of preterm infants have difficulty in reading the behavioral cues of their babies. They must be more sensitive to the preterm infant's often unclear signals, and often appear to be more active in engaging their infants during the first months of
life (Bakeman & Brown, 1980). Observations of face-to-face interactions have suggested that mothers of preterm infants were more verbal, less contingently responsive, and engaged in less infantized behavior and gameplaying than mothers of full-term infants. Furthermore, socioeconomic class was found to negatively impact the ability of mothers to relate to their infants (Field, 1980). Lower class mothers were hypoactive during interactions with their infants; it was suggested that this may be their means of coping with less responsive infants.

While many of the studies of parent-preterm infant interaction focus on the first few months of life, a study by Crnic, Ragozin, Greenberg, Robinson, and Basham (1983) examined interactive behavior throughout the infant's first year of life. Results revealed that many of the interactional differences between preterm and full-term dyads persisted across the first year, with some of the differences being more dramatic at 12 months than in earlier infancy. Specifically, throughout the first year, premature infants were found to be less active and less responsive than full-term infants; they vocalized and smiled less; they averted their gaze and bodies more frequently; and they showed less positive general affective tone. Furthermore, at eight months, the difference in mean scores on vocalization was significantly greater than at four months of age. At 12 months, compared to four months, the
difference in mean scores on affect during unstructured play was significantly greater. The study also revealed that mothers of preterms do not appear to change in their emotional investment with their infants later in infancy. Their activity levels remain higher and their gratification and enjoyment less than mothers of term infants across the first year.

Researchers have investigated the relationship between early social interactions and competence in full-term infants, and reports indicate that caregiver-infant interaction is significantly associated with cognitive-motivational behavior. Thus, curiosity, exploration, language acquisition, and mental test performance appear to be related to competence in social interactions (Bradley & Caldwell, 1976). Beckwith and Cohen (1980) conducted a similar investigation with preterm infants. Findings indicated that elements of caregiver-infant interaction, from the early months of life through age two, were significantly related to mental test performance at age two. The authors concluded that a mutually rewarding social relationship between the caregiver and infant partially mediates mental test performance, possible because of the cognitive and motivational experiences it provides the infant.

Summarizing, researchers have shown interest in parent-infant interactions and the behavior demonstrated by
both participants in the social interaction. Studies have focused upon full-term infants who are developing typically as well as infants, particularly preterm infants, whose development is atypical. Results indicate that interactions between term and preterm dyads differ considerably.

**Coping**

Stress is experienced in the lives of infants and young children, just as in the lives of older children, adolescents and adults. Stress may be defined as tension experienced when an event is perceived as harmful or threatening to one's sense of well-being. Stress is experienced emotionally, cognitively, physically, or, most commonly, in some combination of these three (Lazarus & Folkman, 1984).

Coping refers to a special class of individual reactions to stressors, or the ways in which individuals respond to stressful events or situations (Kagan, 1983; Rutter, 1983). Zeitlin and Williamson (1988) define coping as the process of using learned adaptive behaviors to manage one's world. Adaptive behaviors are behaviors that help an individual survive mentally, physically, emotionally, and socially. Such behaviors range from the sucking reflex of the newborn to the learned and complex coping strategies of the adult. In the earliest months of life, the infant's adaptive behaviors are strongly influenced by the reflexive-
like responses of an immature nervous system. With growth and development, these early sensorimotor reactions are altered and integrated to serve as the substrata for more sophisticated coping behaviors.

Coping to meet the demands of the environment requires the child to negotiate the physical surroundings, interact with objects, and adapt to social expectations. Through transactions with the environment, previously acquired coping strategies are modified and new strategies are learned. The acquisition of coping behavior is influenced by the child's developmental competence and temperament, the environmental demands, the child's experience in managing these demands, and the environmental response to the child's coping efforts (Murphy & Moriarty, 1976).

It is typically assumed that an individual learns to cope without any formal instruction. However, there is growing recognition that many children, particularly those who are at-risk either biologically or environmentally, developmentally delayed, or disabled, may manage more effectively in their environments if taught means of more appropriate and effective coping.

Coping style refers to the way an individual uses certain strategies rather than others to manage his/her world. While the term describes a characteristic way of behaving, it does not describe the specific behavior a child will use in a given situation. The coping style of infants
and toddlers can be characterized by the unique pattern of their sensorimotor organization, reactive coping behaviors, and self-initiated behaviors (Zeitlin & Williamson, 1988).

Mechanic (1978) suggests that most forms of psychosocial stress are not associated with a short-term single stimulus but rather with a complex set of changing conditions that have both a history and a future. Therefore, coping or adaptation should be viewed as a process extending over time. The importance of coping processes has been emphasized by Lazarus and Launier (1978) as they suggest that "the ways people cope with stress may be even more important to overall morale, social functioning, and health/illness than the frequency and severity of episodes of stress themselves" (p. 308).

Children's coping is most adaptive when there is a congruence between the child's coping resources and the demands of the event or the environment (Lerner & East, 1984). In cases in which a "goodness of fit" is lacking, intervention can be helpful by teaching a child more adaptive coping behaviors, by reducing the degree of stress experienced, or by means of both. Some children cope effectively despite high-risk factors such as poverty (Werner & Smith, 1982), while others cope ineffectively despite supportive families and economic advantages (Zeitlin, 1981).
Young children who are developmentally delayed or disabled frequently possess fewer resources for achieving adaptive coping behaviors than their typically developing peers. A neuromotor or cognitive handicap may interfere with acquisition of both the developmental skills and the adaptive behaviors necessary for effective coping. While the presence of a disability does not necessarily imply maladaptive coping, the child with a handicapping condition is more vulnerable to the stress of daily living (MacTurk, Vietz, McCarthy, McQuiston, & Yarrow, 1985).

Results of a study of coping characteristics suggest that differences exist between the coping abilities of disabled and nondisabled children under 3 years of age (Zeitlin & Williamson, 1988). The disabled group was significantly less effective in their coping competence. As a group, their coping behaviors tended to be situationally effective. Behaviors used successfully in one type of situation were not generalized to other types of situations. Also, their coping behaviors were often erratic, rigid, or limited in range.

The greatest difference between the two groups was in their adaptive use of self-initiated coping strategies. The coping pattern of the disabled children tended to be less autonomous and self-generated. These children were not as able to change behavior when necessary to solve a problem or achieve a goal, to enter new situations easily or cautiously.
as the occasion demands, and to balance independent behavior
with necessary dependence on adults (Williamson, 1988).

Brinker and Lewis (1982) suggested that constitutional
differences in children with disabilities, and the effect of
these differences on interactions with the social and
physical environment, often result in their assuming passive
respondent roles rather than active, autonomous roles. The
findings of Zeitlin and Williamson (1990) support this view.

Notably, however, both disabled and nondisabled groups
included individuals with consistently effective coping
behaviors and minimally effective behaviors. Thus, the
presence of a handicapping condition does not mean that a
particular child will have maladaptive coping. Rather, it
suggests a greater vulnerability to stress (Williamson,
1988).

A child with limited coping resources is more likely to
cope adaptively in a predictable environment and one that
imposes few unrealistic expectations, while a child
possessing more coping resources typically can manage a more
challenging environment. While all children may need
assistance in crisis situations, the less adaptive child
needs more support to manage everyday events. A child with
an ineffective coping style uses maladaptive behaviors to
avoid or gain control over stressful events (McNamee, 1982).
Stressful situations may generate three possible types of
behavior: (1) active, facilitative coping in which new
patterns of behavior come into being; (2) coping by defending or perseverating through the use of a narrow, inflexible range of strategies that protect the child rather than enhance new learning; and (3) coping by breakdown or fragmentation through the use of behaviors that are so extreme or maladaptive that the child is isolated from meaningful interactions with his/her environment (Zeitlin & Williamson, 1988).

During the early years of life, events differ in their potential to create a state of uncertainty and hence be perceived as stressful, and in the dominant response profile each provokes. During the first three months, pain and physical discomfort are primary sources of stress, leading to irritability and disturbances in feeding and sleeping. During the period four to 12 months, unassimilable discrepancy and unpredictable events are frequent stressors, leading to behavioral inhibition, withdrawal, and crying. During the second and third years, parental restriction, punishment, and prolonged separation are stressful events that provoke inhibition, protest, depression, and sometimes apathy (Kagan, 1983).

Maccoby (1983) suggests that "the younger the child, the greater the importance of environmental structure in reducing the child's vulnerability to behavioral disruption under potentially stressful conditions" (p. 220). Structure in this sense refers to the presence of familiar routines
and a predictable, understandable physical and social environment. Thus, young children can more effectively cope with an unexpected, potentially distressing event if there is little concurrent change in other aspects of the environment.

Too much intense or novel stimulation can overwhelm an infant, resulting in an "emotional storm" (p. 221), which disrupts all the infant's behavior patterns and halts problem solving activity. "With an arousing event leading to strong negative affect, the younger the child the greater the likelihood of extensive behavioral disorganization" (Maccoby, 1983, p. 221). It is believed that the maturation of the nervous system during early childhood contributes to children's increasing ability to inhibit crying and frustration reactions and to maintain behavioral organization (Maccoby, 1983).

Other potential sources of stress are interactions with caregivers (Tronick, 1982). Stress can be related to such factors as the mistiming of emotional signals, unclear signals, misreading of signals, and over- or understimulation.

In a study by Karraker, Lake, and Parry (1991), relationships between infant stress and coping styles and infant temperament and infant age were examined. Mothers of children ranging in age from three to 18 months were interviewed regarding their infants' responses to a standard
list of potential stressors. Stressors included physical
events such as hunger, loud noises, or bright lights;
interpersonal events such as parent overstimulation or
understimulation during play; changes in the environment
such as modifications in the physical environment or in the
child's routine; and other environmental events such as
exposure to an unfamiliar toy or event. Older infants
reportedly were more likely than younger infants to show
negative emotional responses to the stressors on the
interview list. Furthermore, infants who were more
temperamentally difficult and particularly those who were
more temperamentally active and intense responded in a
negative manner to a greater number of stressors.

Among the aversive events which have been used to study
infants' coping reactions, including crying, is the
heelstick paradigm (Lewis, Worobey, & Thomas, 1989).
Infants who were most reactive at two months (less able to
cope with the stressor) were more likely to have a greater
history of illness a year or more later. Individual
differences in reactivity to stress when infants become
older reflect differences in ability to organize and control
stressful events. As infants mature, it is expected that
those who are better at coping with stress should show less
reactivity to stressors, thus they would be expected to
quiet more quickly. Although high reactivity may initially
be a sign of health, as infants mature it becomes a sign of potential difficulty.

In addition to crying, infants cope with the stress of pain and discomfort by modifying body postures (Lipsett, 1983). Research also suggests that infants are capable of effectively modulating stressful experiences through self-comforting behavior such as sucking (Field, 1990). In a study conducted by Field and Goldson (1984), intensive and minimal care preterm neonates were given pacifiers during heelsticks. It was reported that the infants who had been given pacifiers during the procedure demonstrated less fussing and crying both during and after the heelstick than infants who had not had access to a pacifier. Furthermore, lower heart rates and respiration rates were reported in the minimal care neonates who were provided a pacifier. While the intensive care neonates with pacifiers also cried less, heart rate and respiration were not modified by the sucking treatment. Thus non-nutritive sucking during heelsticks appeared to alleviate behavioral distress in all neonates and physiological arousal in more mature neonates with less severe neonatal complications.

In summary, coping may be defined as the ways in which individuals respond to stressful events. During the early years, events differ greatly in their potential for being perceived as stressful and in the dominant responses each provokes. Children's acquisition of coping behavior is
impacted by developmental competence, temperament, the environmental demands and experience in managing these demands, and the environmental response to coping efforts.

Temperament

There is considerable evidence that infants and young children show wide individual differences in the ways in which they respond to differing situations (Dunn, 1980). Both parents and practitioners have reported that individual differences are evident in infants during the first weeks and months of life. Investigators have demonstrated that as early as the first few days of life, newborns differ notably in terms of irritability, excitability, and consolability (Riese, 1983). Some of these early differences have been attributed to experiential factors such as birth history, biomedical status, or early infant-parent interaction. The etiology of other early individual differences is not clear and appears unrelated to obvious experiential factors. The latter types of early individual differences have been characterized under the construct of temperament (Hubert, Wachs, Peters-Martin, Gandour, 1982).

Diversity exists in how various writers and researchers define temperament. Buss and Plomin (1984), using a behavioral genetic perspective, define temperament as inherited personality traits which appear early in life and are predictive of adult personality characteristics. They
propose three temperament concepts: emotionality, activity, and sociability. Emotionality refers to autonomic nervous system predisposition to respond to stimuli with negative arousal. Negative arousal is a global pattern of distress in the very young infant, and in the older infant, it becomes differentiated into fear and anger. Activity refers to preferred levels of activity as well as speed of action. Finally, sociability focuses upon preference for the basic rewards of social interaction, such as attention and responsiveness.

From a psychophysiological perspective, Rothbart and Derryberry's (1981) definition of temperament focuses on relatively stable constitutionally based individual differences in reactivity of the nervous system and self-regulation. The variation that can result from the interactions between reactive and regulatory processes, from maturation, and from social processes allow for complex distinctions among individual infants. The behavior is a product of both the temperamental patterns of reactivity and self-regulation and the stimuli present in the child's home. Six dimensions of temperament were defined by Rothbart and Derryberry (1981): activity level, smiling and laughter, fear, distress to limitation, soothability, and duration of orienting.

Thomas and Chess (1977), employing a clinical psychiatric approach, define temperament as behavioral
style, the manner in which an individual interacts with the environment, believed to appear early in life and to be in great part genetically determined (Fullard, McDevitt, & Carey, 1984). Thus, the focus is on individual differences in the stylistic elements of behavior, the "how" of behavior rather than the "what" or content of behavior. Thomas, Chess, and Birch (1963), in the New York Longitudinal Study (NYLS), demonstrated the importance of individual differences in temperament as it relates to the ability to function in a given environment.

Based on theoretical and clinical grounds, Thomas and Chess (1977) conceptualized and defined nine dimensions of temperament. Activity level refers to the vigor of movements exhibited during dressing, bathing, feeding, and later, when reaching, crawling, and walking. This dimension also focuses upon the relative proportions of active and inactive periods, as in the sleep-awake cycle. Rhythmicity assesses the predictability and/or unpredictability of repeated functions such as feeding patterns, the sleep-wake cycle, and hunger and elimination schedules. Approach-withdrawal refers to the nature of the initial response to a new stimulus, whether it is a new food, a novel toy, or an unfamiliar person. The dimension of adaptability focuses upon the ease with which responses to new or altered situations can be successfully modified in desired directions. Intensity of reaction refers to the energy
level of response, irrespective of its quality or direction. Threshold of responsiveness is an evaluation of the intensity of stimulation required to elicit a discernible reaction to sensory stimuli, environmental objects, and social contacts. The dimension quality of mood focuses upon the amount of pleasant, joyful, and friendly behavior, as contrasted with unpleasant, crying, and unfriendly behavior. Distractibility assesses the effectiveness of extraneous environmental stimuli in interfering with or in altering the direction of ongoing behavior. The behavior of a distractible infants can be altered easily, while that of a nondistractible infant is difficult to modify. Finally, the dimension of attention span/persistence focuses upon the length of time an infant continues with a particular activity; persistence refers to the length of time the infant will continue when faced with obstacles.

Thomas and Chess (1977) further derived three clinical categories: the difficult child (arrhythmic, low in approach and adaptability, intense, and predominantly negative in mood), the easy child (rhythmic, high in initial approach and adaptability, mild in intensity, and positive in mood), and the slow-to-warm-up child (low in activity, approach, and adaptability, variable in rhythmicity, mild intensity, and slightly negative mood).

In the original NYLS sample, 40% of the children were described as easy, 10% were characterized as difficult, and
15% were classified as slow-to-warm-up. To classify the remaining 35% of children who do not fall clearly into one of the three clusters, Carey (1970) designated the remaining subjects as intermediate high (toward the "difficult" group) and intermediate low (toward the "easy" group), based upon the number of category scores falling on the difficult side of the mean.

The possibility of age differences in the nine dimensions of behavior defined by Thomas and Chess (1977) has received attention by researchers. While no significant age differences were found for the nine categories across the four- to eight-month age range (Carey & McDevitt, 1978), in a sample of one- and two-year-olds, the older children within each age group were seen as more adaptable, more persistent, and more reactive to sensory stimuli (Fullard, McDevitt, & Carey, 1984). According to the authors, this finding suggests that developmental changes between 12 and 36 months of age may be responsible for an increased ability to modify behavior in constructive ways, to become involved in activities for longer periods of time, and a heightened sensitivity to environmental changes.

In addition to age differences, sex differences for the nine categories have been reported (Carey & McDevitt, 1978; Fullard, McDevitt, and Carey, 1984). Across the four- to eight-month period, females were found to be less approaching. Furthermore, one-year-old girls also were
found to be less approaching than one-year-old boys. In addition, girls in the one- to three-year range were rated as less rhythmic than boys. Moreover, females in the four- to eight-month old sample emerged as having slightly but significantly more representation in the difficult, slow-to-warm-up, and intermediate high (approaching the difficult classification) groups. Within the one- to three-year-old sample, slightly more girls than boys were classified in the difficult cluster, though this difference was not statistically significant.

A few studies have examined the construct of temperament as it relates specifically to children following an atypical course of development, such as children who were born preterm. Oberklaid, Sewell, Sanson, and Prior (1991) compared the temperament and behavior of children born preterm and a control group of children who were born full-term. During infancy there were no significant differences on temperament dimensions or clinical temperament categories. For toddlers, temperament scores were similar for the two groups of children, but children in the preterm group were significantly more likely to be classified as having an easy temperament and less likely to be of difficult temperament. It was concluded that as a group preterm children do not differ greatly in temperament from full-term control children. These findings are contrary to the commonly held belief that premature infants are more
difficult in terms of their temperament than full-term infants.

The preterm infants studied by Oberklaid et al. (1991), however, were not a high-risk group in terms of their degree of prematurity, and most of them had neither extremely low birth weights nor medical complications. In the case of very low birth weight infants or those with significant medical complications, a well-documented relationship exists between major medical complications in preterm infants and subsequent temperamental characteristics (Ross, 1987). Overall, the more premature an infant is, the more the child is at risk of subtle neurological insults which may be exhibited as irritability or difficult temperament.

The observation that children may vary in temperament as they grow older, and also may behave differently in different situations, has led some to discount the importance of individual differences of this nature (Rutter, 1983). However, there is evidence that the nature of this individual variability across situations and across ages is itself genetically determined to an extent (Matheny & Dolan, 1975). Furthermore, even though temperamental features change as children grow older, these features may still play an important role in determining individual-environment interactions at any one time (Rutter, 1977). What is constitutional is a broad inborn disposition that is then acted upon and, in turn, reacts to environmental
circumstances. There are limits to the impact of environment, however (Mohar, 1988). Although a child may be more amenable or vulnerable to change at certain ages or in certain situational circumstances, the environmental variables are not strong enough to fully cancel the effects of temperament.

The term "temperament risk factors" (Carey, 1986) was intended to identify any potentially problematic temperamental characteristics predisposing a child to a "poor fit" or incompatible relationship with the environment, to excessive stress within the caretaker-child context, and secondary medical problems in the child's physical health, development, and behavior (Carey, 1990). "Temperament risk factors are properly spoken of as consisting of certain specific characteristics that predispose a defined group of children to a certain kind of problem in a particular situation." (Carey, 1990, p. 29). The definition does not imply that there are any characteristics that serve universally as an obstacle to adjustment for all individuals or for all environments.

Temperament in itself is not the cause of maladjustment. The crucial element is the blending of individual characteristics with environmental influences and demands (Thomas & Chess, 1977). The concept of "goodness of fit", essential to an understanding of the variable impact of temperament risk factors, has been utilized to illustrate
the temperament-environment interactive process. Goodness of fit results when the properties of the environment and its expectations and demands match the individual's own capacities, characteristics, and style of behavior (Thomas & Chess, 1977). With the presence of this consonance between the child and the environment, optimal development in a progressive direction is more likely. Conversely, poorness of fit involves discrepancies and dissonances between the child and the environment such that distorted development and maladaptation are more likely to occur. Thus children categorized as difficult can remain free of adjustment problems provided their caregivers handle them skillfully. Easy children are not immune and can develop deviant behavior in certain environmental settings (Carey, 1990).

A variety of specific factors have been shown to influence the goodness of fit and the impact of temperament risk factors, among them the strength of the temperament characteristics themselves. Negative children and those with adaptation difficulties are not all equally so. The stronger and more pervasive the behavior in a specific setting, the greater the chances of conflict with the caregiver (Carey, 1990). Other characteristics of the child, such as age seem to be important. For example, inattentiveness is not considered as much of a problem for toddlers as it is for children of school-age. The child's sex also appears to make a difference; it has been noted
that slow-to-warm-up boys are tolerated much less than girls with identical traits (Caspi, Elder, & Bem, 1988).

Elements of the environment, such as a family's social class and culture and the mother's parity, also influence the impact of temperament risk factors. From an anthropological perspective and throughout various cultures, certain kinds of infants and children are identified as troublesome or difficult, but the "cultural niche" into which the child is born determines what specific characteristics identify such a child. Further, it has been reported that an infant's temperament makes a greater impact on a multiparous mother's adaptation to the child than it does on a primiparous mother (Carey, 1990).

Research relating to temperament has also focused upon its potential impact on cognitive development. Lamb (1982) reviewed a group of studies that suggest that the infant's sociability, or reaction to unfamiliar people, is correlated with performance on tests of cognitive development, such as the Bayley Scales. Lamb notes that a portion of the overlap between sociability and test score is due to the friendliness and cooperativeness of the infant during the course of the test, but some may be due to more fundamental differences in infants' competence.

In support of the hypothesis that the effective environment depends on the characteristics of the child, Wachs and Gandour (1983) found that, within the group of
easy infants, higher amounts of kinesthetic and emotional stimulation were related to advanced sensorimotor development. Within the difficult group, however, there were no significant associations between cognitive development and positive environmental features, but there was a relationship between noise and confusion in the home and slower sensorimotor development.

Another dimension of temperament, activity level, may be related to cognitive performance. Matheny and Brown (1971) reported that twins higher in activity level tended to have lower IQs than less active twins at four years of age. In addition, they found that the more active twin also tended to have the shorter attention span. It was suggested that their finding that activity level differences predict IQ differences at four years of age could be an artifact of attention span. Rutter (1983) has concluded that a high level of activity in an infant is a positive predictor in at least one population: active infants are less likely than inactive infants to show the slowed development that is often seen in cases of institutional deprivation. Thus activity in infancy can serve to either facilitate or impair cognitive development, depending on a child's attention span and on the features of the caregiving environment (Bates, 1987).

There is very limited direct evidence with regard to either the extent or the nature of the contribution of
temperament in modifying children's reactions to stress events (Rutter, 1983). Significant associations have been reported, however, between temperamental features and psychiatric disorder, and between temperament and other people's responses to the child (Rutter, 1977). Lacking are studies of the role of temperament in reactions to stressful events. Only a few such studies exist, one of which focused on children's responses to the birth of a sibling (Dunn, Kendrick, & MacNamee, 1981). They found that the child's temperament significantly predicted changes in behavior after the birth of a sibling, and that there were significant interactions with the mother's emotional state and with the pattern of mother-child interaction.

Children's temperaments may be risk factors not only directly, but also indirectly, through the changes brought about in their caregivers (Carey, 1990). Recent studies have focused upon the impact of the child's temperament on phenomena such as parental marital satisfaction, maternal employment patterns, and emotions. Difficult temperament in infants has been associated with decreased marital satisfaction (McMillen, 1985), increased likelihood of maternal depression (Wolfkind & DeSalis, 1982), and increased likelihood that mothers would stay home with their infants rather than return to the work force (Galambos & Lerner, 1987).
In summary, temperament is a construct that has been defined in various ways. The clinical psychiatric approach employed by Thomas and Chess (1977) has been among the most widely used, and focuses on individual differences in the stylistic elements of behavior. Based on theoretical and clinical grounds and central to this approach, nine dimensions of temperament and three clinical categories have been derived. Researchers have examined the construct of temperament as it relates to both typically and atypically developing children, including preterm, low birth weight infants.

**Exploration and Play of Infants and Toddlers**

Interest in the play of infants and toddlers has increased in recent years. Research has helped differentiate between exploration and play and has led to a clearer understanding of the characteristics of play (Johnson, Christie, & Yawkey, 1987). Research by Hutt (1971) and Weisler and McCall (1976) has suggested that exploration and play are similar in that they are intrinsically motivated behaviors that are not directed by externally imposed goals.

Important differences between exploration and play also have been described, however. Exploration is said to be "stimulus-dominated" behavior, the purpose of which is to acquire information about an element or object in the
environment. Play, on the other hand, is "organism-dominated" behavior, and engagement in play is not intended to gain information about the environment. Rather, play is concerned with generating stimulation and is governed by the needs and wishes of the child (Johnson, Christie, & Yawkey, 1987). As Hutt (1971) suggests, "In play the emphasis changes from the question of 'what does this object do?' to 'what can I do with this object?"' (p. 246).

Other factors differentiate exploration and play. Among them are the timing; play generally follows exploration. Furthermore, exploration generally involves a strange object, while play involves objects familiar to the child. Exploration and play can be differentiated according to behavior and mood as well. During exploration, the child's behavior may be described as stereotyped and the mood as serious, while during play the child's behavior is much more variable, involving more creativity and autonomy on the part of the child, and the mood may be described as joyful (Johnson et al., 1987). Although one may make such distinctions on an intuitive level, it may not be possible to clearly distinguish between the two as a young child engages in activity. Infants and toddlers may move from exploration to play and from play to exploration repeatedly and within a brief period of time.

Developmental theorists have argued that the young child's perceptual and manipulative exploration of and play
with elements and objects in the environment may be the most important learning experience of the early years of life. Piaget (1962) was among the first of the contemporary theorists to emphasize the infant's exploratory and play behavior as essential for cognitive stimulation. In his terms, the adaptive processes of assimilation and accommodation depend upon such experiences during the sensorimotor period. The development of object permanence, the concept of causality, imitative learning processes, and sensorimotor intelligence are rooted in the infant's exploratory and playful interaction with the environment.

Infants and toddlers engage in exploration and play via sensory experiences, through physical movement, and through social interaction. Play provides opportunities to affect and control the environment in ways that the immature organism is not capable of doing in other contexts (Garvey, 1974). Bruner (1973) argued that for infants, exploration and play provide a forum for the development and practice of behavioral subroutines that are subsequently integrated into increasingly complex behavioral sequences. Such a position assumes that through such activity the infant acquires skills and strategies that are used later in more goal-directed ways (Weisler & McCall, 1976).

Thus, the environment and its inherent opportunities for exploration and play are likely to significantly impact the acquisition of skills and strategies. Collard (1971)
examined the exploratory and play behaviors of infants reared in an institution and in lower- and middle-class homes. Infants residing in an institution exhibited fewer schemas in their play than did either of the groups of home infants, and the lower-class-home infants showed fewer schemas than did the middle-class home infants. The institutional infants also made significantly fewer exploratory responses to the toys than did the home infants. Further, the institutional babies made many more repetitive, less mature play responses such as waving and banging the toy than did the home infants. It was suggested that this stereotyped play may be similar in function to rocking and head-banging, which were frequently observed in the institutional group. The lower-class-home infants made many more mature responses requiring fine motor coordination (such as poking or turning a bead around on a chain) than did the institutional infants, and they also made more social responses with the toy than did the institutional group. The middle-class-home babies made more responses requiring fine motor coordination and more social responses with the toy than did the lower-class-home babies.

The results suggest that opportunity for exploration and play with a variety of objects may be a factor which increases the number of schemas in a baby's repertoire as well as the amount of the child's exploratory behavior. The infants who resided in a home environment had been given
more freedom to explore, and this group not only explored more in the experimental situation than the institutional babies did but also showed significantly more patterns of exploration and play than did the institutionalized group of infants (Collard, 1971).

According to Marino (1988), "play offers an arena for spontaneous performance of social, motor, cognitive, and language skills" (p.227), and therefore, suggests that observation of play provides professionals with a far richer and possibly more valid assessment of early ability than that gained through more traditional developmental assessments. Furthermore, when utilizing free play observations, practitioners and researchers are provided with an opportunity for viewing the parent's/caregiver's skill at engaging the child in a range of developmentally appropriate activities. In addition, infant play is emerging as a predictor of cognitive and language ability. Bates (1979), in a longitudinal study of infants between the ages of 9 and 13 months, observed that two measures of play, combinatorial play and symbolic play, were the best predictors of language production and comprehension. Using a different approach to validating play as a measure of developmental status, Hill and Nicolich (1980) studied toddlers with Down syndrome. Findings indicated that performance on an eight-level play scale correlated 0.66 (p<.001) with performance on the Bayley Mental Development
Index even after controlling for chronological age.

Jennings, Harmon, Morgan, Gaiter, and Yarrow (1979) examined relationships between infants' exploratory play and cognitive functioning. Conceptually, exploratory play is thought to reflect the current level of cognitive functioning. Exploratory play, however, is also viewed as a means of learning about the environment; thus it directly influences the course of cognitive development. Thus, causality is seen as circular with level of cognitive functioning influencing play, and play, in turn, influencing later cognitive functioning.

Exploration is a necessary precursor to play, and much of infant play is exploratory in nature. During the early months of life there are significant changes in how infants play with objects. The neonate is generally equipped with reflexes and sensory capacities but does not know how to play with objects in the environment; play develops through experience (Johnson, Christie, & Yawkey, 1987). According to Piaget (1962), objects direct the infant's actions initially and then come under control of the child, thus providing the child with an opportunity to employ action schemes. Infants repeat actions on objects and then generalize these actions to a range of other objects in the environment.

During early life, an unlimited number of behaviors can be categorized as exploration or play. These behaviors
follow a systematic developmental sequence that is applicable in both the typical course of development and in atypical development (Belsky & Most, 1981; Fenson & Schell, 1986; Marino, 1988). For the first five months, most exploration is thought to be visual (Marino, 1988). Neurologically intact infants are capable of visually fixing on an object and tracking its motion almost from birth, and scanning and tracking skills improve as the infant grows older. By five months of age, the infant is capable of increased voluntary control of motor activity and thus is ready to engage in visually guided manipulative exploration. Fenson, Kagan, Kearsley and Zelazo (1976), in a study of age differences in manipulative play, reported that play at seven months is characterized by close visual and tactual examination of single objects, accompanied by mouthing. Banging of objects was prevalent at this level as well. According to Belsky and Most (1981), in its earliest form, infant exploratory behavior is viewed as undifferentiated, and manipulation includes exploring through touch and mouthing, that is, in ways not specific to the object manipulated (Belsky & Most, 1981; Fenson & Schell, 1986; Marino, 1988). Ruff (1982), in a study of exploratory behavior in 6-, 9-, and 12-month-old infants, reported that duration of mouthing and the frequency with which infants alternated between mouthing and looking decreased over age. It was also reported that the type of mouthing, regardless
of the amount, seems to change. The fact that 12-month-olds spend a greater proportion of the time spent mouthing with passive mouthing rather than active mouthing and show fewer alternations suggests that what mouthing takes place at this age has a different function than at either six or nine months of age. It may be that mouthing, for 12-month-olds, is primarily used as a place-holding action (McCall, 1974) and no longer serves an exploratory function.

Over time, such exploration is modified so that the child's actions become increasingly tailored to fit the specific features of the object. Belsky and Most (1981) term this exploration functional or functional-relational. Fenson et al. (1976) also focused on relational acts, defined as the combining or relating of two objects in their study. In addition, three subclasses of relational acts were distinguished. Acts that involved the association of two objects in an other than appropriate manner (e.g., touching a spoon against the base of a pot) were termed simple (nonaccommodative) relational acts. Acts which involved appropriate associations between objects (e.g., placing a lid on a pot) were termed accommodative relational acts. Acts of combining two similar objects, such as two cups or two spoons, were called grouping.

The data of Fenson et al. (1976) indicated that typically developing children begin to physically combine objects as early as nine months and that their combinations
often show appreciation of the sociocultural use of objects and recognition of physical and/or functional similarities among objects. By one year, the child also begins to attend to a different kind of relation, that involving the connection between actions and their effects.

Rosenblatt (1977) has also described significant shifts in how young children use objects. Over time, the child moves from using only one toy at a time to using two or more objects in play simultaneously, and often in an increasingly predictable way. At a later stage of development, then, the child pays greater attention to the physical characteristics of objects and demonstrates an awareness of how different objects are used in daily life.

Eventually, activity moves beyond the discovery of an object's properties to the use of preexisting knowledge in manipulating objects, referred to as pretense play, which emerges by the beginning of the second year of life in the typical course of development (Belsky & Most, 1981; Fenson & Schell, 1986; Marino, 1988). Pretend play is an arena for the child to use toys creatively, to find out what can be done with a toy. Pretend play may be thought of as true play, and it is a major developmental advance over exploration. Cognitive advancement in the form of representational thought allows the child to engage in pretense (Marino, 1988).
Developmental trends in the evolution of pretense have been examined by various researchers. Fenson and Ramsay (1980) report two significant trends occurring typically during the second year of life. One is progressive decetration from self in the focus of a child's actions; the second is increasing integration of separate actions into a more cohesive demonstration of behavior. The earliest pretend play is centered around the child with the child assuming the role of actor (Marino, 1988). Lowe (1975) described children's early actions as centered about or directed toward the self, rather than as decentered. Thus, in these self-focused actions, which typically could be observed at approximately one year of age, children simulate their own routine activities such as eating, drinking, and sleeping. By 24 months, the pretense involves other animate or lifelike objects, such as dolls or stuffed animals (Marino, 1988). These other-focused acts can take two forms, active or passive (Lowe, 1975). In the active form, the child arranges conditions so that the recipient can engage in independent action, such as placing a comb in a doll's hand, or holding a mirror so that a doll or play partner such as a parent can gaze into it. In the passive form, the child serves as the agent of the action, as when a child is observed combing a doll's hair. Furthermore, the active form reportedly emerged after the passive form. Another feature of pretense which becomes modified over time
is the child's dependence on realistic props (Marino, 1988). Furthermore, the number of events in the pretense episode changes over time; initial pretense is limited to a single episode, but late in the second year children exhibit multischeme pretense (Marino, 1988). Fenson and Ramsay (1980) indicate that during the second year children begin to combine individual self-, other-, and object-focused acts into integrated sequences which can take a variety of forms. In one type, which Nicolich (1977) termed "single scheme combinations" children are observed repeating the same action several times, directing it toward different recipients or using a different tool or item.

While this developmental progression of play is accepted as accurate for typically developing children, interesting variations in play occur in atypical populations, such as a slower progression through the sequence or arrested development of play behaviors (Marino, 1988). Among studies examining the play of atypical populations of children are a few studies focusing on the play of preterm infants. According to Ungerer and Sigman (1983), play level is correlated with corrected age rather than chronological age. In 1981, Harmon and Culp described preterm children as less active and less likely to explore the playroom than their full-term counterparts. Furthermore, the preterm children remained nearer their mothers and yet demonstrated little interest in them.
In a study designed to examine the distribution of behaviors of infants with Down syndrome and nondelayed infants while exploring objects, MacTurk et al. (1985) reported that the two groups of children did not differ in the total amounts of various behaviors, but varied significantly in the distribution of behavior. The nondelayed sample displayed a significantly greater number of exploratory and social behaviors, while the infants with Down syndrome looked at the toys more frequently. Furthermore, persistent, goal-directed behaviors were an important aspect of the infants' behavioral repertoires, regardless of their presumed differences in cognitive abilities.

In sum, exploration and play, similar constructs in some respects and different in others, serve a variety of functions. Through such activity children practice skills and develop ever more goal-directed strategies for interacting with the environment. A developmental progression is evident in the evolution of exploratory and play strategies, and may be applied to both typically and atypically developing children.

Family Involvement With Children Who Are Technology Dependent

The active involvement of the families of children who are medically fragile appears to vary greatly. Job
responsibilities, cultural differences, financial constraints, parental inexperience, needs of siblings, fear or discomfort in medical settings, and distance from the setting are some of the many factors that inhibit parents' physical availability to their children residing in the health care setting (Goldberger, 1988b). In some cases, a child's biological parents may no longer be involved in their child's life (Child Life in a Rehabilitation Hospital, 1985). It has been suggested that the perception of the child's illness and disability as overwhelming often contributes to the family's gradual decrease and eventual cessation of involvement and interaction. Mothers of infants having long illnesses may feel so overwhelmed by the precariousness of their child's prognosis that they withdraw emotionally from them, as evidenced by their lack of interaction (Minde, Whitelaw, Brown, & Fitzhardinge, 1983). Similar results emerged from a study by Minde, Perrota, and Corter (1982). The relationship between parental behavior and medical condition was examined in a sample of 20 same-sex premature twin-pairs with different degrees of medical complications. Mothers showed a distinct preference for interaction with their healthier infant.

Parents of children with medically complex conditions often experience profound feelings of separation, loss, and guilt when their child must spend extended periods of time, or, in many cases, all of their early lives in the hospital.
The impact on parents' self-esteem can be devastating. Parents' feelings of parenting competence and confidence in their ability to meet their children's developmental and emotional needs can be severely damaged, which is likely to impact on the level and quality of involvement parents have with their children (Hochstadt & Yost, 1989). Furthermore, because of the characteristics of these children, parents and caregivers must work hard to develop and maintain interactions with infants having complex technological needs, also potentially affecting the amount and quality of involvement and interaction.

In sum, the level of family contact maintained with children who are technology dependent throughout an extended hospitalization is variable. Several factors may impact upon parents' physical availability and the quality of their continued involvement and interaction.

Caregiving Environments

Certain types of experiences appear to be important for nourishing the behavioral development of a child. Included are such things as the opportunity to form a basic attachment to a mother or caregiver; an emotional climate characterized by mutual pleasure, sensitive need gratification, and minimization of restriction and punishment; a physical environment that is both stimulating and responsive, offering a variety of carefully modulated
sensory experiences; freedom to explore and master the environment; a daily schedule that is orderly and predictable; and an opportunity to assimilate and interpret experiences within a consistent cultural milieu (Elardo, Bradley, & Caldwell, 1975).

Wachs, Uzgiris, and Hunt (1971) also reported elements of the home environment to be consistently related to infant development, and those most strongly related were intensity and variety of stimulation, and opportunities to hear vocal labels for objects, actions, and relationships. Furthermore, they found that the first factor was at several ages negatively correlated with developmental test performance, suggesting the harmful effects of overstimulation. Wachs et al. (1971) argue that certain types of environmental stimuli may be related in a curvilinear rather than a linear manner to psychological development.

In a more recent study, Wachs (1985) found seven environmental factors in infancy which affect cognitive development at five years of age. Availability of stimulation materials, variety of simulation materials, responsivity of the physical environment, and regularity of scheduling positively affected cognitive development. Ambient background noise, overcrowding and physical restraint were negatively related to cognitive outcome.
The relationship between environment and mental test performance was examined by Elardo et al. (1975). It was reported that during the first year of life the organization of the physical and temporal environment and, to a lesser extent, opportunities for variety in daily stimulation seem most strongly related to mental test performance. Beginning at 12 months, though, provision of appropriate play materials and caregiver involvement with the child seem to show the strongest relationships. After 12 months of age, the most enriching environments experienced by children in the sample could be described as those in which a primary caregiver provided the child with a variety of age-appropriate learning materials and also consciously encouraged developmental advances by talking to, looking at, and otherwise positively responding to and attending to the child. Therefore, it has been suggested that different aspects of the home environment are most salient at certain times in development (Bradley, Caldwell, & Elardo, 1979; Elardo, Bradley, & Caldwell, 1975).

The development of an infant is linked to the dynamic interaction of the child with the environment (Heriza & Sweeney, 1990). "Environmental influences can exacerbate or ameliorate the effects of a non-optimal perinatal factor, and in many cases infants who are at biologic risk are also at environmental risk" (Aylward & Pfeiffer, 1989, p. 3). Research has focused upon both the social and the physical
environments to which children who are at-risk are subject. Lindgren, Harper, and Blackman (1986) discuss the importance of psychosocial factors and the limited accuracy of biomedical factors alone as predictors of future developmental functioning. Those likely to be vulnerable to an adverse behavioral outcome are those very low birth weight infants who suffer significant perinatal stress and medical complications and who experience a caretaking environment characterized by stresses such as poor socioeconomic status, teenage mother, and lack of social supports (Oberklaid et al., 1991). Furthermore, predictive studies of preterm and low birth weight infants have consistently found social background factors superior to perinatal variables as predictors of later cognitive ability (Siegel, Saigal, Rosenbaum, Morton, Young, Berenbaum, & Stoskopf, 1982).

Many children who are technology dependent require long-term care in a health care environment, and a growing number are residing in acute care settings for significant portions of their early lives, even after having reached a medically stable status (Hochstadt & Yost, 1989; Kahn, 1984; Newacheck, Budetti, & McManus, 1984). The actual number of chronically health-impaired infants and toddlers residing in acute care hospitals on an ongoing basis is not currently known, however (Hochstadt & Yost, 1989). In one study, Hochstadt and Yost (1989) report that the duration of
residence in the hospital setting for a group of children with complex medical needs ranged from six months to the child's entire life. As Whitford (1988) describes, for infants who are ventilator dependent, a mean hospitalization of over 200 days is not uncommon. According to the Report of the Surgeon General's Workshop on Children with Handicaps and Their Families (U. S. Department of Health and Human Services, 1982) the duration of hospitalization for children requiring mechanical ventilation ranged from 285 to 1250 days.

Hospitalization is typically viewed as a crisis that impacts in a negative manner on the course of a child's development (Davis, Foster, Whitworth, & Skinner, 1982). Spitz (1945) was among the first to describe the undesirable psychological and developmental effects of long-term care on infants. Numerous additional studies have clinically documented the often psychosocially harmful quality of institutional care for young children (Bowlby, Robertson, & Rosenbluth, 1952; Freud, 1952; Robertson, 1958).

Few options currently exist which might be capable of providing for the numerous needs of these infants and toddlers outside a medical facility. Even in cases where the child is eventually to be transitioned home, into foster care, or another placement, the child typically remains in the acute care facility for an extended period (Dixon & Holmes, 1987).
The intensive care unit is often the only inpatient unit that is equipped and adequately staffed to care for children with complex medical needs such as mechanical ventilation (Dixon & Holmes, 1987; Jansen, DeWitt, Meshul, Krasnoff, Lau, & Keens, 1989). It has been suggested that the environment of the intensive care unit may contribute to unfavorable outcome, therefore, the longer an infant stays in intensive care the more vulnerable the child is developmentally and behaviorally (Gottfried, Wallace-Lande, & Sherman-Brown, 1981; Lawson, Daum, & Turkewitz, 1977; Oberklaid et al, 1991). In a study by Landry et al. (1984) infants with bronchopulmonary dysplasia (BPD) having been hospitalized for a period ranging from 16 to 59 weeks had significantly lower Bayley scores than infants with BPD who had been hospitalized for shorter periods of time, despite the similarity in birth weights and gestational ages. The researchers suggest that the apparent delay may be attributed to the extreme length of hospitalization and related factors, such as the hospital environment and the availability of primary caretakers, rather than to the respiratory disease.

Little documented data regarding the effects of the intensive care environment, and even less data on the effects of specific treatment procedures on young children, is available (Field, 1990). A sizeable body of literature describing the neonatal intensive care environment in
general exists, however (Linn, Horowitz, Buddin, Leake, & Fox, 1985). This environment has been described as "unique in its continuous activity, regular disruptions of sleeping infants, numerous uncomfortable and often painful events, use of sophisticated equipment, and large numbers of frequently changing caregivers" (Goldberger, 1988a).

The stimulation to which patients are exposed in such an environment has been questioned and studied by Lawson, Daum, & Turkewitz (1977). They observed the intensive care environment for a one minute period every 15 minutes for a total of five 24-hour periods. The results indicated that the infants in the NICU area were exposed to extensive environmental stimuli, including light, sound, and touch. Conclusions were that while the infants in such a setting were not at all understimulated, the patterning of stimulation to which such infants were exposed might not provide an adequate foundation for optimal development.

Overall, the environment in an intensive care area, as well as in other inpatient areas of the hospital, often provides an overabundance of stimulation for the infants and toddlers residing there. This stimulation, including the ongoing drone of equipment, the murmur of continuously operating televisions and radios, and the sound of equipment alarms emitted without warning, has been described as both monotonous and unpredictable (Goldberger, 1988a).

Furthermore, the nature of the stimuli to which infants are
often exposed may be harmful to the development of sensory integration as well as to the development and maintenance of orienting responses to external events (Goldberger, 1988b). Finally, the experiences to which children are exposed, often on a daily basis, may place a child's social and emotional health at risk. To illustrate, in a case study by Dixon and Holmes (1987), it was reported that for children residing in the intensive care environment, their "chief entertainment was watching emergency resuscitations" (p. 186).

Often, minimal space and few opportunities for developmentally appropriate exploratory play are available in intensive care environments. Within such a setting, the use of hazardous equipment may confine children to their bed space and limited floor space (Jansen et al., 1989). Children may spend significant amounts of time confined to cribs, highchairs, and playpens until such a time that caregivers are available to supervise exploration and play. Furthermore, young children may be restrained to prevent pulling at medical tubing or equipment (Goldberger, 1988a).

The psychosocial orientation of the staff also influences children's experiences. According to Hochstadt and Yost (1989), when a state of general medical stability has been reached, the extramedical aspects of caregiving take on a primary level of importance. This nonclinical focus often creates uncertainty in the medical team, whose
primary orientation is clinical. Staff attitudes can affect significantly the quality of care and interaction which children receive (Jansen, DeWitt, Meshul, Krasnoff, Lau, & Keens, 1989).

In a study by Marton, Dawson, and Minde (1980), the nature and frequency of contacts of hospital personnel with preterm infants in a neonatal intensive and post-intensive care unit were investigated. While those in the post-intensive care unit received touching, burping, and holding, those in the intensive care setting received the bulk of their contacts during medical procedures. Thus, intensive care contacts were likely to be associated with discomfort and post-intensive care contacts were more likely to be soothing. Overall, however, preterm infants received relatively low rates of contact from health care staff, with a contact rate of less than eight minutes per hour. This investigation did not determine how well the quantity and timing of stimulation provided by ward staff matched the infant's state of receptiveness. Goldberger (1988a) has observed that many of the social interactions to which infants are subject are noncontingent and intrusive. Often children will make contact with numerous caregivers and few of the interactions will be responsive to the child's own cues. Contingent responsive care is made less likely by tracheostomies, ventilators, or the effects of handicapping
conditions which often make verbal communication or vocalization difficult.

With a focus on the provision of contingent stimulation, Als, Lawhorn, and Brown (1986) conducted a study in which the nursing care of infants was modified based on the behavioral cues of the infant. The infants in the experimental group participated in intervention which was individualized and contingency-based, while a control group of infants received standard nursing care. At a corrected age of one month, infants in the experimental group demonstrated well-modulated behavior with higher thresholds to motor disorganization and more optimal self-regulating ability. The infants in this group also demonstrated an increased ability to cuddle, more muscle tension, a higher level of motor maturity, and better behavioral organization and interaction. The experimental infants also showed a significantly lower incidence of motoric extension behaviors and a higher number of age-appropriate reflexes than the infants in the control group. Furthermore, the infants receiving contingent stimulation and care reportedly had higher Bayley Mental and Motor Scale scores at three, six, and nine months.

Heriza and Sweeney (1990) emphasize the importance of cross-modal stimulation but also stress that the timing of such stimulation is crucial because the age and health of an infant influences his/her ability to handle sensory
information. Oehler (1985), in an investigation of tactile and visual stimulation in three groups of 26 to 30-weeks gestational age preterm infants, reported different responses to stimulation for those infants who were healthy, moderately healthy, and sick. Infants who were sick were able to handle one stimulus at a time, either touch or voice, but voice and touch together resulted in an increase in avoidance reactions. Healthy infants demonstrated more self-regulatory behaviors when exposed to voice, touch, and touch and voice combined than moderately healthy or sick infants.

Recognizing the potential detrimental effects of an intensive care setting on children's behavior and development, a growing number of hospitals are beginning to focus on providing care for children who are technology dependent in other areas of the hospital, such as a general pediatric unit or a specially designed transitional unit (Dixon & Holmes, 1987; Merkens, 1990). In such areas, more appropriate levels of stimulation and opportunities for interaction with peers may be provided. Occasionally, children will be transferred to a new facility entirely, a transitional hospital, where the focus is on further medical stabilization, developmental stimulation, and on opportunities for parent training and trial care prior to discharge to home (Battle, 1987), or to an extended care, skilled nursing facility (Dixon & Holmes, 1987).
Within the past ten years, home care has emerged as a viable option for some infants with an ongoing dependence on high-technology equipment. This trend can be attributed to several factors, the first of which is the general pattern of care that has moved from the hospital environment to the home setting. A second factor is the atmosphere of cost containment facilitated by the prospective payment legislation, which has resulted in shorter hospital stays and increased reimbursement for home care. The third factor has been the technologic advances, many of which can be utilized in the home setting, associated with increasing medical knowledge regarding effective treatment of an ever-increasing population of children who are high-risk and medically fragile (Delaney & Zolondick, 1991).

In general, professionals agree that many of these children would be more comfortable and receive more appropriate types and levels of stimulation in home care environments. The premise that home care facilitates parent-infant bonding and optimal environmental stimulation for the child has recently contributed to the trend toward discharge to home for the young child with medically complex needs. The child can thrive and develop within the home environment while receiving individual attention from family members. Furthermore, the home environment is believed to eliminate the threat of nosocomial infection as well as
lessens the number of noxious procedures that the infant must sustain while in the hospital setting (Embon, 1991).

However, many medical professionals and families are fearful and skeptical of transitions to home, due to the belief that the strain on nonprofessional caregivers would be too great (Kahn, 1984), and feelings expressed by parents that the nursing staff is more capable of responding effectively to the infant's needs (Embon, 1991). It is often believed that the children are too ill to benefit from home care (Kahn, 1984). Other factors which determine the feasibility of home care are family structure, coping ability, financial resources, access to community resources, and proximity to a tertiary care center (Burr, Guyer, Todres, Abrahams, & Chiodo, 1983). Home care, therefore, is not always a realistic option (Dixon & Holmes, 1987).

In summary, environmental factors important for a child's development and psychosocial health have received focus in the literature. Hospital settings, specifically intensive care settings, which may serve as a long-term residence for young children who are technology dependent often are deficient of these factors and may be detrimental to children's development and socioemotional health. Within recent years, alternative care environments for children with medically complex needs have been utilized, including general pediatric units, transitional units within acute care hospitals, and transitional facilities. Increasing
numbers of young children are also being discharged to home environments, although this is not a realistic option for all children with complex medical needs.

Summary

In this chapter, a review of relevant literature in the following areas has been presented: (1) the consequences of perinatal complications, (2) parent-infant interaction; (3) coping behavior of infants and toddlers, (4) the temperament of young children, (5) exploration and play of infants and toddlers, (6) family involvement with children who are technology dependent, and (7) caregiving environments.

Relatively little is known regarding the behavior and development of preterm and other infants with medically complex conditions. Respiratory distress syndrome and bronchopulmonary dysplasia are common consequences of preterm birth and very low birth weight. Studies of infants with such conditions report significant developmental delays, interactional difficulties and decreased tolerance of stimulation.

The behaviors of parents and their infants during social interaction have received considerable attention in the research literature. Comparisons of infant-mother dyads in which the infant is typically developing and those in which the infant is following an atypical course of
development have revealed significant differences between the two, differences which persist over time.

Coping may be defined as the ways in which individuals respond to stressful events. During the early years, events differ significantly in their potential for being perceived as stressful and in the dominant responses each provokes. Children's acquisition of coping behavior is influenced by developmental competence, temperament, the environmental demands, and the environmental response to coping efforts.

While definitions of temperament exist, the clinical psychiatric approach has been among the most widely used. This approach focuses on individual differences in the stylistic elements of behavior. Researchers have examined the construct of temperament as it relates to both typically and atypically developing children, including preterm, low birth weight infants.

Exploration and play serve a variety of functions including practice of skills and the development of goal-directed strategies for interacting with the environment. A developmental progression, which may be applied to children developing typically as well as to those developing in an atypical manner, is evident in exploratory and play strategies.

The level of continued family involvement with children who are technology dependent is variable. Several factors
are likely to influence parents' physical availability and the quality of their interaction with their child.

Finally, environmental factors important for a child's development and psychosocial health have received attention by researchers. Hospital settings, specifically intensive care settings, which may serve as a long-term residence for young children who are technology dependent, are often deficient in these factors and may be detrimental to children's development and socioemotional health. Increasing numbers of these children are being discharged to home environments, which are believed to provide more appropriate forms and levels of stimulation than a hospital setting. However, due to a variety of factors, this is not a realistic option for all children with medically complex conditions.
CHAPTER III

METHODS

This study examined the following factors and the relationships between these variables: developmental outcome, interactional behavior, and coping behavior. Secondly, the potential impact of the independent variables temperament and exploratory/play behavior upon developmental outcome and behavior (dependent variables) were explored. Third, elements of the social and physical environment (independent variables), specifically, family involvement and quality of the environment were examined in order to evaluate the relationship to children's development and behavior (dependent variables). The impact of birth weight (independent variable) on the development and behavior (dependent variables) of children who are technology dependent was also investigated. Finally, the relative contributions of child-based factors, environmental factors, and health factors (independent variables) to developmental outcome and behavior (dependent variables) were examined. This chapter includes a description of the subjects in the study and their families, the procedures employed in data
collection, the instrumentation, the analysis of data, and limitations of the research.

Subjects

Criteria. This study focused on two groups of children who are technology dependent: (1) a group of children who have been residing and receiving medical care in a health care facility since birth (hereafter referred to as the hospital group), and (2) a group of children who, following an extended period of hospital care, have subsequently been discharged to their home setting or a foster home setting (hereafter referred to as the home care group). Criteria for subject selection were as follows: (1) 36 months chronological age or less; (2) primary diagnoses of illnesses/conditions affecting respiratory functioning, such as bronchopulmonary dysplasia or congenital anomalies of the respiratory system; (3) classification as technology dependent according to the definition of the Task Force on Technology Dependent Children (1988), thus requiring device-based respiratory support, such as tracheostomy tube care, suctioning, oxygen support, CPAP (continuous positive airway pressure), or mechanical ventilation for at least a part of each day; (4) classification as medically stable by medical staff; (5) documentation of no greater than a grade II intraventricular hemorrhage (IVH); (6) at least minimal visual and auditory capabilities.
Selection Procedure. A listing of infants and toddlers meeting the study inclusion criteria and who were residing in home settings was provided by the Nurse Clinician affiliated with the Neonatal Developmental Unit at Columbus Children's Hospital. A total of 17 children who had received hospital care in the Newborn Developmental Unit and who were residing in a home setting (i.e., the home of their parents or that of a foster family) met the study criteria. Consent for participation in the research was obtained from the parents/foster parents of 14 (82%) of the children. Twelve of the children were in the care of their birth parents, while two were in foster homes. The parents of three children declined to participate in the study.

A sample of children meeting the criteria for inclusion in the study and who currently reside in an institutional setting was drawn from the patient population of Lifelines Children's Rehabilitation Hospital in Indianapolis, Indiana, through consultation with the facility's medical director and administrative staff. A total of 18 children within the hospital setting met the criteria for inclusion during the three-month data collection period (i.e., March, 1992 through May, 1992). The families or legal guardians of each of these children was contacted to request participation in the project; 16 (89%) of these parents/guardians agreed to participate in the project. Thus the total sample for the research was comprised of a total of 30 infants and toddlers.
who could be classified as technology dependent, 14 comprising the home care group and 16 constituting the hospital group.

Setting

Home care group. Prior to their discharge to a home setting, children included in the home care group had received transitional hospital care in the Newborn Developmental Unit (NDU) within Columbus Children's Hospital. This period of transitional care followed a period of intensive care in either the Neonatal Intensive Care Unit (NICU) or the Surgical Intensive Care Unit (SICU), also within Columbus Children's Hospital. The Newborn Developmental Unit was developed and opened in July, 1990 as a specialized transitional care unit within an acute care pediatric hospital. The NDU is designed to provide care for up to 20 infants and toddlers; among the pediatric professionals providing care and services are specially trained nurses, occupational therapists, physical therapists, an early interventionist, social workers, and a speech therapist. Family involvement is encouraged, and private space is available on the unit for family use. Environmentally, sound-absorbing ceiling and floor tiles have been utilized, and natural lighting as opposed to overhead lighting is used during daylight hours. Individual bedside lighting is available for use as needed; lighting
patterns to which the infants are exposed have been designed to promote day and night cycling for the infants.

For the purposes of this research, interactions with children in the home care group took place on the floor in an area of the home that was familiar to the child and relatively free of distracting items, such as a television, and excessive noise. The specific location in each home was determined in collaboration with the child's parents and/or caregiver. In all cases, a living room area of the family/foster family home served as the interaction site. All families who participated in the study live in communities within 200 miles of Columbus, Ohio.

Hospital group. Lifelines Children's Rehabilitation Hospital is a 60-bed pediatric facility located in Indianapolis, Indiana. The mission of this institution is to provide rehabilitative care and services to children from early infancy through late adolescence. Lifelines Hospital accepts referrals from health care agencies and facilities throughout the state of Indiana as well as from neighboring states such as Ohio and Michigan. Lifelines Children's Rehabilitation Hospital is organized around three specialized rehabilitation programs: respiratory management, brain injury/spinal cord injury, and comprehensive rehabilitation. Each of these programs has experienced pediatric trained staff. Nurses; respiratory, physical, occupational, and speech therapists; family
services personnel, and child life and education personnel provide individualized medical, developmental, and psychosocial care. Established psychosocial policies include open visiting for family members and friends, rooming-in for parents, primary nursing, and developmentally appropriate space and equipment for exploration, play, and social interaction with peers.

Within the context of the study, interactions with caregivers and children in the hospital group took place either on the floor in the child's room or in a familiar playroom space, both of which were kept devoid of excessive distractions to the extent possible. The specific location for each child was determined in collaboration with the child's primary nurse.

Characteristics of Children, Families, & Environments

Children. Characteristics of the children were derived through review of medical charts and/or consultation with parents/caregivers. In Table 1, chronological age, gestational age, and birth weight of the children in the home care and hospital groups are presented. In terms of chronological age, the groups did not differ significantly, as shown on Table 1 (mean of 13.43 months in the home care group and 15.31 months in the hospital group, t=-0.77). The groups were found to be significantly different, however, with regard to gestational age (mean gestational age of
31.86 weeks for the home care group and 27.81 weeks for the hospital group, t=2.32). Children in the hospital group had been born at significantly earlier gestational ages than children in the home care group. In addition, children in the hospital group were found to be of lower birth weight than those in the home care group (mean birth weights of 1042 grams and 1787 grams respectively), a difference which was significant (t=2.02).

In Table 2, gender, birth status, ethnicity, type of respiratory life support required, and diagnosis of the children in the home care and hospital groups are presented. On the variables gender and birth status, chi square was utilized to analyze the differences between the groups. On the variables ethnicity, technology required, and diagnosis, due to inadequate counts (less than five) in at least one of the cells, chi square was not a valid test (Isaac & Michael, 1982). In such cases, Fisher's Test of Exact Probability is recommended and was thus utilized. Fisher's Test of Exact Probability, a nonparametric procedure, "yields the probability of observing a table that gives at least as much evidence of association as the one actually observed, given that the null hypothesis is true" (SAS Institute Inc., 1989, p. 865). The home care group was comprised of nine males and five females, while the hospital group included 10 males and six females. The groups were not significantly different in
Table 1

Chronological Age, Gestational Age, and Birth Weight For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child's age (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care group</td>
<td>13.43</td>
<td>7.79</td>
<td>4</td>
<td>29</td>
<td>-0.77</td>
<td>.45</td>
</tr>
<tr>
<td>Hospital group</td>
<td>15.31</td>
<td>5.59</td>
<td>7</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care group</td>
<td>31.86</td>
<td>5.84</td>
<td>25</td>
<td>40</td>
<td>2.32</td>
<td>.03</td>
</tr>
<tr>
<td>Hospital group</td>
<td>27.81</td>
<td>3.58</td>
<td>24</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth Weight (grams)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care group</td>
<td>1787</td>
<td>1283</td>
<td>625</td>
<td>4503</td>
<td>2.02</td>
<td>.05</td>
</tr>
<tr>
<td>Hospital group *</td>
<td>1042</td>
<td>614</td>
<td>490</td>
<td>3097</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Birth weight data was available for 15 of the 16 children in the hospital group.
Table 2
Characteristics of the Children in the Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Home Care</th>
<th>Hospital</th>
<th>Chi Square</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 (64.3%)</td>
<td>10 (62.5%)</td>
<td>0.01</td>
<td>.92</td>
</tr>
<tr>
<td>Female</td>
<td>5 (35.7%)</td>
<td>6 (37.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singleton</td>
<td>9 (64.3%)</td>
<td>11 (68.8%)</td>
<td>0.07</td>
<td>.80</td>
</tr>
<tr>
<td>Twin</td>
<td>5 (35.7%)</td>
<td>5 (31.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>12 (85.7%)</td>
<td>7 (43.8%)</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>African-American</td>
<td>2 (14.3%)</td>
<td>9 (56.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Support Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen (nasal canula)</td>
<td>4 (28.6%)</td>
<td>2 (12.5%)</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>4 (28.6%)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tracheostomy &amp; oxygen</td>
<td>4 (28.6%)</td>
<td>4 (25.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPAP</td>
<td>-</td>
<td>8 (50.0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen-day &amp; ventilator-night</td>
<td>1 (7.1%)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CPAP-day &amp; ventilator-night</td>
<td>1 (7.1%)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Continuous ventiler</td>
<td>-</td>
<td>2 (12.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPD</td>
<td>8 (57.1%)</td>
<td>15 (93.8%)</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Structural anomalies</td>
<td>6 (42.9%)</td>
<td>1 (6.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Home care group: n=14  Hospital group: n=16
gender composition ($X^2 = .01$). With regard to birth status, 35.7 and 31.3\% respectively of the children in the home care and hospital groups were twins, a difference which was not found to be significant ($X^2 = .07$). Further, 56.3\% of the children in the hospital group were black, while only 14.3\% of the children in the home care group were black, a difference which was found to be significant (Fisher Exact Test $p = .01$). A significant difference between the groups was also found in the type of respiratory life support technology required, with children in the hospital group requiring higher level technological support than children in the home care group (Fisher Exact Test $p = .0001$).

The largest proportion of children in both groups had been diagnosed with bronchopulmonary dysplasia (BPD). The remaining children were classified as having structural anomalies of the airway, three of whom had been diagnosed with Pierre Robin Syndrome; the remaining four had not been diagnosed specifically, although a genetic disorder was suspected (according to caregivers). A significant difference was found between the home care and hospital groups in diagnosis; 57.1\% of the home care group was comprised of children with BPD while 93.8\% of the children in the hospital group had BPD (Fisher Exact Test $p = .03$).

Table 3 focuses upon the length of hospitalization as well as the length of time in the current residence for both the home care and hospital groups. For children in the
home, the mean hospital stay was 209.64 days, while the mean period of hospitalization for the hospital group at the time of data collection was 463.25 days, a difference which was significant (t=-3.62). For the children in the home care group, the period of hospitalization included both time spent in the NICU/SICU and the NDU in Columbus Children's Hospital. For the hospital group, the hospitalization period included both acute care hospitalization and current rehabilitative hospitalization in Lifelines Children's Rehabilitation Hospital. Children in both groups were in their current caregiving environment (i.e., home setting or rehabilitation hospital setting) for a minimum of 30 days and a maximum of 379 days and 365 days respectively at the time of the data collection visit. The difference between the two groups with regard to time in their caregiving environment was not significant (t=.67).

**Families.** Data relative to the families of the children were obtained through a review of the medical chart and/or during an interview with parents and/or caregivers. In Table 4 maternal ages for the children in both groups are noted. Mothers of children in the hospital group were significantly younger than those of children in the home (mean ages 21.73 and 29.43 years respectively, t=3.07).

Table 5 includes data on both groups relative to the marital status of the mothers of the children, family
Table 3
Length of Time in Hospital and Current Residence
For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total days in hospital</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>209.64</td>
<td>210.75</td>
<td>30</td>
<td>784</td>
<td>-3.62</td>
</tr>
<tr>
<td>Hospital</td>
<td>463.25</td>
<td>173.11</td>
<td>199</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>Time in current residence (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>203.00</td>
<td>120.73</td>
<td>30</td>
<td>379</td>
<td>0.67</td>
</tr>
<tr>
<td>Hospital</td>
<td>175.06</td>
<td>108.87</td>
<td>30</td>
<td>365</td>
<td></td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16
Table 4
Maternal Age
For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Home care group</th>
<th>Hospital group</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age</td>
<td>29.43 5.96</td>
<td>21.73 6.56</td>
<td>3.07</td>
<td>.005</td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16
* Maternal age data was available for 11 of the 16 children in the hospital group.

Table 5
Family Demographics for the Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Home care</th>
<th>Hospital</th>
<th>Fisher Exact Test Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>3 21.4%</td>
<td>10 62.5%</td>
<td>.03</td>
</tr>
<tr>
<td>Married</td>
<td>11 78.6%</td>
<td>6 37.5%</td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper class</td>
<td>2 14.3%</td>
<td>- -</td>
<td>.05</td>
</tr>
<tr>
<td>Upper middle class</td>
<td>3 21.4%</td>
<td>1 6.3%</td>
<td></td>
</tr>
<tr>
<td>Middle class</td>
<td>5 35.7%</td>
<td>3 18.8%</td>
<td></td>
</tr>
<tr>
<td>Lower middle class</td>
<td>3 21.4%</td>
<td>4 25.0%</td>
<td></td>
</tr>
<tr>
<td>Lower class</td>
<td>1 7.1%</td>
<td>8 50.0%</td>
<td></td>
</tr>
<tr>
<td>Other children in parent's/foster parent's home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1 7.1%</td>
<td>7 43.8%</td>
<td>.12</td>
</tr>
<tr>
<td>One</td>
<td>8 57.1%</td>
<td>5 31.3%</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>3 21.4%</td>
<td>3 18.8%</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>1 7.1%</td>
<td>1 6.3%</td>
<td></td>
</tr>
<tr>
<td>Four</td>
<td>- - - -</td>
<td>- - - -</td>
<td></td>
</tr>
<tr>
<td>Five</td>
<td>1 7.1%</td>
<td>- - - -</td>
<td></td>
</tr>
</tbody>
</table>
socioeconomic status classification, and the number of other children who reside in the parents' or foster parents' home. On each of these variables, because of inadequate cell counts, chi square was not a valid test; Fisher's Test of Exact Probability was thus utilized. In the home care group, 78.6% of the children's mothers were married while in the hospital group only 37.5% of the children's mothers were married, a difference which was significant (Fisher Exact Test p=.03). Thus in the home care group, the mothers of the majority of children were married, while in the hospital group, the majority of the children's mothers had never been married. A significant difference in family socioeconomic status between the groups was also found (Fisher Exact Test p=.05). In the home care group, 10 of the 14 families (72%) were classified in the middle, upper middle, or upper classes. In the hospital group, however, 12 of the 16 families (75%) were classified in the lower middle or lower classes. With regard to the number of children residing in the parents' or foster parents' home (excluding the study child in the home care group), no significant differences between the two groups were found.

Temperament classification. Dependent upon the child's developmental level, either the Revised Infant Temperament Questionnaire or the Toddler Temperament Scale was utilized to assess temperament. The questionnaires were completed by mothers/foster mothers in the home setting and by children's
primary nurses in the hospital setting. Table 6 presents data on the temperament diagnostic clusters characterizing the children in the groups. Within the home care group, 29% of the children were categorized as having an easy temperament while 19% of the infants and toddlers in the hospital group were so classified. Of the children in the home care group, 21% were found to be of difficult temperament, while of the children in the hospital group, 19% were of difficult temperament. No statistically significant differences between the groups were found.

Included on Table 7 are data relating to the nine dimensions of temperament. A significant difference between the groups of children was evident only for the dimension of mood, with children in the hospital group being rated by parents/caregivers as more negative in mood (Fisher Exact Test p=.007). Guidelines for interpreting data are included in Appendix B. A rating system, rather than actual scores, was employed because two forms of the temperament rating scale were used in the research, an infant scale and a toddler scale. The placement of actual scores on the temperament profile differed according to the form of temperament questionnaire used, making comparison between scores on the two scales difficult. The rating system utilized, however, allowed for meaningful comparison between the developmental groups in that it rated the position of
Table 6
Temperament Diagnostic Clusters
For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Home Care n=14</th>
<th></th>
<th>Hospital n=16</th>
<th></th>
<th>Fisher Exact Test Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy</td>
<td>4 28.6%</td>
<td>3 18.8%</td>
<td>.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate low</td>
<td>5 35.7%</td>
<td>4 25.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficult</td>
<td>3 21.4%</td>
<td>3 18.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate high</td>
<td>2 14.3%</td>
<td>6 37.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slow-to-warm-up</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7
Temperament Dimension Ratings--Home Care & Hospital Groups

<table>
<thead>
<tr>
<th>Dimension Rating</th>
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<th>Hospital</th>
<th>Fisher Exact Test Prob.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>28.6%</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>35.7%</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>35.7%</td>
<td>8</td>
</tr>
<tr>
<td><strong>Rhythmicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>28.6%</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>42.9%</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>28.6%</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>21.4%</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>50.0%</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>28.6%</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Adaptability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>42.9%</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>21.4%</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>21.4%</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>14.3%</td>
<td>2</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>35.7%</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>28.6%</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>35.7%</td>
<td>7</td>
</tr>
<tr>
<td><strong>Mood</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>14.3%</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>14.3%</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>57.1%</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>14.3%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Persistence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>28.6%</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>35.7%</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>28.6%</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>7.1%</td>
<td>1</td>
</tr>
<tr>
<td><strong>Distractibility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>28.6%</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>35.7%</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>28.6%</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>7.1%</td>
<td>2</td>
</tr>
<tr>
<td><strong>Threshold</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>21.4%</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>50.0%</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>14.3%</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>14.3%</td>
<td>5</td>
</tr>
</tbody>
</table>
the numerical score relative to the mean on each of the temperament questionnaires.

**Exploratory/play behavior.** A brief observation of children engaged in solitary play with a selection of toys and objects was used as a measure of exploratory/play behavior. The most sophisticated level of exploratory/play behavior demonstrated by the groups was compared (see Table 8). For at least 50% of the infants and toddlers in both groups, simple manipulation was the most sophisticated exploratory behavior observed (50% for the home care group and 56% for the hospital group). No significant difference between the two groups was found, however.

**Social and physical environments.** The primary caregivers of children in the hospital group provided information regarding family contact maintained with the children. While it might be assumed that children in the home care group had consistent contact with parents or foster parents, children in the hospital group experienced considerable variation in the level of family contact maintained, as shown in Table 9. Daily contact or contact every other day was maintained 25% of the families. Another 19% of the families maintained weekly or bi-weekly contact with their hospitalized child. The majority of the families (56%), however, maintained irregular contact with their hospitalized child.
Table 8

Exploration and Play Behavior
Most Sophisticated Level Observed
By Group

<table>
<thead>
<tr>
<th>Level of Behavior</th>
<th>Home Care</th>
<th></th>
<th>Hospital</th>
<th></th>
<th>Fisher Exact Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>Prob.</td>
</tr>
<tr>
<td>Looking only</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>6.3%</td>
<td>.93</td>
</tr>
<tr>
<td>Mouthing</td>
<td>1</td>
<td>7.1%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Simple manipulation</td>
<td>7</td>
<td>50.0%</td>
<td>9</td>
<td>56.3%</td>
<td></td>
</tr>
<tr>
<td>Functional</td>
<td>2</td>
<td>14.3%</td>
<td>2</td>
<td>12.5%</td>
<td></td>
</tr>
<tr>
<td>Relational</td>
<td>2</td>
<td>14.3%</td>
<td>1</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td>Functional-relational</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>6.3%</td>
<td></td>
</tr>
<tr>
<td>Enactive naming</td>
<td>1</td>
<td>7.1%</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pretend self</td>
<td>1</td>
<td>7.1%</td>
<td>2</td>
<td>12.5%</td>
<td></td>
</tr>
<tr>
<td>Pretend other</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Substitution</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Sequence pretend</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Sequence pretend</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>substitution</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Double substitution</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16
Table 9
Family Involvement With Children
In the Hospital Group
n=16

<table>
<thead>
<tr>
<th>Level of Involvement</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily/every other day contact</td>
<td>4</td>
<td>25.0%</td>
</tr>
<tr>
<td>Weekly/bi-weekly contact</td>
<td>3</td>
<td>18.8%</td>
</tr>
<tr>
<td>Irregular contact</td>
<td>9</td>
<td>56.2%</td>
</tr>
</tbody>
</table>
The frequencies of early intervention services received by children in the home care and hospital groups were determined during interviews with parents/foster parents or caregivers. As shown in Table 10, within the home care group, 71% of the children received early intervention services one to two times weekly, while in the hospital group, all children received such services five times weekly, a difference which was significant (Fisher Exact Test p=.0001).

The Home Observation for Measurement of the Environment (HOME) was completed through observations of the researcher and interviews with the parent/foster parent of children in the home and with primary nurses of children in the hospital. In Table 11 scores for both groups on the HOME are listed (see Appendix B for interpretive information). The HOME total mean score for the home care group was 33.57 while that for the hospital group was 27.31, a difference which was found to be significant (t=3.44). Although both of these mean scores fell within the middle range in terms of level of supportiveness for cognitive and emotional development, children in the home care group resided in more supportive environments than children in the hospital group.

On all of the HOME subscales but the organization subscale (HOMEORG) and the involvement subscale (HOMEINV), the scores between the home care and hospital groups were significantly different. The children in the home care
Table 10

Frequency of Formal Early Intervention Services Received For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Frequency of service</th>
<th>Home Care</th>
<th>Hospital</th>
<th>Fisher Exact Test</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>No Services</td>
<td>3</td>
<td>21.4%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1-2 times weekly</td>
<td>10</td>
<td>71.4%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3-5 times weekly</td>
<td>1</td>
<td>7.1%</td>
<td>16</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16
Table 11
 HOME Scores For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min.</td>
<td>Max.</td>
<td></td>
</tr>
<tr>
<td>HOMETOT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>33.57</td>
<td>6.05</td>
<td>22</td>
<td>40</td>
<td>3.44</td>
</tr>
<tr>
<td>Hospital</td>
<td>27.31</td>
<td>3.81</td>
<td>20</td>
<td>33</td>
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</tr>
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<td>HOMERES</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Home care</td>
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<td>1.54</td>
<td>6</td>
<td>11</td>
<td>2.05</td>
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<tr>
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<td>7.88</td>
<td>1.63</td>
<td>5</td>
<td>11</td>
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<td>HOMEACC</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>0.77</td>
<td>6</td>
<td>8</td>
<td>5.55</td>
</tr>
<tr>
<td>Hospital</td>
<td>6.00</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>HOMEORG</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>3.92</td>
<td>0.47</td>
<td>3</td>
<td>5</td>
<td>0.72</td>
</tr>
<tr>
<td>Hospital</td>
<td>3.81</td>
<td>0.40</td>
<td>3</td>
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<td>HOMEPLY</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>6.29</td>
<td>1.82</td>
<td>3</td>
<td>9</td>
<td>2.06</td>
</tr>
<tr>
<td>Hospital</td>
<td>5.06</td>
<td>1.44</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>HOMEINV</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>4.86</td>
<td>1.92</td>
<td>1</td>
<td>6</td>
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</tr>
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<td>6</td>
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<td>HOMEVAR</td>
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</tr>
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<td>4</td>
<td>5.21</td>
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<td>Hospital</td>
<td>0.50</td>
<td>0.63</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Home care group:  n=14   Hospital group:  n=16
group experienced more emotional and verbal responsivity on the part of parents and caregivers than children in the hospital group \((t=2.05)\). Acceptance of the children's behavior was greater in the home care group than in the hospital groups as well \((t=5.55)\). Attention to the provision of appropriate play materials was also greater for the home care than for the hospital group \((t=2.06)\). Lastly, opportunities for variety in daily stimulation were greater for the home care group than for the hospital group \((t=5.21)\).

**Summary of characteristics.** The home care and hospital groups were similar on several characteristics, including chronological age, gender composition, and birth status. The mean age of children in the home care group was approximately 13 months while the mean for children in the hospital group was approximately 15 months. Both groups were composed primarily of male children and singleton births, although approximately one-third of the children in both groups were twins. The length of time in the current residence, a home setting or a rehabilitation hospital setting, was similar for both groups as well.

Significant differences between the groups were found in gestational age, and the difference between the groups in birth weight approached significance. Children in the home care group were of greater gestational age and birth weight than children in the hospital group. The groups also
differed significantly in racial composition; the home care group was predominantly Caucasian while the children making up the hospital group were primarily African-American. Furthermore, significant differences were found between the groups in the level of technology required for life support and in diagnosis. Children in the hospital group required higher levels of technological support than children in the home care group. In addition, while both groups were comprised primarily of children with bronchopulmonary dysplasia (BPD) rather than those with structural anomalies of the airway, the hospital group included a significantly higher proportion of children with BPD than the home care group. Finally, the children in the hospital group had been hospitalized for significantly longer periods than the children in the home care group.

Temperamentally, no significant differences were found between the groups in temperament cluster classification or on the majority of the temperament dimension ratings. Children in both groups tended to be low on the activity dimension, arrhythmic, slowly adapting, more withdrawing than approaching, mild in intensity, low in persistence, and low in distractibility. Further, children in the home care group tended to have a lower threshold than the children in the hospital group, although this difference was not statistically significant. With regard to mood, however, the children in the two groups differed significantly, with
the children in the home care group being more positive in mood than children in the hospital group.

Similarities between the groups were also found in exploratory/play behavior demonstrated by the children. The highest level of exploratory behavior demonstrated by the majority of children in both groups was simple manipulation.

The families of the children in the home care and hospital groups were similar in terms of the number of other children in the parents'/foster parents' home; the majority of families had either no other children or only one other child in the home.

Significant differences between the families emerged on maternal age, marital status, and socioeconomic status. The mothers of children in the home care group were older than mother of children in the hospital group. Furthermore, the majority of mothers in the home care group were married, while the majority of mothers in the hospital group had never been married. Lastly, the families of children comprising the home care group were of higher socioeconomic status than those of children in the hospital group.

The social and physical environments to which the children in the home care and hospital groups were subjected were similar in only a few respects and different in many ways. Similarities were found in the organization of the physical and temporal environment and in parental/caregiver involvement with the child. The groups were significantly
different in the frequency of participation in early intervention programming; the majority of children in the home care group participated in such programming only one or two times weekly, while all the children in the hospital group received early intervention services five times weekly. Differences were also found between the groups on the overall quality of the home environment, the emotional and verbal responsivity of the parent/caregiver, the acceptance of the child's behavior, the provision of appropriate play materials, and opportunities for variety in daily stimulation. Overall, the quality of the environment for the home care group was higher than the quality for the hospital group. Similarly, children in the home care group experienced a higher level of emotional and verbal responsivity on the part of the parent/caregiver, a higher level of acceptance of their behavior, more attention to the provision of play materials, and more variety in daily stimulation than children in the hospital group.

**Procedures**

To gain permission to initiate the study, the research proposal was first submitted to the Human Subjects Committee of The Ohio State University. When approval from this committee had been obtained (see Appendix C), the proposal was submitted simultaneously to the Human Subjects Research Committee of Children's Hospital, Columbus, Ohio, (see
Appendix C) and the Research Review Committee at Lifelines Children's Rehabilitation Hospital, Indianapolis, Indiana (see Appendix C).

When approval from each of the above review committees had been obtained, copies of the proposal were delivered to the Director of Children's Homecare Services and to the Nurse Clinician affiliated with the Newborn Developmental Unit (NDU), both at Children's Hospital, as well as the designated administrative contact at Lifelines Children's Rehabilitation Hospital. In addition, arrangements were made to meet with these health care representatives to discuss the research project and answer any questions relating to the project. During each of these meetings, arrangements for obtaining a listing of potential study subjects were discussed.

Prior to beginning data collection, the researcher engaged in an intensive training period regarding the administration/observation and scoring of each instrument employed. Available training materials and manuals relating to the use and scoring of each instrument were utilized to gain competency in the administration of each tool. Also during this training period, the researcher and a colleague piloted each of the observational/interview instruments with three children not included in the study. The ages of the children were 5 months, 13 months, and 20 months. Two of these children (the five- and 13-month-old) were following a
typical course of development, while the 20-month-old had been hospitalized for rehabilitative purposes secondary to an injury. Interobserver reliabilities ranged from 84% to 94% on each of the six domains of the Battelle Developmental Inventory. Inter-rater reliabilities on the Infant Rating Scales were 92% on the infant ratings and 90% on the maternal/caregiver ratings. With regard to the Early Coping Inventory, the overall inter-rater reliability was 86%. The inter-observer reliability on the exploration/play assessment measure was 96%.

Because of hospital policies, representatives of Columbus Children's Hospital were required to make telephone or personal contact with the families of potential study subjects prior to releasing information about subjects (i.e., child's name, parents'/foster parents' names, address, telephone number, the child's primary diagnosis, and the child's medical record number). Due to competing responsibilities, the representative of Children's Homecare Services was unable to participate in developing a listing of potential subjects. A total of 17 families who had a child meeting the criteria for inclusion in the study were contacted by the Nurse Clinician of the NDU, 14 (82%) of whom provided permission for further contact regarding study participation. Each of these families was contacted initially by letter to request their participation in the project, and to briefly inform them of the purpose of the
study and the nature of the participation of the child and
themselves (see Appendix D). A detailed project summary was
also included in this mailing (see Appendix E). Five to
seven days following this mailing, families were contacted
by telephone. The purpose of this telephone call was to
review the purpose of the project and the procedures to be
followed. Any questions that families had were answered and
verbal consent to participate in the study was secured.
Arrangements for the home visit were also made; visits were
scheduled during a time when the parents expected the child
to be awake and alert, and at a time that did not conflict
with aspects of the child's daily routine (e.g., medication
administration, feedings, therapy sessions). All 14
families (home care group) contacted by the researcher
agreed to participate in the research.

The administrative contact at Lifelines Children's
Rehabilitation Hospital provided a listing of all children
meeting the study criteria who were patients during the data
collection period (i.e., March 1992 through May 1992). A
total of 18 children met the criteria for inclusion in the
project. Each of these families was initially contacted via
a letter sent by the administrative contact at Lifelines
which briefly introduced the study and encouraged families
to participate in the project. In addition, a letter, a
detailed project summary, and a consent form (see Appendix
F) were sent by the researcher to each of the families.
Five to seven days following this mailing, each of the families was contacted by telephone to briefly explain the study and its purpose and to request the return of the signed consent form. Questions relating to the study were answered and arrangements for visiting each child at Lifelines Children's Rehabilitation Hospital were made. Whenever possible, arrangements for visits were made such that families could be present during the data collection process. The scheduling of visits was also dependent upon the children's therapy sessions, as disruptions to children's daily routines were to be minimized. In addition, inquiries were made about medications which might affect a child's ability to participate in the required assessments, and visits were thus scheduled to assure a child's optimal ability to participate in the assessment procedures.

If the consent form had not been received within five days, a reminder postcard was sent which requested the return of the consent form and confirmed the date and time frame for data collection. In those cases where the consent forms still had not been secured, families were contacted by telephone a second time and asked to return the consent form (in three cases, a second consent form was sent). Of the 18 families contacted by the researcher, 16 (89%) provided consent for their child's participation in the project.
At the beginning of the visit with each child and family/caregiver, the procedures to be followed during the course of the data collection period were reviewed, and in the home care group, written consent was obtained at this time (see Appendix F). Subsequently, a parent, foster parent, and/or caregiver completed an interview to obtain selected family information (see Appendix G) and medical information relating to the child involved in the study (see Appendix H).

For the purposes of data collection at Lifelines Children's Rehabilitation Hospital, the child's primary nurse served as the caregiver and informant on each of the research measures. In 3 of the 16 hospital group cases, the child's mother was present during data collection and provided demographic information; each of these mothers was involved daily with her child and expressed a strong interest in the study. In the home care group, the child's mother or foster mother served as the caregiver and informant during the data collection process. In 4 of the 14 home care group cases, the child's father was present during the home visit and served as a co-informant.

Following the interaction with the child's parent, foster parent, and/or caregiver, the researcher initiated interaction with the infant/toddler. Initial responses toward the unfamiliar researcher were noted (see Appendix I). After several minutes, the researcher administered the
Battelle Developmental Inventory and conducted a brief exploration/play assessment (see Appendix J).

During the course of the play assessment, the child was observed as he/she engaged in exploration and play with a selection of toys/objects for a period of no longer than five minutes. (In only three cases did children continue exploration and play with the materials for the full five minutes; in the remaining cases, children explored materials for 90 seconds or less.) Objects used during the session included the following: a miniature baby bottle, a miniature hair brush, a cup, a baby doll, a rattle, a wheeled cart with a selection of blocks, a toy telephone, and a ring stack. Utilizing a modified version of the procedures employed by Belsky and Most (1981), children were observed in solitary play.

In order to make objects readily accessible to children, careful positioning of the child and of the materials was often necessary. In some cases the child was placed in a sidelying position with the objects placed within easy eye contact and reaching distance. If the child had special seating available, the child was seated with the objects available on a tray table to make them accessible. In other cases, the child was held on the lap of the parent/caregiver, and objects were placed on a tray table for easy manipulation. Often only a few of the objects could be utilized at one time; the smallest objects, those
that could be held in the child's hand were then offered first (i.e., the miniature baby bottle, the miniature hair brush, the cup, the baby doll, the rattle, and two of the blocks in the wheeled cart). The larger, more complex objects were offered secondarily (i.e., the wheeled cart and blocks, the toy telephone, and the ring stack).

By means of time sampling, each 15 seconds, the most competent level of play observed was recorded. At the end of the exploration and play period, totals of each level of exploration/play behavior were computed and the highest level of exploration/play behavior was recorded.

Following the exploration/play assessment, a brief observation of approximately three minutes was conducted of the child and parent/foster parent/caregiver involved in an unstructured face-to-face interaction. Based upon this observation, the Interaction Rating Scales (see Appendix K) were completed.

Subsequently, the researcher asked the parent/foster parent/caregiver to complete a questionnaire focusing upon information relating to the child's temperament. While the questionnaires frequently make reference to the parent, primary nurses completing the questionnaires relative to children within the hospital group were asked to answer such questions with regard to themselves, as one of the most constant and consistent person's in the child's life. The form of temperament questionnaire utilized (i.e., Revised
Infant Temperament Questionnaire or the Toddler Temperament Scale) was based upon the developmental functioning of the child as determined by the administration of the Battelle Developmental Inventory. The revised Infant Temperament Questionnaire was employed for infants of a developmental age of less than 12 months. The Toddler Temperament Scale was utilized for children of a developmental age of 12 months to 36 months.

While the parent/caregiver completed the temperament questionnaire, the researcher completed observational portions of an assessment of the environment in which the child resides (i.e., the HOME, Home Observation for Measurement of the Environment). When the parent/caregiver had completed the temperament questionnaire, an informal interview technique was used to complete portions of the HOME which could not be completed through observation alone.

Finally, an assessment of the child's coping behavior was conducted using the Early Coping Inventory. This measure, too, was completed through observation and interviews with parents, foster parents, and/or caregivers.

Following home or hospital visits, information regarding the child's medical history which could not be obtained through consultation with a parent/caregiver was obtained through review of the child's medical chart (see Appendix H).
During all interactions between the child and the researcher, a parent, foster parent, or caregiver was present or in close proximity. Because of the nature of physical impairments and medical needs of these children, considerable latitude in administering any of the measures was required. If a child became distressed, which occurred rarely, the researcher modified her own behavior during the interaction with the child until the child calmed and then returned to the administration of additional tasks. The amount of time the child remained distressed was noted, as well as the circumstances surrounding any distress behavior exhibited by the child (antecedents to distress behavior, nature of distress behavior, and actions necessary to calm the child) (see Appendix I).

Following the completion of a visit, a letter of thanks was sent to each participating family, foster family, or legal guardian (see Appendix L). Also, upon completion of data collection, a letter of thanks was sent to each of the agency representatives who assisted in providing the names and addresses of potential research subjects (see Appendix M). Finally, upon the completion of data analysis, a summary of the results of the study was made available to these representatives and interested families of children participating in the study.

To safeguard confidentiality, code numbers were utilized to identify each child. Children's names were not
connected with the information collected, and neither the children nor families were identified in any way. Records relating to children participating in the study were available only to the researcher.

**Instruments**

**Battelle Developmental Inventory.** The Battelle Developmental Inventory (BDI), developed in 1984 by Newborg, Stock, Wnek, Guidubaldi, and Svinicki, is intended for use with both typically and atypically developing children, birth to eight years of age and is divided into five domains: Personal-Social (social/emotional adjustment), Adaptive, Motor, Communication, and cognitive. Each domain is further subdivided into subdomains. Several purposes for the BDI have been described, including the assessment and identification of children with handicapping conditions, assessment of children without handicaps, determination of individual strengths and weaknesses, development of Individual Education Plans, tracking of individual progress, and planning and evaluation of instructional programs. The BDI was designed for use by teachers, diagnosticians, and multidisciplinary teams.

Scoring is based upon a three-point scale. For the most part, the scoring is: 0=rarely or never, 1=sometimes, or 2=typical; however, some items have specific criteria. Raw scores may then be converted to percentiles and standard
scores. Scores for each of the five domains, as well as a BDI total score, may be calculated.

Items for the BDI were initially drawn from a pool of 4,000 items in use in developmental testing and programming. The original version was administered to 152 children so that procedures could be standardized and adaptations could be included for children with handicapping conditions.

The standard error of measurement (SEM) for all domain scores is small, and the SEM for the BDI total score ranges from 1.30 (84-95 months) to 5.47 (36-47 months). Test-retest reliability, reported across domains and age levels for a four-week retest time, ranges from .71 to .99, with most coefficients above .80. Stability of test scores over a longer period of time was not reported. Interrater reliability ranges from .70 to 1.0, with most coefficients above .80. Split-half reliability was not reported.

Content validity was ensured by the item selection and test development procedures. Item-Total score and Domain-Total score correlations were judged to be good, suggesting the BDI is a homogeneous measure of development. The validity of the developmental nature of the BDI is supported by significant t-test comparisons between adjacent age groups on components of the BDI. High age-score correlations also support the developmental organization of the battery.
Several studies support the criterion-related and construct validity of the BDI and its domains. According to the authors, factor analyses of the pilot data lend moderate to good support for the BDI Domain organization; actual data, however, have not been published.

Moderately high correlations with the Vineland Social Maturity Scale and the Developmental Activities Screening Inventory have been reported. For children of preschool and kindergarten age, the BDI adequately predicts performance on the Peabody Picture Vocabulary Test--Revised, the Developmental Test of Visual Motor Integration, and reaction time. Furthermore, the BDI was significantly correlated with the Bayley Scales of Infant Development, the Minnesota Child Development Inventory, and the Stanford-Binet for a three- to five-year-old group of moderately to severely handicapped children.

**Interaction Rating Scales.** The Interaction Rating Scales, developed by Field and her colleagues (Field, 1980), were based on the literature describing face-to-face interactions between parents and their infants (see Appendix K). These scales were designed for use in clinical situations, such as a clinic waiting room or a physician's office. An observer completes a rating scale based upon a brief face-to-face, spontaneous interaction of a parent/caregiver and an infant. The rating scale includes seven ratings of the infant's behavior and ten ratings of
the mother's behavior. Each of the items is rated on a 3-point scales with descriptors for each point. With such a scale, Field (1980) believed it was possible to reduce the level of ambiguity often associated with Likert-type 5- or 7-point scales in which typically only the endpoints are described.

The infant ratings include a state rating, physical activity, head orientation, gaze behavior, facial expressions, fussiness, and vocalizations. The parent's or caregiver's ratings are similar to those of the infant, and include a state rating, physical activity, head orientation, gaze behavior, silence during infant gaze aversion, facial expressions, vocalizations, infantized behaviors, contingent responsivity, and game playing. The seven infant ratings are totaled and divided by seven for an average rating on the scale. Similarly, the ten parent/caregiver ratings are totaled and divided by ten for an average rating for that scale.

These scales have been used in numerous studies conducted by Field and her associates, and they reportedly have predictive validity to later developmental assessments, such as the Bayley scales and the McCarthy scales (Field, Dempsey, & Shuman, 1983). Furthermore, interobserver reliabilities appear to be fairly high, ranging from .82 to .96 for the infant face-to-face interactions ratings and
from .82 to .98 for the mother face-to-face interaction ratings (Field, 1991).

In addition, the Interaction Rating Scales have been employed in several comparison studies, including comparisons between teenage and adult mothers; comparisons across levels of infant maturity, including prematurity, full-term, and postmature infants; and across medical conditions, such as sick and healthy preterm infants (Field, 1991). In each of these studies, the scales have effectively discriminated these groups of mother-infant dyads, and they have been considered sensitive measures of early parent/caregiver face-to-face interactions.

Early Coping Inventory. The Early Coping Inventory, developed by Zeitlin and Williamson (1988), is an observation instrument which assesses the coping-related behaviors used by infants and toddlers in everyday living. Analysis of an individual child's scores on the Inventory provides the examiner with information about level of coping effectiveness, coping style, and specific coping strengths and vulnerabilities.

The Early Coping Inventory is comprised of 48 items which may be divided into three categories: (1) sensorimotor organization, (2) reactive behavior, and (3) self-initiated behavior. The instrument is designed for children in the chronological age range of 4 to 36 months or
for older children with disabilities who function in this developmental age range.

Each item on the Inventory is rated on a five-point scale which is designed to reflect coping effectiveness. A rating of (1) may be interpreted as "ineffective coping" while a rating of (5) indicates "consistently effective coping across situations". "Effectiveness" is defined by the instrument's developers as (a) appropriate for the situation, (b) appropriate for the child's developmental age, and (c) successfully used by the child.

Scores yielded include raw scores and level of effectiveness scores for the three categories of adaptive behavior into which the items may be divided--sensorimotor organization, reactive behavior, and self-initiated behavior. Raw scores are determined by summing the ratings in each category, which then may be converted to ratings of one to five, which are termed effectiveness scores. An "adaptive behavior index", ranging from one to five, can then be computed by adding the effectiveness scores for the three categories.

While the adaptive behavior index provides a global measure of the effectiveness with which a child copes, the coping profile graphically describes the child's coping style and unique pattern of behavior. It illustrates the relationships among the three categories, sensorimotor organization, reactive behavior, and self-initiated
behavior. The range of scores focuses upon the consistency of the child's behavior across categories of coping behavior, or the existence of idiosyncratic patterns of strengths and vulnerabilities.

A child's most adaptive coping behaviors, those rated as most effective (assigned ratings of four and five), and a child's least adaptive coping behaviors, those rated as least effective (assigned ratings of one and two) are indicative of a child's greatest coping strengths and vulnerabilities.

The Early Coping Inventory was examined to determine its construct/content validity. One element of validity developed from the early childhood, coping-related literature; item content and definitions of coping constructs were derived from this body of literature. Furthermore, items were originally generated by educational, psychosocial, and rehabilitative professionals. From an initial pool of 75 items, the current 48 items were selected and subjected to field tests for the purpose of item development and revision.

Another element in the establishment of construct/content validity of the Inventory was to submit the research edition of the instrument to six judges for analysis. Judges were leading experts in infant and early childhood development and have been involved in pioneering work focusing on coping behavior. The judges agreed that
items were related to constructs which define coping and an item's corresponding category. Several items received low agreement ratings from judges and were subsequently revised according to their suggestions in the final version of the instrument.

To establish the reliability of the Early Coping Inventory four video tapes were made of young children who were appropriate in age for assessment with the Inventory. Two video tapes included children who were enrolled in an early intervention program while the two remaining tapes were of nondisabled children. Twenty-four individuals, who were considered to be typical users of the Early Coping Inventory (e.g., occupational therapists, speech and language pathologists, educators, nurses, psychologists), comprised an observer reliability group. Following two training sessions subjects viewed the video tapes and completed an Early Coping Inventory for each child. After an interval of six weeks, the tapes were viewed again and a second Inventory was completed for each child.

Interrater reliability coefficients with regard to the score for the Adaptive Behavior Index and the three category scores ranged from .80 to .94 across both viewings of the video tapes.

Test-retest reliability was assessed by applying Friedman's ANOVA to the scores for the Adaptive Behavior Index and to the scores for the three categories
(sensorimotor organization, reactive behavior, and self-initiated behavior) for each video tape. Of the 16 reliability checks, Friedman's ANOVA reached significance only five times. In eleven instances test-retest results produced no statistically significant shift in scoring.

Revised Infant Temperament Questionnaire. The revised Infant Temperament Questionnaire, developed by Carey and McDevitt (1978), resulted from efforts to improve the psychometric characteristics of the original Infant Temperament Questionnaire. This tool, consisting of 95 items, was developed for use by pediatricians as a screening device for difficult temperament in infants, and its application has also been extended to child development research. The conceptualization of temperament according to Thomas, Chess, and Birch (1963) served as the basis for the revision of the Infant Temperament Questionnaire. According to this scheme, temperament is subdivided into the nine dimensions of activity, rhythmicity, approach, adaptability, intensity, mood, persistence, distractibility, and threshold. Using the first six of these dimensions, it is possible to classify all infants into the diagnostic clusters of difficult (arrhythmic, withdrawing, low adaptability, intense, and negative), easy (characteristics opposite of the above), slow-to-warm-up (inactive, low in approach and adaptability, mild, and negative), or intermediate (all others). The intermediate diagnostic
group was further subdivided into "high" (approaching difficult) and "low" (approaching easy).

Internal consistency ranges from .49 for distractibility to .71 for approach. The median value was .57 and internal consistency for the whole instrument was .83 (Carey & McDevitt, 1978).

The test-retest reliability of the revised version of the Infant Temperament Questionnaire remained satisfactory despite the increased number tested (n=41) and an almost doubled time interval (25.1 day interval). The range was from 0.66 for intensity to 0.81 for mood with a median value of .75 for rhythmicity and distractibility and .86 for the whole instrument.

External validity has not been established with certainty because of the lack of standardized observational techniques focusing upon these phenomena. A study using the original version of the Infant Temperament Questionnaire have verified that difficult babies cry more than do babies in other clusters (Sarett, 1976).

The original and the revised questionnaires appear to measure approximately the same phenomena. Respective frequencies of the more difficult diagnoses by the original and revised techniques are as follows: difficult, 12.0% and 9.4%; slow-to-warm-up, 8.0% and 5.9%; and intermediate high, 10.5% and 11.3% (Carey & McDevitt, 1978).
The Toddler Temperament Scale (TTS), developed by Fullard, McDevitt, and Carey (1984), was designed for determining temperamental characteristics in one-to three-year-old children and is intended for both clinical and research use. The TTS assesses the nine temperament categories utilized in the New York Longitudinal Study: activity, rhythmicity, distractibility, approach, adaptability, persistence, threshold, intensity, and mood. The questionnaire consists of 97 items, with the number of items per category ranging from 8 to 13, with a median of 11.

The instrument uses a Likert scale with possible item scores ranging from one to six. A score of one indicates that the statement is almost never true while a score of six indicates that the item is almost always true of the child's behavior. Nine category scores are obtained by adding item scores in each category. Based upon these category scores a diagnostic cluster may be determined (i.e., easy, difficult, slow-to-warm-up, or intermediate).

Two indices of reliability were examined by Fullard et al. (1984). The first (alpha) focuses upon the internal consistency of each scale. For the one-year-old sample, alpha coefficients for the nine categories ranged from .59 to .86 with a median of .70. All categories except sensory threshold (alpha=.57) were .60 or above. For the two-year-old sample, alphas ranged from .53 to .85 with a median of
.72. All categories except sensory threshold (alpha=.57) and adaptability (alpha=.53) were .60 or above. The one-month test-retest reliabilities, the second reliability assessment, ranged from .69 (distractibility) to .89 (approach) with a median of .81.

Investigation of the external validity of the TTS has been difficult because researchers have not yet developed a standardized comprehensive observational technique against which to compare it (Fullard et al., 1984). Validity studies to date have relied on brief professional ratings and have overall demonstrated significant validity (Carey, 1982).

Three studies specifically testing the concurrent validity of the TTS have been conducted. Wilson and Matheny (1983) compared laboratory assessments of infant twins by a technique derived from the Bayley Infant Behavior Record with TTS scores. At 12 months, a strong convergence was evident (r=.52) between their laboratory factor of emotional tone, attention, social orientation to staff, distractability, and activity with the first factor obtained from the TTS consisting of adaptability, attention and persistence, approach, mood, and distractibility. At 24 months the same laboratory factor correlated at the same level (r=.52) with the TTS first factor, which consisted then of mood, adaptability, intensity, approach, and activity.
In a study of predictive validity (McDevitt & Carey, 1981), a group of infants rated on the Infant Temperament Questionnaire (ITQ) were assessed with the TTS an average of 17 months later. Significant longitudinal stability was observed for all nine categories (range 0.24 to 0.58, median=.38, all p<.005) indicating that the ITQ and TTS are tapping similar characteristics in their respective developmental periods.

Exploration and Play Assessment. The exploration/play observational tool (see Appendix J) employed in the current study is based primarily upon the 12-step exploration/play sequence developed and examined empirically by Belsky and Most (1981). In addition, because the primary means of exploration for very young/developmentally immature infants is visual (Marino, 1988), looking behavior was also measured.

In order to assess the validity and scalability of the hypothesized developmental sequence, the data were subjected to Guttman scalar analysis and produced a coefficient of reproducibility of .95 and a coefficient of scalability of .77. Analysis of individual infants' performance indicated that this level-of-play scale satisfied the requirements of a valid Guttman scale (i.e., reproducibility coefficient above .90 and scalability coefficient above .60). Thus the scale can be considered valid as well as unidimensional and
cumulative, and the levels of play that are lower on the scale emerge prior to the higher levels of play.

Following transcription of play narratives, coders blind to the purpose of the study and the age and gender of the infants scored the narratives in terms of the highest level of play observed within a given time-sampling period. To test for intercoder agreement, the scores of two coders on 12 15-minute narratives were intercorrelated. Across the 12 levels of play that were coded, reliability coefficients ranged from .79 to .98.

**Home Observation for Measurement of the Environment.**

The Home Observation for Measurement of the Environment (HOME) inventory, an instrument developed by Caldwell and Bradley (1984), is designed to assess the quality and quantity of support for social, cognitive, and emotional development that is available to a child in the home environment. It is intended to serve as a comprehensive assessment that provides information about objects and events in the home environment and transactions between parents or caregivers and children. The version of the HOME employed in the current study is intended for use with children ages birth to three years of age and consists of six subscales and 45 items. The subscales include: (1) emotional and verbal responsivity of the parent/primary caregiver; (2) acceptance of the child's behavior; (3) organization of the physical and temporal environment; (4)
the provision of appropriate play materials; (5)
parent/caregiver involvement with the child; and (6)
opportunities for variety in daily stimulation.

Information is obtained via observations and
semistructured interviews in the home environment with the
parent/caregiver and child. The Inventory is administered
at a time when the child is awake and can be observed in
his/her normal routine for that time of day.

Three primary uses of the HOME have been identified as
follows: (1) identification of home environments that pose
a risk for children's development; (2) evaluation of
programs designed to improve caregiving skills; and (3)
basic research on the relationship between home environment
and children's health and development.

All items on the HOME receive binary scores (yes or
no), and no attempt is made to rate finer gradations.
Scores consist of the total number of items marked "yes";
subscores for each of the six subscales as well as a total
score are obtained.

Using data obtained from families in Syracuse, New
York, an item analysis was performed on the 45 items
comprising the Inventory. As part of that analysis,
Cronbach Alpha coefficients were computed as a means of
estimated the reliability of the six subscales and the total
score. The coefficients ranged in magnitude from .49 to .78
for the six subscales, and the internal consistency of the
total scale was calculated to be .84. Point-biserial correlations were also calculated between individual items and their factor scores. These correlations ranged from .39 to .73. Based on these results, the researchers concluded that the factor structure of the HOME was sufficiently clear and the subscales sufficiently stable to warrant using the HOME as an index of the quality of stimulation to be found in the child's environment (Caldwell & Bradley, 1984).

HOME data were later gathered from 174 families residing in Little Rock, Arkansas. Internal consistency estimates were made for the total scale and each of the subscales. The coefficients range from .38 to .89. When the length of the subscales was considered, Caldwell and Bradley (1984) suggested that the internal consistency of the HOME appears to be at an acceptable level.

Stability of the instrument was also evaluated via HOME data collected from 91 families when the child was six months, 12 months, and 24 months of age. Results for the six subscales and the total scale indicate a moderate to high degree of stability for all subscales, ranging from r=.24 to r=.77. It was suggested that the obtained correlations may be low estimates of the subscales' stability for two reasons. First, none of the subscales is comprised of more than 11 items. Thus a change of only one or two points could potentially affect a family's standing relative to others in the group to a significant degree.
Secondly, the six-month and one-year intervals between test sessions represent a considerably longer time period than is typically used in calculating test-retest reliability coefficients.

Since the mean total score on the HOME increased over two points from the six-month assessment to the 12-month assessment and one point between the 12-month and the 24-month assessments, intraclass correlations were also computed as an index of the HOME's stability. These coefficients measure the similarity of paired scores in relation to the total variability of all scores. As expected, the intraclass coefficients were slightly lower than the product-moment coefficients. This is because they consider the fact that retest scores tend to be higher than the original scores whereas product-moment correlations do not. Given that the HOME scores increased over the three test periods, the intraclass coefficients may be considered a more accurate measure of test-retest agreement.

Part of the rationale for the development of the HOME Inventory was to develop a more sensitive measure of environmental influence than gross socioeconomic indices. Given the demonstrated relationship between socioeconomic status (SES) and cognitive development, such an instrument is thought to be useful. It was important to determine whether the Inventory is valid for assessing most of the
same aspects of the home environment as do various SES indices.

All but one of the correlations between HOME subscale scores and SES measures were in the expected direction. Many of the correlations between mother's occupation and the home environment factors assessed by the HOME were not statistically significant. However, mother's education, father's presence, father's education, father's occupation, and crowding in the home all had significant relationships with the home environment variables.

Because of the emphasis on selecting items which would assess the types of environmental stimulation important for cognitive development, it was important to determine the validity of the test in terms of its relationship to measured mental test performance. HOME scores were correlated with Bayley Infant Scales scores and the Stanford-Binet Intelligence Test. At six months, the subscales organization of the environment and variety in daily stimulation had significant relationships to six-month Bayley MDI scores ($r=.22$ and $r=.20$ respectively). Furthermore, the subscale variety in daily stimulation was significantly associated with 12-month Bayley MDI scores ($r=.27$). Significant correlations between 12-month HOME scores and 12-month Bayley MDI scores were as follows: the subscale appropriate play materials ($r=.28$); the subscale maternal involvement ($r=.278$); and the total score ($r=.30$).
Correlations between HOME scores at 6, 12, and 24 months, and 36-month Stanford-Binet scores were significant across all subscales and the total score.

Data Analysis

The Battelle Developmental Inventory (BDI), the Interaction Rating Scales (IRS), the Early Coping Inventory (ECI), the Revised Infant Temperament Questionnaire (ITQ), the Toddler Temperament Scale (TTS), and the Home Observation for Measurement of the Environment (HOME) were scored according to established guidelines (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1984; Field, 1980; Zeitlin & Williamson, 1988; Carey & McDevitt, 1977; Fullard, McDevitt, & Carey, 1984; Caldwell & Bradley, 1984). The Exploration/Play Assessment was evaluated according to modified guidelines originally developed by Belsky and Most (1981). Rather than focusing on all play behaviors observed, as in the Belsky and Most (1981) study, only the highest level of play demonstrated was recorded.

BDI scores used in the analysis include the total standard score, the personal social domain standard score, the adaptive domain standard score, the gross motor standard score, the fine motor standard score, the communication domain standard score, and the cognitive domain standard score. IRS ratings used in data analysis include an infant rating and a maternal/caregiver rating. ECI scores used in
the analysis include the adaptive behavior index, the sensorimotor score, the reactive behavior score, and the self-initiated behavior score. Data analysis also utilizes a rating of the temperament diagnostic cluster and ratings of the nine dimensions of behavior related to temperament (i.e., activity, rhythmicity, approach, adaptability, intensity, mood, persistence, distractibility, and threshold). Temperament dimension ratings are ratings of the location of the dimension score relative to the normative mean (i.e., above or below the mean by less than one standard deviation, above or below the mean by greater than one standard deviation). The exploration/play observation rating used in the analysis of data was the highest level of exploratory behavior demonstrated by the child. Lastly, the HOME total score and six subscale scores (responsivity, acceptance, organization, play materials, involvement, and variety) were employed during data analysis.

Descriptive statistics were used to delineate the characteristics of both the home care and hospital groups. Frequencies, percentages, means, standard deviations, and ranges were reported as appropriate. Differences between characteristics of the home care and hospital groups were determined by t-tests, chi square, or the Fisher Exact Test.

Descriptive statistics, specifically frequencies and percentages, were used to analyze temperament and
exploratory/play behavior ratings. The Fisher Test of Exact
Probability was used to determine significant differences
between the home care and hospital groups on these
variables.

Descriptive statistics were also used to analyze
aspects of the social and physical environment for each
group (i.e., family involvement in the hospital group,
participation in early intervention services for the home
care group, and HOME scores). Frequencies, percentages,
means, standard deviations, and ranges were used as the data
dictated. Significant differences between groups relative
to the HOME scores were determined using t-tests.

Relationships between independent variables were
derived through use of Pearson product moment correlation
coefficients (interval data) or Spearman rank order
correlation coefficients (ordinal data). Relationships
between independent and dependent variables also were
analyzed using Pearson product moment correlation
coefficients or Spearman rank order correlation
coefficients, depending on the nature of the data.

Descriptive statistics (i.e., means, standard
deviations, and ranges) were utilized in the analyses of BDI
scores, IRS ratings, and ECI scores. In addition, these
scores and ratings were subjected to t-tests to compare
group means.
Pearson product moment correlation coefficients were used to identify relationships between BDI scores, IRS ratings, and ECI scores. Simple linear regression and stepwise multiple regression strategies were also employed in data analyses.

The relationship of the temperament diagnostic cluster rating to BDI, IRS, and ECI scores was determined through the use of analysis of variance (F-ratio).

Spearman rank order correlation coefficients were used to identify relationships between dependent variables (i.e., BDI, IRS, and ECI scores) and (a) exploratory/play behavior and (b) level of family involvement.

Pearson product moment correlation coefficients were used to distinguish associations between HOME scores and (a) BDI scores, (B) the IRS infant rating, and (c) ECI scores. Further analysis was done through the use of stepwise multiple regression.

To specify relationships between birth weight and dependent variables (i.e., BDI, IRS, and ECI scores), Pearson product moment correlation coefficients were applied. Simple linear regression was also used in the analysis of this data.

Finally, multiple linear regression techniques were used to determine significant interactions between child-based factors (i.e., temperament diagnostic cluster and exploratory/play behavior), environmental factors.
(i.e., level of family involvement, participation in early intervention programming, and qualities of the residential environment), and health factors (i.e., birth weight and level of technology required) in determining the BDI total score, the IRS infant rating, and the ECI adaptive behavior score.

The data analysis utilized SAS on the mainframe computer system at The Ohio State University. A consultant with The Ohio State University Instruction and Research Computer Center served as the statistical consultant for this study.

Limitations

Several limitations of the present research have been identified. First, the number of subjects studied in each group was small, therefore, the results must be seen as tentative. Secondly, the selection of subjects for the study was non-random; permission for participation was requested from the families/foster families of all children meeting the criteria for inclusion in the study.

In addition, the results of this study can be generalized only to children with characteristics matching those of the children included in the sample groups. It may be that results would differ for samples of children from other geographic areas. Health care facilities differ
greatly, thus, findings for children residing in various types of institutions may differ significantly.

A fourth limitation relates to the observational tool used in the measure of exploratory/play behavior. This tool was developed for use with infants and toddlers following a typical course of development, therefore, using the tool with technology dependent children was difficult. The procedures for presenting toys and objects to the children had to be modified extensively so that individual children could participate in the play session. Furthermore, the items used with individual children were not always consistent; size and nature of several objects limited the extent of exploration possible by certain children.

A final limitation of the study was the possible existence of experimenter bias. The researcher collected all data. Recruiting one or more additional observers was not possible given the extensive amount of travel associated with the implementation of this study.
CHAPTER IV
RESULTS

In this study, the relationships between developmental outcome, interactive behavior, and coping behavior for two groups of technology dependent infants and toddlers were examined. In addition, temperamental characteristics and exploratory/play behavior of the children were explored to determine their impact on the factors identified above. The potential influence of family involvement and qualities of the residential environment on developmental outcome and behavior were also investigated. A health factor, birth weight, was also considered to determine its potential influence on the above factors. Finally, the relative contributions of selected child-based factors (i.e., temperament, exploratory/play behavior), environmental characteristics (i.e., level of family involvement, overall quality of the home environment), and selected health factors (i.e., birth weight, technological support required) to developmental outcome, interactive behavior, and coping behavior were examined.
This chapter provides a discussion of the statistical findings of this research. Descriptive and inferential statistics were used to analyze data. The .05 level of significance was used in all analyses.

The results are presented here in three sections: (1) results of hypotheses testing; (2) additional analyses; and (3) summary.

**Results of Hypotheses Testing**

In this section, data related to the nine hypotheses tested in this investigation are presented.

**Hypothesis I:** Differences in (a) developmental outcome, (b) interactional behavior, and (c) coping behavior will be evident between children who are technology dependent and reside in a home setting and those who reside and receive care in a health care facility.

The hypothesis of differences between the home care and hospital groups in developmental outcome, interactional behavior and coping behavior was not supported. No significant differences between the home care and hospital groups in terms of developmental outcome, interactional behavior, or coping behavior were found.

Data were analyzed using t-tests, the results of which are reported in Tables 12 through 15. With regard to developmental outcome measures, the following BDI standard
scores were utilized: total score, personal social domain score, adaptive domain score, gross motor score, fine motor score, communication domain score, and cognitive domain score. In addition, BDI age equivalents and an overall index of the level of developmental lag were used in the data analysis. The IRS infant rating and the four ECI scores (i.e., adaptive behavior index, sensorimotor organization score, reactive behavior score, and self-initiated behavior score) were employed in data analysis.

BDI percentile ranks and standard T-scores are included in Table 12. Mean T-scores and percentile ranks for each of the BDI domains and for the BDI overall were found to be low for both groups. The total standard score for the home care group was 31.07 with a corresponding percentile rank of three, while the standard score for the hospital group was 29.88 with a corresponding percentile rank of two. The difference between the groups was not significant (t=0.43). The total and domain scores for the home care group were slightly higher than those for the hospital group, except in the case of the gross motor domain. The gross motor score for the hospital group was slightly higher than the score for the home care group. No significant differences were found between the home care and hospital groups on any of the developmental outcome scores.

Mean age equivalents in months, (see Table 13), were obtained for the groups on the overall BDI and for each of
Table 12

<table>
<thead>
<tr>
<th>Score</th>
<th>%</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>3</td>
<td>31.07</td>
<td>8.21</td>
<td>27 50</td>
<td>0.43</td>
<td>.67</td>
</tr>
<tr>
<td>Hospital</td>
<td>2</td>
<td>29.88</td>
<td>7.14</td>
<td>27 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal social</td>
<td>3</td>
<td>30.14</td>
<td>6.61</td>
<td>27 48</td>
<td>0.13</td>
<td>.90</td>
</tr>
<tr>
<td>Hospital</td>
<td>2</td>
<td>29.81</td>
<td>7.33</td>
<td>27 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptive</td>
<td>3</td>
<td>31.00</td>
<td>8.56</td>
<td>27 53</td>
<td>0.48</td>
<td>.64</td>
</tr>
<tr>
<td>Hospital</td>
<td>2</td>
<td>29.63</td>
<td>7.18</td>
<td>27 49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross motor</td>
<td>2</td>
<td>29.79</td>
<td>5.90</td>
<td>27 43</td>
<td>-0.55</td>
<td>.59</td>
</tr>
<tr>
<td>Hospital</td>
<td>3</td>
<td>31.25</td>
<td>8.33</td>
<td>27 52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine motor</td>
<td>5</td>
<td>34.00</td>
<td>9.33</td>
<td>27 51</td>
<td>0.38</td>
<td>.71</td>
</tr>
<tr>
<td>Hospital</td>
<td>4</td>
<td>32.75</td>
<td>8.88</td>
<td>27 51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>3</td>
<td>31.50</td>
<td>9.18</td>
<td>27 52</td>
<td>0.53</td>
<td>.60</td>
</tr>
<tr>
<td>Hospital</td>
<td>3</td>
<td>30.00</td>
<td>6.31</td>
<td>27 46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive</td>
<td>6</td>
<td>34.64</td>
<td>11.63</td>
<td>27 58</td>
<td>0.22</td>
<td>.83</td>
</tr>
<tr>
<td>Hospital</td>
<td>5</td>
<td>33.75</td>
<td>10.67</td>
<td>27 58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16

Note. Possible range for standard T-scores is 27 to 73.
Table 13

BDI Age Equivalents, and Overall Developmental Lag For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>5.00</td>
<td>2.25</td>
<td>2</td>
<td>10</td>
<td>0.19</td>
</tr>
<tr>
<td>Hospital</td>
<td>4.81</td>
<td>3.15</td>
<td>1</td>
<td>12</td>
<td>0.19</td>
</tr>
<tr>
<td>Personal social devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>4.79</td>
<td>3.38</td>
<td>2</td>
<td>24</td>
<td>0.50</td>
</tr>
<tr>
<td>Hospital</td>
<td>4.13</td>
<td>3.76</td>
<td>1</td>
<td>15</td>
<td>0.50</td>
</tr>
<tr>
<td>Adaptive devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>4.71</td>
<td>2.33</td>
<td>1</td>
<td>10</td>
<td>0.81</td>
</tr>
<tr>
<td>Hospital</td>
<td>4.00</td>
<td>2.48</td>
<td>1</td>
<td>10</td>
<td>0.81</td>
</tr>
<tr>
<td>Gross motor devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>4.29</td>
<td>2.79</td>
<td>1</td>
<td>10</td>
<td>-0.08</td>
</tr>
<tr>
<td>Hospital</td>
<td>4.38</td>
<td>3.48</td>
<td>0</td>
<td>13</td>
<td>-0.08</td>
</tr>
<tr>
<td>Fine motor devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>4.07</td>
<td>1.82</td>
<td>2</td>
<td>8</td>
<td>-0.46</td>
</tr>
<tr>
<td>Hospital</td>
<td>4.50</td>
<td>3.01</td>
<td>1</td>
<td>12</td>
<td>-0.46</td>
</tr>
<tr>
<td>Communication devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>3.36</td>
<td>1.08</td>
<td>1</td>
<td>5</td>
<td>-0.25</td>
</tr>
<tr>
<td>Hospital</td>
<td>3.56</td>
<td>2.87</td>
<td>1</td>
<td>11</td>
<td>-0.25</td>
</tr>
<tr>
<td>Cognitive devel. equiv. (months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>7.21</td>
<td>3.24</td>
<td>4</td>
<td>14</td>
<td>0.36</td>
</tr>
<tr>
<td>Hospital</td>
<td>6.75</td>
<td>3.80</td>
<td>1</td>
<td>15</td>
<td>0.36</td>
</tr>
<tr>
<td>Developmental lag (corrected age - devel. equiv.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>6.57</td>
<td>5.87</td>
<td>0</td>
<td>19</td>
<td>-0.56</td>
</tr>
<tr>
<td>Hospital</td>
<td>7.69</td>
<td>5.10</td>
<td>1</td>
<td>20</td>
<td>-0.56</td>
</tr>
</tbody>
</table>

Home care group: n=14
Hospital group: n=16
the six domains. The mean age equivalent represents the average skill level overall or the average skill level in specific developmental domains. The mean overall age equivalent for the home care group was 5.00 months and for the hospital group was 4.81 months. Thus the mean skill level of the children in the home care group was five months while the mean skill level for the hospital group was 4.81 months. The difference between the two groups was not significant (t=0.19). The greatest age equivalent was found in the cognitive domain; for children in the home care group the cognitive age equivalent was 7.21 months and in the hospital group the cognitive age equivalent was 6.75 months. The lowest age equivalent was found in the communication domain for both the home care and hospital groups (3.36 months and 3.56 months respectively). Thus, for both groups, the highest level of skill was in the cognitive domain while the lowest level of skill was in the communication domain. The mean overall developmental lag (the difference between the child's age corrected for prematurity and the age equivalent) was 6.57 months for the home care group and 7.69 months for the hospital group. The difference between the home care and hospital groups on developmental lag was not found to be significant (t=-0.56).

Table 14 includes interactive behavior (IRS) ratings for the home care and hospital groups. The mean ratings (i.e., 2.31 for the home care group and 2.21 for the
Table 14
IRS Infant Ratings For
Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant rating</td>
<td>2.31</td>
<td>0.35</td>
<td>1.71</td>
<td>2.71</td>
<td>0.62</td>
</tr>
<tr>
<td>Home care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>2.21</td>
<td>0.51</td>
<td>1.14</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>

Note. The rating (possible range 1.00 to 3.00) is indicative of interactive skill demonstrated during a brief face-to-face interaction between parent/caregiver and child. The higher the numeric rating the higher the level of interactive skill demonstrated.
hospital group) are moderately high, indicating that a moderately high level of interactive behavior/skill was demonstrated by the children during the course of a brief face-to-face interaction with a parent or familiar caregiver. No significant differences were found between the groups in infant interactive behavior (t=0.62).

In Table 15, data relating to the Early Coping Inventory (ECI) are reported. The four scores for the home care group were slightly higher than those for the hospital group, although the differences were not significant. The mean sensorimotor organization score was the highest for both the home care and hospital groups and the scores (3.74 and 3.64 respectively) may be interpreted as representing situationally effective behavior, with some generalization of behaviors across situations noted. For both groups, the mean adaptive behavior index and reactive behavior score (3.31 and 3.38 respectively for the home care group; 3.23 and 3.34 respectively for the hospital group) represent situationally effective behavior on the part of the children. The mean self-initiated behavior score for both groups (2.81 for the home care group and 2.71 for the hospital group) represent minimally effective behavior, with effective behaviors in a few types of situations.

Hypothesis II: Infants and toddlers who are technology dependent, residing in either home or hospital settings, will have ratings on
Table 15

ECI Scores For Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Scores</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive behavior index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care Sensorimotor organization</td>
<td>3.31</td>
<td>0.40</td>
<td>2.60</td>
<td>4.10</td>
<td>0.41</td>
</tr>
<tr>
<td>Hospital</td>
<td>3.23</td>
<td>0.65</td>
<td>1.80</td>
<td>4.40</td>
<td></td>
</tr>
<tr>
<td>Reactive behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>3.74</td>
<td>0.43</td>
<td>2.90</td>
<td>4.30</td>
<td>0.49</td>
</tr>
<tr>
<td>Hospital</td>
<td>3.64</td>
<td>0.63</td>
<td>2.10</td>
<td>4.70</td>
<td></td>
</tr>
<tr>
<td>Self-initiated behavior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>3.38</td>
<td>0.41</td>
<td>2.80</td>
<td>4.40</td>
<td>0.20</td>
</tr>
<tr>
<td>Hospital</td>
<td>3.34</td>
<td>0.53</td>
<td>2.00</td>
<td>4.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care group: n=14</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hospital group: n=16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
interactional behavior, as measured by the Interaction Rating Scales, which will be positively related to (a) developmental outcome and (b) coping behavior.

This hypothesis was partially supported. Significant relationships between interactive behavior and developmental outcome variables were not found, although significant relationships between interactive behavior and coping behavior were revealed.

For each group, Pearson product moment correlations were utilized in the data analysis. The IRS infant rating (independent variable), the BDI total and six domain scores (dependent variables), and the four ECI scores (dependent variables) were used in the analysis. Correlations are reported in Table 16. No significant relationships between the quality of the child's interactive behavior (IRS infant rating) and developmental outcome (BDI scores) were found for either the home care or hospital groups.

The quality of the child's interactive behavior was related to the effectiveness of the child's coping behavior (ECI scores), however. The adaptive behavior index was significantly related to the interactive behavior score for both groups (r=.73 for the home care group; r=.78 for the hospital group). Higher interactive behavior scores were associated with higher adaptive behavior indices. Thus
Table 16
Pearson Product Moment Correlation Coefficients
IRS Infant Rating and (a) BDI Scores and (b) ECI Scores
Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>IRS Rating</th>
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<td>BDI cognitive</td>
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<td>Hospital 1.00</td>
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<td>Home care</td>
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<td>.74***</td>
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<td>Hospital</td>
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</tr>
<tr>
<td>ECI reactive behavior</td>
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<tr>
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<tr>
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<td>Home care</td>
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<td>.74***</td>
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<tr>
<td>Hospital</td>
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</tbody>
</table>

* p<.05   ** p<.01   *** p<.001
children who demonstrated stronger interactive skills were also coping more effectively overall.

The interactive behavior score also was significantly related to the sensorimotor organization score for both groups (r = .73 for the home care group; r = .74 for the hospital group). Higher interactive behavior scores were associated with higher sensorimotor organization scores. Children who exhibited more effective interactive behavior also demonstrated more effective coping behavior in the realm of sensorimotor organization (i.e., self regulatory behaviors, adaptive responses to sensory stimuli, and the purposeful use of the sensory and motor systems).

The interactive behavior score was significantly associated with the reactive behavior score for both the home care (r = .58) and the hospital (r = .78) groups. Higher interactive behavior scores were associated with higher reactive behavior scores. Children who employed more effective interactive behavior demonstrated more effective coping in the area of reactive behavior (i.e., actions used to respond to demands of the physical and social environments).

The interactive behavior score was significantly related with the self-initiated behavior score for both groups (r = .64 for the home care group; r = .74 for the hospital group). Children who demonstrated more effective interactive behavior also demonstrated more effective coping
in the realm of self-initiated behavior (i.e., autonomously generated, self-directed actions used to meet personal needs and to interact with the physical and social environments).

Simple linear regression analyses, the results of which are reported in Table 17, revealed that the interactive behavior rating accounted for 54% of the variance in the adaptive behavior index in the home care group and 62% of in the hospital group (F=13.93; F=22.39). In both groups, the predictive quality of the child's interactive behavior with regard to overall adaptive behavior was significant. When focusing on specific categories of coping behavior, the interactive behavior rating accounted for 53% of the variance in ECI sensorimotor organization score for the home care group and 55% of the variance in the hospital group (F=13.61; F=17.11). For both groups, the child's interactive behavior rating was predictive of the child's coping behavior in the realm of sensorimotor organization. The interactive behavior rating also accounted for 34% of the variance in the ECI reactive behavior score for the home care group and 61% of the variance for the hospital group (F=6.13; F=21.90). For both groups, interactive behavior was predictive of coping in the area of reactive behavior. Finally, for both the home care and hospital groups, the interactive behavior rating accounted for 41% and 54% respectively of the variance in the ECI self-initiated behavior score (F=8.50; F=16.69).
Table 17
Simple Linear Regression
IRS Infant Rating and (a) BDI Standard Scores, and (b) ECI Scores
Separate Analyses for Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>$R^2$</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
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<td>.12</td>
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<td>.22</td>
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<td>Hospital group</td>
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<td>0.00</td>
<td>.99</td>
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<tr>
<td><strong>BDI personal social</strong></td>
<td></td>
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<tr>
<td>Home care group</td>
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<td>0.95</td>
<td>.35</td>
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<td><strong>BDI cognitive</strong></td>
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<td>Hospital group</td>
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<td>Hospital group</td>
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<td>.0004</td>
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<td>Hospital group</td>
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<td>16.69</td>
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</table>
Thus, for both groups, interactive behavior was significantly predictive of coping in the realm of self-initiated behavior.

Hypothesis III: In children who are technology dependent, residing in both home and in hospital settings, there will be a positive relationship between coping behavior, as measured by the Early Coping Inventory, and developmental outcome.

Although significant relationships between selected ECI scores and indices of developmental outcome were found, the hypothesis of a positive relationship between coping behavior and developmental outcome was only partially supported.

Data for each group were analyzed using Pearson product moment correlation techniques. Included in the analysis were ECI scores (adaptive behavior index, sensorimotor organization score, reactive behavior score, and self-initiated behavior score) as independent variables, and BDI standard scores (total and domain scores) as dependent variables. Correlations are reported in Table 18. (See Appendix N for variable abbreviations and names.)

With respect to the home care group, none of the correlations were in the expected direction. Four significant relationships between the coping effectiveness scores and the developmental outcome scores emerged.
Table 18

Pearson Product Moment Correlation Coefficients
ECI Scores and BDI Scores
Separate Analyses for Home Care and Hospital Groups

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<th></th>
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<th>ESO</th>
<th>ERB</th>
<th>ESIB</th>
</tr>
</thead>
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<td>BA</td>
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<td>BGM</td>
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<td>-.47</td>
<td>-.63**</td>
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<td>-.48</td>
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<td>-.30</td>
<td>-.27</td>
<td>-.42</td>
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<tr>
<td>Hospital</td>
<td>.49*</td>
<td>.46</td>
<td>.47</td>
<td>.48</td>
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</tbody>
</table>

* p<.05  **p<.01
The ECI adaptive behavior index was negatively related to the BDI fine motor score ($r=-.57$). Thus higher adaptive behavior indices were associated with lower fine motor scores. In addition, the ECI self-initiated behavior score was negatively related to the BDI fine motor score ($r=-.63$). Higher self-initiated behavior scores were associated with lower fine motor scores.

For the hospital group, correlations were in the expected direction, although only two of the relationships were found to be significant. Significant findings included a positive relationship between the ECI adaptive behavior index and the BDI cognitive domain score ($r=.49$). Higher adaptive behavior indices were associated with higher cognitive domain scores. A significant relationship was also found between the ECI reactive behavior score and the BDI fine motor score ($r=.51$). Higher reactive behavior scores were associated with higher fine motor scores.

Stepwise multiple regression procedures were also utilized to analyze the relationships between ECI and BDI scores for each group; results are shown in Tables 19 and 20. Findings show that for the home care group the ECI self-initiated behavior score accounts for 39% of the variance in the BDI fine motor score ($F=7.82$). Children's coping skills in the realm of self-initiated behavior were significantly predictive of their fine motor skills. For the hospital group, the ECI reactive behavior score
### Table 19

**Stepwise Multiple Regression**  
**Significant Relationships Between ECI and BDI Scores**  
**Home Care Group**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Step and HOME Variable Entered</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
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<td>.39</td>
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<td>.02</td>
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</table>

### Table 20

**Stepwise Multiple Regression**  
**Significant Relationships Between ECI and BDI Scores**  
**Hospital Group**

<table>
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<th>Dependent Variable</th>
<th>Step and HOME Variable Entered</th>
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<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
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<td>Step 1—ECI reactive behavior score</td>
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<td>4.84</td>
<td>.05</td>
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<tr>
<td>BDI cognitive score</td>
<td>Step 1—ECI adaptive behavior index</td>
<td>.24</td>
<td>4.41</td>
<td>.05</td>
</tr>
</tbody>
</table>
accounted for 26% of the variance in the BDI fine motor score. Coping skills in the area of reactive behavior were predictive of fine motor development. In addition, the ECI adaptive behavior index accounted for 24% of the variance in the BDI cognitive domain score ($F = 4.41$). Thus for children in this group, overall adaptive behavior was predictive of their cognitive skills.

Hypothesis IV: Children who are technology dependent, residing in both home and hospital settings, who are categorized as being of "easy" temperament will be assessed with more optimal (a) developmental outcome, (b) interactive behavior, and (c) coping behavior than those of other temperament diagnostic clusters (i.e., intermediate low, difficult, intermediate high, and slow-to-warm-up).

The hypothesis of more optimal developmental outcome, interactive behavior, and coping behavior for children in the "easy" diagnostic cluster than for children in the remaining diagnostic clusters failed to be supported.

Analysis of variance statistics, the results of which are shown in Table 21, were used to examine relationships between the independent variable temperament diagnostic cluster and the following dependent variables: (a) BDI standard scores, (b) the IRS infant rating, and
Table 21
Analysis of Variance
Temperament Diagnostic Cluster and (a) BDI Scores, (b) IRS Rating and (c) ECI Scores
Separate Analyses for Home Care and Hospital Groups

<table>
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<th>Dependent Variable</th>
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<th>P</th>
</tr>
</thead>
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<td>.65</td>
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<td>BDI personal social domain</td>
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<td>Hospital</td>
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<td>.45</td>
</tr>
<tr>
<td>Hospital</td>
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<td>.20</td>
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<tr>
<td>Hospital</td>
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<td>.16</td>
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</table>
(c) ECI scores. For neither the home care nor the hospital group were there significant differences in BDI scores, IRS infant ratings, or ECI scores for different temperament diagnostic clusters.

Hypothesis V: Exploratory and play behavior of infants and toddlers who are technology dependent, residing in home and hospital settings, will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior.

The hypothesis was only partially supported. For the home care group, the level of exploratory/play behavior was significantly related to select aspects of developmental outcome, but in a negative rather than positive direction. Further, the level of exploratory behavior was positively related to interactional behavior for the hospital but not the home care group. Finally, exploratory behavior was positively related to coping behavior for both groups.

Spearman rank order correlation techniques were employed in separate data analyses for the home care and hospital groups, results of which are reported in Table 22. In these analyses, exploratory behavior was the independent variable and BDI scores, the IRS rating, and ECI scores were the dependent variables. For the home care group, significant relationships between level of exploratory/play
Table 22
Spearman Rank Order Correlation Coefficients
Exploration/Play Behavior and (a) BDI Scores,
(b) IRS Infant Rating, and (c) ECI Scores
Separate Analyses for Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Exploration/Play Level</th>
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</thead>
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<tr>
<td>BDI personal social</td>
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<tr>
<td>Home care</td>
<td>.68**</td>
<td>.65**</td>
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</tbody>
</table>

* p<.05    ** p<.01    *** p<.001
behavior and BDI scores were not in the direction expected. For these children, the level of exploratory/play behavior demonstrated was related negatively to the BDI total score ($r = -0.53$), personal social ($r = -0.53$), gross motor score ($r = -0.54$), fine motor score ($r = -0.79$), and communication score ($r = -0.53$). Higher levels of exploratory/play behavior were associated with lower BDI scores for the home care group. For the hospital group, the level of exploratory/play behavior was not significantly related to any of the BDI scores.

For the hospital group, the level of exploratory/play behavior was significantly related to the IRS infant rating ($r = 0.51$). Higher levels of exploratory/play behavior were associated with higher IRS ratings. For the home care group, the level of exploratory behavior was not significantly related to the IRS infant rating.

For both the home care and hospital groups, significant positive relationships were found between the level of exploratory behavior and each of the ECI scores. Higher levels of exploratory behavior were associated with higher adaptive behavior indices ($r = 0.78$; $r = 0.66$), higher sensorimotor organization scores ($r = 0.61$; $r = 0.60$), higher reactive behavior scores ($r = 0.75$; $r = 0.54$), and higher self-initiated behavior scores ($r = 0.68$; $r = 0.65$).

Hypothesis VI: The level of family involvement will be positively related to (a) developmental
outcome, (b) interactive behavior, and (c) coping behavior in families with a child who is technology dependent and residing in a hospital setting.

On the basis of the results, the hypothesis of a positive relationship between level of family involvement and (a) developmental outcome, (b) interactive behavior, and (c) coping behavior was only partially supported. The level of family involvement was positively related to two areas of developmental outcome, although not related significantly to either interactive behavior or coping behavior.

Spearman rank order correlation techniques were used in the analysis of data; correlations between level of family involvement (independent variable), and (a) the BDI total and domain scores, (b) the IRS infant rating, and (c) the ECI scores (dependent variables) are provided in Table 23. Significant relationships between level of family involvement and the BDI adaptive domain score ($r=0.55$), and the BDI communication domain score ($r=0.56$) were found. Higher levels of family involvement were associated with higher adaptive and communication scores. No significant relationships emerged between level of family involvement and other BDI scores, the IRS infant rating, or ECI scores.

Hypothesis VII: The quality of the environment in which the child resides will be positively related to
Table 23

Spearman Rank Order Correlation Coefficients
Family Involvement and (a) BDI Standard Scores, (b) IRS Infant Rating, and (c) ECI Scores
Hospital Group

<table>
<thead>
<tr>
<th>Family Involvement</th>
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</thead>
<tbody>
<tr>
<td>BDI Total</td>
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<td>BDI personal social</td>
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<td>BDI adaptive</td>
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<td>BDI gross motor</td>
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<td>BDI fine motor</td>
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<tr>
<td>BDI communication</td>
<td>.56*</td>
</tr>
<tr>
<td>BDI cognitive</td>
<td>.42</td>
</tr>
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<td>IRS infant rating</td>
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<tr>
<td>ECI self-initiated behavior</td>
<td>.10</td>
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</table>

* p<.05
(a) developmental outcome, (b) interactive behavior and (c) coping behavior in families with a child who is technology dependent and residing in the home as well as for those residing in a hospital.

This hypothesis was only partially supported. For the home care group, significant positive relationships between indices of quality in the home environment and interactive behavior as well as aspects of coping behavior were found, although no relationships between developmental outcome and aspects of the home environment emerged. For the hospital group, only a few significant positive relationships were found between qualities of the home environment and (a) developmental outcome, (b) interactive behavior, and (c) coping behavior.

Pearson product moment correlation techniques were used to analyze the relationship between the HOME total and subscale scores (independent variables) and (a) BDI standard total and domain scores, (b) the IRS infant rating, and (c) ECI scores (dependent variables). Separate analyses were performed for the home care and hospital groups, and the results of these analyses are reported in Table 24. (See Appendix N for variable abbreviations and names.)

For the home care group, none of the HOME scores were significantly related to the BDI scores. For the hospital
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<th>ACC</th>
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</table>

* p<.05  **p<.01
group, the HOME variety subscale score was significantly related to the BDI total score ($r=.59$), personal social score ($r=.58$), adaptive score ($r=.63$), and communication score ($r=.68$). Greater variety in daily stimulation was associated with higher BDI scores.

For the home care group, the IRS infant rating was significantly related to the HOME responsivity subscale score ($r=.66$), organization subscale score ($r=.53$), play materials subscale score ($r=.63$), involvement subscale score ($r=.69$), variety subscale score ($r=.56$), and the total score ($r=.75$). Higher HOME subscale and total scores were associated with higher IRS ratings. For the hospital group, only the HOME organization subscale score was related significantly to the IRS infant rating ($r=.53$). Higher organization subscale scores were associated with higher IRS ratings.

For the home care group, the HOME play materials subscale score, the involvement subscale score, and the total score were related significantly to the ECI adaptive behavior index ($r=.54$; $r=.63$; $r=.59$). Higher play materials, involvement, and total HOME scores were associated with higher adaptive behavior indices. Further, the ECI sensorimotor organization score was related significantly to the HOME organization subscale score ($r=.54$), the play materials subscale score ($r=.61$), the involvement subscale score ($r=.71$), and the HOME total score
Higher organization, play materials, involvement, and total HOME scores were associated with higher sensorimotor organization scores. Finally, significant relationships were found between the ECI self-initiated behavior score and the HOME involvement subscale score ($r=.63$) and the HOME total score ($r=.58$). Higher involvement and total HOME scores were associated with higher self-initiated behavior scores.

For the hospital group, the HOME responsivity subscale score was related significantly to the ECI reactive behavior and self-initiated behavior scores ($r=.49$; $r=.49$).

Stepwise multiple regression procedures were also used in the analysis of data, and results for each group are reported in Tables 25 and 26. For the home care group, none of the HOME scores were predictive of the BDI scores. For the hospital group, the HOME variety subscale score was found to be predictive of the BDI total score ($F=7.48$), the BDI personal social score ($F=7.18$), the BDI adaptive score ($F=9.27$), and the BDI communication score ($F=12.34$). The opportunities for variety in daily stimulation accounted for 35% of the variance in overall developmental outcome, 34% of the variance in personal social development, 40% of the variance in adaptive behavior, and 47% of the variance in communication skills.
Table 25
Stepwise Multiple Regression
Significant Relationships Between HOME Scores and (a) BDI Scores, (b) IRS Rating, and (c) ECI Scores
Home Care Group

<table>
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<tr>
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<th>Step and HOME Variable Entered</th>
<th>( R^2 )</th>
<th>( F )</th>
<th>( p )</th>
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<td>7.69</td>
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</table>

Table 26
Stepwise Multiple Regression
Significant Relationships Between HOME Scores and (a) BDI Scores, (b) IRS Rating, and (c) ECI Scores
Hospital Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Step and HOME Variable Entered</th>
<th>( R^2 )</th>
<th>( F )</th>
<th>( p )</th>
</tr>
</thead>
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<td>Step 1--Organization</td>
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<td>5.48</td>
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<td>ECI reactive behavior</td>
<td>Step 1--Responsivity</td>
<td>.24</td>
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</table>
With regard to the IRS rating, for the home care group, the total HOME score was predictive of the IRS infant rating and accounted for 57% of the variance in infant interactive behavior (F=15.74). For the hospital group, the HOME organization subscale score was predictive of the IRS rating. The organization of the physical and temporal environment accounted for 28% of the variance in infant interactive behavior.

For children in the home care group, the HOME involvement subscale score was found to be predictive of the ECI adaptive behavior index (F=7.97), the ECI sensorimotor organization score (F=12.18), and the ECI self-initiated behavior score (F=7.69). Parent involvement with the child accounted for 40% of the variance in overall coping behavior, 50% of the variance in coping behavior in the area of sensorimotor organization, and 39% of the variance in self-initiated coping behavior. For children in the hospital group, the HOME responsivity subscale score was predictive of the ECI reactive behavior score. The emotional and verbal responsivity of the parent accounted for 24% of the variance in reactive behavior.

Hypothesis VIII: Birth weight will be positively related to (a) developmental outcome, (b) interactive behavior, and (c) coping behavior for children who are technology dependent residing in home and hospital settings.
On the basis of results, the hypothesis of a positive relationship between birth weight and (a) developmental outcome, (b) interactive behavior, and (c) coping behavior failed to be supported.

Pearson product moment correlations were utilized to determine relationships between birth weight (independent variable) and BDI total and domain scores, the IRS infant rating, and ECI scores (dependent variables). The results of these analyses are reported in Table 27 and indicate that birth weight is not significantly related to BDI scores, the IRS infant rating, or ECI scores. Furthermore, the majority of the relationships are not in the expected direction.

Simple linear regression analyses were also used to analyze relationships between birth weight and (a) BDI standard scores, (b) the IRS infant rating, and (c) ECI scores, results of which are reported in Table 28. Separate analyses were conducted for the home care and hospital groups. Results indicate that birth weight did not uniquely account for a significant amount of the variance in any of the dependent variables (i.e., BDI scores, IRS infant rating, and ECI scores).

Hypothesis IX: Child based factors (i.e., temperament, exploratory/play behavior), environmental factors (i.e., family involvement, and the quality of the environment), and health
Table 27
Pearson Product Moment Correlation Coefficients
Birth Weight and (a) BDI, (b) IRS, and (c) ECI Scores
Separate Analyses for Home Care and Hospital Groups

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<td>-0.05</td>
<td>-0.09</td>
</tr>
<tr>
<td>ECI reactive behavior</td>
<td>-0.40</td>
<td>0.12</td>
</tr>
<tr>
<td>ECI self-initiated behavior</td>
<td>0.04</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Note. None of the above correlations were significant at p<.05.
### Table 28
Simple Linear Regression
Birth Weight and (a) BDI Scores, (b) IRS infant rating, and (c) ECI Scores
Separate Analyses for Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>R²</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BDI total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.09</td>
<td>1.21</td>
<td>.29</td>
</tr>
<tr>
<td>Hospital</td>
<td>.07</td>
<td>1.01</td>
<td>.33</td>
</tr>
<tr>
<td><strong>BDI personal social domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.09</td>
<td>1.17</td>
<td>.30</td>
</tr>
<tr>
<td>Hospital</td>
<td>.07</td>
<td>0.94</td>
<td>.35</td>
</tr>
<tr>
<td><strong>BDI adaptive domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.07</td>
<td>0.88</td>
<td>.37</td>
</tr>
<tr>
<td>Hospital</td>
<td>.07</td>
<td>0.93</td>
<td>.35</td>
</tr>
<tr>
<td><strong>BDI gross motor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.10</td>
<td>1.36</td>
<td>.27</td>
</tr>
<tr>
<td>Hospital</td>
<td>.002</td>
<td>0.03</td>
<td>.87</td>
</tr>
<tr>
<td><strong>BDI fine motor</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.06</td>
<td>0.71</td>
<td>.42</td>
</tr>
<tr>
<td>Hospital</td>
<td>.0008</td>
<td>0.01</td>
<td>.92</td>
</tr>
<tr>
<td><strong>BDI communication domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.10</td>
<td>1.30</td>
<td>.28</td>
</tr>
<tr>
<td>Hospital</td>
<td>.08</td>
<td>1.12</td>
<td>.31</td>
</tr>
<tr>
<td><strong>BDI cognitive domain</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.11</td>
<td>1.46</td>
<td>.25</td>
</tr>
<tr>
<td>Hospital</td>
<td>.06</td>
<td>0.83</td>
<td>.38</td>
</tr>
<tr>
<td><strong>IRS infant rating</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.18</td>
<td>2.64</td>
<td>.13</td>
</tr>
<tr>
<td>Hospital</td>
<td>.0007</td>
<td>0.01</td>
<td>.93</td>
</tr>
<tr>
<td><strong>ECI adaptive behavior index</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.01</td>
<td>0.17</td>
<td>.69</td>
</tr>
<tr>
<td>Hospital</td>
<td>.0007</td>
<td>0.01</td>
<td>.92</td>
</tr>
<tr>
<td><strong>ECI sensorimotor organization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.002</td>
<td>0.03</td>
<td>.87</td>
</tr>
<tr>
<td>Hospital</td>
<td>.008</td>
<td>0.10</td>
<td>.76</td>
</tr>
<tr>
<td><strong>ECI reactive behavior</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.16</td>
<td>2.29</td>
<td>.16</td>
</tr>
<tr>
<td>Hospital</td>
<td>.01</td>
<td>0.19</td>
<td>.67</td>
</tr>
<tr>
<td><strong>ECI self-initiated behavior</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home care</td>
<td>.002</td>
<td>0.02</td>
<td>.89</td>
</tr>
<tr>
<td>Hospital</td>
<td>.002</td>
<td>0.03</td>
<td>.88</td>
</tr>
</tbody>
</table>
factors (i.e., birth weight, technological support required) will interact to determine (a) developmental outcome, interactive behavior, and (c) coping behavior.

The hypothesis of an interaction between health, child-based, and environmental factors to determine developmental outcome, interactive behavior and coping behavior was partially supported. For the home care group, no significant interactive effects on developmental outcome were found, although significant coactive effects on interactive behavior and coping behavior emerged. For the hospital group, significant interactive effects on developmental outcome, interactive behavior, and coping behavior were found.

For both the home care and hospital groups, multiple linear regression was utilized to determine significant interactional effects on the BDI total score, the IRS infant rating, and ECI adaptive behavior index. These dependent variables represent an overall index of developmental outcome, interactive behavior and coping behavior. The independent variables utilized in these analyses are temperament diagnostic cluster, level of exploratory/play behavior, level of family involvement, the HOME total score, birth weight, and
level of technology required by the child. The results of these analyses are reported in Tables 29 and 30.

For the home care group, no significant interactive effects on the BDI total score were found. For the subjects in the hospital group, the interactive effect of temperament diagnostic cluster and level of family involvement on the BDI total score was significant ($R^2 = .64, F=3.61$). Taken interactively, the child's behavioral style and level of family involvement significantly impacted the child's overall developmental outcome.

For the home care group, the interaction between temperament diagnostic cluster and total HOME score accounted for approximately 73% of the variance in the IRS infant rating ($F=6.12$). The child's behavioral style and the quality of the home environment had a coactive effect upon the child's interactive behavior. Also accounting for a significant amount of variance in the IRS rating was the interaction between birth weight and the total HOME score ($R^2 = .69, F=12.13$). Infant interactive behavior was jointly affected by the child's birth weight and the quality of the home environment. A third significant interaction effect on the IRS rating involved the three-way interaction of birth weight, level of technology, and total HOME score. The interaction of these factors accounted for 71% of the
Table 29

Multiple Linear Regression
BDI Total Score, IRS Infant Rating, ECI Adaptive Behavior Index and Selected Independent Variables
Significant Two-Way and Three-Way Interaction Effects
Home Care Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Interaction Effect</th>
<th>R²</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS Rating</td>
<td>1. Temperament cluster X total HOME score</td>
<td>.73</td>
<td>6.12</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>2. Birth weight X total HOME score</td>
<td>.69</td>
<td>12.13</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>3. Birth weight X level of technology X total HOME score</td>
<td>.71</td>
<td>3.98</td>
<td>.04</td>
</tr>
<tr>
<td>ECI Adaptive Behavior Index</td>
<td>Birth weight X level of play</td>
<td>.77</td>
<td>3.90</td>
<td>.05</td>
</tr>
</tbody>
</table>
Table 30

Multiple Linear Regression
BDI Total Score, IRS Infant Rating, ECI Adaptive Behavior
Index and Selected Independent Variables
Significant Two-Way and Three-Way Interaction Effects
Hospital Group

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Interaction Effect</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI Total Score</td>
<td>Temperament cluster X family involvement</td>
<td>.64</td>
<td>3.61</td>
<td>.04</td>
</tr>
<tr>
<td>IRS Rating</td>
<td>Birth weight X temperament cluster</td>
<td>.61</td>
<td>3.96</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Birth weight X level of play</td>
<td>.76</td>
<td>4.31</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>Birth weight X level of technology X level of play</td>
<td>.94</td>
<td>8.37</td>
<td>.02</td>
</tr>
<tr>
<td>ECI Adaptive</td>
<td>Level of play X level of technology X family involvement</td>
<td>.91</td>
<td>5.11</td>
<td>.04</td>
</tr>
<tr>
<td>Behavior Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
variance in the IRS infant rating (F=3.98). The child's birth weight, the level of life supporting technology required by the child, and the overall quality of the home environment taken together impacted the child's interactive behavior.

For the hospital group, birth weight and temperament diagnostic cluster interacted to significantly affect the IRS rating, the interaction accounting for 61% of the variance in the rating (F=3.96). The child's birth weight and behavioral style acted together to influence the child's interactive behavior. The interaction of birth weight and level of exploratory/play behavior on the IRS rating also was significant (R²=.76, F=4.31). Birth weight and the level of exploratory behavior demonstrated by the child taken together impacted the child's interactive behavior. A three-way interaction also was found to be significant: the interaction of birth weight, level of technology, and level of play (R²=.94, F=8.37). The child's birth weight, the level of technology required by the child, and the child's exploratory behavior acted in combination to significantly influence the child's interactive behavior.

In consideration of the ECI adaptive behavior index, an interaction effect involving birth weight and level of exploratory/play behavior was found. This interaction accounted for 77% of the variance in the ECI adaptive behavior index (F=3.90). A child's birth weight and the
exploratory behavior demonstrated by the child jointly affected the child's coping behavior overall. A significant three-way interaction was found for the hospital group; level of exploratory/play behavior, level of technology, and level of family involvement taken coactively impacted the adaptive behavior index ($R^2 = .91, F=5.11$). For a child in the hospital group, the level of exploratory behavior, the level of technology required for life support, and the level of family involvement with the child acted together to influence the child's coping behavior.

For both the home care and hospital groups, significant interactive effects for the IRS infant rating and the ECI adaptive behavior index were found. In terms of the BDI total score, however, a significant interactive effect emerged for the hospital group but not for the home care group.

Additional Analyses

Relationships Between Selected Independent Variables

In this section, the relationships between selected independent variables were analyzed using t-tests, Pearson product moment correlation coefficients, or Spearman rank order correlation coefficients as appropriate, the results of which are reported in Tables 31 through 42 found in Appendices 0 through S.
Relationships between selected health factors. In Table 31 (see Appendix 0), children in both diagnostic categories (BPD and structural anomalies of the airway) are described in terms of gestational age, birth weight, and length of hospitalization in days. Significant differences between the diagnostic groups were found with regard to gestational age; children with BPD were of lower gestational age than children with structural anomalies (t=-7.33, p=.0001). Children in the BPD diagnostic group were also significantly lower in birth weight than children having structural anomalies of the airway (t=-6.26, p=.0007). In terms of length of hospitalization, children with BPD were hospitalized for significantly longer periods than children with anomalies of the airway (t=4.05, p=.0004).

Relationships between temperament dimensions and (a) health factors, (b) environmental factors and (c) child related factors. Spearman rank order correlation coefficients were employed to determine relationships between temperament dimensions and selected independent variables (i.e., birth weight, gestational age, length of hospitalization, level of technology required, level of family involvement, frequency of participation in early intervention services, and level of exploratory/play behavior), the results of which are reported in Table 32 located in Appendix P. (A listing of variable abbreviations and names as used in the correlations table is provided in
Table 33, also found in Appendix P.) Several significant relationships were found for both the home care and hospital groups.

For the home care group, ratings on the temperament dimension intensity were significantly related to the level of exploratory/play behavior observed \((r=-.57, p<.05)\). For children in the home care group, higher intensity was associated with higher levels of exploratory/play behavior. On the dimension distractibility, also, a significant relationship with level of exploratory/play behavior resulted \((r=.57, p<.05)\). Higher ratings of distractibility were associated with higher levels of exploratory/play behavior. Also for the home care group, a significant relationship between the temperament dimension threshold and frequency of early intervention services was found \((r=.58, p<.05)\). A higher threshold was associated with a higher frequency of participation in early intervention programming.

For the hospital group, a significant relationship between the temperament dimension activity and the level of exploratory/play behavior observed \((r=-.55, p<.05)\). Higher activity levels were associated with higher levels of exploratory/play behavior. In addition, the dimension of adaptability was significantly related to length of hospitalization \((r=.53, p<.05)\). Higher levels of adaptability were associated with longer hospitalizations.
Finally, on the dimension of threshold, a significant relationships with level of technology was discovered ($r=.69$, $p<.01$). Higher thresholds were associated with requirements for higher levels of technology.

No significant relationships between any of the temperament dimensions and birth weight, gestational age, or level of family involvement were found. Further, the temperament dimensions rhythmicity, approach/withdrawal, mood, and persistence were not related significantly to any of the independent variables selected for this analysis.

**Relationships between exploratory/play behavior and (a) chronological age, (b) health factors, and (c) early intervention participation.** Spearman rank order correlation coefficients were used in the analysis of relationships between exploratory/play behavior and selected independent variables (i.e., chronological age, birth weight, gestational age, length of hospitalization, level of technology required, and frequency of participation in early intervention programming) for the children in both the home care and hospital groups. The results of these analyses are reported on Table 34 (see Appendix Q).

The level of exploratory/play behavior was significantly related to chronological age for both the home care and hospital groups ($r=.68$, $p<.01$; $r=.58$, $p<.05$). Higher levels of exploratory/play behavior were associated with higher chronological ages. The level of
exploratory/play behavior was significantly related to length of hospitalization for the hospital group but not for the home care group ($r=.58$, $p<.05$). Higher levels of exploratory/play behavior were associated with longer hospitalizations. Exploratory/play behavior was not significantly related to birth weight, gestational age, level of technology, or frequency of participation in early intervention services in either the home care or hospital group.

Relationships between family involvement and (a) health factors, (b) demographic factors and (c) exploratory/play behavior. For the hospital group, Spearman rank order correlation coefficients were utilized in the analysis of relationships between the level of family involvement and selected independent variables (i.e., birth weight, gestational age, length of hospitalization, level of technology required, socioeconomic status, maternal age, and level of exploratory/play behavior observed). The results of these analyses are reported in Table 35 (see Appendix R). Level of family involvement was significantly related to socioeconomic status ($r=.81$, $p<.0001$) and to maternal age ($r=-.75$, $p<.01$). For children in the hospital group, higher levels of family involvement were associated with higher socioeconomic status and with higher maternal age. No significant relationships were found between level of family
involvement and birth weight, gestational age, length of hospitalization, or level of technology.

Relationships between quality of the caregiving environment and (a) exploratory/play behavior, (b) temperament dimensions (c) maternal age, and (d) socioeconomic status. Spearman rank order correlation coefficients were used in the analyses of relationships between quality of the caregiving environment (HOME scores) and (a) exploratory/play behavior, and (b) ratings on temperament dimensions for both the home care and hospital groups. The results of these analyses are reported in Table 36 (see Appendix S). Variable abbreviations and names are also listed in Appendix S. For both groups, several significant relationships between these variables were found.

For children in the home care group, the HOME acceptance subscale score was positively related to the temperament activity rating (r=.62, p<.05). A higher level of acceptance of the child's behavior was associated with a lower activity rating. Furthermore, the HOME involvement subscale score was positively related to the temperament mood rating (r=.69, p<.01). A higher level of parent/caregiver involvement with the child was associated with a more positive mood rating. Both the HOME organization and variety subscale scores were significantly related to the temperament distractibility rating (r=.57,
p<.05; r=.55, p<.05 respectively). Thus, higher levels of organization of the physical and temporal environment as well as of opportunities for variety in stimulation were associated with higher distractibility ratings. Finally, a significant relationship was found between the HOME play materials subscale score and the temperament threshold rating (r=.53, p<.05). More attention to the provision of appropriate play materials was associated with higher threshold ratings.

For children in the hospital group, both the HOME play materials and variety subscale scores were significantly related to the level of exploratory/play behavior observed (r=.67, p<.01; r=-.50, p<.05, respectively). More attention to the provision of appropriate play materials was associated with higher levels of exploratory/play behavior, while more opportunities for variety in stimulation were associated with lower levels of exploratory/play behavior. The HOME involvement subscale score was positively related to both the temperament activity rating and the temperament intensity rating (r=.54, p<.05; r=.57, p<.05). Higher levels of parent/caregiver involvement were associated with both lower activity ratings and milder intensity ratings. Lastly, significant positive relationships were found between the HOME total score and the temperament persistence and distractibility ratings (r=.51, p<.05; r=.52, p<.05, respectively). Thus the higher the overall quality of the
environment in which the children reside, the higher the levels of persistence and distractibility demonstrated by the children.

No significant relationships for either the home care or hospital group were revealed between any of the HOME scores and the temperament dimensions rhythmicity, approach/withdrawal, or adaptability. Also, for both groups, none of the relationships between the HOME responsivity subscale score and either the level of exploratory/play behavior or the temperament dimensions were significant.

Pearson product moment correlation coefficients were utilized to examine relationships between HOME scores and maternal age for the home care group; correlations are provided in Table 37 (see Appendix S). Variable abbreviations and names are also provided in Appendix S. The HOME total score, the responsivity subscale score, and the involvement subscale score were significantly related to maternal age (r=.60, p<.05; r=.62, p<.05; r=.60, p<.05). Higher quality of the overall home environment, greater emotional and verbal responsivity of the parent, and greater involvement with the child were associated with higher maternal age.

Spearman rank order correlation coefficients were employed to explore relationships between HOME scores and socioeconomic status, the results of which are reviewed in
Table 38 (see Appendix S). A listing of variable abbreviations and names is also provided in Appendix S. The HOME total score ($r=-.82$, $p<.001$), the responsivity subscale score ($r=-.67$, $p<.01$), the acceptance subscale score ($r=-.57$, $p<.05$), the play materials subscale score ($r=-.73$, $p<.01$), the involvement subscale score ($r=-.64$, $p<.01$), and the variety subscale score ($r=-.80$, $p<.001$) were significantly related to socioeconomic status. Higher overall quality of the home environment, greater emotional and verbal responsivity of the parent, and greater acceptance of the child were associated with higher socioeconomic status. In addition, more attention to the provision of appropriate play materials, greater parent involvement with the child, and more attention to variety in daily stimulation were associated with higher socioeconomic status.

Relationships between maternal/caregiver interactive behavior and (a) infant interactive behavior, (b) maternal age, and (c) socioeconomic status. For each group, Pearson product moment correlation coefficients were used to determine relationships between the IRS maternal/caregiver rating and the IRS infant rating. These ratings were found to be significantly correlated for the home care group ($r=.59$, $p<.03$), but not for the hospital group ($r=.25$, $p<.35$). Higher maternal/caregiver ratings were associated with higher infant ratings only for the home care group.
Thus, within this group, the infants of mothers who demonstrated higher quality interactive behavior were more likely to demonstrate higher quality interactive behavior themselves.

For the home care group, the relationship between the IRS maternal rating and maternal age was examined using the Pearson product moment correlation coefficient. The IRS maternal rating was found to be significantly related to maternal age ($r = .76, p < .01$). Higher maternal ratings on the Interaction Rating Scale were associated with higher maternal age. The relationship of the IRS maternal rating and socioeconomic status was examined using the Spearman rank order correlation coefficient. The IRS maternal rating was significantly related to socioeconomic status ($r = -.76, p < .001$). Higher maternal ratings on the Interaction Rating Scale were associated with higher socioeconomic status.

**Relationships Between Independent and Dependent Variables**

Relationships between frequency of early intervention participation and (a) developmental outcome, (b) interactive behavior, and (c) coping behavior. For the home care group, Spearman rank order correlation coefficients were employed to determine relationships between frequency of participation in early intervention programming and BDI scores, the IRS infant rating, and ECI scores, the results of which are provided in Table 39 (see Appendix T).
Significant relationships were found between frequency of participation in early intervention services and the BDI fine motor score. More frequent participation in early intervention programming was associated with higher fine motor scores ($r=.62$, $p<.05$). Significant relationships between frequency of participation in early intervention programming and three ECI scores were also revealed. More frequent participation in early intervention programming was associated with higher adaptive behavior indices ($r=.55$, $p<.05$), higher reactive behavior scores ($r=.62$, $p<.05$), and higher self-initiated behavior scores ($r=.56$, $p<.05$). Frequency of participation in early intervention programming was not significantly related to BDI total, personal social, adaptive, gross motor, communication, or cognitive scores; the IRS infant rating; or the ECI sensorimotor organization score.

Relationships between health factors and (a) developmental outcome, (b) interactive behavior, and (c) coping behavior. Spearman rank order correlation coefficients were utilized to analyze relationships between level of life support technology required by the children and (a) BDI scores, (b) the IRS infant rating, and (c) ECI scores. Results of these analyses are reported in Table 40 (see Appendix U).

For the home care group, a significant relationship was found between level of technology and the BDI fine motor
standard score \((r=-.64, \ p<.01)\). For children in this group, higher levels of technological requirements are associated with lower fine motor scores. For children in the hospital group, a significant relationship was discovered between level of technology and the BDI communication domain standard score \((r=-.53, \ p<.05)\). For this group of children, higher levels of technology were associated with lower communication scores. For both the home care and hospital groups, a significant relationship was found between level of technology required and overall developmental lag \((r=.56, \ p<.05; \ r=.57, \ p<.05)\). Higher levels of technology were associated with greater developmental lag overall. No significant relationships emerged between level of technology required and either the IRS infant rating or any of the ECI scores.

Pearson product moment correlation coefficients were used to examine relationships between gestational age and length of hospitalization and (a) BDI standard scores, (b) the IRS infant rating, and (c) ECI scores. Correlations are reported in Table 41 (see Appendix U). Variable abbreviations and names are also listed in Appendix U. For the home care group, length of hospitalization was significantly related to the ECI reactive behavior score \((r=.68, \ p<.01)\). Longer hospitalizations were associated with higher reactive behavior scores. For the home care group, length of hospitalization was not significantly
related to any of the BDI scores, the IRS infant rating, or the remaining ECI scores.

For the hospital group, length of hospitalization was significantly related to the BDI total score ($r = -0.56$, $p < 0.05$), the BDI personal social domain score ($r = -0.54$, $p < 0.05$), the BDI adaptive domain score ($r = -0.57$, $p < 0.05$), the BDI gross motor score ($r = -0.54$, $p < 0.05$), the BDI fine motor score ($r = -0.69$, $p < 0.01$), and the BDI communication domain score ($r = -0.67$, $p < 0.01$). Thus, longer hospitalizations were associated with lower BDI total scores, personal social scores, adaptive scores, gross motor scores, fine motor scores, and communication scores. For this group, length of hospitalization was not significantly associated with the BDI cognitive domain score, the IRS infant rating, or the ECI scores.

**Comparisons of sample and normative groups on dependent variables.** T-tests were used to test differences between the study groups and normative groups on each of the dependent variable scores. T-values and probabilities are listed on Table 42 (see Appendix V). On each of the BDI scores, significant differences were found between the sample groups and BDI norms. The BDI total score, the personal social score, the adaptive score, the gross motor score, the fine motor score, the communication score, and the cognitive score were significantly lower for the home care and hospital groups than for the normative group.
Thus, less optimal developmental outcome was evident for the study groups than for the children in the normative group.

On the IRS infant rating, significant differences were found when comparing ratings for the sample groups with results from previous work with both full-term and healthy preterm infants (Field, 1980). Both the home care and hospital groups were rated significantly lower than full-term and healthy preterm infants. The children in the current study were found to demonstrate less optimal interactive behavior than either full-term or healthy preterm infants studied by Field (1980).

Finally, on ECI scores, significant differences were found in comparisons between the sample groups and both nondisabled and disabled normative groups (Zeitlin & Williamson, 1988). On the adaptive behavior index, group means for the home care group and the hospital group were significantly lower than those for the nondisabled normative group. Sensorimotor scores for the home care group were significantly lower than scores for the nondisabled normative group but significantly higher than scores for the disabled normative group. For the hospital group, sensorimotor scores were lower than those of the nondisabled normative. Reactive behavior scores for the home care and hospital groups were significantly lower than scores for the nondisabled normative group. Self-initiated behavior scores for the home care and hospital groups also were lower than
norms for the nondisabled group. No significant differences, however, were found on the adaptive behavior index between either of the sample groups and the disabled normative group. Further, sensorimotor scores for the hospital group were not significantly different than norms for the disabled group. On reactive behavior scores, differences between the home care and hospital groups and the disabled normative group were not significant. Lastly, no significant differences were found on self-initiated behavior scores between either the home care or hospital group and the disabled normative group. The children in the home care and hospital groups exhibited less optimal coping behavior than a normative group of children who were nondisabled. When compared with a group of children with disabilities, however, the children in the home care group demonstrated more optimal sensorimotor organization. No other significant differences between the normative group of children with disabilities and either the home care or hospital groups were found.

Summary

Six of the hypotheses tested in this investigation were partially supported. No significant relationships between interactional behavior and developmental outcome emerged, but significant positive relationships between interactional behavior and coping behavior were found for both groups. In
addition, significant relationships between categories of coping behavior and areas of developmental outcome were found for both the home care and hospital groups. Only the findings for the hospital group were in the expected direction, however. Exploratory behavior and developmental outcome were related for the home care group, while exploratory behavior was associated with interactive behavior for the hospital group. Positive relationships between exploratory and coping behavior were found for both groups. Significant relationships were also found between family involvement and developmental outcome for the hospital group. While no relationships between quality of the home environment and developmental outcome were found for the home group, relationships were found for the hospital group. For both groups, interactive and coping behavior were associated with characteristics of the caregiving environment. Finally, interactive effects were evident for both the home care and hospital group.

Three of the hypotheses in this study failed to be supported by the results. No significant differences were found between the groups on developmental outcome, interactive behavior, or coping behavior. Secondly, for neither group were significant differences in development and behavior revealed for different temperament clusters. Lastly, results showed that birth weight was not
significantly related to children's developmental outcome, interactive behavior, or coping behavior.

Further analyses revealed significant differences between diagnostic categories on selected health factors. Further, an examination of relationships between temperament dimensions and selected health, environmental, and child-based factors revealed significant associations for both the home care and hospital groups. Relationships were found between exploratory/play behavior and selected independent variables as well. In addition, the level of family involvement was related to socioeconomic status and maternal age. Characteristics of the caregiving environment were found to be related to temperament dimension ratings, exploratory behavior, socioeconomic status, and maternal age. Relationships between maternal/caregiver interactive behavior and infant interactive behavior, maternal age, and socioeconomic status also emerged. Frequency of participation in early intervention programming was associated with developmental outcome and coping behavior. Moreover, level of technology and length of hospitalization were related to developmental outcome. Finally, significant differences were found between study groups and normative samples on developmental outcome, interactive behavior, and coping behavior.
CHAPTER V
DISCUSSION AND RECOMMENDATIONS

Introduction

The purpose of this study was to investigate developmental outcome, interactive behavior, and coping behavior of infants and toddlers who are technology dependent. Furthermore, child-based factors, specifically, temperament and exploratory/play behavior were examined as having a potential effect on development and behavior. Environmental factors, such as level of family involvement and qualities of the residential environment, and a health factor, birth weight, were also explored to determine their impact upon development and behavior. Finally, possible interactions between child-based, environmental, and health factors as they affect developmental outcome and behavior were examined.

The vulnerability/resiliency framework (Rutter, 1979; Garmezy, 1981; and Werner & Smith, 1982) guided this research. This theoretical framework is based upon observations that individuals who had experienced potentially detrimental circumstances early in their lives
were able to emerge with minimal negative consequences. Risk and protective factors have been utilized in the development of a framework for the prediction of physical and psychological health (Holahan & Moos, 1987). Risk assesses life circumstances and person-related factors which are associated with increased physical and psychological vulnerability. Protective factors involve person based strengths or the availability of environmental resources and have an important role in maintaining health despite stressful life events.

The interplay of stressful events and protective factors is continual, therefore, physical and psychological health is impacted by an ever changing balance between stressful events which serve to increase vulnerability and protective factors which serve to increase an individual's resilience.

Two groups of infants and toddlers who are technology dependent comprised the study sample. Children in both groups were under the age of three and had been diagnosed with an illness/condition which impacts respiratory functioning, thus necessitating various forms of technological life support, including oxygen support, a tracheostomy tube, continuous positive airway pressure (CPAP), or mechanical ventilation for at least a part of each day. Furthermore, the children were considered medically stable, had at least minimal visual and auditory
capabilities, and had no greater than a grade II intraventricular hemorrhage. The children in the home care group (n=14), resided in a home setting, either the home of their birth parents or the home of foster parents. The infants and toddlers in the hospital group (n=16), resided in a children's rehabilitation hospital.

The research instruments utilized include a developmental outcome measure (the BDI), an interactive behavior measure (the IRS), a coping behavior measure (the ECI), a measure of temperament (the RITQ or TTS), a measure of exploratory/play behavior, and a measure of qualities of the home environment (HOME). In addition, demographic information, medical information, and family involvement information were obtained.

This chapter is divided into three sections. The first section includes a discussion of the findings in the study. A summary follows, and lastly, implications and recommendations are considered.

Discussion of the Findings

Sample characteristics. The study groups were similar only on a limited number of characteristics. Both the home care and hospital groups were comprised primarily of male children and singleton births. In both groups, however, nearly one-third of the children were twins, while in the general population less than 1% of all births are twin
births. Many twins are born preterm and are of low birth weight; it is not surprising that the proportion of twins in these two groups of technology dependent children is relatively high. Many of the children in the study groups also were of low gestational age and low birth weight. The mean age of the children in the two groups was also similar (i.e., 13 and 15 months). A final similarity was in the length of time in the current residence (i.e., the home or hospital setting), with means of 203 and 175 days for the study groups.

While similarities between the groups existed, several significant differences between the groups were also evident. The children in the hospital group had significantly lower gestational ages (mean gestational ages for the home care and hospital groups of approximately 31 and 28 weeks). Children in the hospital group also were of lower birth weight than children in the home care group, although the difference was not statistically significant (mean birth weights were 1787 and 1042 grams). In addition, the groups differed in racial make-up. While the majority of the children in the hospital group were African-American, the majority of the children in the home care group were Caucasian. Differences between the groups in their technological life support requirements also were evident; the children in the hospital group required proportionately more sophisticated technology. Thus, the children in the
hospital group appeared to be more medically fragile than children in the home care group. In terms of diagnosis, the groups differed as well; the hospital group was comprised of proportionately more children with bronchopulmonary dysplasia (BPD) than the home care group. Lastly, the groups differed in length of hospitalization. With a mean of 209 days for the home care group and 463 days for the hospital group, the children in the hospital group had experienced significantly longer hospitalizations than the home care group.

The families of the children comprising these two groups also differed. The mothers in the home care group were significantly older than the mothers of children in the hospital group (mean ages of 29 and 21 years). Significant differences in marital status and socioeconomic status also were revealed. The majority of the mothers in the home care group were married while in the hospital group, most mothers had never been married. In addition, the families of children in the home care group were generally of higher socioeconomic status than the families of children in the hospital group. Thus, the families of children residing in the hospital setting, based upon the younger age of the mothers, their never married status, and their lower socioeconomic status had available to them less resources for parenting a child who is technology dependent. Taking their medically complex child home given their current
situation may have been overwhelming for them. Medical, socioeconomic, and maturity factors determined whether children remained in hospital care or were discharged to a home setting. The only demographic similarity found between the families was in the number of other children in the family's home. In both groups, the majority of the families had one or no additional children living in the home.

Temperamental characteristics. The home care and hospital groups were similar in the distribution of temperament clusters. Within the home care group, half of the children were classified as being either easy or difficult in temperament, while the remaining children were in intermediate temperament categories. Slightly less than half of the children in the hospital group were categorized as either easy or difficult; the intermediate temperament classifications accounted for the rest. None of the children in either group were considered slow-to-warm-up. In the original New York Longitudinal Study sample, 40% of the children were described as having an easy temperament, 10% were described as being difficult, 15% were slow-to-warm-up, and the remaining 35% were characterized as intermediate (Thomas, Chess, & Birch, 1963; Carey, 1970). Fewer of the children in the study groups were described as easy or slow-to-warm-up than the children in the original temperament research, and a greater percentage were of difficult temperament or grouped in the intermediate categories.
Differences in distribution of temperament categories may be related to neurophysiological factors. In addition, such factors may have interacted with environmental factors. Furthermore, the groups were similar in terms of their rating on each of the temperament dimensions except the dimension of mood. The children in the hospital group were rated significantly more negative in mood than the children in the home care group. This finding, too, may be explained by the interaction of a child's unique neurophysiological characteristics with elements of the caregiving environment. The hospital environment, with its nonnormative and potentially detrimental features, may have a negative effect upon mood. The home environment, thought to be more supportive than an institutional setting, may serve to impact mood in a positive direction.

Exploratory/play behavior. The home care and hospital groups were similar in exploratory behavior demonstrated by the children. The most common level of exploratory behavior observed in both groups was simple manipulation. Many of the children engaged in visually guided manipulation during the observational assessment, such as turning a toy over or touching and looking at an object. Few children in either group engaged in any pretense play behavior. Belsky and Most (1981) also noted a high incidence of simple manipulation in their study of free play behavior in infants between 7 1/2 and 21 months of age and who are typically
developing, although greater frequencies of pretense behavior were evident in their sample of children than in the current study. Belsky and Most (1981) found that exploratory behavior follows a developmental sequence. In the sample of Belsky and Most (1981), which included children following a typical course of development, simple manipulative behavior was predominant in younger children. Older children demonstrated a wider variety of behaviors, including pretense behavior. In children developing atypically, the sequence appears to be the same, although the progression may be slowed (Marino, 1988). Therefore, the predominance of simple manipulative behavior and the rare demonstration of pretense behavior in the sample groups may be a function of their developmental delay. In addition, exposure to nonnormative caregiving environments may also explain the findings. Opportunities for exploration and play in such environments may be limited, thus limiting children's development of exploratory behavior.

Characteristics of the caregiving environment.

Significant differences were found between the caregiving environments of the home care and hospital groups. Children in the hospital group were involved in early intervention programming five times weekly, while most children in the home care group were involved only one to two times a week. A comparison of means on the HOME total score reveals that
the home environments were significantly more supportive of children's development than the hospital environment. The majority of the subscale scores for the home care and hospital groups, too, were significantly different, with greater parent/caregiver responsivity, acceptance of the child's behavior, availability of play materials, and variety in daily stimulation evident in the home than in the hospital environment. The two environments did not differ in the organization of the physical and temporal environment or in the involvement of parents/caregivers with the child. In support of these findings, Embon (1991), suggests that more appropriate types and levels of stimulation are available to children in home care environments than in hospital environments. Sights, sounds, and interaction with both physical and social aspects of the environment may be more easily controlled within a home setting than a hospital setting. Furthermore, individualized attention from family members and a limited number of home care nursing staff may contribute to developmental and behavioral progress. The fact that the two groups were similar in terms of the organization of the environment and involvement with the child might be expected. Given the complexity of care and the amount of equipment necessary in the care of children who are technology dependent, careful organization of the caregiving environment is essential. Moreover, due to the medically fragile status of the children in both groups,
careful involvement with and monitoring of the child and the child's activities is necessary, regardless of the environment in which the child receives care.

In summary, similarities between the children in the home care and hospital groups were limited; only gender composition, birth status, age, time in current residence, distribution of temperament classifications, and exploratory/play behavior demonstrated were comparable. The families of the children were similar only in the number of other children within the parents' or foster parents' home. Lastly, the groups' caregiving environments were comparable in organization and parent/caregiver involvement.

Differences between the study groups, however, were numerous. The children in the hospital group had lower gestational ages and birth weights than those in the home care group, and were predominantly African American. Furthermore, more of the children in the hospital group had bronchopulmonary dysplasia and required higher levels of technological support and longer hospitalizations than children in the home care group. The mothers of children in the hospital group were younger and of lower socioeconomic status than mothers of children in the home care group. Moreover, the majority of the mothers of children in the hospital group had never been married. Finally, environmental differences were marked; children in the hospital group participated in more early intervention
programming. Responsivity of caregivers, the degree of acceptance of children's behavior, variety in stimulation, and the availability of play materials were less for the hospital group than the home care group.

**Findings related to the hypotheses.** Nine hypotheses were tested to determine (1) differences between the home care and hospital groups on the dependent variables: developmental outcome, interactive behavior and coping behavior; (2) relationships between the dependent variables; (3) relationships between selected independent variables and the dependent variables; and (4) interactions between child-based, environmental, and health factors which potentially influence developmental outcome, interactive behavior, and coping behavior.

It was first hypothesized that the home care and hospital groups would be significantly different in terms of developmental outcome, interactive behavior, and coping behavior. The results of analyses indicated no support for this hypothesis. The home care and hospital groups were similar in terms of developmental outcome, interactive behavior, and coping behavior.

Previous studies of children in institutional settings have suggested that the environment and experiences to which children are subjected within an institution are detrimental to children's development and behavior (Provence & Lipton, 1962; Spitz, 1945). Studies of caretaking in intensive care
environments reveal that most staff contacts with infants were task-oriented and involved medical nursing care rather than pleasant social activities. Young children studied were approached infrequently for the purpose of vocalization, social handling, touching, or rocking (Linn, Horowitz, Buddin, Leake, & Fox, 1985). It was suggested that children enduring such experiences are at increased risk for dysfunctional parent-infant interactions (Marton, Dawson, & Minde, 1980). Thus, it might be expected that those children in the hospital group, who had experienced longer hospitalizations and had essentially never known a traditional "home" would be characterized by a significantly less optimal developmental outcome than children who live in a traditional home setting with parents or foster parents. Because the two groups did not differ substantially, it may be that the environment and experiences of children in this particular institution have been successfully modified to lessen adverse effects on the children. Characteristics of and experiences within the hospital may have served a protective function for the children in the hospital group. This children's rehabilitation hospital was designed to provide appropriate psychosocial as well as medical care. Specifically, individually designed opportunities for exploration, play, and interaction with adults and other children were provided. Specially designed play environments were available to all children, and rather than
being restricted to their beds, play spaces on the floor were created. With an environment designed to be supportive for development, children have the opportunity to progress developmentally and behaviorally.

For children living in a home setting, it might be expected that developmental and behavioral progress would occur most effectively here. It would seem that overstimulation can be more effectively controlled in a traditional home environment, and both medical and psychosocial care can be more easily individualized. Finally, family and caregiver support is likely to be more consistent in a home setting than in a health care facility (Embon, 1991). Yet, in a home setting, various factors may impact upon a child's actual progress, including the family's ability to read the child's behavioral cues and to respond contingently to those cues. The availability of external support systems (e.g. early intervention programming, family support groups, support from extended family and friends, respite services, and home nursing care) may also influence a child's development and behavior. Factors such as these may either lessen or facilitate the potential positive impact of a home as opposed to a hospital setting.

It was secondly hypothesized that for both groups, interactional behavior would be positively related to both developmental outcome and coping behavior. This hypothesis
received partial support; significant relationships were found between interactive behavior and coping behavior for both groups. Thus, as expected, children in both groups who demonstrated weaker interactive skills were also coping less effectively. Children who have developmental delays appear to have a more limited repertoire of responses and are often deficient in their capacity to elicit and maintain social interaction (Brazelton, 1979). Similarly, young children who are developmentally delayed have fewer resources for achieving adaptive coping behaviors (Zeitlin & Williamson, 1988).

For neither group, however, was interactive behavior related significantly to developmental outcome. This finding contrasts with the results of research which indicates that competence in social interactions is associated with mental test performance (Bradley & Caldwell, 1976; Beckwith & Cohen, 1980). It may be that factors, such as experiences within the environment and the child's illness/condition impact developmental outcome and interactive behavior differentially. This explanation is supported by analyses associated with this investigation which indicated that for the home care group aspects of the environment greatly influenced interactive behavior but not development. For the hospital group, limited aspects of the environment impacted development and interactive behavior. In addition, the level of technology required by the
children in both groups influenced development but not interactive behavior.

The third hypothesis stated that a positive relationship would be found between coping behavior and developmental outcome. Results indicated partial support for this hypothesis. The findings for the two groups differed substantially. For the home care group, two significant relationships were revealed, although in a negative rather than a positive direction. Surprisingly, more optimal coping behavior, particularly in the category of self-initiated behavior, was associated with less optimal fine motor development. It may be that the more supportive home environment positively impacts the child's ability to initiate action upon the environment while having a less salient effect upon fine motor development. Further, the development of fine motor skills may require carefully focused attention and programming which may not be as much of a priority due to competing caregiving demands. In addition, parents/caregivers may not have a good understanding of the attention and programming needed to assist the child's fine motor development.

An alternative explanation is that the severity of the child's illness or condition may affect developmental outcome to a greater extent than coping behavior. Therefore, a child whose condition is more severe may be developing less optimally but may nonetheless be able to
cope effectively with environmental demands. This explanation is supported by analyses of the data which reveal that the level of technology required by a child significantly impacts development but negligibly affects coping ability.

For the hospital group, more optimal coping behavior was associated with more optimal developmental outcome, although only the relationships between reactive behavior and fine motor development and between overall coping behavior and cognitive development were significant. It seems that elements in the rehabilitative hospital environment impacted coping behavior and development in similar ways. Intensive individualized intervention by specially trained pediatric staff may have positively affected the children's ability to cope with environmental demands as well as their development.

An alternative explanation is that for children in the hospital environment to advance developmentally, particularly in the areas of fine motor skills and cognition, more optimal coping behavior was necessary. Good coping ability, possibly fostered through participation in early intervention services, may have allowed these children to effectively handle the numerous stressors associated with a hospital setting (i.e., numerous caregivers, high levels of sensory stimulation) and progress developmentally despite potentially harmful environmental characteristics.
A fourth hypothesis tested in this study was that children of easy temperament would achieve more optimal developmental outcome, interactive behavior and coping behavior than children of other temperament clusters. No differences in developmental outcome or behavior were found for different temperament clusters, therefore this hypothesis failed to be supported.

These findings contrast with results of previous work which suggest that temperament, particularly the infant's sociability, is correlated positively with performance on tests of cognitive development (Lamb, 1982). Moreover, another dimension of temperament, activity level, was related to cognitive performance in a study by Matheny and Brown (1971). It was reported that twins higher in activity level tended to have lower IQ's than less active twins at four years of age. Level of activity was a positive predictor, however, for children who received care in institutional environments (Rutter, 1983). Active infants were less likely than inactive infants to show the slowed development that is often associated with institutional deprivation.

Limited research on the role of temperament in coping with stressful events and circumstances has been conducted. One study focused upon children's responses to the birth of a sibling (Dunn, Kendrick, & MacNamee, 1981). Results
indicated that the child's temperament significantly predicted changes in behavior after the birth of a sibling.

Previous work, however, has focused upon healthy children following a typical course of development. For young children who are technology dependent, therefore, it may be that other factors influence development and behavior to a greater extent than the child's temperament. Health factors, such as the severity of the child's illness or condition, or specific environmental factors may play a major role in the determination of developmental progress and behavior, thus lessening the effect of the child's disposition. Support for this explanation exists, for results of this study showed that the level of technology required impacted development. Moreover, characteristics of the caregiving environment affected development as well as interactive and coping behavior.

The hypothesis that a child's exploratory/play behavior is positively related to developmental outcome and behavior was partially supported by the findings. Results indicated differences between the home care and hospital groups in how exploratory behavior is associated with development and behavior.

For the home care group lower levels of exploratory/play behavior were unexpectedly associated with more optimal overall developmental outcome, as well as more optimal outcome in the personal social, gross motor, fine
motor, and communication domains. These findings contrast with results of other studies which indicate that play behavior is a predictor of cognitive and language ability (Marino, 1988). Moreover, Hill and Nicolich (1980), in a study of toddlers with Down syndrome, found that performance on a play scale was positively related with performance on the Bayley Mental Development Index. According to Jennings et al. (1979), exploratory play is thought to reflect the current level of cognitive functioning.

Given the contrasts between the findings of this study and of previous work, for the children in the home care group, it is possible that parents and caregivers focus on developing and eliciting specific skills rather than providing opportunities for and encouraging solitary exploration and play with toys. Thus, the repertoire of schemas that a child has for exploring objects in the environment may be limited.

For the hospital group, the level of exploratory behavior was related in the expected direction to interactive behavior. Higher levels of play behavior were associated with more optimal interactive behavior. It seems that exploratory and interactive behavior are impacted similarly for children in this group. The child who has developed successful strategies for handling the physical environment also is more likely to have developed effective strategies for handling the social environment. It may also
be that in the rehabilitation hospital setting interaction with both the physical and social environments receives focus by parents, caregivers, and therapists. In the home care setting a significant relationship between exploratory and interactive behavior was not revealed. Possibly in this setting the priorities of parent and caregivers of individual children varied. The development of higher levels of exploratory and interactive behavior may have been afforded differential attention according to these priorities and possibly the resources available.

For both groups, higher levels of exploratory/play behavior were associated with more optimal coping behavior. It seems, then, that children who have the ability to interact with the environment in more sophisticated ways also have the ability to cope with environmental demands more effectively. Thus, more advanced exploratory behavior may be viewed as a protective factor which has a role in optimizing a child's ability to adapt to the environment. Factors operating within both caregiving environments appear to influence exploratory and coping behavior similarly.

Another hypothesis of the study was that for the hospital group, level of family involvement is positively related to developmental outcome, interactive behavior, and coping behavior. The results indicated partial support for this hypothesis. While all correlations were in a positive direction, the level of involvement was significantly
related to select aspects of developmental outcome but not to either interactive or coping behavior. More family involvement was associated with more optimal adaptive and communication skills. Both of these developmental domains may require more intensive interaction with adults than other areas of development in order to achieve progress. The time spent in therapeutic or early intervention sessions may not be sufficient for sustained progress in these areas of development. Time with family members may serve as supplemental time which successfully enhances children's abilities. An alternative explanation is that for children in the hospital group, family members focus their interactions with their children to a greater extent on aspects of adaptive and communicative behavior.

A seventh hypothesis was that the quality of the environment in which the child resides is positively related to developmental outcome, interactive behavior, and coping behavior. This hypothesis, too, was partially supported by the results, and differences between the groups were evident.

For children in the hospital group, but not in the home care group, aspects of the environment appeared to significantly impact developmental outcome. Specifically, the variety in daily stimulation appeared to exert an effect upon developmental outcome. Greater variety was associated with more optimal overall developmental outcome, as well as
development specifically in the personal social, adaptive, and communication domains.

Prior research indicates that certain types of experiences are important for optimizing children's behavior and development (Elardo, Bradley, & Caldwell, 1975). Wachs, Uzgiris, and Hunt (1971) found certain elements of the environment to be consistently related to infant development. Similar to the findings in the current research, Wachs et al. (1971) reported that the intensity and variety of stimulation were most strongly related to developmental outcome, although in a negative direction. Thus, unlike in the present study, intensity and variety of stimulation was associated with less optimal developmental outcome, suggesting the harmful effects of overstimulation.

For the home care group, various elements of the home environment were related to interactive behavior. More specifically, greater overall environmental quality, as well as greater verbal and emotional responsivity of the parent, attention to the provision of appropriate play materials, parent involvement with the child, and variety in daily stimulation were associated with more optimal interactive behavior. For this group, greater attention to aspects of both the physical and social environment appear to be important to the development of a child's interactive skills. Greater parental involvement and responsivity provide children opportunities for engaging in interactions
which are sensitive to the child's needs and behavioral
cues, thus maximizing the child's development of
interactional skills. As Field (1979) discusses, positive
and harmonious interactions between a caregiver and a child
feature the caregiver slowing down, exaggerating and
repeating their behaviors, contingently responding by
imitating or highlighting the child's behavior, taking turns
or not interrupting the child, and respecting the child's
need for an occasional break from the interaction. The
infant in such an interaction is typically described as
looking attentive and sounding content, thus exhibiting
desirable interactive behavior.

In addition, the provision of appropriate play
materials and variety in daily stimulation may be related to
the level of interactive behavior in that sensitive
attention to these aspects of the environment may prevent or
decrease sensory overload and subsequent withdrawal by the
infant.

For the hospital group, only the organization of the
physical and temporal environment was related to interactive
behavior. More attention to the organization of the
environment was associated with more optimal interactive
behavior. Here, too, sensitive organization of the
environment may decrease the likelihood of sensory overload
and the infant's withdrawal from the physical and social
environment.
For the home care group, more optimal overall coping behavior was associated with greater parental involvement with the child, greater attention to the provision of appropriate play materials, and a higher quality home environment overall. The quality of the environment appears to impact a child's overall ability to cope with environmental demands. Sensorimotor organization, too, is impacted significantly by qualities of the environment, particularly the level of parental involvement, availability of appropriate play materials, and the physical and temporal organization of the environment. Finally, self-initiated behavior was significantly affected by both parental involvement and the quality of the environment taken as a whole. According to Murphy and Moriarty (1976), the acquisition of effective coping behavior is influenced by environmental demands, the child's experience in managing these demands, and the environmental response to the child's coping efforts.

For the hospital group, limited aspects of the institutional environment seemed to exert important effects upon coping behavior as well. The emotional and verbal responsivity of the caregiver seemed to significantly influence both reactive behavior and self-initiated behavior. The more responsive the caregiver, the more optimal were the child's reactive and self-initiated behavior. Reactive behavior is closely dependent upon
environmental cues (Zeitlin & Williamson, 1988), and sensitive caregiving can make it possible to tailor the environment so that the child may respond to the demands of the environment in an adaptive fashion. Self-initiated behaviors are self-directed actions used to interact with objects and people (Zeitlin & Williamson, 1988), and through sensitive caregiving the environment can be structured in such a manner that the child will be motivated to interact with aspects of the environment rather than withdraw due to overstimulation.

The eighth hypothesis was that birth weight is positively related to developmental outcome, interactive behavior, and coping behavior for both the home care and hospital groups. This hypothesis received no support from the findings. Birth weight in isolation seemed to exert no significant effect for either group on development or behavior. For infants and toddlers in the two groups included in the current study, it seems that other factors exerted a more important effect on developmental outcome, interactive behavior, and coping behavior than birth weight. Some researchers have indicated that birth weight is an important predictor of developmental outcome (Bennett, Robinson, & Sells, 1982; Ludman, Halperin, Driscoll, Driscoll, & Belmont, 1987). The results of this study, however, support the conclusions of many investigators that other biomedical and sociodemographic factors exert a more
important influence on behavior and development than birth weight (Meisels, Plunkett, Roloff, Pasick, & Stiefel, 1986; Meisels, Plunkett, Pasick, Stiefel, & Roloff, 1987; Luchi, Bennett, & Jackson, 1991).

It was finally hypothesized that selected child-based, environmental, and health factors interact to determine developmental outcome, interactive behavior, and coping behavior. Partial support for this hypothesis was found, and it appears that interactive effects differed between the home care and hospital groups. For the home care group, no significant interactive effects on developmental outcome emerged, although such effects on interactive and coping behavior were found. The effect of the overall quality of the home environment on interactive behavior was dependent upon a child's temperament classification. Thus, child-based and environmental factors operated together to impact interactive behavior. In addition, the effect of environmental quality on interactive behavior was dependent upon the child's birth weight. Furthermore, the effect of the quality of the child's environment on interactive behavior was dependent upon both birth weight and the level of technology required for life support by the child. Thus, health and environmental factors coacted to influence interactive behavior. While the main effects of temperament cluster and birth weight were not predictive of interactive behavior, when these factors were considered together with
the overall quality of the home environment, interactive behavior could be predicted.

Also for the home care group, the effect of the level of exploratory behavior on overall coping behavior was dependent upon birth weight. Here, too, the main effect of birth weight was not predictive of coping behavior, but coping behavior could be predicted by considering the interaction of birth weight and exploratory behavior. Thus, health factors and child-based factors acted together to determine coping behavior in the home care group.

For the hospital group, significant interactive effects on developmental outcome, interactive behavior and coping behavior were found. For this group, temperament (a child-related factor) and family involvement (an environmental factor) interacted to determine overall developmental outcome. While temperament alone was not predictive of developmental outcome, temperament in conjunction with the level of family involvement was predictive of developmental outcome. For this group, child-related and environmental factors interacted to determine overall developmental outcome. It appears that the determination of developmental outcome is a complex matter in which multiple factors must be considered together, thus the individual contribution of any one factor may be lessened.

The effect of temperament on interactive behavior was dependent upon birth weight of the child. Secondly, the
impact of level of exploratory behavior upon interactive behavior was dependent upon birth weight. Third, the effect of exploratory behavior on interactive behavior was dependent upon both birth weight and the level of technology required by the child. Health factors and child-related factors appear to act jointly as they impact interactive behavior. While birth weight and temperament independently were not predictive of interactive behavior, together and with other child-related and health factors, they were predictive of interactive behavior.

Finally, the effect of the level of family involvement on overall coping behavior depended upon the level of exploratory behavior demonstrated by the child and the level of technological life support required by the child. While the level of exploratory behavior in isolation was related to overall coping behavior, the family involvement and the level of technology required were not significantly related. The interaction of the three factors, however, was predictive of overall coping behavior.

**Findings of additional analyses.** Several significant relationships were found among the independent variables in the study. Findings indicated that children with bronchopulmonary dysplasia (BPD) and those with structural anomalies of the airway were different on selected health factors. Children with BPD were of lower gestational
ages, lower birth weights, and experienced longer hospitalizations. Bronchopulmonary dysplasia is a chronic lung disease which is known to affect primarily premature infants. This disease often leads to a dependence on mechanical ventilation and requires extended hospitalization (Overstreet, Jackson, van Belle, & Truog, 1991).

The group of children having structural anomalies of the airway, however, is not comprised of infants with a single diagnosis, thus, this group may be less homogeneous than the group with BPD. While three of the children in this group had been diagnosed with Pierre Robin syndrome, the remaining four children in this group had not been specifically diagnosed. Parents and caregivers indicated that a genetic disorder or abnormality may be responsible for the anomalies seen in the children's airways. Rather than preterm birth and low birth weight, then, the children in this group are distinguished by the fact that a genetic disorder may be operating to impact the children's respiratory functioning. In such cases, lengthy hospitalizations were not as likely as for children who were born prematurely.

Relationships between temperamental characteristics and selected health, environmental, and child-related factors were found for both the home care and hospital groups. For the home care group, children of higher intensity exhibited higher levels of exploratory/play behavior. It may be that
children who respond to a situation or object with greater energy are more active in their exploration of their surroundings. Therefore, greater energy may be directed to expanding exploratory strategies.

Children in the home care group who were more distractible also exhibited higher level exploratory behavior. Possibly a child who can be more easily diverted from an ongoing activity can be exposed to other aspects of the environment and potential strategies for exploring those environmental features. With greater and more varied exploratory experience, higher level exploratory and play behavior may become a part of the child's repertoire.

Also with regard to the home care group, children with a higher threshold participated more frequently in early intervention programming. Children with higher thresholds require stimulation of a more intense level to evoke a response. It may be that early intervention services and therapy, which typically involve levels of activity and stimulation appropriate for an individual child, are structured in such a way that children's tolerance for activity and stimulation increases.

For the hospital group, children who were more active demonstrated higher levels of exploratory and play behavior. This seems logical in that a child who is active rather than passive is more likely to seek out opportunities for exploring the environment. Through more intensive
engagement in exploratory activity, children may learn to use a variety of strategies for acting upon the environment. A child's repertoire of explorative strategies could broaden through increased exploratory experience.

Also for the children in the hospital group, those who were the most adaptable had been hospitalized the longest. It seems that the ease with which a child appears to adapt to new situations may be a function of the amount of experience a child has within a hospital environment. Possibly with increasing time in a health care environment, children have more experience with change and consequently develop strategies for effectively adapting to such change. Another plausible explanation may be that increased experience with aspects of a health care environment, including frequently changing caregivers and often unpredictable exposure to new sights, sounds, and smells, may increase over time a child's level of tolerance for environmental stimuli.

Lastly, for the hospital group, children who had higher thresholds were those whose requirements for technological assistance were greater. Thus, for children who needed more sophisticated forms of technology, the intensity level of stimulation needed to evoke a response in the child was greater. It seems plausible that with increased levels of technology, the amount and intensity of stimulation to which the children are subjected increases. As a result of such
experiences children may develop a tolerance for higher levels of stimulation and an associated higher threshold.

Significant relationships between exploratory behavior and chronological age were found for both the home care and hospital groups. Children who demonstrated higher levels of exploratory and play behavior were older. This is not surprising as other researchers have found a systematic developmental sequence of exploratory behavior, which appears to be applicable in both the typical course of development and in atypical development (Belsky & Most, 1981; Fenson & Schell, 1986; Marino, 1988). In addition, a relationship between exploratory behavior and length of hospitalization was also found for the hospital group. Children who demonstrated the highest levels of play behavior were those that had been hospitalized for the longest periods. This finding may simply be an artifact of children's increasing age; the oldest children in this group also have been hospitalized for the longest periods. Moreover, as suggested earlier, play behavior follows a developmental sequence (Belsky & Most, 1981), thus it might be expected that the oldest children and, therefore, those who have experienced the longest hospitalizations, would demonstrate higher level exploratory and play behavior.

For the hospital group, it was found that the level of family involvement was positively related to socioeconomic status and negatively related to maternal age. Older
mothers and those of higher socioeconomic status maintained higher levels of family involvement with their hospitalized child than younger mothers and those of lower socioeconomic status. This might be expected, as it would seem that older mothers and those of higher social class have available to them more personal and economic resources for coping with the stressful nature of having a child who has a medically complex condition. In turn, these mothers might be more likely to maintain regular contact with their children. Younger and lower class mothers, with fewer emotional and economic resources, may perceive their child's illness or condition as overwhelming, which may result in the gradual decrease and possible cessation of involvement with their children who are technology dependent (Child Life in a Rehabilitation Hospital, 1985).

Relationships between qualities of the home environment and temperament dimension ratings were found for both the home care and hospital groups. For the home care group, parents of children demonstrating lower activity levels were more accepting of their behavior than parents of children with a high activity level. This might be expected, as less active children might be easier to care for. Secondly, parents of children having a more positive mood were more involved with their child. This finding is also not surprising, because involvement with children of a more positive mood might be perceived as more pleasant and
rewarding. Third, more distractible children experienced more organized home environments and more variety in stimulation. Possibly parents discovered that with a distractible child, careful organization of the environment was necessary for effective caregiving; the child had a role in shaping the environment. Alternatively, it may be that in a carefully organized environment children experience levels of stimulation which they can handle and in turn it may be easier to focus their attention on various aspects of the environment. In contrast, in an environment which is not organized in a manner respective of children's tolerance for stimulation, children may have a tendency to tune out or withdraw from the environment, which may make it difficult to focus their attention on desired elements within the environment. Moreover, in an environment characterized by variety, children's interests may be stimulated so that their attention may be easily diverted to activities and events taking place. In an environment devoid of variety, a monotonous environment, the child's interests may fail to be stimulated, possibly resulting in the child tuning out or withdrawing from the surroundings. Lastly, children who had access to more appropriate play materials had higher threshold ratings. Possibly, with the availability of play materials sensitive to the child's needs, the child may be receptive to more varied stimulation, increasing the child's tolerance. If play materials are inappropriate for the
child, successful experiences with various stimuli are less likely, possibly leading to decreased tolerance for stimulation.

For the hospital group, children who had access to more appropriate play materials demonstrated higher levels of exploratory behavior. It might be expected that toys and objects geared to a child's needs would make it possible for the child to engage in more exploration and play and thus increase the child's repertoire of exploratory strategies. Children who experienced more variety in stimulation, however, demonstrated lower levels of play behavior. It may be that there is an optimal level of variety in stimulation which allows the child to develop exploratory skills. Beyond that level, though, children may experience sensory overload, possibly contributing to withdrawal from stimulation. In such cases, children's exploratory and play behavior could be negatively impacted.

Also for the hospital group, children who experienced higher quality environments were more persistent and distractible than those whose environments were of lower quality. High quality environments may provide experiences for children which offer them success and are rewarding and interesting to the child, in that way increasing their persistence. In addition, an environment which is interesting and sensitive to the child's needs offers ample opportunities for exploration. The ease with which a
child's interest may be diverted to another appealing activity may be higher than in a monotonous or overwhelming environment. In the latter type of environment, the child may have a tendency to retreat from rather than seek stimulation.

For the home care group, mothers who were older were more likely to be responsive to and involved with their child than younger mothers. Further, the overall home environment provided by older mothers was of higher quality than the environment which children of young mothers experienced. It is possible that the level of maturity of older mothers and a greater level of experience and understanding of what is important for a child may influence them as they structure the environment in which they care for their children. Also for children in the home care group, mothers of higher socioeconomic status provided higher quality environments for their children. This is not surprising in that material and economic resources, which could improve the quality of a caregiving environment, may be more readily available to families of higher socioeconomic status. Furthermore, older mothers and those of higher socioeconomic status interacted more appropriately and sensitively with their infants. These mothers were likely to be more highly educated and possibly had a better understanding of their children's cues and how to respond to those cues.
The frequency of participation in early intervention programming for the home care group impacted significantly upon fine motor development and coping behavior. Children who participated more frequently in early intervention services evidenced less optimal fine motor development but more optimal coping behavior, reactive and self-initiated behavior. It may have been that the goals of early intervention for these children focused primarily on areas of development other than fine motor skills. Thus, despite more involvement in programming, less progress in this developmental domain was realized. The fact that more optimal coping behavior was associated with greater early intervention participation may indicate that services provided the children in the home group assisted children in developing adaptive coping strategies. Alternatively, given that early intervention often focuses on the child within a family unit, through the intervention sessions, parents may have gained skills in optimizing their child's ability to cope with the demands of the environment.

Higher levels of technological life support were associated with less optimal fine motor development for children in the home care group, and less optimal communication for children in the hospital group. The use of more sophisticated life support equipment is likely to restrict the child's mobility and active interaction with the environment. These restrictions appear to impact
negatively upon the development of fine motor skills and slow the developmental progress of children in the home setting. For children in the hospital group, those requiring more sophisticated technology had tracheostomies. A tracheostomy may significantly impact a child's ability to vocalize, thus negatively impacting expressive communication and communication ability in general.

For the hospital group, children who had been hospitalized for longer periods were developing less optimally in all areas except cognition. As discussed previously, the undesirable effects on development of long-term care in an institutional setting have been documented by Spitz (1945), Freud (1952), and Robertson (1958). The fact that the cognitive development of children in this group was not significantly impacted by length of hospitalization may be due to positive changes in the organization of caregiving in many modern health care institutions and the resultant programming available to patients. Programming may serve to positively influence children’s cognitive development, thus offsetting the potential negative effects of long-term hospitalization.

For children in the home care group, those who had experienced longer hospitalizations were found to demonstrate more optimal reactive behavior. It may be that, over time, elements of the environments in which they received care, caregiving strategies, or child-based factors
were operating to optimize the children's coping in the realm of reactive behavior.

**Comparisons between study groups and published norms on developmental outcome, interactive behavior and coping behavior.** It is notable that for children in both study groups, developmental outcome scores were extremely low (scores ranking at no greater than the sixth percentile). Further, the average overall skill level for both groups was approximately five months. Based upon ages corrected for prematurity, the average overall developmental lag was approximately seven months for the home care group and eight months for the hospital group. For the infants and toddlers studied, regardless of whether they live in a home or hospital setting, significant developmental delays were prevalent. Comparisons on developmental outcome between the study groups and published norms (Newborg et al., 1984) indicate that children in both groups were developing less optimally than children in the normative sample. Given often lengthy hospitalizations in nonnormative, often overstimulating environments and decreased levels of energy and low stamina associated with the child's illness or condition, significant developmental delays found for the study groups do not seem surprising.

The ratings of interactive behavior demonstrated by subjects during a brief, unstructured, face-to-face interaction with a parent or familiar caregiver indicated a
moderate level of interactive skill for both groups of subjects. When ratings for the groups were compared with results from previous research (Field, 1980b), it was found that children in the study groups evidenced significantly less optimal interactive behavior than either full-term or healthy preterm infants. It may be that the interactive skills of the children in the study groups have been adversely affected by noncontingent interactions with caregivers. Contingent care by parents or caregivers is made more difficult by technological life support equipment, such as tracheostomies (Goldberger, 1988a). Within hospital settings, particularly intensive care settings, the frequent occurrence of noncontingent and intrusive interactions has been observed clinically (Goldberger, 1988a) and supported by empirical work (Marton, Dawson, & Minde, 1980).

Furthermore, studies of high-risk infants indicate interaction deficits in the form of relative unresponsiveness to social stimulation (Field, 1977). This unresponsiveness has been found to be characterized by gaze aversion, squirming, and fussing (Field, 1979). As suggested by Field (1979), high risk infants may experience greater information processing demands placed on them by caregivers responding noncontingently to the them, which may result in unresponsive behavior. It may also be that the high risk infant is less able to process animate stimulation (Field, 1979).
In terms of coping behavior, scores for both the home care and hospital groups are indicative of situationally effective behavior in general, although scores in the self-initiated behavior category represent minimally effective behavior with effective behaviors in a limited number of situations. In comparisons of the study groups and a nondisabled normative group (Zeitlin & Williamson, 1988), results revealed that children in both the home care and hospital groups demonstrated less effective coping behavior than children without disabilities. When comparing study groups with a disabled normative group, however, coping behaviors were similar across groups in all categories of coping behavior but one. Surprisingly, more optimal sensorimotor organization was found for children in the home care group than for children in the disabled normative group. Possibly, parents/caregivers of these children modified the environment and caregiving strategies in ways which promoted more optimal sensorimotor organization than parents of children in the disabled normative group.

In general, the coping behavior of the infants and toddlers studied may have been adversely affected by the intensity of the acute care settings in which these children received care during the early weeks or months of their lives. While all categories of coping behavior were likely to be affected, self-initiated behavior was likely to be the most significantly affected. Few opportunities may have
existed for initiation on the part of the infants. The NICU (Neonatal Intensive Care Unit) routine is typically one in which infants are acted upon, often noncontingently (Goldberger, 1988a). Further, the infants may experience various levels of restriction by health care staff, thus discouraging infants' initiation of behavior. In addition, their illnesses or conditions may render children with complex medical needs less able than nondisabled children to initiate behavior due to decreased stamina and energy. Brinker and Lewis (1982) suggested that constitutional differences in children with chronic conditions or disabilities, and the effect of these differences on interactions with the social and physical environment, often result in the children's assumption of passive roles rather than active autonomous roles.

The similarity in coping behavior for the study groups and the norms for disabled children may be due to the fact that each group was comprised of children whose handicaps ranged from mild through severe. Disabilities, regardless of the nature, may impact selected aspects of coping similarly. In the area of sensorimotor organization, however, it may be that for the home care and disabled groups, aspects of caregiving or environmental characteristics acted to differentially influence behavior.
Findings in Relation to the Vulnerability/Resiliency Framework

According to the vulnerability/resiliency framework, physical and psychosocial health is influenced by the interplay of various risk and protective factors. For the infants and toddlers studied, such factors were identified within the context of this investigation. For children within both the home care and hospital groups, the requirement for more sophisticated technological life support was a risk factor and thus increased children's vulnerability for significant developmental delays. Interactive and coping behavior, however, were not as likely to be negatively impacted by higher level technological needs. For children within the hospital group, a second risk factor which was revealed in this study was the length of hospitalization; longer hospitalizations increased children's likelihood of significant developmental delays although not of interactional or coping difficulties.

For both groups, factors which served a protective function relative to development and behavior were also revealed. Such factors played an important role in optimizing developmental and behavioral outcomes. For children in the home, a high quality caregiving environment, in which caregivers were emotionally and verbally responsive, appropriate play materials were accessible, caregivers maintained a high level of involvement, and
variety in daily stimulation was provided, was protective of children's interactive behavior. Infants and toddlers in environments with such qualities evidenced more optimal behavior during face-to-face interactions. Specific elements of a high quality caregiving environment, including access to appropriate play materials and a high level of parental involvement, were also protective of coping behavior. In addition, greater access to early intervention services was a protective factor which positively impacted children's ability to cope with the demands of their environments.

For children within the hospital group, a high quality environment, particularly one which included variety in stimulation, and a high level of family involvement served a protective function with regard to developmental outcome. Finally, a caregiving environment which was well organized was protective of interactive behavior, while a verbally and emotionally responsive primary caregiver played a role in optimizing coping behavior.

Summary

Despite significant differences in demographic characteristics, health status, and caregiving environments, the two groups of children studied did not differ in developmental outcome, interactive behavior, or coping behavior. This finding contrasts with findings of other
researchers which suggest that an institutional environment negatively impacts behavior and development while a home environment provides a positive influence. It is possible that the physical and social environment, the children's experiences, and the access to early intervention services within the hospital setting mitigated the potential negative effects of low socioeconomic status, having a young mother, and complex technological needs. For children in the home care group, it may be that various factors were operating to lessen the potential positive impact of a home environment.

Nevertheless, these children were not developing typically. Comparisons between children in the study groups and those studied by others revealed significant differences. Developmental outcome scores and interactive behavior ratings for children in both study groups were significantly lower than norms for typically and atypically developing children. Coping behavior of children in the study groups was less effective than that of children in a nondisabled comparison group but similar to coping behavior of children in a disabled group. Overall, the infants and toddlers studied were significantly developmentally delayed, did not engage in skillful social interaction, had difficulty in coping with the demands of their caregiving environments, and were passive in interactions with their surroundings.
An examination of relationships between interactive behavior and coping behavior, as well as between exploratory behavior and coping, indicated similarities for the two groups. Children who were able to interact skillfully during face-to-face contact with a parent or caregiver also were able to cope effectively with environmental demands. Moreover, children who used more sophisticated strategies for exploring their surroundings also possessed good coping skills. It seems that health, child-related, and environmental factors influenced these forms of behavior in comparable ways within the groups.

Temperamental characteristics seemed to affect exploratory and play behavior to an extent for both the home care and hospital groups. In the home care group, children high in intensity, who responded with greater energy to events or objects, and those who were distractible demonstrated more sophisticated techniques of exploring play objects. In the hospital group, infants and toddlers who were more active engaged in more complex play with toys and objects.

The quality of the caregiving environment, also, influenced interactive behavior and the child's coping abilities within both the home care and hospital groups. For children in the home, those who experienced responsive caregiving and a high level of parental involvement, had access to play materials, and were exposed to a variety of
opportunities were more skillful in social interactions with a caregiver. Also for this group, children who had access to appropriate toys and whose parents maintained a high level of involvement were able to adapt more effectively to their environments. Moreover, the quality of the caregiving environment was influenced by both maternal age and socioeconomic status, such that older mothers and those of higher social class structured an environment more supportive for developmental and behavioral progress than younger mothers and those of lower socioeconomic status. Thus, children of older mothers and those of higher social class were likely to experience higher quality caregiving environments, and, therefore, were likely to exhibit more skilled interactive and coping behavior. Finally, access to early intervention services, while not significantly influencing interactive behavior, played an important role in optimizing children's ability to adapt to environmental demands. Children who participated more frequently in such programming demonstrated more effective coping behavior.

For children in the hospital, those whose caregiving environment was well organized interacted more optimally in face-to-face contact. Furthermore, hospitalized children whose caregivers were responsive to their cues and needs were better able to cope with the various demands of the hospital environment.
The relationships between developmental outcome and coping behavior, however, differed for the home care and hospital groups, as did the associations between developmental outcome and exploratory/play behavior. For the home care group, infants and toddlers with less skillful fine motor development were unexpectedly coping more effectively with their environments. In addition, children with more delayed personal social, gross motor, fine motor, and communication skills were utilizing more complex exploratory techniques during play with toys. Within the hospital group, however, as expected, children with more functional fine motor and cognitive skills were showing better coping abilities.

Different factors appear to be operating within each of the groups to influence developmental outcome. Within the hospital group, it appears that the degree of family involvement, aspects of the caregiving environment, and length of hospitalization impacted development significantly. Thus, children who had more contact with their families and experienced greater variety in stimulation within their caregiving environment realized more favorable developmental outcomes. Relatedly, mothers who were likely to maintain greater involvement with their children were older and of higher social class. Thus, within the hospital group, children with older and higher class mothers were likely to experience more extensive
family contact, which was likely to positively impact their development. Further, infants and toddlers who experienced longer hospitalizations evidenced greater developmental delay. In contrast, within the home care group, developmental outcome seemed not to be extensively impacted by any of the factors studied.

Finally, within the hospital group, while the child's temperament and birth weight independently appeared to impact negligibly upon developmental outcome, interactive behavior, and coping behavior, in interaction with other factors they seemed to be important in determining development and behavior. For the home care group, too, temperament and birth weight appeared to be important when considered together, but only on interactive and coping behavior.

According to the vulnerability/resiliency framework, individual variation exists in children's responses to stressful events (Murphy & Moriarty, 1976). In this study of children who are technology dependent, such variation was evident in developmental outcome, interactive behavior, and coping behavior. While the developmental outcomes of all children studied were less than optimal, a range of ability existed. Moreover, within both the home care and hospital groups, were children whose interactive behavior was dysfunctional as well as those whose behavior was more optimal. In terms of coping behavior, too, children in each
group were found whose coping behavior was minimally effective and those who coping was effective more often than not.

Theoretically, developmental outcome and behavior can be predicted based upon the balance of risk and protective factors operating within an individual child's life. Werner and Smith (1982) suggested that health factors and temperament assume a major role in impacting development and behavior during the early years of life. In addition, Holahan and Moos (1987) discuss the importance of family support and access to external supports in determining outcomes of young children. The findings of this study were compatible with the conclusions of these investigators. Birth weight, temperament, and level of technology required for life support, in interaction with other factors, impacted upon development and behavior. Caregiving factors were important predictors of more optimal developmental and behavioral outcomes, specifically, sensitive and responsive caregiving, acceptance of the child's behavior, a high level of family involvement, and greater frequency of participation in early intervention programming.

Werner (1989) stated that if risk factors and stressors are greater than the protective factors operating in a child's life, even relatively resilient children are likely to face developmental and behavioral difficulties. Therefore, due to the numerous health related risks and
stressors facing children who are technology dependent on a daily basis, it is likely that these children will continue to experience significant difficulties, particularly developmental delays. The quality of the caregiving environment and child-related factors may serve only a limited protective function. It seems, however, that interactive behavior and coping behavior have the potential for reaching more optimal levels. Environmental and child-related factors seem to have a greater protective function with regard to both of these categories of behavior.

Implications and Recommendations

Various implications can be drawn for both parents of young children who are technology dependent and professionals who provide care and services to children with complex medical needs. Secondly, recommendations for further research also can be made and will be included in the final section.

Implications. Parents and professionals are presented with numerous challenges as they assume responsibility for the care of infants and toddlers who are technology dependent. The needs of these children are diverse, and careful and sensitive structuring of caregiving routines is essential. The findings of this study hold several implications for both parents and professionals.
Findings indicated that the majority of the children studied were characterized as being significantly developmentally delayed, limited in interactional skills, and restricted in the ability to cope with the demands of the social and physical environment. Thus caregiving and interactional strategies which are successful with children who are developing along a more typical course may be less effective or even harmful with children who are technology dependent. Careful training of professionals and parents may be necessary to assure that they are able to effectively read children's behavioral cues and respond in a sensitive manner.

In addition, professionals and parents must receive training which will allow them to provide opportunities for the children to interact with the environment in meaningful ways. Sensory impairments or decreased mobility may limit children's ability to explore their surroundings, however. Furthermore, children in the study groups were found to be minimally effective in self-initiated behavior, often assuming passive, respondent roles rather than active autonomous ones. Lastly, children may become overwhelmed by high levels of stimulation. Professionals and parents may need to seek creative ways of maximizing the children's opportunities for exploration and interaction given their limitations. If children are provided with opportunities which are tailored to their needs and tolerance for type and
level of stimulation, their development, interactional skills, and ability to cope with environmental demands may be enhanced.

Exploratory behavior was found to be associated with areas of developmental outcome, interactive behavior, and coping behavior. Professionals and parents should determine what opportunities for exploration and play with objects each child has during daily routines, as well as what materials are available for the child to explore. Assistance in devising opportunities for play may be necessary as well as assistance in obtaining appropriate play materials. Parents and professionals may also need to be educated about the value of exploration and play for children's development.

For the hospital group, a higher level of family involvement was associated with more optimal development in select areas, although not related significantly with interactive or coping behavior. Professionals within the health care environment should reinforce the importance of the time parents are able to spend with their children. Health care staff should model for parents successful interactive techniques and activities for positively influencing children's development. With this guidance, then, parents may develop a level of comfort and feeling of competence with regard to the parenting role. In turn, if parents can be helped to feel positively about interactions
with their children, the frequency and quality of parent-child contacts may increase.

Because older mothers and those of higher socioeconomic status seemed to maintain higher levels of contact, younger and lower class mothers may need additional support and encouragement to increase their involvement with their children. Modeling of appropriate interactional and caregiving techniques may be necessary in order to increase their level of comfort with parenting a child having complex medical needs. In addition, helping them to focus on positive qualities in their children, rather than medical problems or behavioral deficits, may help them to see their children in a more positive light. It should be remembered, however, that while younger and lower class mothers may require more support in order to maintain contact with their children, other mothers may also require support. Each family's requirements for this type of support should be assessed individually.

Results indicated that certain qualities of the caregiving environment were related to developmental outcome, interactive behavior, and coping behavior. Professionals and parents should be educated regarding potential environmental effects on the behavior and development of children who are technology dependent. Furthermore, guidelines for modifying the environment to maximize benefits for the children should be shared.
Regular monitoring of the caregiving environment may be necessary to determine the appropriateness of the surroundings over time.

Given that older mothers and those of higher socioeconomic status appear to provide more positive caregiving environments for their technology dependent children, younger mothers and those of lower socioeconomic status may need professional assistance in providing a more optimal environment for their children. Educational support, help in structuring the environment and daily routine, and assistance in providing appropriate materials for the child's may be necessary. In addition, information about the child's behavior and appropriate expectations for behavior should be shared. Positive forms of involvement also should be discussed and modeled for the parent. While it appears that younger and lower class mothers may need greater assistance, the ability of all mothers to provide an appropriate environment for their children should be evaluated and appropriate support given.

In isolation, neither a child's birth weight or temperament appeared to significantly influence developmental outcome, interactive behavior, or coping behavior. Yet in interaction with other factors, their effects upon development and behavior were important. Parents and professionals should be made aware of these potential interactive effects and appropriately counseled on
how to maximize the positive effect of a combination of factors. The nursing staff should make themselves available to parents for support and open discussion of the effects of various child-related, environmental, and health factors upon behavior and development.

**Recommendations for further research.** The population of technology dependent children is an emerging and growing population in the United States. Prior to the current research, empirical study of children who are technology dependent has been limited. The findings of this study build upon and contribute to the knowledge gained from previous research on the behavior and development of infants and toddlers who are following an atypical course of development. Additional research is necessary, however, to further expand upon this body of knowledge. The total sample studied in the current research was small (N=30) and heterogeneous in terms of children's ages, maternal age, and socioeconomic status. Studies including larger samples of infants and toddlers who are technology dependent should be conducted. Samples matched on age, gender, level of technological requirements, and length of time in the current caregiving environment also should be recruited. Obtaining matched samples may be difficult, however, due to inherent differences in children who remain hospitalized and those who are discharged to home settings. In addition,
studies should be designed to control for demographic factors, such as maternal age and socioeconomic status. Furthermore, replication studies should be conducted to determine the consistency of findings across samples. Multi-site studies would provide useful data regarding children with complex medical conditions in various regions of the country and in different health care environments.

Longitudinal studies of the development and behavior of children who are technology dependent would provide parents and professionals important information about children over time. Such studies should be initiated while children are receiving care in the acute care setting and should provide follow-up in regular intervals over a period of several years. Through this sort of research, change in children's development and behavior over time and in various caregiving environments could be measured.

In addition, this study focused on young children who had illnesses or conditions impacting respiratory functioning. Research involving children having other diagnoses and who are technology dependent is needed. Comparative studies of children having various diagnoses would provide information important to both the parents of such children and professionals who work with infants and toddlers with various medically complex conditions.

Another possible direction for research concerns interactive behavior of children dependent upon technology.
In this study, interactive behavior during a face-to-face interaction was observed. A rating of maternal/caregiver behavior during the interaction was also obtained. Infant and maternal/caregiver behavior during other types of interactions, such as feeding or play with toys, could offer insight regarding both caregiver behavior and the children's behavior in various contexts. This information could then be used in planning for and structuring different types of interactions so that optimal behavior is encouraged and facilitated.

Experimental studies of interactional behavior could vary environmental characteristics and caregiving strategies to determine effects on behavior. The results of studies such as this could be used in training caregivers, therapists, and early intervention specialists so that the benefits of their interactions with children could be maximized.

While young children who are technology dependent may have limited opportunities for interaction with peers, experimental studies of peer play interactions could be conducted. Findings could assist caregivers and professionals in planning for successful peer interactions and in that way help to build children's social interaction skills.

Exploratory and play behavior of children who are technology dependent warrants further investigation. The
play observation strategy utilized in the present study had limited utility, thus alternative measures of play behavior should be utilized. In addition, the use of videotaping equipment would be useful in study children's exploratory behavior. This technique would allow the researcher to gauge time spent in exploration of object, forms of behavior, and number of various behaviors more accurately than the observation procedure used in this study.

With technological advancements in pediatric health care, it is likely that the population of technology dependent children will grow. Thus, research which focuses on their characteristics, behavioral and developmental outcomes, and appropriate programming and intervention to meet their needs is essential. Only with such information will it be possible for parents and professionals to meet the diverse needs of children who are technology dependent in a sensitive manner.
APPENDIX A

COMPUTATIONS FOR THE HOLLINGSHEAD INDEX
COMPUTATIONS FOR HOLLINGSHEAD INDEX

1) Rate educational level of parents:

Mom__________    Dad__________

graduate professional training ..........1
standard college or university grad....2
partial college training .................3
high school graduate or GED ............4
partial high school .....................5
junior high school .....................6
< 7 years school .........................7

2) Use highest educational level and multiply by four:

Educational rating _____ x 4 = _____

3) Rate occupational level of parents:

Mom__________    Dad__________

High executive, proprietor of large business or
  major professional........................1
Business manager of large concern, owner of
  medium size business, lesser professional ....2
Admin. personnel, owner of small industrial
  business, or minor professional...........3
Clerical or sales worker, technician, or
  owner of small business...................4
Skilled manual employee....................5
Machine operator, semi-skilled labor ........6
Unskilled labor..............................7

4) Use highest occupational level, and multiply by seven:

Occupational rating _____ x 7 = _____

5) Add educational and occupational rating:

_____ + _____ = _____ (Index of Social Position)

6) Compute the social class from the following table:

<table>
<thead>
<tr>
<th>Index of Social Position</th>
<th>Social Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-17</td>
<td>I --Upper class</td>
</tr>
<tr>
<td>18-27</td>
<td>II --Upper Middle Class</td>
</tr>
<tr>
<td>28-43</td>
<td>III --Middle Class</td>
</tr>
<tr>
<td>44-60</td>
<td>IV --Lower Middle Class</td>
</tr>
<tr>
<td>61-77</td>
<td>V --Lower Class</td>
</tr>
</tbody>
</table>

Social Class: __________________________
APPENDIX B

GUIDELINES FOR INTERPRETING DATA IN TABLES

261
Interpretive Guidelines

Temperament Dimensions

Note. Ratings are based on the location of dimension scores relative to the normative mean and can be interpreted as follows:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>dimension score &gt; one standard deviation above the mean</td>
</tr>
<tr>
<td>2</td>
<td>mean &lt; dimension score &lt; one standard deviation above the mean</td>
</tr>
<tr>
<td>3</td>
<td>mean &gt; dimension score &gt; one standard deviation below the mean</td>
</tr>
<tr>
<td>4</td>
<td>dimension score &lt; one standard deviation below the mean</td>
</tr>
</tbody>
</table>

The ratings relative to specific temperament dimensions can be interpreted as follows:

<table>
<thead>
<tr>
<th>Interpretation of End Point Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
</tr>
<tr>
<td>Activity</td>
</tr>
<tr>
<td>Rhythmicity</td>
</tr>
<tr>
<td>Approach/Withdrawal</td>
</tr>
<tr>
<td>Adaptability</td>
</tr>
<tr>
<td>Intensity</td>
</tr>
<tr>
<td>Mood</td>
</tr>
<tr>
<td>Persistence</td>
</tr>
<tr>
<td>Distractibility</td>
</tr>
<tr>
<td>Threshold</td>
</tr>
</tbody>
</table>
Interpretive Guidelines

Early Coping Inventory

Note. The score, which ranges from 1.00 to 5.00 is indicative of coping effectiveness, with higher scores reflecting more effective coping ability. "Effectiveness" means the behavior is:
   a. appropriate for the situation
   b. appropriate for the child's developmental age
   c. successfully used by the child

Descriptive Interpretation of Numerical Scores

<table>
<thead>
<tr>
<th>Score</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0-1.5</td>
<td>Behavior is not effective.</td>
</tr>
<tr>
<td>1.6-1.9</td>
<td>Behavior is not effective, with some behaviors</td>
</tr>
<tr>
<td></td>
<td>minimally effective.</td>
</tr>
<tr>
<td>2.0-2.5</td>
<td>Behavior is minimally effective.</td>
</tr>
<tr>
<td>2.6-2.9</td>
<td>Behavior is minimally effective, with effective behaviors in a few types of situations.</td>
</tr>
<tr>
<td>3.0-3.5</td>
<td>Behavior is situationally effective.</td>
</tr>
<tr>
<td>3.6-3.9</td>
<td>Behavior is situationally effective, with some generalization of behaviors.</td>
</tr>
<tr>
<td>4.0-4.5</td>
<td>Behavior is effective more often than not.</td>
</tr>
<tr>
<td>4.6-4.9</td>
<td>Behavior is effective more often than not, with consistency in some types of situations.</td>
</tr>
<tr>
<td>5.0</td>
<td>Behavior is consistently effective across situations</td>
</tr>
</tbody>
</table>
Interpretive Guidelines

HOME Scores

Note. The total score (HOMETOT), which can range from 0 to 45, is indicative of the overall supportive quality of the living environment for a child's cognitive and emotional development. The higher the score the more supportive for development is the environment. The score can be interpreted according to the following guidelines:

<table>
<thead>
<tr>
<th>Score</th>
<th>Level of Supportiveness of Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25</td>
<td>Low to Middle</td>
</tr>
<tr>
<td>26-36</td>
<td>Middle</td>
</tr>
<tr>
<td>37-45</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Subscales</th>
<th>Possible score</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOMERES</td>
<td>Emotional &amp; verbal responsivity of parent/caregiver</td>
<td>11</td>
</tr>
<tr>
<td>HOMEACC</td>
<td>Acceptance of child's behavior</td>
<td>8</td>
</tr>
<tr>
<td>HOMEORG</td>
<td>Organization of physical &amp; temporal environment</td>
<td>6</td>
</tr>
<tr>
<td>HOMEPLOY</td>
<td>Provision of appropriate play materials</td>
<td>9</td>
</tr>
<tr>
<td>HOMEINV</td>
<td>Parent/caregiver involvement with the child</td>
<td>6</td>
</tr>
<tr>
<td>HOMEVAR</td>
<td>Opportunities for variety in daily stimulation</td>
<td>5</td>
</tr>
</tbody>
</table>
APPENDIX C

HUMAN SUBJECTS APPROVALS
Research Involving Human Subjects

ACTION OF THE REVIEW COMMITTEE

With regard to the employment of human subjects in the proposed research protocol:

91B0224  A MULTIVARIATE DESCRIPTIVE STUDY OF INFANTS AND TODDLERS WHO ARE TECHNOLOGY DEPENDENT, Rosemary Bolig, Hannah L. Nissen, Family Relations and Human Development

THE BEHAVIORAL AND SOCIAL SCIENCES REVIEW COMMITTEE HAS TAKEN THE FOLLOWING ACTION:

_____ APPROVED   _____ DISAPPROVED

_____ WAIVER OF WRITTEN CONSENT GRANTED

* Conditions stated by the Committee have been met by the Investigator and, therefore, the protocol is APPROVED.

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least four (4) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects Review Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: December 20, 1991   Signed: 

(Chairperson)
MEMORANDUM

From: Vincent V. Hamparian, PhD  
Chairperson, Human Subjects Research Committee

To: Hannah Nissen, RN and Rosemary Bolig, PhD

Date: February 17, 1992

Re: EXPEDITED APPROVAL OF PROTOCOL:  A MULTIVARIATE DESCRIPTIVE STUDY OF INFANTS AND TODDLERS WHO ARE TECHNOLOGY DEPENDENT

Protocol No.: 92HSE014

The above protocol has been approved by expedited review with the requirement of obtaining informed consent. Confidentiality will be maintained.

VHV/bes
March 4, 1991

Hannah Nissan, M.S.
Department of Family Relations
& Human Development
College of Human Ecology
The Ohio State University
Columbus, Ohio 43210

Dear Hannah:

Lifelines Children's Rehabilitation Hospital is pleased to participate in data collection for your research study, "A Multivariate Study of Infants and Toddlers Who Are Technology Dependent." The research proposal has been read and approved by the Administrator, Medical Staff Organization, and Governor Board in lieu of an Institutional Review Board.

We have enclosed an introduction letter that we would like included in the initial mailing to our families. We are looking forward to your data collection at Lifelines and more importantly, the results of your research.

Please do not hesitate to contact me if I can be of further assistance.

Warmest regards.

Ann Ruhmkorf
Assistant Administrator

enclosures
APPENDIX D

LETTERS TO PARENTS, FOSTER PARENTS, AND GUARDIANS OF CHILDREN MEETING RESEARCH CRITERIA
Dear [Name],

As a parent of a child who is medically fragile, you are concerned with helping your child, [Name], to have the best possible life. We share your concern for the healthy growth and development of young children. We are writing to ask for your help with a study being conducted at The Ohio State University in cooperation with Columbus Children's Hospital and Lifelines Children's Rehabilitation Hospital, Indianapolis, Indiana, to study children with complex medical problems. Through studies such as this, those who take care of and work with such children will become more aware of how young children with complex medical needs develop and behave in different situations. Using this information, it will be possible to better meet the unique needs of such children and improve the quality of care and services they receive.

If you are willing to be a part of this project, arrangements will be made for a visit with [Name] and his/her caregivers at Lifelines Children's Rehabilitation Hospital. During this visit, you or someone who knows [Name] well will be asked questions about his/her personality and behavior and about the environment where he/she spends his/her time each day. Also, the researcher will test how [Name] is growing and progressing and will watch him/her as he/she plays alone and with someone. This visit will take no longer than two hours.

We hope that you will help us with this project. Within a few days of receiving this letter, Hannah Nissen will be contacting you by telephone to answer any questions you may have about the study and to make arrangements for the visit.

Enclosed is a project summary, which describes the study in more detail, and a consent form. Please carefully read and sign the consent form and return it in the enclosed stamped envelope. Thank you for your time and consideration. We're looking forward to talking with you soon about this important study.

Sincerely,

Rosemary Bolić, Ph.D.
Associate Professor, Department of Family Relations and Human Development

Hannah Nissen, M.S.
Doctoral Candidate

[Signature]

Hannah Nissen, M.S.
Doctoral Candidate
Dear ____________,

As a foster parent of a child who is medically fragile, you are concerned with helping your child, ____________, to have the best possible life. We share your concern for the healthy growth and development of young children. We are writing to ask for your help with a study being conducted at The Ohio State University in cooperation with Columbus Children's Hospital and Lifelines Children's Rehabilitation Hospital, Indianapolis, Indiana, to study children with complex medical problems. Through studies such as this, those who take care of and work with such children will become more aware of how young children with complex medical needs develop and behave in different situations. Using this information, it will be possible to better meet the unique needs of children who are medically fragile and improve the quality of care and services they receive.

If you are willing to be a part of this project, arrangements will be made for a visit with you and ____________ in your home. During this visit, you will be asked questions about his/her personality and behavior and about the environment where he/she spends time each day. Also, with your help, the researcher, will test how ____________ is progressing. Finally, the researcher will watch him/her as he/she plays alone and with you. This visit will take no longer than two hours.

We hope that you will help us with this project. Within a few days of receiving this letter, Hannah Nissen will be contacting you by telephone to answer any questions you may have about the study and to make arrangements for the visit to your home.

Enclosed is a project summary which describes the study in more detail. Thank you for your time and consideration. We are looking forward to talking with you soon regarding this important study.

Sincerely,

Rosemary Boli, Ph.D.
Associate Professor, Department of Family Relations and Human Development

Hannah Nissen, M.S.
Doctoral Candidate
Dear ___________________,

As the legal guardian of ________________, a child who is medically fragile, you are concerned with helping him/her to have the best possible life. We share your concern for the healthy growth and development of young children. We are writing to ask for your help with a study being conducted at The Ohio State University in cooperation with Columbus Children's Hospital and Lifelines Children's Rehabilitation Hospital, Indianapolis, Indiana, to study children with complex medical problems. Through studies such as this, those who take care of and work with such children will become more aware of how young children with complex medical needs develop and behave in different situations. Using this information, it will be possible to better meet the unique needs of children who are medically fragile and improve the quality of care and services they receive.

If you are willing to provide consent, arrangements will be made for a visit with _______________ and his/her caregivers at Lifelines Rehabilitation Hospital. During this visit, someone who knows _______________ well will be asked questions about his/her personality and behavior and about the environment in which he/she spends time each day. Also, the researcher will test how _______________ is progressing and will watch him/her as he/she plays alone and with a caregiver. This visit will take no longer than two hours.

We hope that you will help us with this project. Within a few days of receiving this letter, Hannah Nissen will be contacting you by telephone to answer any questions you may have about the study and to discuss arrangements for the visit to Lifelines.

Enclosed is a project summary, which describes the study in more detail, and a consent form. Please carefully read and sign the consent form and return it in the enclosed stamped envelope. Thank you for your time and consideration. We are looking forward to talking with you soon regarding this important study.

Sincerely,

Rosemary Bolig, Ph.D.  
Associate Professor, Department of Family Relations and Human Development

Hannah Nissen, M.S.  
Doctoral Candidate
APPENDIX E

PROJECT SUMMARY
A research study is being done at The Ohio State University to study children with medical problems. We are asking parents, foster parents, and guardians of children with medical problems to participate and to allow their child to take part in this study. Studies such as this will help those who care for these children to be more aware of how children with complex medical needs grow and behave in different situations. Using this information, it will be possible to better meet the needs of children with medical problems and improve the quality of care they receive.

To be included in the project, a child must:
1. be 36 months of age or younger
2. require tracheostomy tube care, oxygen support, mechanical ventilation or other device-based respiratory support
3. have a primary diagnosis which involves respiratory impairment
4. have had no intraventricular hemorrhage, or a grade I or II hemorrhage only
5. have at least minimal vision and hearing
6. be medically stable

Please note the following points:

1. Participation in this study is entirely voluntary. You can withdraw your permission at any time, and the quality of the child's care will in no way be negatively affected if you choose not to take part in the project.

2. Everything you tell us and all information collected from your child's medical chart will be strictly confidential. Your name and the child's name will not be connected in any way with the findings of this important study.

3. The procedures are as follows: Arrangements for a visit with the child and yourself and/or the child's caregiver will be made, requiring no longer than 2 hours. During this visit, a researcher will talk with you or a caregiver about the child and his/her family, and his/her personality. Secondly, with your help or the help of the child's caregiver, a short test of how the child is growing will be done. Also, the researcher will watch the child play, and will talk with you or a caregiver about how the child copes with activities and daily life.
In addition, with your help or the help of a caregiver, the researcher will try to answer some questions about the place in which the child lives. Finally, the researcher will spend some time watching the child as he/she interacts with you or a caregiver. To get necessary medical information about the child, the researcher will talk with you or briefly review the child's medical chart.

4. Discomfort or stress that may be faced during this research: While the researcher will be careful about causing stress for the child, it is possible that the child may become frustrated during the test of growth or play times. If this happens, with your help or that of the child's caregiver, the child will be calmed, and when he/she seems ready, testing and play will continue.

5. Risks involved in participation: NONE

6. Possible benefits of participation: Participation will provide opportunities for better understanding how the child is progressing and behaving.

7. The researcher will answer any questions about the research as they come up during the project.

Your participation and that of your child will be greatly appreciated and will help us in helping others who have children with medical problems.

Rosemary Bolig, Ph.D.                      Hannah Nissen, M.S.
Dept. of Family Relations                  Dept. of Family Relations
    and Human Development                   and Human Development
College of Human Ecology                    College of Human Ecology
The Ohio State University                  The Ohio State University
Columbus, Ohio 43210                       Columbus, Ohio 43210
Ph: 614-457-0136 or 614-292-9430
APPENDIX F

CONSENT FORMS
CONSENT FOR PARTICIPATION IN
SOCIAL AND BEHAVIORAL RESEARCH

I consent to participating in (or my child's participation in) research entitled:

A Multivariate Descriptive Study of Infants and Toddlers Who are Technology Dependent

Rosemary Bolig (Principal Investigator) or his/her authorized representative has explained the purpose of the study, the procedures to be followed, and the expected duration of my (my child's) participation. Possible benefits of the study have been described as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Further, I understand that I am (my child is) free to withdraw consent at any time and to discontinue participation in the study without prejudice to me (my child).

I understand that the researcher will have access to my child's medical chart to get necessary information. I also understand that all information gathered will be kept completely confidential; my name, the name of my child, and any other identifying information will not be included in any reports of project results. Only the researcher will have access to the information gathered.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ___________________  Signed: ___________________
(Participant)

Signed: ___________________
(Principal Investigator or authorized representative)

Witness: ___________________
FULL TITLE OF STUDY: A Multivariate Descriptive Study of Infants and Toddlers Who are Technology Dependent

I. INFORMATION FOR THE PARTICIPANT AND THE PARENT(S) OR GUARDIAN:

1. PARTICIPANT'S LEGAL NAME _________________________________
   DATE OF BIRTH: _____________________

2. FULL TITLE OF THE STUDY: A Multivariate Descriptive Study of Infants and Toddlers Who are Technology Dependent

3. PRINCIPLE INVESTIGATOR(S): Hannah Nissen, Rosemary Bolig

4. PURPOSE OF THE STUDY: It is the purpose of this project to study the development and behavior of children with complex medical problems.

5. HOW THE STUDY WILL BE PERFORMED: The researcher will make arrangements for a home visit with the child and yourself and/or the child’s caregiver. During this visit, the researcher will talk with you about the child and his/her family, and you will be asked to complete a questionnaire about the child’s personality. Secondly, a short test of how the child is growing and progressing will be done. Also, the researcher will watch the child play. Furthermore, the researcher will talk with you about how the child copes with activities and daily life, and about the places in the house where the child spends time. Finally, the researcher will spend a short time watching the child as he/she plays with you or a caregiver. To get necessary medical information about the child, the researcher will briefly review the child's medical chart at Columbus Children's Hospital.

6. EXPECTED DURATION OF THE SUBJECT'S PARTICIPATION: One home visit will be made, requiring no more than 2 hours. Of that time, about 20 to 30 minutes will be spent with the child. The rest of the time will be spent talking with you or having you complete a questionnaire.

7. EXPERIMENTAL PRODUCT(S) OR PROCEDURE(S): None.

8. FDA INVESTIGATIONAL NEW DRUG (IND) OR INVESTIGATIONAL DEVICE (IDE) NUMBER: None
FULL TITLE OF STUDY: A Multivariate Descriptive Study of Infants and Toddlers Who are Technology Dependent

9. APPROVED OR ACCEPTED PRODUCT(S) OR PROCEDURE(S) WHICH MIGHT EXPOSE THE SUBJECT TO SOME RISK: None

10. POSSIBLE RISKS: The risk involved is extremely low; during the developmental test or play times, the child may feel some frustration. The researcher, however, has had several years experience in working with young children with complex medical problems. She is skilled in using techniques with children which will minimize the possibility of frustration. In addition, a parent or caregiver will be nearby during these times and will help to decide the how long and how intensely the child can participate in activities.

11. PREGNANCY STATEMENT: Not applicable.

12. POSSIBLE BENEFITS: You and the child's caregivers will have the opportunity to get information about how the child is growing and progressing.

13. APPROPRIATE ALTERNATIVE TREATMENT(S) OR PROCEDURES: None.

14. METHODS USED TO MAINTAIN CONFIDENTIALITY: Code numbers will be used to identify each child. Your name and the child's name and address will be found only on one informational form; code numbers will be used on all other forms. Your name and the child's name will not be connected with the information collected, and neither you nor the child will be identified in any way. Results will be reported only in terms of the whole group of subjects. Records relating to those participating in the study will be kept in a locked cabinet and will be available only to the researcher.

15. POSSIBLE ADDITIONAL COSTS TO THE SUBJECT OR THIRD-PARTY PAYER: None

16. VOLUNTARY PARTICIPATION: Participation in this study is voluntary; refusal to participate will involve no penalty or loss of benefits to which the subject is otherwise entitled.
CONSENT TO RESEARCH TREATMENT OR PROCEDURES

FULL TITLE OF STUDY: A Multivariate Descriptive Study of Infants and Toddlers Who Are Technology Dependent

II. INFORMATIVE STATEMENT AND SIGNATURES:

STATEMENT OF CONFIDENTIALITY:

I understand that all records, written and/or visual (if applicable) will be maintained in a confidential manner. These records will be available only to the investigators. Information may be published or shared with another person only with my permission or if personal identifiers have been removed.

COMPENSATION STATEMENT:

If I or my child should become ill, hurt, or unusually upset due to participation in this study, I understand that immediate treatment is available at Children's Hospital. I also understand that costs of such treatment will be at my expense and that financial compensation is not available. For further explanation and for any questions concerning my rights, I may contact the Legal Services Office at (614) 461-2557.

FREEDOM TO WITHDRAW:

I understand that I am free to withdraw my child (or myself) from the study at any time without affecting on-going or future care.

NEW DEVELOPMENTS:

I understand that any new information that becomes available during this study that might affect my willingness to stay in it will be discussed with me.
CONSENT TO RESEARCH TREATMENT OR PROCEDURES

FULL TITLE OF STUDY: A Multivariate Descriptive Study of Infants and Toddlers Who Are Technology Dependent

II. INFORMATIVE STATEMENTS AND SIGNATURES (CONTINUED):

The information has been explained to me and I understand it. Any further questions I may have in regard to this study will be answered by:

(Principal Investigator or Authorized Representative) (Phone number)

I understand that I am not giving up my child's/my legal rights. I consent to enroll my child (myself) in this study.

CONSENT SIGNATURES

WRITTEN CONSENT
I have had the study explained to me and I agree to participate.

Date:___________________ Date:___________________

Parent/Legal Guardian Parent/Legal Guardian

Patient Assent Witness

Person Obtaining Consent

I certify that I have explained the research, its purposes, and procedures to the subject or his/her representative or both before requesting the subject or representative to sign.

Signed __________________________

(Principal Investigator or Authorized Agent)
APPENDIX G

FAMILY INFORMATION
FAMILY INVOLVEMENT

(Lifelines Rehabilitation Hospital)

1. Does family visit the child? _____Yes _____No

2. If so, how often?______________________________
   -duration of visits:________________________

3. Comments regarding involvement and nature of interaction with child:______________________________
   ______________________________
   ______________________________
   ______________________________
DEMOGRAPHIC INFORMATION

Child's Name______________________________

Parents' Names___________________________

Address_________________________________

________________________________________

Telephone Number________________________

Child's Gender

___Male

___Female

Child's Ethnicity

___Caucasian

___Black

___Asian

___Hispanic

___Other(__________)

Mother's Ethnicity

___Caucasian

___Black

___Asian

___Hispanic

___Other(__________)

Father's Ethnicity

___Caucasian

___Black

___Asian

___Hispanic

___Other(__________)

Mother's Age______

Father's Age_____
<table>
<thead>
<tr>
<th>Mother's Education</th>
<th>Father's Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate Training</td>
<td>Graduate Training</td>
</tr>
<tr>
<td>College Grad.</td>
<td>College Grad.</td>
</tr>
<tr>
<td>Some College</td>
<td>Some College</td>
</tr>
<tr>
<td>High School Grad.</td>
<td>High School Grad.</td>
</tr>
<tr>
<td>Some High School</td>
<td>Some High School</td>
</tr>
<tr>
<td>Junior High</td>
<td>Junior High</td>
</tr>
<tr>
<td>&lt; 7 years school</td>
<td>&lt; 7 years school</td>
</tr>
</tbody>
</table>

**Mother's Occupation**

**Father's Occupation**

**Mother's Employment Status:**
- Not Employed
- Part-time (< 40 hrs.)
- Full-time (40 hrs. +)

**Father's Employment Status:**
- Not Employed
- Part-time (< 40 hrs.)
- Full-time (40 hrs. +)

**Marital Status:**
- Never Married
- Married
- Separated
- Divorced
- Widowed

**Other Children Living in the Parents' Home:**

(Age and Gender of Each)
APPENDIX H

MEDICAL INFORMATION
MEDICAL INFORMATION FORM

Child's Birth Date: ________________ Chronological age: ____

Child's Birth Weight: ________ Gestational Age: ________

Date of Admission to Lifelines Rehabilitation Hospital: ______________________

Child's Age When Admitted: _______

Duration of acute care hospitalization: ____________________

Child's Current Age: ______________

Duration of Lifelines Hospitalization to Date: _________

Child's Primary Diagnosis: ________________________________

Other Diagnoses/Medical Conditions: ________________________

Technological Needs:

_____ Tracheostomy

_____ Mechanical ventilation

_____ Oxygen

_____ Gastrostomy Tube

_____ Apnea Monitor

_____ Other (__________________________________________)

Services Received:

_____ Physical Therapy

_____ Occupational Therapy

_____ Speech/Language Therapy

_____ Early Intervention Programming

_____ Other (_____________________________)

Code # _____
MEDICAL INFORMATION FORM

Children Receiving Home Care

Child's Birth Date:___________ Chronological age:_______
Child's Birth Weight:_______ Gestational Age:__________
Date of Discharge To Home From an Acute Care Hospital:_____
Length of Hospitalization in an Acute Care Hospital:_______
Child's Age When Discharged to Home:__________
Child's Current Age:____________
Length of Time Child Has Been Living at Home:___________
Child's Primary Diagnosis:_________________________________
Other Diagnoses/Medical Conditions:_________________________

Technological Needs:

____ Tracheostomy
____ Mechanical ventilation
____ Oxygen
____ Gastrostomy Tube
____ Apnea Monitor
____ Other(_____________________________________________)

Services Received:

____ Physical Therapy
____ Occupational Therapy
____ Speech/Language Therapy
____ Early Intervention Programming
____ Other(_______________________________)
APPENDIX I

OBSERVATIONS DURING DATA-GATHERING SESSIONS
OBSERVATIONS DURING DATA GATHERING SESSIONS

1. Initial responses to the unfamiliar researcher:

2. Distress Behavior:
   - Antecedents to distress behavior:
   - Nature of distress behavior:
   - Length of time child remains distressed:
   - Actions taken to calm the child:

3. Nature of interruptions during the above assessments:
APPENDIX J

EXPLORATION AND PLAY OBSERVATION
**EXPLORATION AND PLAY ASSESSMENT: RECORDING SHEET**

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*Code #:___*
EXPLORATION AND PLAY ASSESSMENT (CONTINUED)

Toys with which child interacts: ______________________________________

Length of time child is involved in exploration and/or play with objects: ______________________________________

Additional comments: ______________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________
EXPLORATION/PLAY BEHAVIORS

Operational definitions of exploration/play behaviors in the 12-step sequence developed by Belsky and Most (1981):

1. **Mouthing**—indiscriminate mouthing of materials

2. **Simple manipulation**—visually guided manipulation (excluding indiscriminate banging and shaking) at least five seconds in duration that cannot be coded in any other category (e.g., turn over an object, touch and look at an object)

3. **Functional**—visually guided manipulation that is particularly appropriate for a certain object and involves the intentional extraction of some unique piece of information (e.g., spin wheels on a cart)

4. **Relational**—bringing together and integrating two or more materials in an inappropriate manner, a manner not initially intended by the manufacturer (e.g., touch spoon to stick)

5. **Functional-relational**—bringing together and integrating two objects in a manner intended by the manufacturer (e.g., place peg in hole in pegboard)

6. **Enactive naming**—approximate pretense activity but without confirming evidence of actual pretense behavior (e.g., touch cup to lip without tilting head back or tipping cup)

7. **Pretend self**—pretense behavior directed toward self in which pretense is apparent (e.g., raise cup to lip and tip cup; stroke own hair with a miniature brush)

8. **Pretend other**—pretense behavior directed away from child toward other (e.g., feed doll with a spoon, brush doll's hair)

9. **Substitution**—using a "meaningless" object in a creative or imaginative manner (e.g., drink from a seashell; feed baby with a stick as a bottle) or using an object in a pretense act in a way that differs from how it was previously used by the child (e.g., using hairbrush to brush teeth after already using it as a hairbrush on self or other)
10. **Sequence pretend**—repetition of a single pretense act with minor variation (e.g., drink from bottle; give doll drink; pour into cup) or linking together different pretense schemes (e.g., stir in cup, then drink; put doll in cradle, then put a blanket on doll)

11. **Sequence pretend substitution**—same as sequence pretend except using an object substitution within sequence (e.g., put doll in cradle, cover with blanket; feed self with spoon, then with stick)

12. **Double substitution**—pretense play in which two materials are transformed, within a single act, into something they are not in reality (e.g., treat peg as doll and a piece of green felt as a blanket, and cover peg with felt)
APPENDIX K

INTERACTION RATING SCALES
INTERACTION OF THE CHILD AND PARENT/CAREGIVER

(Child Ratings)

A. State rating
   1. predominantly drowsy
   2. somewhat drowsy
   3. predominantly alert

B. Physical activity
   1. frequent squirming/arching of back
   2. occasional squirming/arching of back
   3. relaxed body with cycling of limbs toward mother

C. Head orientation
   1. frequent head aversion
   2. occasional head aversion
   3. rare head aversion

D. Gaze behavior
   1. seldom looks at parent
   2. sometimes looks at parent
   3. frequently looks at parent

E. Facial expressions
   1. frequent pouting or cry face
   2. bland expression
   3. occasional smiling or contented expression

F. Fussiness
   1. frequent fussing or crying
   2. occasional fussing
   3. no fussing

G. Vocalizations
   1. no vocalizations
   2. a few vocalizations
   3. several vocalizations

(Perent/Caregiver Ratings)

A. State rating
   1. predominantly depressed or anxious looking
   2. somewhat depressed or anxious looking
   3. alert and attentive

B. Physical activity
   1. minimal activity or overly active
   2. moderate activity
   3. some activity

C. Head orientation
   1. frequent head aversion
   2. occasional head aversion
   3. infrequent head aversion

D. Gaze behavior
   1. seldom looks at infant
   2. sometimes looks at infant
   3. constantly looks at baby

E. Silence during infant gaze aversion
   1. rarely quiet when infant looking away
   2. sometimes quiet when infant looking away
   3. usually quiet when infant looking away

F. Facial expressions
   1. flat or tense expressions
   2. alternately flat or tense and contented
   3. frequent smiling or contented expression

G. Vocalizations
   1. constant, noncontingent talking or no talking
   2. moderate amount of talking and somewhat contingent
   3. contingent talking and sensitive pacing of vocalizations
(Parent/Caregiver Ratings/continued)

H. Infantized behaviors
1. never imitative of infant or no simplified behaviors
2. sometimes imitative and some simplified behaviors
3. frequent imitative and simplified behaviors

I. Contingent responsivity
1. rarely responds in kind or with short latency to infant behaviors
2. sometimes responds in kind or with short latency to infant behaviors
3. often responds in kind or with short latency to infant behaviors

J. Game playing
1. rarely plays infant, age appropriate games
2. sometimes plays infant, age appropriate games
3. often plays infant, age appropriate games

SCORING FOR CHILD AND PARENT/CAREGIVER

1) Infant Face-to-Face Rating=Total/7
2) Parent/Caregiver Face-to-Face Rating=Total/10
APPENDIX L

LETTER OF THANKS TO PARTICIPANTS
Dear __________________,

I'd like to thank you again for your willingness to participate in our research study. Your time and the time spent with ________________ are greatly appreciated. The information you've shared and the opportunity to interact with and observe ________________ have been valuable. The information gathered will be useful in better understanding and meeting the needs of young medically fragile children.

Best wishes to you and your family.

Sincerely,

Rosemary Bolig, Ph.D.
Associate Professor, Department of Family Relations and Human Development

Hannah Nissen

Hannah Nissen, M.S.
Doctoral Candidate
APPENDIX M

LETTER OF THANKS TO MEDICAL PROFESSIONALS
Dear ______________,

Data collection for our research project focusing on medically fragile children is now complete. Thank you very much for your help in the implementation of the study. We will be glad to share our results with you and other interested staff when the data have been analyzed.

Sincerely,

Rosemary Bolig, Ph.D.
Associate Professor, Department of Family Relations and Human Development

Hannah Nissen
Hannah Nissen, M.S.
Doctoral Candidate
APPENDIX N

VARIABLE ABBREVIATIONS AND NAMES
AS USED IN TABLES
### Abbreviations and Variable Names Used in the Correlations Tables

**BDI, IRS, ECI, HOME Scores**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable Name</th>
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<tr>
<td>BDIT</td>
<td>BDI total standard score</td>
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<tr>
<td>BPS</td>
<td>BDI personal social domain standard score</td>
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<tr>
<td>BA</td>
<td>BDI adaptive domain standard score</td>
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<tr>
<td>BGM</td>
<td>BDI gross motor domain standard score</td>
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<tr>
<td>BFM</td>
<td>BDI fine motor domain standard score</td>
</tr>
<tr>
<td>BC</td>
<td>BDI communication domain standard score</td>
</tr>
<tr>
<td>BCG</td>
<td>BDI cognitive domain standard score</td>
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<tr>
<td>IRS</td>
<td>IRS infant rating</td>
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<tr>
<td>ECIABI</td>
<td>ECI adaptive behavior index</td>
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<tr>
<td>ESO</td>
<td>ECI sensorimotor organization score</td>
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<tr>
<td>ERB</td>
<td>ECI reactive behavior score</td>
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<tr>
<td>ESIB</td>
<td>ECI self-initiated behavior score</td>
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APPENDIX O

RELATIONSHIPS BETWEEN HEALTH FACTORS
### Table 31
Gestational Age, Birth Weight, and Length of Hospitalization For Children with Bronchopulmonary Dysplasia (BPD) and Children with Structural Anomalies of the Airway

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<thead>
<tr>
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<th>Max.</th>
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Children with BPD: n=23
Children with structural anomalies of the airway: n=7

* Birth weight data was available for 22 of the 23 children with BPD.
APPENDIX P

RELATIONSHIPS BETWEEN TEMPERAMENT DIMENSIONS AND SELECTED INDEPENDENT VARIABLES
Table 32
Spearman Rank Order Correlation Coefficients
Temperament Dimensions and Selected Independent Variables
Home Care and Hospital Groups

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<td></td>
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<td></td>
</tr>
<tr>
<td>Home</td>
<td>.05</td>
<td>-.09</td>
<td>.03</td>
<td>.15</td>
<td>--</td>
<td>.24</td>
<td>.57*</td>
</tr>
<tr>
<td>Hospital</td>
<td>.05</td>
<td>-.06</td>
<td>.44</td>
<td>.19</td>
<td>.03</td>
<td>--</td>
<td>.21</td>
</tr>
<tr>
<td>TTHR</td>
<td></td>
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<td></td>
</tr>
<tr>
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<td>-.16</td>
<td>.44</td>
<td>.40</td>
<td>--</td>
<td>.58*</td>
<td>.43</td>
</tr>
<tr>
<td>Hospital</td>
<td>-.18</td>
<td>-.14</td>
<td>.36</td>
<td>.69**</td>
<td>.09</td>
<td>--</td>
<td>.07</td>
</tr>
</tbody>
</table>

* p<.05  **p<.01

Notes. (1) Correlation coefficients could not be obtained for the home care group on the variable "INVOL" because all subjects in the group received the same rating because of their home care residential status.

(2) Correlation coefficients could not be obtained for the hospital group on the variable "EI" because all subjects in the group received the same level of early intervention programming (i.e., 3-5 times weekly).
Table 33
Abbreviations and Variable Names
Used in Correlation Table 32
Temperament Dimensions and Selected Variables

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>TACT</td>
<td>Temperament activity rating</td>
</tr>
<tr>
<td>TRHY</td>
<td>Temperament rhythmicity rating</td>
</tr>
<tr>
<td>TAPP</td>
<td>Temperament approach/withdrawal rating</td>
</tr>
<tr>
<td>TADA</td>
<td>Temperament adaptability rating</td>
</tr>
<tr>
<td>TINT</td>
<td>Temperament intensity rating</td>
</tr>
<tr>
<td>TMOOD</td>
<td>Temperament mood rating</td>
</tr>
<tr>
<td>TPERS</td>
<td>Temperament persistence rating</td>
</tr>
<tr>
<td>TDIST</td>
<td>Temperament distractibility rating</td>
</tr>
<tr>
<td>TTHR</td>
<td>Temperament threshold rating</td>
</tr>
<tr>
<td>BW</td>
<td>Birth weight</td>
</tr>
<tr>
<td>GA</td>
<td>Gestational age</td>
</tr>
<tr>
<td>HOSP</td>
<td>Duration of hospitalization (days)</td>
</tr>
<tr>
<td>TECH</td>
<td>Level of technological support required</td>
</tr>
<tr>
<td>INVOL</td>
<td>Level of family involvement</td>
</tr>
<tr>
<td>EI</td>
<td>Frequency of participation in early intervention services</td>
</tr>
<tr>
<td>EXPL</td>
<td>Level of exploratory/play behavior</td>
</tr>
</tbody>
</table>
APPENDIX Q

RELATIONSHIPS BETWEEN EXPLORATORY/PLAY BEHAVIOR AND SELECTED INDEPENDENT VARIABLES
Table 34

Spearman Rank Order Correlation Coefficients
Exploratory/Play Behavior and Selected Independent Variables
Home Care and Hospital Groups

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>BW</th>
<th>GA</th>
<th>HOSP</th>
<th>TECH</th>
<th>EI</th>
</tr>
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<td>.04</td>
<td>.34</td>
<td>.44</td>
<td>.51</td>
</tr>
<tr>
<td>EXPLOR Hospital</td>
<td>.58*</td>
<td>.16</td>
<td>.15</td>
<td>.58*</td>
<td>-.07</td>
<td>--</td>
</tr>
</tbody>
</table>

* p<.05   ** p<.01

Note. No correlation coefficient could be computed for the variable "EI" for the hospital group because all children received the same rating (all children receive the same frequency of early intervention services).

Abbreviations and Variable Names

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable name</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPLOR</td>
<td>Level of exploratory/play behavior</td>
</tr>
<tr>
<td>CA</td>
<td>Chronological age</td>
</tr>
<tr>
<td>BW</td>
<td>Birth weight</td>
</tr>
<tr>
<td>GA</td>
<td>Gestational age</td>
</tr>
<tr>
<td>HOSP</td>
<td>Length of hospitalization (days)</td>
</tr>
<tr>
<td>TECH</td>
<td>Level of technology required</td>
</tr>
<tr>
<td>EI</td>
<td>Frequency of participation in early intervention programming</td>
</tr>
</tbody>
</table>
APPENDIX R

RELATIONSHIPS BETWEEN FAMILY INVOLVEMENT AND SELECTED INDEPENDENT VARIABLES
### Table 35

**Spearman Rank Order Correlation Coefficients**  
Family Involvement and Selected Independent Variables  
Hospital Group

<table>
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<tr>
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<th>Variable name</th>
</tr>
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<tr>
<td>BW</td>
<td>Birth weight</td>
</tr>
<tr>
<td>GA</td>
<td>Gestational age</td>
</tr>
<tr>
<td>HOSP</td>
<td>Length of hospitalization (days)</td>
</tr>
<tr>
<td>SES</td>
<td>Socioeconomic status</td>
</tr>
<tr>
<td>MATAGE</td>
<td>Maternal age</td>
</tr>
<tr>
<td>TECH</td>
<td>Level of technology required</td>
</tr>
<tr>
<td>EXPLOR</td>
<td>Level of exploratory/play behavior</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BW</th>
<th>GA</th>
<th>HOSP</th>
<th>SES</th>
<th>MATAGE</th>
<th>TECH</th>
<th>EXPLOR</th>
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<td>.81**</td>
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<td>-.07</td>
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</table>

** p<.01  **** p<.0001
APPENDIX S

RELATIONSHIPS BETWEEN THE CAREGIVING ENVIRONMENT AND SELECTED INDEPENDENT VARIABLES
Table 36

Spearman Rank Order Correlation Coefficients
HOME Scores and (a) Exploratory/Play Behavior,
(b) Temperament Dimensions
Home Care and Hospital Groups

<table>
<thead>
<tr>
<th></th>
<th>HOME</th>
<th>HRES</th>
<th>HACC</th>
<th>HORG</th>
<th>HPLY</th>
<th>HINV</th>
<th>HVAR</th>
</tr>
</thead>
<tbody>
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<td>.45</td>
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<td>.19</td>
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<td>.54*</td>
<td>.19</td>
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<tr>
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<td>-.39</td>
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<td>.06</td>
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<td>.48</td>
<td>.55*</td>
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<tr>
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<td>.36</td>
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<td>.40</td>
<td>.43</td>
<td>.31</td>
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<td></td>
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<td></td>
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<td>.48</td>
<td>.46</td>
<td>-.15</td>
<td>.53*</td>
<td>.31</td>
<td>.13</td>
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<td>--</td>
<td>.25</td>
<td>.01</td>
<td>.21</td>
<td>-.16</td>
</tr>
</tbody>
</table>

* p<.05  ** p<.01

Note. Correlation coefficients involving the variable HACC could not be computed for the hospital group because all subjects received the same score.
Table 37
Pearson Product Moment Correlation Coefficients
HOME Scores and Maternal Age (MATAGE)
Home Care Group

<table>
<thead>
<tr>
<th></th>
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<th>HRES</th>
<th>HACC</th>
<th>HORG</th>
<th>HPLY</th>
<th>HINV</th>
<th>HVAR</th>
</tr>
</thead>
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<td>.22</td>
<td>.28</td>
<td>.36</td>
<td>.60*</td>
<td>.51</td>
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</table>

* p<.05

Table 38
Spearman Rank Order Correlation Coefficients
HOME Scores and Socioeconomic Status (SES)
Home Care Group

<table>
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<tr>
<th></th>
<th>HOME</th>
<th>HRES</th>
<th>HACC</th>
<th>HORG</th>
<th>HPLY</th>
<th>HINV</th>
<th>HVAR</th>
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</thead>
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<td>-.57*</td>
<td>-.28</td>
<td>-.73**</td>
<td>-.64**</td>
<td>-.80***</td>
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</table>

* p<.05  ** p<.01  *** p<.001
### Abbreviations and Variable Names

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOME</td>
<td>Total HOME score</td>
</tr>
<tr>
<td>HRES</td>
<td>Emotional and verbal responsivity of parent/caregiver HOME subscale score</td>
</tr>
<tr>
<td>HACC</td>
<td>Acceptance of child's behavior HOME subscale score</td>
</tr>
<tr>
<td>HORG</td>
<td>Organization of physical and temporal environment HOME subscale score</td>
</tr>
<tr>
<td>HPLY</td>
<td>Provision of appropriate play materials HOME subscale score</td>
</tr>
<tr>
<td>HINV</td>
<td>Parent/caregiver involvement with child HOME subscale score</td>
</tr>
<tr>
<td>HVAR</td>
<td>Opportunities for variety in daily stimulation HOME subscale score</td>
</tr>
<tr>
<td>EXPL</td>
<td>Level of exploratory/play behavior</td>
</tr>
<tr>
<td>TACT</td>
<td>Temperament activity rating</td>
</tr>
<tr>
<td>TRHY</td>
<td>Temperament rhythmicity rating</td>
</tr>
<tr>
<td>TAPP</td>
<td>Temperament approach/withdrawal rating</td>
</tr>
<tr>
<td>TADA</td>
<td>Temperament adaptability rating</td>
</tr>
<tr>
<td>TINT</td>
<td>Temperament intensity rating</td>
</tr>
<tr>
<td>TMOOD</td>
<td>Temperament mood rating</td>
</tr>
<tr>
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<td>Temperament persistence rating</td>
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<tr>
<td>TDIST</td>
<td>Temperament distractibility rating</td>
</tr>
<tr>
<td>TTHR</td>
<td>Temperament threshold rating</td>
</tr>
</tbody>
</table>
APPENDIX T

RELATIONSHIPS BETWEEN FREQUENCY OF EARLY INTERVENTION PROGRAMMING AND DEPENDENT VARIABLES
Table 39

Spearman Rank Order Correlation Coefficients
Frequency of Early Intervention Services and
(a) BDI Standard Scores, (b) IRS Rating, and (c) ECI Scores
Home Care Group

<table>
<thead>
<tr>
<th>Early Intervention Services</th>
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<tbody>
<tr>
<td>BDIT</td>
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<td>BPS</td>
<td>-.49</td>
</tr>
<tr>
<td>BA</td>
<td>-.49</td>
</tr>
<tr>
<td>BGM</td>
<td>-.52</td>
</tr>
<tr>
<td>BFM</td>
<td>-.62*</td>
</tr>
<tr>
<td>BCOM</td>
<td>-.49</td>
</tr>
<tr>
<td>BCOG</td>
<td>-.38</td>
</tr>
<tr>
<td>IRS</td>
<td>.38</td>
</tr>
<tr>
<td>ECIABI</td>
<td>.55*</td>
</tr>
<tr>
<td>ESO</td>
<td>.51</td>
</tr>
<tr>
<td>ERB</td>
<td>.62*</td>
</tr>
<tr>
<td>ESIB</td>
<td>.56*</td>
</tr>
</tbody>
</table>

* p < .05

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable Name</th>
</tr>
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<tbody>
<tr>
<td>BDIT</td>
<td>BDI total standard score</td>
</tr>
<tr>
<td>BPS</td>
<td>BDI personal social domain standard score</td>
</tr>
<tr>
<td>BA</td>
<td>BDI adaptive domain standard score</td>
</tr>
<tr>
<td>BGM</td>
<td>BDI gross motor standard score</td>
</tr>
<tr>
<td>BFM</td>
<td>BDI fine motor standard score</td>
</tr>
<tr>
<td>BCOM</td>
<td>BDI communication domain standard score</td>
</tr>
<tr>
<td>BCOG</td>
<td>BDI cognitive domain standard score</td>
</tr>
<tr>
<td>IRS</td>
<td>IRS infant rating</td>
</tr>
<tr>
<td>ECIABI</td>
<td>ECI adaptive behavior index</td>
</tr>
<tr>
<td>ESO</td>
<td>ECI sensorimotor organization score</td>
</tr>
<tr>
<td>ERB</td>
<td>ECI reactive behavior score</td>
</tr>
<tr>
<td>ESIB</td>
<td>ECI self-initiated behavior score</td>
</tr>
</tbody>
</table>
APPENDIX U

RELATIONSHIPS BETWEEN HEALTH FACTORS AND DEPENDENT VARIABLE
Table 40

Spearman Rank Order Correlation Coefficients
Level of Technology and (a) BDI Scores, (b) IRS Infant Rating, and (c) ECI Scores
Home Care and Hospital Groups

<table>
<thead>
<tr>
<th>Level of Technology</th>
<th>Home care</th>
<th>Hospital</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>BA</td>
<td>-.49</td>
<td>-.25</td>
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<tr>
<td>BGM</td>
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<td>-.44</td>
</tr>
<tr>
<td>BFM</td>
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<tr>
<td>BCOM</td>
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<td>-.53*</td>
</tr>
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<td>BCOG</td>
<td>-.34</td>
<td>-.21</td>
</tr>
<tr>
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<tr>
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<td>-.12</td>
</tr>
<tr>
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<td>ESIB</td>
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<td>-.35</td>
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</table>

* p<.05    ** p<.01
Table 41

Pearson Product Moment Correlation Coefficients
Gestational Age, and Duration of Hospitalization
with (a) BDI Scores, (b) IRS Infant Rating, and
(c) ECI Scores
Home Care and Hospital Groups

<table>
<thead>
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<th>HOSP</th>
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<tbody>
<tr>
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<tr>
<td>Home care</td>
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<td>-.19</td>
</tr>
<tr>
<td>Hospital</td>
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<td>-.56*</td>
</tr>
<tr>
<td>BPS</td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
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<tr>
<td>BGM</td>
<td>BDI gross motor standard score</td>
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<td>BFM</td>
<td>BDI fine motor standard score</td>
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<td>BCOM</td>
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<td>BDI cognitive domain standard score</td>
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<td>ECI adaptive behavior index</td>
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APPENDIX V

COMPARISONS OF SAMPLE GROUPS AND NORMATIVE GROUPS

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Table 42
T-values and Probabilities
BDI, IRS, and ECI Scores
Sample and Normative Groups

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LIST OF REFERENCES


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