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Maternal perception of child vulnerability in preschoolers born very low birth weight

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MATERNAL PERCEPTION OF CHILD VULNERABILITY IN PRESCHOOLERS BORN VERY LOW BIRTH WEIGHT

BY

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B.A., Psychology, McGill University, 2003
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DISSERTATION

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ABSTRACT

Research suggests that mothers of children born preterm are at high risk of perceiving their children as vulnerable even long after their children's health has improved. Although studies have examined the prevalence of maternal perception of child vulnerability within children born preterm, few studies have examined the relationship between maternal perception of child vulnerability and observed maternal behaviors, and the contextual factors associated with perceived vulnerability. The current study sought to examine the relationship between perceived vulnerability and observed maternal behavior (i.e., maternal overprotection, maternal hostility, and maternal responsiveness); clarify the relative role of health-related variables (i.e., neonatal illness severity, post-neonatal health factors, functional health impairment) in maternal perception of child vulnerability, and (3) examine the relative importance of a comprehensive range of contextual variables including neonatal illness severity, post-

neonatal health, functional health impairment, socio-demographic, and maternal psychosocial health factors in maternal perception of child vulnerability in a sample of preschoolers born very low birth weight (N=54). Results indicated that maternal perception of child vulnerability was not significantly associated with observed maternal overprotection, maternal hostility, and maternal responsiveness during mother-child interactions. Results also indicated that with regard to health-related variables, child rehospitalization was most strongly associated with perceived vulnerability. When examining all contextual factors together, maternal depressive symptoms were most strongly related to perceived vulnerability, followed by child rehospitalization. As a group, maternal psychosocial health factors accounted for the most variance in perceived vulnerability, followed by post-neonatal health factors. Together these findings provide a better understanding of maternal perception of child vulnerabilty in children born preterm and highlight the need for longitudinal study designs, larger samples, and comprehensive multimethod assessments of child current health in future studies examining perceived vulnerability.

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INTRODUCTION

The Importance of Parental Perceptions

The importance of the parent-child relationship for children's social, emotional, and cognitive development has been documented by several decades of research. The majority of research examining the parent-child relationship has focused on behavioral (observable) components of the relationship by examining parent-child interaction patterns and the interactive behaviors of the parent and the child (e.g., Brazelton, 1994; Malphurs et al., 1996; McDonough, 2004; van den Boom, 1995). Although understanding behavioral components of the parent-child relationship provides valuable information, many have argued that a sole focus on the behavioral aspects provides an incomplete understanding of the nature of the relationship. Many researchers believe, in order to gain a complete understanding, an assessment of the subjective experience of both partners in the relationship is also necessary (Sameroff & Emde, 1989; Sameroff & Seifer, 1983; Seifer, 2000; Stern, 1995; Zeanah & Anders, 1987; Zeanah & Barton, 1989; Zeanah et al., 1997). According to this perspective, examining the beliefs, expectations, and perceptions of both the parent and the child (i.e., subjective components) is essential.

Recently, those examining the subjective aspect of the parent-child relationship have placed particular importance on understanding the perceptions parents hold regarding their children (Benoit, Zeanah, & Parkers, 1997; Sameroff, 2004; Seifer, 2000). According to Seifer (2000), understanding how parents perceive their children is as important as understanding the actual behaviors that occur during parent-child interactions, since parental perceptions provide critical information regarding how

parents experience their children and interpret their behavior. In addition, parental perceptions are believed to have overarching effects on child development through direct processes, such as disciplinary styles or teaching techniques, and indirect processes, such as the manner in which parents structure their children's physical and social environments (Seifer, 2000; Zeanah & Anders, 1987). Literature shows that the perceptions parents hold regarding their children provide an interpretative context to the parent-child relationship and have developmental relevance, inasmuch as they affect parent and child behavior, as well as dyadic behavior (Seifer, 2000).

Although the applied clinical literature has long acknowledged the importance of understanding the perceptions parents hold regarding their children (e.g., Clark, Paulson, & Conlin, 1993; Cramer & Stern, 1988; Lieberman & Pawl, 1993; Lorber, O'Leary, & Kendziora, 2003; Schechter et al., 2006; Stern, 1995), empirical research on this topic has been relatively limited. To date, research pertaining to parental perceptions has been scattered across various research domains (e.g., developmental psychology, child psychology, pediatric psychology) and has largely focused on parental perception of the parent-child attachment relationship (e.g., Zeanah et al., 1997), as well as parental perception of child temperament (e.g., Pauli-Pott, Mertesacker, & Bade, 2003), child behavior problems (e.g., Reid, Kavanagh, & Baldwin, 1987), and child development (e.g., Delgado & Ford, 1998). In recent years, however, the relatively small research area of parental perception of child vulnerability has been gaining interest and importance.

Parental Perception of Child Vulnerability

Parental perception of child vulnerability refers to the perception held by parents that one's child is highly vulnerable to illness, injury, and/or death. Parental perception of

child vulnerability has been found to be particularly common among parents whose children have experienced illness, injury, and/or recurrent hospitalizations in infancy or early childhood (Thomasgard & Metz, 1995). The concept of parental perception of child vulnerability originally stems from Green and Solnit's (1964) 'vulnerable child' study. In their now classic study, Green and Solnit examined the difficulties faced by 25 children who had experienced a variety of medical conditions in childhood (e.g., seizures and apnea in the neonatal period, croup at 18 months, diagnosis of congenital heart disease at 3 months, salicylate poisoning at 2 years, perforated appendicitis with complications at 6 years, and diabetes at 10 years). They found that the majority of their sample developed behavioral difficulties (i.e., separation problems, excessive somatic concerns, academic underachievement) and that, despite the current normal health of the sample, parents of all 25 children continued to believe that their children were at risk for serious illness and death. Based on these findings, Green and Solnit coined the term "vulnerable child syndrome" to describe both the behavioral difficulties demonstrated by these children and the continued anxiety parents held regarding their children's health (Green & Solnit, 1964). Green and Solnit hypothesized that parents' anxiety regarding their children's health had long-term negative effects on the parent-child relationship, leading to child behavioral difficulties.

Despite the significant methodological limitations associated with their study, such as the use of unstandardized measures, the heterogeneity of the child medical conditions included in the study, and the failure to assess children's objective medical vulnerability, Green and Solnit's (1964) conceptualization of the vulnerable child syndrome and their hypothesis regarding the role of parental health concerns in children's

behavioral difficulties were very influential in generating interest in parental perception of child vulnerability. As a result of their work, researchers began examining both what contributed to heightened perception of child vulnerability as well as how such perceptions influence both child outcomes and parental behavior (see Thomasgard & Metz, 1995 for review). Although still in its infancy, research on parental perception of child vulnerability has been increasing, both among healthy children and children with current and/or past pediatric conditions. Interest has been particularly evident among parents of children born preterm (children born at less than 37 weeks gestation).

Parental Perception of Child Vulnerability in Children Born Preterm

Many have emphasized that as a result of the countless medical procedures, the prolonged hospitalizations, and the medical complications associated with prematurity, parents of children born preterm are at high risk of perceiving their children as vulnerable (Miles & Holditch-Davis, 1997). Studies, in fact, indicate that parents of preschoolers born preterm are more likely to perceive their children as vulnerable compared to both parents of preschoolers born full-term who never experienced serious medical complications and parents of preschoolers born full-term who experienced severe neonatal complications requiring NICU hospitalizations (Culley, Perrin, & Chaberski, 1989; Perrin, West, & Culley, 1989).

In fact, studies indicate that a high percentage of parents of children born preterm perceive their children as vulnerable (Culley et al., 1989; Estroff, Yando, Burke, & Snyder, 1994; Perrin et. al, 1989). Estroff and colleagues, for instance, examined the rates of perceived vulnerability in a sample of 80 parents of children born preterm and very low birth weight (VLBW; <1500 grams) and found that approximately 64% of parents

scored above the clinical cut-off score (i.e., score of 10) on the Child Vulnerability Scale, indicating that they continued to perceive their children as highly vulnerable at 3- to 4-years of age (Estroff et al., 1994).

Parental perception of child vulnerability among parents of children born preterm also appears elevated even in the presence of contradictory health information. Studies, for instance, indicate that even among children born preterm and VLBW whose current health is assessed as normal and whose objective medical vulnerability is considered minimal by medical professionals, parental perception of child vulnerability is elevated (Culley et al., 1989; Perrin et al., 1989). Perrin and colleagues, for example, compared maternal perceptions of child vulnerability in 39 preschoolers born preterm and VLBW who were currently assessed as healthy and 41 preschoolers born full term who were also assessed as healthy. They found that compared to approximately 3% of parents of healthy preschoolers born full-term, approximately 30% of parents of healthy preschoolers born preterm and VLBW scored above the clinical cut-off score, thereby indicating that they continued to perceive their children as highly vulnerable (Perrin et al., 1989).

Research also suggests that parental perceptions of child vulnerability among parents of children born preterm are relatively stable and long-lasting (Stern, Karraher, McIntosh, Moritzen, & Olexia, 2006; Teti, Hess, & O'Connell, 2005). Teti and colleagues (2005), for instance, examined the stability of parental perception of child vulnerability in a sample of 97 infants born preterm and VLBW and found high stability from 3- to 12-months of age ($r=.59$, $p=.001$). Similarly, Stern and colleagues (2006) examined the stability of perceived vulnerability from 5 to 32 months of age in a sample of 56 children born preterm and found significant stability ($r=.36$, $p=.013$). Although the

stability findings reported above are confounded by the failure of both studies to control for objective medical vulnerability, the high stability reported suggests that perceptions of child vulnerability among parents of children born preterm may be particularly long-lasting.

Studies showing the high prevalence as well as the stability of perceived vulnerability among parents of children born preterm are particularly important given that there is growing research linking parental perception of child vulnerability with child behavioral outcomes. As reviewed in the following sections (*see section below for detailed review of existing studies*), research examining the relationship between perceived vulnerability and child outcomes suggests that maternal perceptions of child vulnerability are associated with child behavioral difficulties in children born preterm (Culley et al., 1989; Estroff et al., 1994; de Ocampo, Macias, Saylor, & Katikanemi, 2003; Perrin et al., 1989), in children with other medical conditions (Anthony, Gil, & Schanberg, 2003; Mullins, Fuemmeler, Holf, Chaney, van Pelt, & Ewing, 2004), and in healthy children (Bendall, Field, Yando, Lang, Martinez, & Pickens, 1994; Forysth, Horwitz, Leventhal, Burger, & eaf, 1996; Thomasgard & Metz, 1996). Despite the limited number of studies in this research area, existing findings indicate that maternal perceptions of child vulnerability are concurrently associated with parental report of child externalizing and internalizing behavioral difficulties (Bendall et al., 1994; Culley et al., 1989; Estroff et al., 1994; Forysth et al., 1996; de Ocampo et al., 2003; Perrin et al., 1989) and child self-report of internalizing behavioral difficulties (Anthony et al., 2003; Mullins et al., 2004). They are also predictive of future parental report of child externalizing and internalizing behavioral difficulties (Thomasgard & Metz, 1996).

Although perceptions of child vulnerability among parents of children born preterm may be warranted and adaptive during children's first months of life when the risk of medical complication and rehospitalization is high, the continuation of such perceptions after children's health has improved and their objective medical vulnerability is considered minimal may become maladaptive. Examining the impact of heightened parental perception of child vulnerability, particularly among children who are currently assessed as healthy, may be particularly relevant since research indicates that the majority of children born preterm, including those born VLBW, show "normal" developmental and health outcomes (Colvin, McGuire, & Folwie, 2004). Although it is possible that parents who continue to perceive their children as vulnerable are better at identifying subtle indicators of objective vulnerability in their children than are medical professionals, it is also possible that these parents have difficulty revising their vulnerability perceptions when medical information calls for such revisions. Although current research cannot clarify which of these processes are at play or to what extent each process is present, future exploration of the relationship between objective and perceived child vulnerability may provide some clarification.

To date, the bulk of research examining perceived vulnerability in children born preterm has focused on understanding the impact of parental perception of child vulnerability on child outcomes and parental behaviors as well as understanding what contextual factors contribute to heightened parental perception of child vulnerability. Although the empirical literature in these areas is still relatively limited, the following sections will review existing studies on each topic.

Parental Perception of Child Vulnerability and Child Behavioral Outcomes

The higher risk of behavioral difficulties among children born preterm, compared to children born full-term, has long been documented by research findings (see Bhutto, Cleves, Casey, Cradock, & Anand, 2002 for review). Both higher rates of externalizing behavioral problems (e.g., distractibility, Attention Deficit Hyperactivity Disorder, aggressivity) and internalizing behavioral problems (e.g., sadness/unhappiness, withdrawal, social anxiety, depressive moods, passivity) among children born preterm have been reported (see Bhutta et al., 2002). Although the higher risk of behavioral difficulties has long been acknowledged, research has, to date, failed to clarify what factors account for such risk. Although the role of child medical factors in child behavioral outcomes has often been emphasized (e.g., Aylward, 2005), studies indicate that medical factors alone fail to account for the behavioral difficulties found in preterm populations (Nadeau, Tessier, Boivin, Lefebvre, & Robaey, 2003; Tessier, Nadeau, & Boivin, 1997; Thompson et al., 1994). Studies, in fact, show that medical factors such as birth weight (Anderson & Doyle, 2003; Nadeau et al., 2003; Tessier et al., 1997), gestational age (Anderson & Doyle, 2003; Nadeau et al., 2003; Tessier et al., 1997), and children's current health (Delobel-Ayoub et al., 2006) do not fully account for the behavioral difficulties found in children born preterm. As a result, examining the potential role of parental perception of child vulnerability in the behavioral outcomes of children born preterm may be particularly important given that objective medical vulnerability factors (e.g., birth weight, gestational age, current health) do not appear to fully account for the behavioral difficulties found in this population.

To date, the few studies that have examined the relationship between parental perception of child vulnerability and child behavioral outcomes in children born preterm

have relied exclusively on parental report of child behavioral difficulties (Culley et al., 1989; Estroff et al., 1994; de Ocampo et al., 2003). Although based entirely on parental report, these studies indicate that parental perception of child vulnerability is associated with parental report of child behavioral difficulties (Culley et al., 1989; Estroff et al., 1994; de Ocampo et al., 2003; Perrin et al., 1989).

Estroff and colleagues (1994), for example, examined the relationship between maternal perception of child vulnerability on the Vulnerable Child Scale (VCS; Perrin et al., 1989) and maternal report of child behavioral difficulties on the Child Behavior Checklist (Achenbach, Edelbrock, & Howell, 1987) in 50 preschoolers born preterm and VLBW. Findings indicated that mothers who perceived their children as vulnerable were significantly more likely to rate their children on the Child Behavior Checklist as aggressive, destructive, socially withdrawn, and as having more somatic problems. In fact, the mean *t* score (*t*=74) on the Aggressive Subscale of children perceived as vulnerable was in the clinical range. Mothers who perceived their children as vulnerable were not, however, more likely to rate their children as depressed or as having sleep problems. Despite being limited by the failure to control for children's current health, the finding that perceived vulnerability and maternal report of behavioral difficulties are associated indirectly supports a relationship between perceived child vulnerability and child behavioral difficulty.

In a similar study, Perrin and colleagues (1989) examined the relationship between maternal perception of child vulnerability and maternal behavioral ratings in a sample of 39 preschoolers born preterm and VLBW using the Vulnerable Child Scale (VCS; Perrin et al., 1989) and the Personality Inventory for Children (Wirt, Lochar, &

Klinedienst, 1982). In contrast to Estroff and colleagues' study, the relationship between perceived child vulnerability and behavioral ratings was examined only in a sample of children who were considered currently healthy (i.e., no hospitalization since the age of 6 months, no ongoing illness, no regular use of medication). In this healthy preterm sample, Perrin and colleagues found that maternal perception of child vulnerability was significantly associated with maternal report of child internalizing ($r=-.31$, $p<.05$) and externalizing behaviors ($r=-.25$, $p<.05$). Maternal perception of child vulnerability was not, however, significantly associated with parental report of social difficulties. Their findings, hence, suggest that among healthy children born preterm without objective medical vulnerability, maternal perception of child vulnerability was also associated with maternal report of behavioral difficulties.

Studies examining the relationship between parental perception of child vulnerability and child outcomes in other pediatric samples have also reported significant associations between parental perception of child vulnerability and child self-report of internalizing difficulties (Anthony et al., 2003; Mullins et al., 2004). Anthony and colleagues (2003), for instance, examined the concurrent association between perceived child vulnerability and child self-report ratings in a sample of 69 seven to fourteen year-old children with rheumatic or pulmonary disease. Using the Child Vulnerability Scale (Forsyth et al., 1996) and the Social Anxiety Scale for Children-Revised (La Greca & Stone, 1993), they found that maternal perception of child vulnerability was significantly associated with child self-report ratings on the General Social Distress and the Social Avoidance/Distress in New Situations subscales of the Social Anxiety Scale for Children-Revised, even after controlling for physician-rated disease severity. Thus, even after

controlling for children's objective medical vulnerability (i.e., physician-rated illness severity), maternal perception of child vulnerability was associated with child self-report of social anxiety. This finding is particularly important given that Anthony and colleagues (2003) both carefully controlled for objective medical vulnerability and avoided sole reliance on parental report of child behavioral difficulty by examining child self-report. As a result of addressing these methodological limitations, Anthony and colleagues' (2003) finding suggests that parental perception of child vulnerability may be associated with child behavioral difficulties, even once objective medical vulnerability and parental reporting bias is taken into account.

Similar to Anthony and colleagues study, Mullin and colleagues (2004) examined the concurrent association between perceived child vulnerability and child self-report ratings in a sample of 43 eight to twelve year-old children with Type 1 Diabetes Mellitus. Using the Child Vulnerability Scale (Forsyth et al., 1996) and the Children's Depression Inventory (Kovacs, 1992), they found that maternal perception of child vulnerability was significantly and positively associated with child self-report ratings on the Children's Depression Inventory.

Similarly, studies examining the relationship between perceived vulnerability and child outcomes in healthy samples indicate that parental perception of child vulnerability is both concurrently associated with parental report of child internalizing and externalizing behaviors (Bendall et al., 1994; Forysth et al., 1996) as well as predicative of later parental report of internalizing and externalizing behavioral difficulties (Thomasgard & Metz, 1996). In a prospective study examining how maternal perceptions of child vulnerability predicted later maternal ratings of behavioral problems, for

instance, Thomasgard and Metz (1996) found that maternal perception of child vulnerability between 2 and 5 years of age predicted maternal rating of behavioral difficulty at a two-year follow-up. More specifically, their results indicated that mothers who rated their daughters as vulnerable reported significantly more internalizing behaviors at the two-year follow-up, while mothers who had rated their sons as vulnerable were significantly more likely to report externalizing problems at the two-year follow-up.

The finding that parental perception of child vulnerability is associated with parental report of behavioral difficulties and child self-report of internalizing difficulties (i.e., social anxiety, depression) provides some support for the potential relationship between perceived vulnerability and poorer child behavioral outcomes. Conclusions, however, are difficult to make given the significant limitations associated with this area of research: namely, the almost exclusive reliance on parental report of child behavioral difficulty and the frequent failure to control for child's current health. As a result of these limitations, the precise role that parental perception of child vulnerability plays in child behavioral difficulty, as well as the extent of that role, is unclear. Future research, thus, will benefit from assessing the relationship between perceived child vulnerability and child behavioral difficulty while using observational measures of child behavioral difficulty and controlling for child's current health.

Parental Perceptions of Child Vulnerability and Parental Interactive Behaviors

As previously noted, Green and Solnit (1964) first hypothesized that perceptions of child vulnerability, and the presence of what they termed the "vulnerable child syndrome," led to parent-child interaction difficulties. They specifically theorized that

parents who viewed their children as vulnerable were more likely to display overprotective behaviors (Green & Solnit, 1964). Others have since noted that parental perception of child vulnerability may be associated with heightened parental overprotectiveness, that is, a behavioral pattern of overly intrusive behavior, excessive regulation of children's activities, and limited granting of age-appropriate autonomy intended for the safety and security of the child (Miles & Holditch-Davis, 1997; Thomasgard & Metz, 1995).

Few studies, however, have actually examined the relationship between parental perception of child vulnerability and parental overprotection. The few studies that have examined this relationship have focused on the relationship between maternal perception of child vulnerability and maternal report of overprotectiveness (de Ocampo et al., 1994; Mullins et al., 2004; Stern et al., 2006; Thomasgard, 1998; Thomasgard & Metz, 1997; Thomasgard, Metz, Edelbrock, & Shonkoff, 1995). Findings from these studies indicate a significant, although somewhat weak (i.e., .2-.3), relationship between maternal report of child vulnerability and maternal report of overprotectiveness. The paucity of studies examining the relationship between perceived vulnerability and parental overprotection is particularly evident among preterm populations, given that only two studies (i.e., de Ocampo et al., 2003; Stern et al., 2006) have examined this relationship, each using different measures of parental overprotection.

In the first study, de Ocampo and colleagues (2003) examined the relationship between maternal perception of child vulnerability and maternal report of overprotection in a sample of ninety 21- to 81- month old children. Children included in this study were considered high risk at birth and had been hospitalized in the neonatal intensive care unit.

Eligibility criteria included any of the following: birth weight less than 1500 grams, 5-minute APGAR score of less than 3, head circumference and weight less than the 5th percentile, perinatal exposure to cocaine, Grade III or IV intraventricular hemorrhage, extra corporeal membrane oxygenation, periventricular leukomalacia, neonatal seizures, and/or mechanical ventilation for more than 7 days. As a result of the broad eligibility criteria, the study sample was not exclusively preterm. More than 70% were considered preterm and more than 60% were considered VLBW. Using the Child Vulnerability Scale (Forsyth et al., 1996) and the Parental Protection Scale (PPS; Thomasgard et al., 1995), de Ocampo and colleagues examined the association between perceived child vulnerability and components of overprotectiveness, that is, maternal report of supervision (e.g., "I know exactly what my child is doing") , dependency (e.g., "I allow my child to do things on his/her own"), control (e.g., "I dress my child even if he/she can do it alone"), and separation difficulty (e.g., "I have difficulty leaving my child with a babysitter"). Their findings indicated that maternal perception of child vulnerability was significantly associated with the Separation subscale scores on the Parental Overprotection Scale (r=.31), in that mothers who perceived their children as vulnerable were more likely to report difficulty separating from their children.

The findings from de Ocampo and colleagues' study suggest that maternal perception of child vulnerability may be associated with some aspects of maternal overprotection (i.e., maternal separation difficulties). De Ocampo and colleagues' study design, however, does not allow for a clear understanding of this relationship. In fact, a number of problems associated with the study limit the conclusions that can be made regarding the relationship between child vulnerability perception and maternal

overprotectiveness. First, de Ocampo and colleagues' study failed to control for children's current health. By failing to do so, it is unclear whether the relationship between perceived child vulnerability and maternal report of overprotection (i.e., separation difficulties) may be at least partially attributed to children's current health level.

Second**,** de Ocampo and colleagues' study relied exclusively on parental report of parental behavior. Sole reliance on parental report is concerning given the questionable validity and reliability of parental self-report measures. Parental responses to parenting questionnaires, for instance, have been shown to be highly influenced by parental characteristics such as family structure, education status, family socioeconomic status, parental psychopathology, and parental distress (Alessi, 1988; Bates & Bayles, 1984; Chamberlain & Patterson, 1995, Forehand, Furey, & McMahon, 1984; Lancaster, Prior, & Adler, 1989; Vitaro, Tremblay, & Gagnon, 1995), suggesting both an objective and subjective component to parent report (Bates & Bayles, 1984; Matheny, Wilson, Thoben, 1987; Seifer, 2002; Seifer, Sameroff, Dickstein, Schiller, & Hayden, 2004). Parental responses have also been questioned in term of their representativeness of actual behavioral practice or knowledge of effective parenting practices (Aspland & Gardner, 2003; Patterson, 1982). Similarly, responses to parenting self-report questionnaires have been shown to be particularly vulnerable, both consciously and unconsciously, to social desirability motives (Rosenbaum, 1986). In addition, concerns have been raised whether parents have distorted recollections of their actual parenting behaviors when completing parenting self-report questionnaires (Holden, 1983; Mrazek, Dowdney, Rutter, & Quinron, 1982).

Concerns regarding the interpretation of questions and response options have also been raised. For instance, individual parents may interpret questions and response options (e.g., frequency categories) differently (Holden, 1983). Lastly, many have questioned the "generality" of parenting self-report questionnaires, stating that most of these measures are not context-specific and ask about "general" parenting practices. As a result, parents who respond differently to their children depending upon the context may have difficulty reporting upon their parenting behavior "in general" (Dowdney, Mrazek, Quinton, & Rutter, 1984; Johnson, 2001; Locke & Prinz, 2002; Mrazek et al., 1982; Pappas-Jones & Adamson, 1987; Socolar, Winsor, Hunter, Catellier, & Kotch, 1999). As a result of the limitations associated with self-report parenting questionnaires, many have emphasized the need for behavioral observation of parenting behaviors (Gardner, Miller-Perrin & Perrin, 1999). Although observations of parenting behaviors have their own limitations (e.g., context-specificity, social desirability influences), they may be more appropriate to assessing parenting behaviors (Gardner et al., 1999).

Lastly, the sample included in de Ocampo and colleagues' study was extremely heterogeneous with regard to age and preterm/full-term status. The ages of the children included in the study (i.e., 21-81 months old) varied substantially, and it is unclear how child age influenced their findings. For example, it is unclear whether the relationship found between perceived vulnerability and parent separation difficulties (i.e., Separation subscale of the Parent Protection Scale) differed with child age. In addition, children born both preterm (70% of the sample) and full-term (30%) were included in the study. Furthermore, the preterm sample included varied substantially with regard to birth weight and gestational age. For instance, birth weight ranged from under 1500 grams to above

2500 grams, and children classified as appropriate weight for gestation age (AGA) and small weight for gestation age (SGA) were included in the sample. This heterogeneity is concerning given that research has long acknowledged the outcome differences associated birth weight differences (Aylward 2002; 2005). For example, children born with birth weights above 2500 grams have been shown to have significantly better developmental and health outcomes than those born with birth weights under 1500 grams (Aylward 2002; 2005). Similarly, children classified as AGA have significantly better outcomes than those classified as SGA (Yinon, Mazkereth, Rosentzweig, Jarus-Hakak, Schiff, & Simchen, 2005). The heterogeneity found within de Ocampo and colleagues' sample limits the generalizability of their findings.

In the second more methodologically sound study, Stern and colleagues (2006) examined the relationship between perceived vulnerability and observed maternal behavior in a sample of 56 five-month-old infants born preterm. In this study, Stern and colleagues examined the relationship between maternal perception of child vulnerability and observed maternal intrusiveness, a defining feature of overprotectiveness that is often considered the best available behavioral proxy for the construct of overprotection (Anderson & Coyne, 1991; 1993; Coyne, Wortman, & Lehman, 1988; Holmbeck et al., 2002; Levy, 1943, 1970; Parker, Tupling, & Brown, 1979; Thomasgard et al., 1995). In order to examine this relationship, maternal perception of child vulnerability was assessed using the Vulnerable Child Scale (Perrin et al., 1989) and maternal intrusiveness, sensitivity, and hostility were coded during a mother-infant free-play interaction using a modified version of the Emotional Availability Scales (EAS; Biringen, Robinson, & Emde, 1988). Results indicated that mothers who perceived their infants as

more vulnerable were more likely to display intrusive and hostile behaviors during mother-infant interactions.

Although Stern and colleagues' (2006) findings suggest that maternal perception of child vulnerability may be associated with behavioral components of maternal overprotectiveness, the limitations of their study affect the conclusions that can be made. First, similar to de Ocampo and colleagues (2003), Stern and colleagues (2006) failed to assess children's current health, thereby obscuring the relationship between perceived child vulnerability and maternal intrusiveness/overprotection.

Second, Stern and colleagues' (2006) sole reliance on a mother-child free play interaction to assess maternal behavior is not ideal. Numerous studies emphasize the need for multiple interaction tasks when assessing parent and child behaviors and the importance of considering the types of mother-child interaction tasks most appropriate for the behavior(s) being assessed (Calkins, Smith, Gill, & Johnson, 1998; Ginsburg, Grover, Cord, & Ialongo, 2006; Grolnick, Price, Beiswnger, & Sauck, 2007; Leyendecker, Lamb, & Scholmerich, 1997; Metsapelto, Pulkkinen, & Poikkeus, 2001; Miller, McDonough, Rosenblum, & Sameroff, 2002; Pino, 2000; Seifer, Sameroff, Anagnostopolou, & Elias, 1992). Including tasks that place more performance demands on the parent and the child, such as compliance-based tasks (e.g., a clean-up task), may be particularly important when assessing maternal intrusiveness given that maternal intrusive behaviors are more likely to occur during such tasks. Rubin and colleagues (2002), for instance, found that mothers were more likely to display intrusive behaviors during a clean-up task compared to an unstructured free play task (Rubin, Burgess, & Hastings, 2002). Assessing maternal intrusiveness during both an unstructured free play

and a compliance-based task (e.g., clean-up) may provide a more complete picture of intrusive behaviors.

The age of Stern and colleagues' (2006) sample should also be noted in that their relatively young preterm sample may have impacted their findings. At five months of age, the NICU experience is relatively recent and the risk of future medical complications is still foreseeable. Assessing perceptions of child vulnerability in older samples that have long been discharged from the NICU and are no longer at risk for future medical complications may yield different findings regarding the prevalence of child vulnerability perception and its relationship to maternal behaviors. In addition, although maternal intrusiveness can be assessed during the mother-child interactions of five-month-olds, maternal intrusiveness may be more easily assessed during mother-child interactions of older children, such as toddlers and preschoolers. The increased desire for autonomy and independence found among toddlers and preschoolers (Forman, 2007) may potentially accentuate maternal intrusive behaviors. As a result, maternal intrusive behaviors may be easier to observe during the mother-child interactions of older children.

The health status of the sample should also be addressed. The infants included in Stern and colleagues' (2006) study were relatively healthy and had not experienced medical complications. The mean gestational age of their sample was 33 weeks gestation and infants born prior to 28 weeks gestation were excluded from the study. Also, only children classified as low birth weight (more than 1500 grams) were included in their sample and children who were ill following their birth were excluded from the study. Examining the presence of child vulnerability perceptions as well the relationship between perceived vulnerability and maternal intrusiveness among more medically

compromised preterm samples, such as children born very low birth weights (VLBW), may yield different findings.

In short, Stern and colleagues' (2006) findings, coupled with those reported by de Ocampo and colleagues (2003), support the relationship between parental perception of child vulnerability and parental overprotection in children born preterm. The extent and nature of that relationship, however, is obscured by the limitations associated with both studies. In order to clarify this relationship, future studies will need to examine this relationship while addressing the limitations of both studies.

Interestingly, most studies that have examined the relationship between maternal perception of child vulnerability and maternal behavior have focused on the role of maternal overprotection. Research examining the relationship between maternal perception of child vulnerability and other maternal behaviors, such as maternal hostility and maternal responsiveness, has been minimal. In fact, Stern and colleagues' (2006) study is the only study to date that has examined the relationship between maternal perception of child vulnerability and maternal behaviors other than overprotection (i.e., maternal hostility). As previously noted, Stern and colleagues found that maternal perception of child vulnerability was significantly and positively associated with observed maternal hostility. Stern and colleagues' finding suggests that in order to fully understand the relationship between perceived vulnerability and maternal behavior, a broader range of maternal behaviors must be explored.

Exploring the relationship between maternal perception of child vulnerability and maternal hostility and maternal responsiveness may be particularly relevant given that both maternal hostility (Lyons-Ruth, Alpern, & Rapacholi, 1993; Marchand, Hock, &

Widaman, 2002; Romano, Tremblay, Boulerice, & Swisher, 2005) and maternal responsiveness (Beckwith & Rodning, 1996; Denham, 1993; Steelman, Assel, Swank, Smith, & Landry, 2002) have been shown to be associated with children's socio-emotional outcomes. Maternal hostility (Lok & McMahon, 2006; Whiteside-Mansell, Bradley, Owen, Randolph, & Cauce, 2003) and maternal responsiveness (White-Mansell et al., 2003; Wijnroks, 1999) have also been found to be related to maternal overprotection (i.e., intrusiveness), a behavior that has been linked to perceived vulnerability. Studies examining the relationship between maternal overprotection (i.e., intrusiveness) and maternal hostility have found a positive relationship between both behaviors, indicating that mothers who are more overprotective are also more hostile during mother-child interactions (Lok & McMahon, 2006; Whiteside-Mansell et al., 2003). On the other hand, studies examining the relationship between maternal overprotection (i.e., intrusiveness) and maternal responsiveness have found a negative relationship, indicating that mothers who are more overprotective are less responsive in their interactions during mother-child interactions (White-Mansell et al., 2003; Wijnroks, 1999). Future studies that examine a broader range of maternal behaviors, such as maternal hostility and responsiveness, are therefore needed in order to fully understand the relationship between perceived vulnerability and maternal behaviors.

Contextual Factors Associated with Perception of Child Vulnerability

In addition to examining the relationship between perceived child vulnerability and parental behavior, studies have also examined the contextual factors associated with heightened parental perception of child vulnerability. The three studies that have examined the factors associated with parental perception of child vulnerability in children

born preterm have focused primarily on maternal psychosocial, socio-demographic, and infant medical factors (Allen, Manuel, Legault, Naughton, Pivor, & O'Shea, 2004; Perrin et al., 1989; Teti et al., 2005). Perrin and colleagues (1989), for instance, examined what maternal psychosocial (i.e., maternal well-being, marital relationship quality), socio-demographic (i.e., SES, maternal/paternal education, maternal/paternal age, marital status, child gender, birth order), and child neonatal medical (i.e., birth weights) factors were associated with maternal perception of child vulnerability in a sample of 49 preschoolers born preterm and VLBW (Perrin et al., 1989). Their findings indicated that higher SES, lower birth weight, single maternal marital status, firstborn status, higher maternal and paternal education, lower maternal well-being on the General Well-Being Scale (USPHS, 1979), as well as greater expressiveness within the marital relationship on the Dyadic Adjustment Scale (Spanier, 1976), were associated with higher maternal perceptions of child vulnerability on the Vulnerable Child Scale (VCS; Perrin et al., 1989).

Allen and colleagues (2004) examined which maternal psychosocial and infant medical factors predicted perceptions of child vulnerability in a sample of 116 infants born preterm and VLBW. Prior to the infants' NICU discharge, measures of anxiety, depression, life satisfaction, illness impact on the family, and social support were obtained. Socio-demographic (i.e., birth order, family income, maternal marital status, maternal age, maternal education, maternal ethnicity, child gender) and child neonatal medical variables (birth weights, gestational age, length of NICU hospitalization, and length of ventilation) were also obtained. At 12 months adjusted age, maternal perception of child vulnerability and children's current medical vulnerability were assessed.

Children were considered medically vulnerable if they had one or more of the following: weight/length <5th percentile, tube feeding, home oxygen, tracheostomy, cerebral palsy, severe visual impairment (involvement with a school for the blind), severe hearing impairment (use of hearing aids), ventriculoperitoneal shunt, or anticonvulsant use. Results indicated that higher perceived child vulnerability was significantly associated with higher maternal anxiety, higher maternal depression, greater impact of the illness on family, longer NICU hospitalization, non-firstborn status, current medical vulnerability, as well as lower maternal optimism, life satisfaction, and social support. When examining the relative contributions of each variable, only maternal anxiety remained a significant unique predictor of perceived child vulnerability.

In another prospective study, Teti and colleagues (2005) examined the maternal, psychosocial factors predictive of maternal perceptions of child vulnerability in a sample of 97 mothers of infants born preterm. Prior to the NICU discharge, the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Mother and Baby Scales (MABS; Wolke & St. James-Roberts, 1987) were administered. MABS evaluates maternal adaptation to parenting by assessing maternal confidence in caregiving and in feeding, as well as maternal perceptions of infant alertness and responsiveness. At 3 to 4 months adjusted age, the Maternal Self-Efficacy Scale (Teti & Gelfand, 1991), Parenting Stress Index (Abidin, 1990), and Vulnerable Child Scale (VCS; Perrin et al., 1989) were administered. Results indicated that maternal depression, maternal perceptions of infant alertness and responsiveness, as well as maternal confidence in feeding prior to NICU discharge, predicted maternal perceptions of child vulnerability at 3-4 months of age. Results also indicate that maternal self-efficacy beliefs and perceived parenting stress

were significantly concurrently associated with perceived child vulnerability at 3 to 4 months adjusted age.

Together, the findings from these three studies suggest that certain maternal, child, and socio-demographic factors are associated with heightened perceptions of child vulnerability among preterm populations (Allen et al., 2004; Perrin et al., 1989; Teti et al., 2005). According to their findings, maternal factors such as psychosocial health (e.g., anxiety, depression, life satisfaction, optimism, maternal well-being, self-efficacy beliefs), sense of confidence/competence in parenting (i.e., confidence in feeding, parenting confidence), and sense of support (e.g., social support, marital support) appear to play an important role in child vulnerability perceptions. Their findings also suggest that certain child factors are associated with perceived child vulnerability among children born preterm. Child factors such as medical variables (i.e., lower birth weights, length of NICU hospitalization, medical vulnerability at the time of assessment) and maternal perception of infant alertness and responsiveness during the NICU hospitalization appear to play a role in parental perception of child vulnerability, although the extent of their role is unclear. In addition, their findings also suggest that socio-demographic variables, such as higher SES, maternal single marital status, and higher parental education appear to be associated with heightened perceived child vulnerability among preterm populations.

Although the findings from the studies described above allow for a better understanding of the contextual factors associated with perceived child vulnerability, similar to the previously reviewed studies, the limitations associated with these studies obscure any significant understanding. First, the three studies failed to fully examine the

relationship between health-related factors and parental perception of child vulnerability. Although Perrin and colleagues (1989), as well as Allen and colleagues (2004), examined the association between maternal perception of child vulnerability and neonatal medical factors (e.g., birth weights, gestational age, length of NICU hospitalization, and length of ventilation), both studies failed to examine how post-neonatal health factors influence parental perception of child vulnerability. In fact, all three studies reviewed neglected to examine how post-neonatal health is associated with parental perception of child vulnerability. For instance, child factors such as the number of rehospitalizations since NICU hospitalization, number of medications currently being used, height for age, and weight for age, were not examined.

A better understanding of how post-neonatal health factors influence maternal perception of child vulnerability is needed since there is limited understanding of how health factors after the neonatal period are associated with perceived vulnerability. Although assessing children's post-neonatal and current health is difficult because consensus is limited regarding how to assess health in children (Institute of Medicine, 2004; Saigal et al., 2005), particularly in children born preterm (Schiariti, Hoube, Lismkova, Klassen, & Shoo, 2007), and because no measure currently is available for assessing post-neonatal health in children born preterm, post-neonatal factors indicative of continued health difficulties can be examined in order to provide a better understanding of how more recent health factors are associated with perceived vulnerability. Post-neonatal health factors such as the number times the child is rehospitalized after his/her initial neonatal intensive care admission, the number of medications the child is currently taking, and the child's current growth attainment (i.e.,

height, weight) may, indeed, serve as important markers of continued health difficulties for parents and may influence vulnerability perceptions. In fact, the number of child rehospitalizations has been used as an indicator of child health (Coulibaly, Seguin, Zunzinegui, & Gauvin, 2006, DeMaso et al., 1991; McCormick, Brooks-Gunn, Workman-Daniels, & Peckham, 1993; Skalicky et al., 2006, van Hooijdonk, Droomers, van Loon, van der Lucht, & Kunst, 2006) and has been found to be associated with parental distress (Davis, Edwards, Mohay, & Wollin, 2003; Fraley, 1986; Miles, Holditch-Davis, Schwartz, & Scher, 2007; Zelkowitz, Papageorgiou, & Allard, 1994). Rehospitalization may not only signify the actual continuance of the child's health problems, it may also remind parents of their child's extensive NICU hospitalization and serve as an important reminder of their child's continued health risk**.** Similarly, the continued use of medication and poor growth attainment in children born preterm may also signify continued health difficulties and continued health risks, and may, in turn, influence how parents perceive their child's vulnerability.

Second, the three studies reviewed failed to examine the role of functional health impairment (i.e., morbidity) in parental perception of child vulnerability. Numerous studies examining preterm outcomes have shown that as a result of medical complications associated with prematurity, children born preterm are more likely to display functional limitations, such as impairment in vision, hearing, speech, dexterity, self-care, learning and remembering, thinking and problem-solving, as well as pain and discomfort (Donohue, 2002; Eiser, Eiser, Mayhew, & Gibson, 2005; Fekkes et al., 2000; Jones, Guildea, Stewart, & Cartlidge, 2002; Klassen et al., 2004; Msall, 2005; 2006; Msall & Tremont, 2002; Saigal et al., 2005; Schiariti, Hoube, Lisonkova, Klassen, &

Shoo, 2007; Theunissen et al., 2001). The level of functional health impairment documented in children born preterm has also been associated with maternal well-being (Eiser et al., 2005). The functional health impairments preterm children experience may be particularly meaningful to parents since they are witnessed daily in parent-child interactions. As a result, the level of functional health impairment children experience may play a salient role in parental perception of child vulnerability.

The limitations outlined above emphasize the need for additional studies examining the contextual factors associated with parental perception of child vulnerability. More specifically, these studies highlight the importance of examining post-neonatal health factors and children's functional health impairment in order to obtain a more comprehensive understanding regarding what health-related factors are associated with parental perception of child vulnerability. By including a comprehensive assessment of children's health-related, maternal psychosocial, and socio-demographic factors, future studies will be able to compare the relative influence of these factors on parental perception of child vulnerability.

Study Overview: Aims and Hypotheses

In order to further our understanding of parental perception of child vulnerability and build on the existing studies that have been reviewed in the previous sections, the current study examined maternal perceptions of child vulnerability in a sample of 36-54 month old children born VLBW. More specifically, the current study sought to (1) examine the relationship between maternal perception of child vulnerability and observed maternal behaviors (i.e., maternal overprotection, maternal hostility, maternal responsiveness) during mother-child interaction tasks, while accounting for post-neonatal

factors (e.g., number of rehospitalizations, current medication use, height for age, weight for age) and functional health impairment rating; (2) clarify the relative role of health-related variables (i.e., neonatal illness severity, post-neonatal health factors, functional health impairment) in maternal perception of child vulnerability; and (3) examine the relative importance of a comprehensive range of contextual variables including neonatal illness severity (i.e., length of ventilation), post-neonatal health (i.e., number of rehospitalizations, current medication use, height for age, weight for age), functional health impairment, socio-demographic (i.e., maternal age, household income, maternal relationship status, maternal education level, child age, child gender), and maternal psychosocial health factors (i.e., maternal depression, anxiety, parenting confidence, and social support) in maternal perception of child vulnerability.

Aim One: Perceived Vulnerability and Observed Maternal Behaviors. In order to further our understanding of the relationship between maternal perception of child vulnerability and maternal behavior, limitations associated with previous studies were addressed.

First, given the limitations associated with maternal report of overprotection (*see page 17-18*), and given that maternal intrusive behaviors are considered an essential component of overprotectiveness and the best available behavioral proxy of overprotection (Anderson & Coyne, 1991; 1993; Coyne et al., 1988; Holmbeck et al., 2002; Levy, 1943, 1970; Parker, et al., 1979; Thomasgard et al., 1995), the current study examined the relationship between perceived child vulnerability and maternal overprotection by looking at the association between perceived vulnerability and observed maternal intrusiveness. In addition, in order to better measure maternal

intrusiveness, maternal intrusive behaviors were assessed during two mother-child interaction tasks: an unstructured free play and a compliance-based clean-up task.

Second, since previous studies failed to examine post-neonatal health factors, the current study also examined how post-neonatal health factors influence the relationship between perceived vulnerability and maternal overprotection. More specifically, the relationship between maternal overprotective behaviors (i.e., maternal intrusiveness), perceived vulnerability, and post-neonatal health factors (i.e., number of rehospitalizations, current medication use, height for age, weight for age) was examined in order to better understand whether the relationship between perceived child vulnerability and overprotection is better attributed to children's post-neonatal health.

Third, given the problems associated with the samples used in previous studies (i.e., heterogeneity in health status, wide age range), the current study examined the relationship between perceived child vulnerability and maternal overprotection (i.e., maternal intrusiveness) in a relatively homogeneous sample of 36-54-month-old children born VLBW. Since children included in the study were born preterm, were considered VLBW, and were between the ages of 36 and 54 months, the amount of heterogeneity compared to the samples used in previous studies was minimized.

Furthermore, given that child vulnerability research has focused almost exclusively on the role of maternal overprotection without examining the role of other maternal behaviors in perceived vulnerability, the current study also examined the role of observed maternal hostility and responsiveness in maternal perception of child vulnerability. As previously noted, by examining a broader range of maternal behaviors,

the current study provided a fuller understanding of the relationship between perceived vulnerability and a range of relatively unexplored parental behaviors.

Aim Two: The Role of Health-Related Variables in Perceived Vulnerability. Given the lack of research examining the role of health-related factors in perceived vulnerability, the current study examined the relationship between perceived vulnerability and a range of health-related variables (i.e., neonatal illness severity, post-neonatal health, functional health impairment).

First, because previous studies have neglected the role of post-neonatal health factors in parental perception of child vulnerability, the study examined the relationship between post-neonatal health factors and maternal perception of child vulnerability. More specifically, the role of rehospitalizations, current medication use, height for age, and weight for age was examined.

Second, given that previous studies have neglected to examine the role of children's functional health impairment in parental perception of child vulnerability, the current study examined the relationship between those factors. More specifically, children's functional health impairment ratings were examined in order to help discern whether it is the health factors themselves and/or their manifestation(s) in daily life (functional health impairment) that impacts maternal perception of child vulnerability.

Third, in order to better understand how health-related factors are associated with perceived vulnerability, the current study sought to compare the relative role of neonatal illness severity, post-neonatal health, and functional health impairment factors in perceived vulnerability. Through the comparison, this study sought to better understand how health factors occurring early in the child's life (i.e., neonatal illness severity

factors), more recent health factors (i.e., post-neonatal health factors), and health-related impairments seen in children's daily lives (i.e., functional health impairment) are associated with perceived vulnerability.

Aim Three: The Contextual Variables in Perceived Vulnerability. Although previous perceived vulnerability studies have examined some maternal psychosocial, socio-demographic, and neonatal medical variables, they have not examined how a comprehensive range of maternal psychosocial, socio-demographic and health-related variables relate to perceived vulnerability**.** By including a comprehensive assessment of children's health-related factors (i.e., neonatal, post-neonatal, functional impairment), maternal psychosocial factors, and socio-demographic factors, the current study was also able to compare the relative importance of each of these factors in maternal perception of child vulnerability, hence allowing a better understanding of what places mothers most at risk of perceiving their children as vulnerable. More specifically, the current study assessed the relative role of neonatal illness severity (i.e., length of ventilation), post-neonatal health (i.e., number of rehospitalizations, current medication use, height for age, weight for age), functional health impairment, maternal psychosocial (i.e., maternal depression, anxiety, perceived parenting competence, and perceived social support), and socio-demographic factors (i.e., maternal age, household income, maternal relationship status, maternal education level, child age, and child gender) in perceived child vulnerability.

Aim One: Hypotheses. The following two hypotheses were used to assess the relationship between perceived vulnerability and maternal behaviors.

1- Maternal perception of child vulnerability will be significantly and positively associated with observed maternal intrusive behaviors during the mother-child free play and clean-up tasks, after controlling for post-neonatal health factors (i.e., number of rehospitalizations, current medication use, height for age, weight for age) and functional health impairment ratings. Given that the clean-up task places more performance demands on both the parent and the child, and given that previous studies have found that mothers are more likely to display intrusive behaviors during a clean-up task compared to an unstructured free play task (Rubin et al., 2002), it is hypothesized that the association between observed maternal intrusive behaviors and maternal perception of child vulnerability will be stronger during the mother-child clean-up task compared to the mother-child free play task.

2- Because research on perceived child vulnerability and observed parental behaviors is limited, the proposed study will examine the relationship between perceived vulnerability and observed maternal hostility and responsiveness. Examining maternal hostility and responsiveness is particularly relevant because both behaviors have been associated with children's socio-emotional and cognitive outcomes, and because both behaviors have also been associated with maternal overprotectiveness (*see pages 24-25 for more details*). Given that Stern and colleagues (2006) found a significant and positive relationship between perceived vulnerability and observed maternal hostility, it is predicted that observed maternal hostility will be significantly and positively associated with perceived vulnerability in the current study. Although previous studies have not examined the relationship between perceived vulnerability and maternal responsiveness, the previous finding that maternal overprotection (i.e., intrusiveness) is negatively associated with

maternal responsiveness (White-Mansell et al., 2003; Wijnroks, 1999) suggests that perceived vulnerability may also be negatively associated with maternal responsiveness. Consequently, it is hypothesized that maternal perception of child vulnerability will be negatively associated with observed maternal responsiveness. Since previous studies have found that mothers show less responsive behaviors and more hostile behaviors during a clean-up task compared to a free play task (Johnson, Murray, Hinshaw, Pelham, & Hoza, 2002; Seipp & Johnson, 2005), it was predicted that associations between observed maternal hostility and responsiveness and perceived vulnerability will be stronger during the mother-child clean-up task compared to the mother-child free play task.

Aim Two: Hypotheses. The role of health-related variables in perceived vulnerability was assessed by the following four hypotheses.

3-Given that neonatal illness severity factors have been previously associated with maternal perception of child vulnerability (Allen et al., 2004; Perrin et al., 1989), neonatal illness severity (i.e., length of ventilation) is predicted to be correlated with maternal perception of child vulnerability in the current sample. Children with higher neonatal illness severity will be perceived as more vulnerable by their mothers.

4-Given the recency and symbolization (e.g., “My child is still sick”) of children’s continued health difficulties, and given the documented relationship between children’s continued health difficulties and parental adjustment to preterm birth (Davis et al., 2003; Fraley, 1986; Miles et al., 2007; Zelkowitz et al., 1994), post-neonatal health factors are expected to be correlated with maternal perception of child vulnerability. More specifically, children who have had more rehospitalizations, who are currently using more medications, and/or who have poorer growth indicators (i.e., height, weight) will be

perceived as more vulnerable. Given that studies have not examined the role of post-neonatal factors, follow-up exploratory analyses will be performed in order to examine which post-neonatal health factors (i.e., number of rehospitalizations, current medication use, height for age, weight for age) are more strongly associated with maternal perception of child vulnerability.

5- Given the documented relationship between children's functional health impairment and maternal well-being (Eiser et al., 2005), functional health impairment status is predicted to be positively correlated with maternal perception of child vulnerability. Children who display higher levels of functional impairment will be perceived as more vulnerable by their mothers.

6-When comparing the magnitude of associations (the relative contribution) between perceived child vulnerability and all health-related variables (i.e., neonatal illness severity, post-neonatal health factors, and functional health impairment variables), it is predicted that functional health impairment will be most strongly correlated with maternal perception of child vulnerability, followed by post-neonatal health factors (i.e., number of rehospitalizations, current medication use, height for age, weight for age), and then by neonatal illness severity (i.e., length of ventilation).

Aim Three: Hypothesis. The following hypothesis was used to assess the relationship between perceived vulnerability and contextual variables.

7-Since previous studies have failed to comprehensively assess health-related factors, maternal psychosocial health factors, and socio-demographic factors, the proposed study will explore the relative contributions of children's neonatal illness severity (i.e., length of ventilation), post-neonatal health factors (i.e., number of rehospitalizations, current

medication use, height for age, weight for age), functional health impairment, maternal psychosocial health factors (i.e., maternal depression, anxiety, parenting confidence, and social support), and socio-demographic factors (i.e., maternal age, household income, maternal relationship status, maternal education level, child age, child gender) to maternal perception of child vulnerability.

METHODS

Participants

The current study was part of a larger study that examined cognitive and socio-emotional outcomes of preschoolers born VLBW. The study included a sample of children born VLBW between the ages of 3 and 4.5 years old. A total of 55 mother-child dyads participated in the larger outcome study.

Data collection took place between June 2007 and May 2009. The sample was recruited by University of New Mexico Hospital (UNMH) General Clinical Research Center's (GCRC) pediatric research nurses and a graduate student affiliated with the UNMH Special Baby Clinic. In order to recruit infants, GCRC pediatric nurses created lists of infants who had been admitted previously to the UNMH Newborn Intensive Care Unit (NICU) and who had been followed by the UNMH Special Baby Clinic. The GCRC pediatric nurse determined which children met eligibility criteria and the graduate student affiliated with the Special Baby Clinic called mothers of eligible children and provided them with a brief description of the study. Mothers were asked whether they had questions regarding the study and whether they were interested in participating. If mothers showed interest in participating, mothers were informed that they would be contacted again shortly to answer any remaining questions concerning the study and to schedule a study appointment. All mothers completed consent forms prior to the start of the study. In order to ensure that participants provided informed consent, the research coordinator read the consent form out loud, went over the most important aspects, and answered any questions mothers had regarding consenting and participating.

Children included in this sample were between the ages of 3 and 4.5 years (36 and 54 months), had a gestational age below 32 weeks and/or birth weights of less than 1500 grams. All VLBW preterm children were of singleton births and have been admitted to the Newborn Intensive Care Unit (NICU) at the University of New Mexico Hospital at birth. Infants were excluded from the study if they had been prenatally exposed to drugs, were severely visually/hearing impaired, had a known genetic abnormality, were considered small for gestational age, and/or did not reside with their biological families.

Of the 293 children who were eligible to participate during the duration of data collection, 69 (23.5 %) mothers could be reached. Of the 69 eligible mothers reached, 55 (79.7 %) agreed to participate and completed the study, 4 (5.8 %) agreed to participate but failed to keep their appointment, and 10 (14.5 %) refused to participate. Of the 55 who participated in the outcome study, 49 mother-child dyads completed both the questionnaire and mother-child free play and clean-up tasks, and 6 completed the questionnaire component of the study without the free-play and clean-up tasks. When reviewing the medical records of study participants, one participant was found to have a known genetic abnormality and significant hearing impairment that had not been disclosed during study recruitment. As a result, the participant was excluded from data analysis. The final sample for data analysis included 49 mother-child dyads who completed both the questionnaire and mother-child free play and clean-up tasks and 54 dyads who completed the questionnaire component of the study. As a result, analyses examining maternal behaviors will include information from 49 dyads while analyses using questionnaire-based measures will include information from 54 dyads.

Based on the minimal demographic information (i.e., maternal and child ethnicity,

maternal relationship status, maternal age) available at recruitment, mothers who could not be contacted, mothers who refused to participate, and mothers who failed to keep their scheduled appointments were comparable to those who completed the study. In addition, participants (i.e., those that completed the study) and non-participants (i.e., those that could not be contacted, that refused to participate, or that failed to keep their scheduled appointment) appeared similar to the larger UNMH population.

Child and maternal characteristics for the sample are shown below in Table 1 and Table 2, respectively.

Table 1: Child Demographic Information

	M	SD
Birth weight (grams)	1181.43	286.33
Gestational age (weeks)	29.25	2.32
NICU hospitalization (days)	57.39	36.28
Ventilation (days)	11.28	18.63
1-minute Apgar score	4.58	2.52
5-minute Apgar score	7.13	1.79
Age at testing (months)	46.80	5.83
Gender: female, n (%)	21 (38.89)	
Ethnicity, n (%)		
Caucasian	13 (24.07)	
Hispanic	31 (57.41)	
Native American	5 (9.26)	
African American	5 (9.26)	

Note. N=54.

Table 2: Maternal Demographic Information

	Mean	SD
Age (years)	33.07	7.35
Living with a partner , n(%)	44 (81.48)	
Ethnicity, n (%)		
Caucasian	20 (37.04)	
Hispanic	25 (46.29)	
Native American	4 (7.41)	
African American	5 (9.26)	
Household income, n (%)		
Below 30,000	31(57.41)	
Over 30, 000	23 (42.59)	
Maternal education level		
High school or less	17 (31.48)	
More than high school	37(68.52)	

Note. N=54.

Study Procedure

The study took place at the Mind Research Institute or at the participant's home and took approximately two hours to complete. The research coordinator first briefly explained the study procedure to mothers. Mothers then completed Human Research Review Committee (HRRC)

consent and Health Insurance Portability and Accountability Act (HIPPA) forms with the research coordinator, and a $25 gift card was presented as compensation. Next, mothers received a packet of questionnaires to complete while the research coordinator conducted a developmental assessment (Wechsler Preschool and Primary Scale of Intelligence-Third Edition; *see Appendix for description*) with the child. After the developmental assessment was completed, the research coordinator conducted two executive function performance measures with the child, the Bear/Dragon and Progressive Executive Categorization Battery (*see Appendix for description*). Next, a 15-minute mother-child interaction, consisting of a 10-minute semi-structured free play and a 5-minute clean-up task, was videotaped. During the mother-child free play, mothers were instructed to play with their children as they would normally do so at home. Mothers were provided a standard set of toys (*see Appendix A for toy list*). At the end of the 10-minute free play, the research coordinator presented mothers with a card (*see Appendix B for card description*) containing the clean-up instructions and a clean-up basket. The children and mothers were videotaped for 5 minute or until all of the toys have been placed in the clean-up basket, whichever came first. It should be noted that the purpose of presenting the clean-up instruction in card format was to prevent alerting the child to the clean-up instructions. Following the mother-child interaction tasks, mothers completed the

remaining questionnaires (described below). After questionnaires were filled out, a medical history interview was completed with mothers. Data from the executive function performance measures are part of the larger study and were not used in the current study.

Child Vulnerability Measure

Maternal Perception of Child Vulnerability: Child Vulnerability Scale. The Child Vulnerability Scale (CVS; (CVS; Forsyth et al., 1996) is an 8-item parent self-report measure assessing parents' perceptions of children's general vulnerability to health problems. Respondents are asked to rate each statement on a 4-point response scale ranging from 0 ("definitely false") to 3 ("definitely true"). A perceived child vulnerability score (i.e., CVS) was obtained by summing responses with higher scores reflecting greater perceived vulnerability. The CVS has shown good reliability and validity (Forsyth et al., 1996; Thomasgard et al., 1995). Cronbach's alphas for this sample was .83, indicating good internal consistency.

Maternal Behavior Coding

Maternal Intrusiveness/Overprotectiveness. The Intrusive Parenting scoring of the mother-child coding system of the National Institute of Child Health and Human Development (NICHD) Early Child Care study (Whiteside-Mansell et al., 2003) was used to code maternal intrusiveness/overprotectiveness. The NICHD Early Child Care coding system has been used by numerous research projects including the National Early Head Start Evaluation Project (e.g., Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004) and a national evaluation study of cochlear implants for young children (e.g., Connor, Craig, Raudenbush, Heavner, & Zwolan, 2006). A Maternal Intrusiveness Composite score was obtained by summing scores obtained on two qualitative rating scales, the

Respect for Child Autonomy and the Over Control subscales. The Respect for Child Autonomy subscale was coded during the mother-child free play while the Over Control subscale was coded during the mother-child clean-up task.

The Respect for Autonomy subscale examined the degree in which a mother acted in a manner that recognized and respected the validity of the child's individuality, motives, and perspectives during the mother-child free play. A mother who scored high on this scale was considered intrusive in her interventions with the child, exerting her expectations on the child. A mother could intrude either harshly or with affection; in either case, her actions failed to acknowledge the child's intentions as valid. In contrast, a mother who scored low on this scale acknowledged the child's perspectives and desires during the mother-child free play.

The Over Control subscale assessed the degree in which a mother allowed the child sufficient autonomy in completing the clean-up task. Examples of over-controlling behaviors included: (a) giving many commands or directives; (b) constantly monitoring the child's behavior and progress on the task; (c) directing the child's behavior; and (d) interrupting an activity. The rating obtained was independent of the quality of maternal affect (which is rated separately) since over control could co-occur with both positive and negative affect. A mother who scored high on this scale appeared to have her own agenda and was not interested in letting the child pursue his/her own agenda. A mother who scored low on this scale, on the other hand, provided the appropriate level of child autonomy during the clean-up task.

Overall, three maternal intrusiveness variables were used in the analyses. A Maternal Intrusiveness Composite score was obtained by combining the intrusiveness

scores obtained in the free play interaction task (i.e., Respect for Autonomy subscale score) and in the clean-up interaction task (i.e., Over Control subscale score). This score provided a measure of overall intrusiveness that combined the free play and clean-up intrusiveness subscale scores. The Respect for Autonomy subscale score, the intrusiveness score obtained during the free play task, was also used in order to examine maternal intrusiveness during the free play task. Similarly, the Over Control subscale score, the intrusiveness score obtained during the clean-up task, was used in order to examine maternal intrusiveness during the clean-up task. By using these three scores, maternal intrusiveness could be explored across both interaction tasks (i.e., Maternal Intrusiveness Composite) and within each specific interaction task (Respect for Autonomy subscale score, Over Control subscale score).

Maternal Responsiveness. The Responsive Parenting scoring of the mother-child coding system of the NICHD Early Child Care study (Whiteside-Mansell et al., 2003) was used to code maternal responsiveness. A Maternal Responsive Composite score was obtained by summing scores obtained on four qualitative rating scales: the Supportive Presence scale, the Cognitive Stimulation scale, the Sensitive Guidance scale, and the Positive Regard scale. The Supportive Presence and Stimulation scales were coded during the mother-child free play while the Sensitive Guidance and Positive Regard scales were coded during the mother-child clean-up task.

The Supportive Presence subscale assessed the level of maternal positive regard and emotional support expressed to the child during the mother-child free play. Consequently, a mother who scored high on this scale expressed positive regard and emotional support to the child. Examples of behaviors that supported such an orientation

included acknowledging the child's accomplishments on tasks (e.g., building a house of blocks), and encouraging the child with positive emotional regard (e.g., "You're really good at this." "You got another one right."). A mother who scored low on this scale failed to provide supportive cues and may have appeared passive, uninvolved, aloof, or otherwise unavailable to the child.

The Cognitive Stimulation subscale assessed the degree to which a mother tried to foster her child's cognitive development and learning with age-appropriate stimulation during the mother-child free play. The focus of this scale was on the mother's effortful teaching that may ultimately enhance perceptual, cognitive, and linguistic development. Behaviors characterizing stimulation included: (a) talking about and demonstrating aspects of the toys or physical world; (b) focusing the child's attention on the unique attributes and perceptual qualities of objects; (c) suggesting more sophisticated play activities; (d) verbally responding to and expanding on what the child says; and (e) encouraging the child to actively engage in play with the toys. If the topic or mode of stimulation used was poorly matched to the child's developmental level or interest, then the mother's behavior was not seen as stimulating development, because it was unlikely to affect the child's cognitive development. A mother who scored high on this scale took advantage of play activities to stimulate development. She may have consistently instructed the child and/or engaged in a variety of explicit activities with the intent to facilitate learning, development and achievement.

The Sensitive Guidance subscale assessed the degree to which a mother was attuned to her child’s verbal and behavioral communication and responded appropriately during the clean-up task. A mother who scored high on this scale was aware of her child's

tendency to be compliant or non-compliant and was able to tailor her initial instructions and follow-up behaviors appropriately. For children who were highly cooperative, this meant being relatively nondirective, allowing the child to take the lead and providing appropriate encouragement and praise; for children who were less compliant, this meant providing the appropriate amount of structure and guidance in a clear (potentially firm) and non-hostile manner. A mother who scored high on this scale was attuned to her child's verbal and behavioral communications and responded appropriately to her/his need for autonomy, direction, structure, or self-direction.

The Positive Regard subscale assessed the extent in which a mother displayed warmth, nurturance, and positive affection toward the child and appeared to enjoy interacting with the child during the clean-up task, with extent defined in terms of both frequency and intensity. Examples of behaviors that supported such an orientation included: (a) kissing and hugging the child; (b) affectionately touching the child; (c) smiling at and laughing with the child; and (d) being enthusiastically involved in what the child is saying or doing. Especially important was the provision of praise and positive encouragement for cleaning up. A mother who scored high on this scale appeared to enjoy interacting with the child, had frequent displays of affection, and provided praise and positive encouragement throughout the clean-up task.

Maternal Hostility. The Harsh Parenting scoring of the mother-child coding system of the NICHD Early Child Care study (Whiteside-Mansell et al., 2003) was used to code maternal hostility. A Maternal Hostility Composite score was obtained by summing scores obtained on two qualitative rating scales: the Negative Regard scale, and

the Hostility scale. The Hostility scale was coded during the mother-child free play while the Negative Regard scale was coded during the mother-child clean-up task.

The Hostility subscale assessed the extent to which a mother expressed anger, and/or discounted or rejected the child during the mother-child free play. A mother who scored high on this scale clearly and overtly rejected the child, blamed him or her for mistakes, and otherwise made explicit the message that she did not support the child emotionally.

The Negative Regard subscale assessed a mother's display of hostility, negative affect, and displeasure toward the child during the clean-up task, with extent defined in terms of both frequency and intensity. Examples of behaviors consistent with such orientation included: (a) displaying annoyance or scornful facial expressions and posturing; (b) aggressive handling of the child; (c) explicitly negative or scornful vocal tones; and (d) clear lack of enjoyment of the child during the clean-up task.

Reliability

The mother-child free play and clean-up interaction videos were coded by two graduate level research assistants. The research assistants were trained on the NICHD coding system by the research coordinator and inter-rater reliability between the research assistants and the research coordinator was established to a criterion of 85% (exact agreement). After inter-rater reliability on the training videos was achieved, research assistants were assigned videos to code independently. Fifteen videos (30%) were selected at random to be coded by both research assistants. Inter-rater reliability was calculated using using Cohen's (1960) kappa inter-rater agreement coefficients (Cohen, 1960). Inter-rater reliability ranged from .71 to .91. The following kappa coefficients

were obtained for NICHD Early Child Care coding scales: Respect for Autonomy subscale (.87), Over Control subscale (.91), Supportive Presence subscale (.71), Cognitive Stimulation subscale (.71), Sensitive Guidance subscale (.82), Positive Regard subscale (.83), Negative Regard subscale (.91), Hostility subscale (.89), Intrusiveness Composite (.86), Responsiveness Composite (80), and Hostility Composite (.89).

Child Medical Health Measures

Post-Neonatal Health. In order to assess post-neonatal health, a child medical history parent interview was used. Because no published medical history forms are available for use with children born preterm, a medical history form was created by the author with collaboration from a neonatologist (Janelle Fuller, M.D.) and a neonatal development specialist (Jean Lowe, Ph.D.) at the University of New Mexico Hospital. The form included questions regarding the child's current and previous medical health. Along with other information, the interview provided data regarding the number of previous hospitalizations and surgeries, current medication use, as well as current height, weight, and head circumference. The medical form was created largely based on the medical forms used in the multi-center PROPHET study which examined the neurodevelopmental outcomes of children born extremely low birth weight (<850 grams) treated with early low-dose hydrocortisone treatment (Watterberg et al., 2007). Because consensus is limited regarding how to assess health in children (Institute of Medicine, 2004; Saigal et al., 2006), particularly in children born preterm (Schiariti et al., 2007), and because no measures are currently available for assessing post-neonatal health in children born preterm, four post-neonatal factors indicative of continued health difficulties were examined in order to provide a better understanding of how post-

neonatal health and more recent health factors are associated with perceived vulnerability. Post-neonatal health variables such as the number of previous hospitalizations, the number of medications used (i.e., number of medications repeatedly used in the past three months), and current weight and height for age (percentiles) were used to represent children's post-neonatal health. Information regarding the number of rehospitalizations since NICU and number of current medications was obtained through maternal report while current height, weight, and head circumference were measured at the end of the study visit. Height and weight for age percentiles were obtained using the most recent Centers for Disease Control and Prevention growth charts (http://www.cdc.gov/growthcharts).

Functional Health Impairment. The Health Status Classification System-Preschool Version (HSCS-PS; Saigal et al., 2005) was used to assess functional health impairment. The HSCS-PS is a health status measure that assesses the following health attributes: sight, hearing, speech, mobility, dexterity, self-care, feelings, learning and remembering, thinking and solving problems, and pain and discomfort. An overall functional health impairment score (i.e., HSCS-PS) was obtained by summing the scores obtained for each health domain (Nathan et. al, 2004). The HSCS-PS was developed for use with children between 2.5–5 years of age and has demonstrated good intra-rater reliability, concurrent validity, as well as convergent and discriminant validity. In addition, the HSCS-PS has been used in numerous studies examining functional health impairment of children born preterm and VLBW (e.g., Klassem et al., 2004; Saigal et al., 2005; Schiariti et al., 2007). Cronbach's alphas for this sample was .78, indicating adequate internal consistency.

Neonatal Illness Severity. The length of mechanical ventilation (days on ventilation) was used as a measure of neonatal illness severity. Length of ventilation is considered a valid marker of neonatal illness severity given the documented relationship between length of ventilation and neurodevelopmental outcomes in children born preterm (Walsh et al., 2005). Length of ventilation has, indeed, been shown to be an important predictor of long-term neurodevelopmental outcomes since the risk of neurodevelopmental impairment in preterm populations has been found to increase as the number of days of ventilation increases (Gaillard, Cooke, & Shaw, 2001; Laptook, O'Shea, Shankaran, & Bhaskar, 2005; Wilson-Costello et al., 1998; Walsh et al., 2005; Vohr et al., 2004; Vohr, Wright, Poole, & McDonald, 2005). In order to further examine the relationship between perceived child vulnerability and neonatal illness severity, information regarding birth weight, gestational age, length of NICU hospitalization, and 1-minute and 5-minute APGAR scale scores were also obtained. APGAR scores are given to newborns 1 minute and 5 minutes after their birth and are considered to be a rapid method of assessing the health status of the newborn infant. APGAR scores are obtained by rating the newborn on five criteria (heart rate, respiratory effort, muscle tone, reflex irritability, and color) on a scale of 0-2 and by summing the five obtained values. Birth weight (e.g., Bhutta et al., 2002), gestational age (e.g., Vohr et al., 2005), length of NICU hospitalization (e.g., Furman, Baley, Borawski-Clark, Aucott, & Hack, 1996), and APGAR scores (e.g., Badr, Bookheimer, Purdy, & Deeb, 2009) have all been shown to be associated with short-term and long-term neurodevelopmental outcomes in preterm populations.

Maternal Psychosocial Measures

Maternal Depression Symptoms. The Beck Depression Inventory-II (BDI-II; Beck, Steer & Brown, 1996) was used to assess maternal depression symptoms. The BDI-II is a 21-item self-report measure used to assess the occurrence and severity of symptoms of depression. Respondents are asked to rate each statement on a 4-point response scale. A maternal depression score (i.e., BDI-II) is obtained by summing responses with higher scores representing the presence of more depressive symptoms. The BDI-II has demonstrated good reliability and validity and has been used with diverse populations (Beck et al., 1996). Cronbach's alphas for this sample was .90, indicating good internal consistency.

Maternal Anxiety Symptoms. The State-Trait Anxiety Inventory (STAI; Spielberger, 1989) was used to assess maternal anxiety symptoms.The STAI is a widely used measure of general anxiety that includes a 20-item measure of state anxiety and a 20-item measure of trait anxiety. For the purpose of this study, only the Trait Anxiety Scale was used. The Trait-Anxiety Scale assesses how the respondents feel in general, using a 4-point Likert scale, ranging from 1 ("Almost Never") to 4 ("Almost Always"). A maternal anxiety score (i.e., STAI) was obtained by summing responses with higher scores reflecting more trait anxiety. The Trait-Anxiety Scale has been shown to demonstrate adequate internal consistency and test-retest reliability as well as convergent and discriminant validity (Barnes, Harp, & Jung, 2002; Hishinuma et al., 2000; Kabacoff, Segal, Hersen, & Van Hasselt, 1997; Spielberger, 1989; Vautier, 2004). Cronbach's apha for this sample was .89, indicating good internal consistency.

Maternal Sense of Parenting Confidence. The Sense of Competence Scale of the Parenting Stress Index (PSI; Abidin, 1995) was used to assess maternal sense of

parenting confidence. The 13-item Subscale assesses stress related to a mother's sense that she is not a good or capable parent to her child. A maternal sense of competence score (i.e., PSI-CO) was obtained by summing responses with higher scores indicating increased maternal perceptions of parenting incompetence. The Parenting Stress Index has been found to have strong psychometric characteristics as a whole, including good internal consistency and test–retest reliability and convergent and discriminant validity (Abidin, Flens, & Austin, 2006). Adequate internal consistency and test-retest reliability for the Sense of Competence Scale have also been reported (Coleman & Karraker, 1997). Cronbach's alpha for this sample showed good internal consistencies (.83).

Maternal Perception of Social Support. The Personal Resource Questionnaire (PRQ2000; Weinert, 2003) was used to assess maternal perception of social support. The PRQ2000 is a 15-item self-report inventory that measures perceived social support. The PRQ2000 is scored using a 7-point Likert scale where higher scores indicate a greater sense of perceived social support (range of possible scores is 15 to 105). A maternal social support score (i.e., PRQ) was obtained by summing responses. The PRQ2000 scale has demonstrated good reliability and validity and has been used with low-income, multi-ethnic populations (Weinert, 2003).Cronbach's alpha for this sample was .90, indicating good internal consistency**.**

Demographic Measures

Socio-Demographic Variables. A demographic form was used to obtain socio-demographic information. The form included questions regarding maternal and child ethnicity, maternal and child age, number of household members, family's household income level, maternal relationship status, maternal education level, and maternal

employment status (i.e., unemployed, full-time versus part-time employment, type of employment). In accordance with the maternal and child socio-demographic factors that have been previously associated with perceived child vulnerability (Allen et al., 2004; Perrin et al., 1989; Teti et al., 2005), family household income, maternal age, maternal relationship status, and maternal education level, child age, and child gender were used to explore the relationship between perceived child vulnerability and socio-demographic factors.

RESULTS

Statistical Overview

The distributions of study variables were first examined to determine whether variables were significantly skewed and non-normally distributed. Using Shapiro-Wilk analyses, results indicated that only maternal age, child age, maternal sense of parenting confidence, and maternal anxiety were normally distributed, other variables were significantly skewed (see Table 3 below for more information). Logarithmetic, square root, and reciprocal transformations did not correct skewness. As a result, non-parametric data analyses with untransformed variables were used in subsequent analyses.

Table 3: Non-Normally Distributed Study Variables

	Shapiro-Wilk statistic	*p* value
Perceived child vulnerability (CVS) †	.933	.005**
Maternal intrusiveness composite‡	.949	.033*
Over control subscale	.920	.003**
Supportive presence subscale	.942	.019*
Cognitive stimulation subscale	.919	.003**
Sensitive guidance subscale	.892	.000**
Positive regard subscale	.949	.037*
Maternal hostility composite‡	.489	.000**
Negative regard subscale	.530	.000**
Hostility subscale	.401	.000***
Functional health impairment (HSCS-PS) †	.705	.000**
Number of rehospitalizations†	.547	.000**
Number of current medications†	.863	.000**
Height for age (percentile) †	.891	.000**
Weight for age (percentile) †	.889	.000**
Birth weight†	.957	.039*
Length of NICU hospitalization (days)†	.821	.000**
Length of ventilation (days) †	.497	.000**
Maternal depression (BDI) †	.892	.000**
Maternal perception of social support (PRQ) †	.764	.000**

Note. *p <.05, **p<.01, †N=54, ‡N=49.

Due to the non-normal distributions of the study variables, nonparametric analyses were used to examine the study hypotheses. Spearman rank-order and Spearman partial correlations were used to examine the relationship between perceived child vulnerability and maternal intrusiveness (Hypothesis 1), as well as the relationship between perceived vulnerability and maternal hostility and maternal responsiveness (Hypothesis 2). Spearman rank-order correlations were also used to examine the relationship between perceived vulnerability and neonatal illness severity (Hypothesis 3), the relationship between perceived child vulnerability and post-neonatal health factors (Hypothesis 4), and the relationship between perceived child vulnerability and functional health impairment (Hypothesis 5).

In order to examine which health-related variables (i.e., neonatal illness severity, post-neonatal health factors, functional health impairment variables) accounted for the most variance in perceived child vulnerability (Hypothesis 6), a stepwise multiple regression was performed with each health-related variable entered separately. By entering each variable separately, the specific health-related variables most associated with perceived vulnerability were examined. Following this, multiple regression analyses were conducted with neonatal illness severity, post-neonatal health, and functional health impairment variables entered as blocks (i.e., grouping of variables). The differential contribution of each block (i.e., changes in R^2) was then examined to determine which group of health-related variables accounted for the most variance in perceived vulnerability. By entering the health-related variables as blocks, the relative importance of each group of health-related variables was explored.

In order to examine the differential contribution of maternal psychosocial health, socio-demographic, neonatal illness severity, functional health impairment, and post-neonatal health factors to maternal perception of child vulnerability (Hypothesis 7), multiple regression analyses using stepwise and backward variable selection were performed with variables entered separately. By entering each variable separately, the specific variables most associated with perceived vulnerability were determined. Following this, multiple regression analyses were conducted with neonatal illness severity, post-neonatal health, maternal psychosocial health, and socio-demographic variables entered as blocks (i.e., grouping of variables) in order to examine the differential contribution of each grouping of variables. In order to do this, the two strongest predictors in each category of variables were determined and were used to create blocks of variables. Regression analyses were then performed using these blocks in order to examine the differential contribution of each grouping of variables (i.e., changes in R^2).

Across all analyses, Type I error was controlled by using the Bonferroni method in that the initial alpha level of .05 was divided by the number of tests in each 'family-wise' category. All hypotheses tests were two-sided and used a significance level of 0.05. All statistical analyses were conducted using either SPSS: Version 14 or SAS: Version 9 (SAS Institute Inc., Cary, NC).

Hypothesis One: Perceived Vulnerability and Maternal Intrusiveness

In order to assess the hypothesis that maternal perception of child vulnerability would be significantly and positively associated with observed maternal intrusive behaviors, Spearman rank-order correlation coefficients were first obtained to examine the relationship between perceived child vulnerability and maternal intrusiveness scores (i.e., Maternal Intrusiveness Composite, Respect for Autonomy subscale score, Over Control subscale score). Table 4 below contains relevant variable information while Table 5 contains the correlations found between perceived child vulnerability and maternal intrusiveness scores. Overall, results indicate that perceived child vulnerability scores (CVS) were not significantly associated with Maternal Intrusive Composite score (r= .052, *ns*), Respect for Autonomy subscale score (r= -.013, *ns*), and Over Control subscale score, (r= .076, *ns*), indicating that perceived child vulnerability was not significantly related to observed maternal intrusiveness behaviors both within each interaction task (i.e., free play, clean up) and across interactions tasks. Since the correlations obtained between perceived vulnerability and the intrusiveness scores in the free play (i.e., Respect for Autonomy subscale) and in the clean-up interaction tasks (i.e., Over Control subscale) were low and non-significant, the difference between the correlations was not tested.

Table 4: Relevant Variable Information

	Mean	Standard Deviation	Median	Range
Perceived child vulnerability (CVS) †	5.65	3.96	5.00	0-15.00
Maternal intrusiveness composite‡	6.49	1.75	6.50	4.00-11.00
Respect for child autonomy subscale (free play)	3.95	1.09	4.00	2.00-6.00
Over control subscale (clean-up)	2.54	0.85	2.50	1.00-5.00
Number of rehospitalization†	0.75	1.46	0.00	0.00-9.00
Number of current medications†	1.67	1.59	1.00	0.00-7.00
Current height for age (percentile) †	40.77	33.11	36.00	3.00-97.00
Current weight for age (percentile) †	43.42	33.49	40.00	3.00-97.00
Functional health impairment (HSCS-PS) †	2.13	2.91	1.00	0.00-11.00

Note. †N=54, ‡N=49.

Table 5: Spearman Rank-Order Correlations between Perceived Child Vulnerability and Maternal Intrusive Behaviors

	Maternal intrusive composite	Respect for autonomy subscale (free play)	Over control subscale (clean-up)
Perceived child vulnerability (CVS)	.052	-.013	.076

Note. N=49, * p <.05, **p<.01.

Spearman partial correlation coefficients were then obtained to examine whether the relationship between perceived child vulnerability and maternal intrusiveness scores (i.e., Maternal Intrusiveness Composite score, Respect for Autonomy subscale score, Over Control subscale score) would change after controlling for post-neonatal health variables (i.e., number of rehospitalizations, number of current medications, current height for age, current weight for age) and functional health impairment (e.g., HSCS-PS). Results indicated that even after controlling for post-neonatal health variables (i.e., number of rehospitalizations, number of current medications, current height for age, current weight for age), the relationship between perceived child vulnerability and maternal intrusiveness scores remained non-significant (see Table 6 below for partial correlations between maternal intrusive behaviors and post-neonatal health variables).

Similarly, results indicated that after controlling for functional health impairment (i.e., HSCS-PS), the relationship between perceived child vulnerability and maternal intrusiveness scores remained non-significant (see Table 6 below for partial correlations between maternal intrusive behaviors and functional health impairment).

Table 6: Spearman Partial Correlation between Perceived Child Vulnerability and Maternal Intrusive Behaviors Controlling for Post-Neonatal Health Measures and Functional Health Impairment

Control variable	Maternal intrusive composite	Respect for autonomy subscale (free play)	Over control subscale (clean-up)
Number of hospitalization	.092	.023	.102
Number of current medication	.038	-.031	.069
Current height	.004	-.065	.051
Current weight	.054	-.009	.088
Functional health impairment	.051	-.017	.076

Note. N=49, * p <.05, **p<.01.

Overall, results indicate that perceived child vulnerability was not significantly associated with maternal intrusive behaviors, even after controlling for post-neonatal factors (i.e., rehospitalizations, current medications, height for age, weight for age) and functional health impairment.

Hypothesis Two: Perceived Vulnerability and Maternal Responsiveness and Hostility

In order to examine the relationship between perceived vulnerability and maternal responsiveness and hostility, Spearman rank-order correlation coefficients were obtained to assess the relationship between perceived child vulnerability, maternal responsiveness scores (i.e., Maternal Responsiveness Composite score, Sensitive Guidance subscale score, Positive Regard subscale score, Supportive Presence subscale score, Cognitive Stimulation subscale score) and maternal hostility scores (i.e., Maternal Hostility Composite score, Negative Regard subscale score, Hostility subscale score). Results indicated that perceived child vulnerability was not significantly associated with maternal responsiveness or maternal hostility scores (see Table 7 for relevant variable information and Table 8 for obtained correlations). Since the correlations obtained between perceived vulnerability and the responsiveness and hostility scores in the free play and in the clean-up interaction tasks were low and non-significant, the difference between the correlations was not tested.

Table 7: Relevant Variable Information

	Mean	Standard Deviation	Median	Range
Perceived child vulnerability (CVS) †	5.65	3.96	5.00	0-15.00
Maternal responsiveness composite	13.44	2.77	13.50	9.00-20.50
Supportive presence subscale (free play)	3.98	.98	4.00	2.50-6.00
Cognitive stimulation subscale (free play)	3.22	.96	3.00	1.50-5.50
Sensitive guidance subscale (clean-up)	3.60	.73	4.00	1.50-5.00
Positive regard subscale (clean-up)	2.64	.84	2.50	1.00-5.00
Maternal hostility composite	2.47	1.11	2.00	2.00-8.00
Negative regard subscale (free play)	1.26	.57	2.50.	1.00-3.50
Hostility subscale (clean-up)	1.21	.60	1.00	1.00-4.50

Note. †N=54, ‡N=49.

Table 8: Spearman Rank-Order Correlations between Perceived Child Vulnerability and Maternal Responsiveness and Hostility Behaviors

	Perceived child vulnerability (CVS)	*P* value
Maternal responsiveness composite	.107	.462
Supportive presence subscale (free play)	.178	.221
Cognitive stimulation subscale (free play)	.023	.878
Sensitive guidance subscale (clean-up)	.031	.831
Positive regard subscale (clean-up)	.063	.669
Maternal hostility composite	.027.	.853
Negative regard subscale (free play)	.029	.841
Hostility subscale (clean-up)	-.040	.787

Note. N=49, * p <.05, **p<.01.

Hypothesis Three: Perceived Vulnerability and Neonatal Illness Severity

In order to assess the hypothesis that neonatal illness severity would be significantly and positively associated with maternal perception of child vulnerability, the relationship between perceived vulnerability and length of ventilation (i.e., days on ventilation) was examined. Additionally, in order to further examine the relationship between perceived child vulnerability and neonatal illness severity, the relationship between perceived child vulnerability and birth weight, gestational age, length of NICU hospitalization, and APGAR scores was also examined. Table 9 below contains relevant variable information while Table 10 contains the correlations found between perceived child vulnerability and neonatal illness severity variables.

Using Spearman rank-order correlation, results indicated that perceived child vulnerability was not significantly correlated with length of ventilation (r=-.109, *ns*). Results also indicated that perceived child vulnerability was not significantly associated with birth weight (r=.037, *ns*), gestational age (r=.051, *ns*) and length of NICU hospitalization (r=-.072, *ns*).

Although 1-minute APGAR (r=.295, p<.05) and 5-minute APGAR(r=.324, p<.05) scores were initially significantly correlated with perceived vulnerability, the correlations did not remain significant following Bonferroni adjustment (α=.01).

Table 9: Relevant Variable Information

	Mean	Standard Deviation	Median	Range
Perceived child vulnerability (CVS) †	5.65	3.96	5.00	0.00-15.00
Length of ventilation (days)	14.76	31.76	2.00	0.00-203.00
Birth weight	1179.67	283.96	1220.00	664.00-1688.00
Gestational age	29.26	2.30	29.50	24-35
Length of NICU hospitalization	60.04	40.954	49.00	11.00-203.00
1-minute APGAR	4.53	2.52	4.00	0.00-9.00
5-minute APGAR	7.08	1.83	7.00	1.00-9.00

Note. N=54.

Table 10: Spearman Rank-Order Correlations between Perceived Child Vulnerability and Neonatal Illness Severity Variables

	Perceived child vulnerability (CVS)	*P* value
Days of ventilation	-.109	.426
Birth weight	.037	.786
Gestational age	.051	.710
Length of NICU hospitalization	-.072	.603
1-minute APGAR	.295*†	.032†
5-minute APGAR	.324*†	.018†

Note. N=54, * p <.05, **p<.01, † Correlation was not significant following Bonferroni adjustment.

Hypothesis Four: Perceived Vulnerability and Post-Neonatal Health Measures

In order to assess the hypothesis that higher perceived child vulnerability would be associated with a child's post-neonatal health, the relationship between perceived child vulnerability and post-neonatal factors (i.e., number of rehospitalizations, number of current medications, height for age, weight for age) was examined. Table 11 contains the correlations found between perceived child vulnerability and the post-neonatal health variables (see Table 4 above for relevant variable information). Using Spearman rank-order correlation, results indicated that perceived child vulnerability was significantly associated with the number of rehospitalizations (r=.285, p<.05) and the number of current medications (r=.300, p<.05), but was not significantly associated with children's height for age (r=.112, *ns*) and weight for age(r=.001, *ns*; see Table 10 below). However, the relationship between perceived child vulnerability and the number of rehospitalizations and the number of current medications did not remain significant following Bonferroni correction (α=.0125).

Table 11: Spearman Rank-Order Correlations between Perceived Child Vulnerability and Post-Neonatal Health Variables

	Perceived child vulnerability (CVS)	*P* value
Number of rehospitalizations	.285*[†]	.035[†]
Number of current medications	.300*[†]	.026[†]
Height for age	.112	.426
Weight for age	.001	.994

Note. N=54, * p <.05, **p<.01, [†] Correlation was not significant following Bonferroni adjustment.

Hypothesis Five: Perceived Vulnerability and Functional Health Impairment

In order to examine the hypothesis that children's functional health impairment (i.e., HSCS-PS) would be positively correlated with perceived child vulnerability, a Spearman rank-order correlation was conducted. Results indicated that functional health impairment (HSCS-PS) was not significantly correlated with perceived child vulnerability scores, r_s=-.130, *ns* (see Table 4 for relevant variable information).

Diagnostic Analyses Performed Prior to Examining Hypotheses Six and Seven

In order to examine hypotheses six and seven using regression analyses, regression diagnostic analyses (i.e. leverage/hat values, standardized residuals, studentized residuals, Cook's distances, Mahalanobis distances, covariance of ratios, DFFIT values) were first performed to determine whether any of the cases were exerting undue influence on the regression models (see Appendix C for more information). No influential cases were found in each regression model.

Second, the underlying regression assumptions and cross-validity of the models were assessed in order to determine whether the regression models could generalize. The regression models obtained using the original variables met underlying regression assumptions (i.e., variable types, non-zero variance, independence of x variables/multicollinearity, homoscedasticity, autocorrelation, distribution of residuals, independence of y variables, linearity). Cross-validity of the regression models were then assessed using split-sample validation. Results from split-sample validation indicated that different variables were significant in each split sample and that the variables found to be significant in each split sample were different than those found significant in the regression model using the full sample. The cross-validation/split sample validation results, hence, indicated that the regression findings using the original variables were not stable across samples. As a result, the regression findings using the original variables could not be reliably generalized to other samples.

Due to the above cross-validation findings, dichotomous/categorical variables were created with the non-normally distributed variables (i.e., length of ventilation, number of rehospitalizations, number of current medications, functional health

impairment, maternal sense of social support, maternal depression) using a median split (see Tables 12 and 13 for detailed variable information). Regression analyses were then performed using the dichotomous/categorical variables for the non-normally distributed variables and the interval variables for the normally distributed variables. This meant that for the hypothesis six analyses, four dichotomous/categorical variables (i.e., length of ventilation, child rehospitalization, current medication use, functional health impairment) and two interval variables (i.e., height for age, weight for age) were included in the regression analyses. For hypothesis seven, on the other hand, six interval/continuous variables (i.e., child age, maternal age, maternal anxiety, maternal sense of parenting confidence, current height for age, current weight for age) and twelve dichotomous/categorical variables (i.e., child ethnicity, maternal ethnicity, child gender, maternal relationship status, maternal educational status, family SES, length of ventilation, child rehospitalization, current medication use, functional health impairment, maternal depression, maternal perception of social support) were included in the regression analyses.

The accuracy and generalizability of the regression models obtained using the dichotomous/categorical and interval variables were then examined. Diagnostic analyses (i.e. leverage/hat values, standardized residuals, studentized residuals, Cook's distances, Mahalanobis distances, covariance of ratios, DFFIT values) indicated that no cases were exerting undue influence on the regression models. The underlying regression assumptions and cross-validity of the models were then assessed for generalizability. The regression models met underlying regression assumptions (i.e., variable types, non-zero variance, independence of x variables/multicollinearity, homoscedasticity,

autocorrelation, distribution of residuals, independence of y variables, linearity). Cross-validity of the regression models using split-sample validation was then examined. Results indicated that the same variables were found to be significant in each split sample and that the variables found significant in the split samples were the same as those found significant in the regression model using the full sample. When comparing the cross-validation results using the original variables to those using the dichotomous/categorical variables for non-normally distributed variables and interval data for normally distributed variables, the regression findings using the dichotomous/categorical variables appeared more stable across samples and, hence, more generalizable across samples. As a result, the regression analyses for hypothesis six and seven used the dichotomous/categorical variables for non-normally distributed variables and interval data for normally distributed variables (see Tables 12 and 13 for detailed variable information).

Table 12: Variable Information for Categorical Variables

	Frequency	Percentage
Child ethnicity†		
Caucasian	13	24.07
Hispanic	31	57.41
Other	10	18.52
Maternal ethnicity†		
Caucasian	20	37.04
Hispanic	25	46.30
Other	9	16.67
Child gender†		
Male	33	61.11
Female	21	38.89
Maternal relationship status†		
Living without partner	10	18.52
Living with partner	44	81.48
Maternal education status†		
High school or less	17	31.48
More than high school	37	68.52
Family SES‡		
Below $30,000	31	57.41
$30,000 and above	23	42.59
Length of ventilation†		
Five days or less	31	57.41
Six days or above	23	42.59
Child rehospitalization †		
No rehospitalizations	33	61.11
One or more rehospitalizations	21	38.89
Current medication use†		
Less than two medications	30	55.56
Two or more medications	24	44.44
Functional health impairment (HSCS-PS) †		
Score of 1 or less	34	62.96
Score of 2 or above	20	37.04

Table 12 (cont.)

Maternal sense of social support (PRQ)‡		
Score of 89 or less	25	46.29
Score of 90 or above	28	51.85
Maternal depression (BDI)		
Score of 5 or less	27	50.00
Score of 6 or above	27	50.00

Note. †N=54, ‡N=53.

Table 13: Variable Information for Interval Variables

	Mean	Standard Deviation	Median	Range
Perceived child vulnerability (CVS)	5.76	3.92	5.00	0.00-15.00
Child age	46.80	5.83	46.93	36.03-58.17
Maternal age	33.07	7.35	32.00	19.00-48.00
Maternal anxiety (STAI-T)	34.81	7.95	34.50	20.00-51.00
Maternal sense of parenting confidence (PSI-CO)	25.85	6.90	25.00	15.00-44.00
Current height for age (percentile)‡	40.77	33.11	36.00	3.00-97.00
Current weight for age (percentile)	43.43	33.50	40.00	3.00-97.00

Note. N=54, ‡N=53.

Hypothesis Six: Relative Contribution of Children's Health-Related Factors

In order to compare the relative contribution of all health-related variables to perceived child vulnerability and to examine the hypothesis that functional health impairment would have the strongest relationship with maternal perception of child vulnerability, followed by post-neonatal health factors (i.e., child rehospitalization, current medication use, height for age, weight for age), and then by neonatal illness severity (i.e., length of ventilation), a multiple regression analysis using stepwise variable selection method was performed to examine the relative contribution of the health-related variables proposed (i.e., length of ventilation, child rehospitalization, current medication use, height for age, weight for age, functional health impairment). Results indicated that the overall regression model was significant, R^2 =.098, F (1, 51) =5.565, p<.05 and that only child rehospitalization significantly accounted for perceived child vulnerability variability, β = .314, t(1, 51) = 2.59, p < .05 (see Table 14 below for stepwise regression results). The standardized betas obtained in the stepwise regression analysis also indicated that child rehospitalization was the strongest health-related predictor of perceived child vulnerability (see Table 15 below for standardized beta). The semi-partial correlations obtained in the regression analysis indicate that only the semi-partial correlation between perceived child vulnerability and child rehospitalization (r=.314, p<.05) was significant. Although not significant, current medication use (β = .242, t(1, 51) = 1.818, *ns*) when compared to functional health impairment (β = .087, t(1, 51) = .648, *ns)*, length of ventilation (β =- .006, t(1, 51) = -.043, *ns)*, current height (β = .036, t(1, 51) = .267, *ns)*, and current weight (β = .051, t(1, 51) = .375, *ns)* appeared to be the next strongest health-related predictor of perceived child vulnerability. Overall, the

results of the stepwise regression and the examination of the obtained standardized betas indicate that when comparing the relative contributions of neonatal illness severity, post-neonatal health, and functional health impairment to perceived child vulnerability, child rehospitalization, one of the post-neonatal health variables, is the strongest health-related predictor of perceived child vulnerability. Although non-significant, current medication use, another post-neonatal health variable, appears to be the next strongest health-related variable. Based on these results, post-neonatal health variables appear to the strongest predictors of perceived child vulnerability when compared to neonatal illness severity and functional health impairment.

Table 14: Stepwise Regression Results

	B	*SE b*	B	T	R^2	ΔR^2	Δ F
Model 1					.098*	.098*	5.65*
Constant	2.290	1.559		1.469			
Child rehospitalization	2.498	1.059	.314*	2.59*			

Note.* p <.05, **p<.01; N=54.

Table 15: Standardized Betas of Health-Related Variables

	Standardized Beta	T-test Value
Length of ventilation	-.006	-.043
Child rehospitalization	.314*	2.359
Current medication use	.242	1.818
Current height for age (percentile)	.036	2.67
Current weight for age (percentile)	.051	.375
Functional health impairment (HSCS-PS)	.087	.648

Note. N=54; * p <.05, **p<.01.

In order to further explore the relative contribution of health-related variables to perceived child vulnerability, a multiple regression analysis was conducted with functional health impairment (i.e., HSCS-PS), post-neonatal health factors (i.e., child rehospitalization, current medication use, height for age, weight for age), and neonatal illness severity (i.e., length of ventilation) entered as blocks. First, each block of variables was entered separately to examine the change in R^2 that resulted from entering each respective block into the regression model. The block that resulted in the largest change in R^2 was considered to account for most variance in perceived child vulnerability. Although the change in R^2 that resulted from adding each of the block was non-significant, the post-neonatal health block resulted in the largest change in R^2 (ΔR^2=.162, *ns*) compared to adding the functional health impairment block (ΔR^2=.005, *ns*) or the neonatal illness severity block (ΔR^2=.002, *ns*). As would be expected, adding the functional health impairment block (ΔR^2=.018, total R^2=.180, *ns*) or the neonatal illness severity block (ΔR^2=.002, total R^2=.165, *ns*) to the model that already included the post-neonatal health block did not result in a significant change in R^2. These findings suggest that although non-significant, the post-neonatal health block accounts for the most variance in perceived child vulnerability.

Hypothesis Seven: Relative Contribution of Children's Health-Related, Maternal Psychosocial Health, and Socio-Demographic Factors

In order to determine the differential contribution of children's neonatal illness severity (i.e., length of ventilation), post-neonatal health (i.e., i.e., child rehospitalization, current medication use, height for age, weight for age), functional health impairment (i.e., HSCS-PS), maternal psychosocial health (i.e., maternal depression, anxiety, parenting confidence, and social support), and socio-demographic variables (i.e., maternal age, household income, maternal relationship status, maternal education level, child age, child gender) to maternal perception of child vulnerability, multiple regression analyses using stepwise and backward variable selection methods were used.

When all health-related factors, maternal psychosocial health factors, and socio-demographic factors were entered into the stepwise regression analysis, the overall regression model was significant, R^2 =.304, $F(2, 48)=10.494$, $p<.001$, and only maternal depressive symptoms, $\beta = .457$, $t(2, 48) = 3.768$, $p < .001$, and child rehospitalization, $\beta = .366$, $t(2, 48) = 3.018$, $p < .01$, accounted for a significant amount of the perceived child vulnerability variability. Based on these results, mothers who endorsed more depressive symptoms and who had children who were rehospitalized following their NICU admission perceived their children as more vulnerable (see Table 16 below for stepwise regression results). When the regression results were examined, particularly the standardized beta values obtained for maternal depressive symptoms ($\beta=.457$, $p<.001$) and for child rehospitalization ($\beta=.366$, $p<.01$), maternal depressive symptoms were the strongest predictor of maternal perception of child vulnerability, followed by child rehospitalization.

The semi-partial correlations obtained in the regression analysis indicate that only the semi-partial correlations between perceived vulnerability and maternal depressive symptoms (r=.454, p<.001) and child rehospitalization (r=.363, p<.01) were significant when all variables were entered into the regression model (see Table 17 below).

Table 16: Stepwise Regression Results

	B	*SE b*	B	T	R^2	ΔR^2	Δ F
Model 1					.172	.172**	10.195**
Constant	.926	1.596		.580			
Maternal depression	3.222	1.009	.415	3.193**			
Model 2					.304	.132	9.106**
Constant	-3.604	2.107		-1.711			
Maternal depression	3.546	.942	.457	3.768***			
Child rehospitalization	2.912	.965	.366	3.018**			

Note. * p <.05, **p<.01, ***p<.001; N=54.

Table 17: The Semi-Partial Correlations of the Predictors with Perceived Child Vulnerability

	Semi-partial correlation between the predictor variable and perceived child vulnerability while controlling for the other predictors in the model
Child rehospitalization	.363**[†]
Maternal depression	.454***

Note. N=54, * p <.05, **p<.01, ***p<.001, [†] Correlation was not significant following Bonferroni adjustment.

In order to verify the stepwise regression results, a multiple regression using the backward variable selection method was used. Results were the same as those obtained using the stepwise variable selection method. As with the stepwise regression analysis, the regression analysis using backward variable selection method indicated that maternal depressive symptoms and child rehospitalization accounted for a significant amount of the perceived child vulnerability variability, R^2 =.304, $F(2, 48)=8.590$, $p<.001$.

In order to further explore the relative contribution of health-related factors, maternal psychosocial health factors, and socio-demographic factors to maternal perception of child vulnerability, multiple regression analyses were then conducted with neonatal illness severity, post-neonatal health, maternal psychosocial health, and socio-demographic variables entered as blocks (i.e., grouping of variables). First**,** stepwise regression analyses were performed to determine the two strongest predictors in each category (See Table 18 for regression results). Based on the standardized beta and t-test values obtained in each of the stepwise regressions (see Appendix D for complete regression result), the two strongest predictors in each category of variables were used to create a block for that category (see Table 18 below for standardized beta and t-test values). Because the functional health impairment category only included one measure (i.e., HSCS-PS), and because the HSCS-PS measure assesses *current* functional health, functional health impairment was included in the post-neonatal health category, along with child rehospitalization, current medication use, current height, and current weight. Regression results indicated that child rehospitalization, followed by current medication use, were the strongest predictors in the post-neonatal health category. When examining the strongest neonatal illness severity variables, findings from Hypothesis 2 analyses (*see*

page 69) were used to guide variable selection. Given that length of ventilation was not found to be significantly associated with perceived vulnerability, and given that other neonatal variables (i.e., 1-minute and 5-minute Apgar scores) were found to be significantly associated with perceived vulnerability, birth weight, gestational age, 1-minute and 5-minute Agpar scores, length of ventilation, and length of NICU hospitalization were all entered into the regression analysis. Regression results indicated that 5-minute Apgar scores, followed by length of NICU hospitalization, were the strongest variables in the neonatal illness severity category.

When examining the strongest socio-demographic variables (i.e., maternal age, household income, maternal relationship status, maternal education level, child ethnicity, child age, child gender), child age at testing and maternal relationship status were found to be the strongest predictor variables. Among the maternal psychosocial variables (i.e., maternal depression, maternal anxiety, maternal sense of parenting confidence, maternal perception of social support), maternal depressive symptoms were found to be the strongest predictor, followed by maternal anxiety. To summarize, the post-neonatal health block included child rehospitalization and current medication use, the neonatal illness severity block included five-minute Apgar scores and the length of NICU hospitalization, the socio-demographic block included child age and maternal relationship status, and maternal psychosocial block included maternal depressive symptoms and maternal anxiety.

Once blocks were created, regression analyses were then performed to examine the differential contribution of each respective block. First, each block was entered separately to examine the change in R^2 that resulted from entering each block into the

regression model. More specifically, separate regression analyses were performed looking at the change in R^2 that resulted from entering each block into a regression model. The block that resulted in the largest change in R^2 was considered to account for most variance in perceived child vulnerability. Results indicated that adding the maternal psychosocial health block into the regression model resulted in the largest change in R^2 (ΔR^2=.195, p<.01) compared to adding the post-neonatal health block (ΔR^2=.166, p<.01), the neonatal illness severity block (ΔR^2=.104, p<.05), or the socio-demographic block (ΔR^2=.042, *ns*). Once the maternal psychosocial health block was identified as the block that accounted for the most variance in perceived vulnerability, additional regression analyses were performed to examine what block of variables would account for the most variance in perceived child vulnerability once the maternal psychosocial health block was already in the model. More specifically, separate regression analyses were performed whereby the maternal psychosocial health block was entered first (because it had previously been shown to account for the most variance in perceived with the largest change in R^2) and the post-neonatal health, the neonatal illness severity, and the socio-demographic block were each entered second. The results of these analyses (i.e., change in R^2) were compared in order to determine what block when added second resulted in the largest increase in R^2. Results indicated that adding the post-neonatal health block after the maternal psychosocial block had been entered resulted in the largest change in R^2 (ΔR^2=.166, p<.01) when compared to adding either the neonatal illness severity block (ΔR^2=.110, p<.05) or the socio-demographic block (ΔR^2=.046, *ns*) second. Next, the amount of change in R^2 resulting from adding a third block to a model that already included the maternal psychosocial block (step 1) and the post-neonatal

block (step 2) was examined. In order to determine the third block, analyses were performed to compare the change in R^2 that resulted from either adding the neonatal illness severity block or adding the socio-demographic block to a model that already included the maternal psychosocial block (step 1) and the post-neonatal block (step 2). Results indicate that adding the neonatal illness severity block resulted in the largest change in R^2 (ΔR^2=.104, $p<.05$) compared to adding the socio-demographic block (ΔR^2=.048, *ns*). Adding the socio-demographic block to a model that already included the maternal psychosocial block (step 1), the post-neonatal block (step 2), and the neonatal illness severity block (step 3) did not result in a significant change in R^2 (ΔR^2=.041, *ns*). Overall these results (see Table 19 for a summary of results with change in R^2 and total R^2 information) indicate that as a group, maternal psychosocial variables accounted for the most variance in perceived child vulnerability, followed by post-neonatal health variables, and then followed by neonatal illness severity variables.

Table 18: Stepwise Regression Results used to Create Variable Blocks

	β value for each variable	T-value for each variable	*p*-value for each variable	Overall R^2 for regression model	F value for regression model	*p*-value for regression model
Post-neonatal variables				.098	5.566	.022*
Child rehospitalization	.314	2.359	.022			
Current medication Use	.242	1.818	.075			
Neonatal illness severity variables				.090	4.952	.031*
5-minute Apgar	.300	2.225	.031			
NICU hospitalization	.230	1.630	.110			
Socio-demographic variables				.086	4.719	.035*
Child age	-.294	-2.172	.035			
Maternal relationship status	.113	.829	.411			
Maternal psychosocial health variables				.172	10.611	.002**
Maternal depression	.415	3.257	.002			
Maternal anxiety	.170	1.194	.238			

Note. N=54; * p <.05, **p<.01, ***p<.001.

Table 19: Regression Analyses: Changes in R^2 as a Result of Adding Blocks

1st Block Entered	Δ R^2	Total R^2	2nd Block Entered	Δ R^2	Total R^2	3rd Block Entered	Δ R^2	Total R^2	4th Block Entered	Δ R^2	Total R^2
Maternal psychosocial	.195**	.195**	Post-neonatal health	.166**	.361**	neonatal illness severity	.104*	.465*	socio-demographic	.041	.506

Note. * p <.05, **p<.01, ***p<.001; N=54. Maternal Psychosocial Block includes maternal depression and maternal anxiety**,** Post-Neonatal Health Block includes child rehospitalization and current medication use, Neonatal Illness Severity Block includes 5-minute Apgar scores and length of NICU hospitalization, and Socio-Demographic Block includes child age and maternal relationship status.

DISCUSSION

The purpose of the current study was to extend the child vulnerability literature by examining the impact of maternal perception of child vulnerability on maternal behavior and by examining the contextual factors that contribute to heightened maternal perception of child vulnerability within a sample of preschoolers born VLBW and their mothers. The study specifically examined (1) the relationship between maternal perception of child vulnerability and observed maternal behaviors (i.e., maternal overprotection, maternal hostility, maternal responsiveness); (2) the relative role of health-related variables (i.e., neonatal illness severity, post-neonatal health factors, functional health impairment) in maternal perception of child vulnerability; and (3) the relative importance of neonatal illness severity, post-neonatal health, functional health impairment, socio-demographic, and maternal psychosocial health factors in maternal perception of child vulnerability. Overall, study findings indicated that maternal perception of child vulnerability was not significantly associated with observed maternal overprotection, maternal hostility, and maternal responsiveness. When examining the relative importance of neonatal illness severity, post-neonatal health, functional health impairment, socio-demographic, and maternal psychosocial health factors, findings indicated that maternal depressive symptoms and child rehospitalization following the NICU hospitalization were the strongest predictors of perceived child vulnerability. When variables were examined as a group, findings indicated that maternal psychosocial variables accounted for the most variance in perceived child vulnerability, followed by post-neonatal health variables. With regard to health-related variables, post-neonatal health (i.e., child rehospitalization) was most strongly related to maternal perception of child vulnerability.

The Relationship between Perceived Vulnerability and Maternal Behaviors

As noted above, the current study sought to better understand the relationship between perceived child vulnerability and observed maternal behaviors, particularly the relationship between perceived vulnerability and observed maternal overprotection (as indexed by maternal intrusiveness). Contrary to the hypothesis that maternal perception of child vulnerability would be significantly and positively associated with observed maternal overprotective behaviors, the current study found that perceived vulnerability was not significantly associated with observed maternal overprotective behaviors (i.e., maternal intrusive behaviors). In fact, perceived vulnerability was not significantly related with the observed intrusiveness in the mother-child free play and clean-up interaction tasks. Current findings indicate that mothers of preschoolers born VLBW who perceive their child as more vulnerable did not display more overprotective/intrusive behaviors during the mother-child free play and clean-up interactions even after controlling for post-neonatal health factors and functional health impairment.

The findings from the current study, however, conflict with the findings of previous studies that report a significant association between maternal perception of child vulnerability and maternal report of overprotectiveness on the Parent Protection Scale (Thomasgard et al., 1995) with 21- to 81-month-old children born preterm (de Ocampo et al., 1994), with middle school-aged children with Type I Diabetes Mellitus (Mullins et al., 2004), and with children of varying ages recruited from pediatric clinics (Thomasgard, 1998; Thomasgard & Metz, 1997; Thomasgard et al., 1995). The difference in how maternal overprotection was measured in the current study compared to the studies cited above may account for the conflicting findings in that the behavioral

coding of maternal overprotection (i.e., maternal intrusiveness coding) used in the current study may capture different aspects of overprotection compared to the questionnaire measure of overprotection (i.e., Parent Protection Scale). Many question items on the Parental Protection Scale, for example, are subjective and more general (e.g., “I blame myself when my child gets hurt,” “I trust my child on his/her own,” “I allow my child to do think on his/her own”) and are difficult to observe during mother-child interaction tasks. As a result, the questionnaire-based measure of overprotection may capture the more subjective aspects of overprotection while the behavioral coding of overprotection may capture the more concrete and discrete behavioral aspects of overprotection. In addition, many of the question items on the Parental Protection Scale pertain to behaviors seen in the home-setting that are not often observed during time-limited, semi-structured, and videotaped interactions (e.g., “I make my child go to sleep at a set time,” “I go to my child if he/she cries during the night,” “I have difficulty leaving my child with a babysitter”). Consequently, compared to behavioral coding used in the current study, the questionnaire-based measure may capture how maternal overprotection is displayed in the home. As a result, the difference between behavioral coding and questionnaire-based measures of overprotection and the implication it has for what aspects of overprotection are being assessed (e.g., subjective experience of overprotection, overprotective behaviors seen in the home setting) may account for the conflicting findings.

Given that the current study did not include a questionnaire measure of parental overprotection, it is difficult to determine whether those mothers who perceive their children as vulnerable would show differences in a behavioral versus questionnaire measure of overprotection. Although it is possible that the interaction tasks and the

coding used in the current study are limited in scope and do not capture the overprotectiveness reported by mothers in the questionnaire measures, it is also possible that mothers who endorse overprotective behaviors on a questionnaire measure of overprotection do not demonstrate behaviors that would be considered overprotective in observable mother-child interactions. Future studies should include both a behavioral and a questionnaire-based measure of maternal overprotection to clarify this issue.

The current finding is also inconsistent with the finding reported by Stern and colleagues (2006), the only other study to date that has examined the relationship between perceived child vulnerability and observed maternal intrusiveness in children born preterm. Unlike the current findings, Stern and colleagues' (2006) found that maternal perception of child vulnerability was significantly and positively associated with observed maternal intrusiveness in a sample of five-month-old infants born preterm.

Several factors could account, however, for the difference in findings between the current study and that of Stern and colleagues'. First, Stern and colleagues' sample assessed five-month old infants while the current sample included preschoolers (i.e., 36- to 56-month olds). The age difference between the two samples may partially account for finding differences since the relationship between maternal intrusiveness and perceived vulnerability may change as children get older. For instance, mothers who perceive their young infants as vulnerable may feel more of a need to interact with their infants in ways that are considered intrusive compared to mothers who perceive their preschoolers as vulnerable.

Second, the lack of concordance between the two studies may be related to the different coding systems used to assess maternal intrusiveness. Although Stern and

colleagues reported using the Interaction Rating Scale (Field, 1980), minimal information was provided regarding how maternal intrusiveness was coded and what behaviors were considered "intrusive." Furthermore, a review of the literature indicates that the Interaction Rating Scale has not been previously used to assess maternal intrusiveness, hence making it difficult to examine what behaviors were considered intrusive and to compare with the current study.

The conflicting findings between the current study and that of Stern and colleagues' indicate the need for future studies in this area. Clarifying the relationship between maternal perception of child vulnerability and maternal overprotection is particularly important given that maternal overprotection (i.e., maternal intrusiveness) has been associated with a range of negative child outcomes in both children born preterm (Feldman & Eidelman, 2006; Hebert, Swank, Smith, & Landry, 2004; Landry, Smith, Miller-Loncar, & Swank, 1997; Moore, Saylor, & Boyce 1998) and full term (Egeland, Pianta, & O'Brien, 1993; Culb, Hubbs-Tait, Culp, & Starost, 2001; Hubbs-Tait, Culp, Culp, & Miller, 2002; Ipsa et al., 2004) and since a relationship between perceived vulnerability and maternal overprotection would have possible clinical implications for follow-up programs that address parenting difficulties in children born preterm. Not only should future studies include both a questionnaire and a behavioral measure of overprotection, they should also explore whether the relationship between perceived vulnerability and maternal overprotection changes across childhood using a longitudinal study design.

Given the limited research on perceived child vulnerability and observed maternal behaviors, the current study also explored the relationship between perceived

vulnerability and observed maternal responsiveness and hostility. The study found that perceived vulnerability was not significantly associated with maternal hostility and responsiveness. Similar to above, only one study (e.g., Stern et al., 2006) has previously explored the relationship between perceived vulnerability and maternal hostility, and no study to date has examined the relationship between perceived vulnerability and maternal responsiveness. Contrary to the current findings, Stern and colleagues (2006) found that perceived vulnerability was significantly and positively associated with maternal hostility in a sample of five-month old infants born preterm. The difference in sample ages and the coding systems used, however, may account for the different findings between the two studies. Thus, future studies are needed to clarify whether perceived vulnerability is associated with these maternal behaviors, particularly given the documented relationship between child outcomes and maternal hostility (Lyons-Ruth et al., 1993; Marchand et al., 2002; Romano et al., 2005) and responsiveness (Beckwith & Rodning, 1996; Denham, 1993; Steelman et al., 2002) in children born preterm.

The Importance of Contextual Factors: Maternal Psychosocial Health and Post-Neonatal Health

In addition to examining the relationship between perceived vulnerability and observed maternal behaviors, the current study also sought to better understand which factors place mothers at-risk for perceiving their child as vulnerable. In order to fully examine this and to address limitations associated with previous studies, the current study included a comprehensive assessment of children's health-related factors (i.e., neonatal, post-neonatal, functional impairment), maternal psychosocial health factors, and socio-demographic factors. Findings indicated that maternal depressive symptoms accounted

for the most variance in perceived vulnerability ($\beta = .457$, $t(2, 48) = 3.768$, $p < .001$), followed by child rehospitalization since the NICU admission ($\beta = .366$, $t(2, 48) = 3.018$, $p < .01$). These findings indicate that mothers who reported more depressive symptoms perceive their child as being more vulnerable and children who have been rehospitalized since their initial NICU admission are perceived as more vulnerable by their mothers.

The current finding that mothers who endorsed more depressive symptomatology perceived their child as more vulnerable is supported by previous research. Teti and colleagues (2005), for instance, found that in a sample of children born preterm, maternal depressive symptoms assessed prior to the infants' NICU discharge predicted higher maternal perception of child vulnerability when the child was three- to four- months adjusted age. Similarly, Allen and colleagues (2004) found that in a sample of children born VLBW, maternal depressive symptomatology assessed prior to the infants' NICU discharge predicted higher maternal perception of child vulnerability when the child was twelve months adjusted age. Similar results have also been reported in healthy children (Bendall et al., 1994; Burger, Horwitz, Forsyth, Leventhal, & Leaf, 1993; Kerruish, Settle, Campbell-Strokes, & Taylor, 2005). Bendall and colleagues (1994), for example, found that maternal depressive symptoms at three months of age significantly predicted maternal perceptions of child vulnerability in preschool.

The finding that mothers who endorse more depressive symptoms perceive their child as vulnerable is not surprising, because compared to mothers reporting fewer depressive symptoms, mothers who endorse more depressive symptomatology often rate their child's temperament as more difficult (Atella et al., 2003; Cutrona & Troutman, 1986; Dudley, Roy, Kelk, & Bernard, 2001; Forman, O'Hara, Stuart, Gorman, Larsen, &

Coy, 2007; Mayberry & Affonson, 1993; Orhon, Ulukol, & Soykan, 2007; Pesonen, Raikkonen, Strandberg, keltikangas-Jarvinen, & Jarvenpaa, 2005; Teti & Gelfand, 1991; Ventura & Stevenson, 1986; Whiffen, 1989) and rate their child's behavior as more negative both on questionnaire measures (Boyle & Pickles, 1997; Breslau, Davis, & Prabucki, 1988; Chi & Hinshaw, 2002; Chilcoat & Breslua, 1997; Fergusson, Lynskey, & Horwood, 1993; Luoma, Koivisto, Tamminen, 2004; Renouf & Kovacs, 1994; Richters, 1992 for a review) and on maternal ratings of their child's observed behavior (Field, Morrow, & Adelstein, 1993; Hart, Field, Roitfard, 1999; Richters & Pellegrini, 1989; Rogers & Forehand,1983; Webster-Stratton & Hammond, 1988). The more negative ratings of child temperament and behavior have also been found when comparing the ratings of independent trained observers (Field et al., 1993; Hart et al., 1999; Richters & Pellegrini, 1989; Rogers & Forehand, 1983; Youngstrom, Izard, & Ackerman, 1999), teachers (Chilcoat & Breslua, 1997; Fergusson et al., 1993; Webster-Stratton & Hammond, 1988), and fathers (Webster-Stratton & Hammond, 1988).

Many researchers suggest that depressive symptoms activate a negative perceptual bias, whereby individual who experienced more depressive symptoms interpret environmental and social information more negatively (Chi & Hinshaw, 2002; Ingram, Scott, & Hamill, 2009; Joorman, 2009; Pesonen et al., 2005; Richters, 1992). Because of this tendency to perceive information more negatively, many researchers have suggested that parents who endorse depressive symptoms are consequently prone to interpreting their child's temperament and behaviors more negatively (Pesonen et al., 2005; Richters, 1992; Youngstrom et al., 1999). The finding that depressive symptoms are significantly related to maternal perception of child vulnerability suggests that

perhaps this tendency to interpret information more negatively also influences maternal assessments of child vulnerability.

Interestingly, there is even evidence that the effect of depressive symptomatology on maternal ratings occurs when the level of depressive symptoms is relatively low. Studies have found, for example, that maternal depressive symptoms influence maternal ratings of child temperament and behavior even when the level of endorsed symptomatology is low (Chi & Hinshaw, 2002; Cutrona & Troutman, 1986; Rogers & Forehand, 1983; Whiffen, 1989). For example, Cutrona and Troutman (1986) found that although the sample scores on the Beck's Depression Inventory (Beck et al., 1996) were low (mean of 5.83), maternal depressive symptoms were significantly associated with maternal ratings of temperament difficulty (r=.55, p<.001). Similarly, Whifften (1989) found that maternal depressive symptoms were significantly associated with matenal ratings of temperament difficulty (r=.42, p<.01) even with low sample scores (mean of 5.80) on the Beck's Depression Inventory (Beck et al., 1996). Studies examining the effect of maternal depression on maternal ratings of child behavioral difficulties report comparable findings. For example, Chi and Hindshaw (2002) found that even with relatively low maternal depression scores (mean of 7.73) on the Beck's Depression Inventory (Beck et al., 1996), maternal depression scores significantly accounted for the discrepancy between maternal and teacher ratings of child behavior, with mothers endorsing depressive symptoms rating their children more negatively than teachers.

The finding that maternal depressive symptoms influence maternal ratings even when the level of depressive symptoms endorsed is low suggest that the perceptual bias hypothesized to be associated with depressive symptomatology may also be present to

some extent with low levels of maternal depression. This is particularly relevant for the current study given that the depression scores obtained were relatively low (x=6.93, median= 5.50). Further studies are needed, however, to clarify how maternal depressive symptoms influence maternal perceptions of child vulnerability.

Although the current study indicates a relationship between maternal perception of child vulnerability and maternal depressive symptomatology, the cross-sectional nature of the study limits our understanding of this relationship. It is possible that the depressive symptoms experienced by mothers influence their appraisal of child vulnerability due to the perceptual bias associated with depressive symptoms. It is also possible, however, that it is maternal perception of child vulnerability that influences maternal depressive symptomatology. Teti and colleagues' (2005) finding that maternal depressive symptoms assessed prior to the infants' NICU discharge predict maternal perception of child vulnerability at three- to four-months of age, and Allen and colleagues' (2004) finding that maternal depressive symptoms assessed prior to the infants' NICU discharge predict maternal perception of child vulnerability at twelve months of age, seem to suggest that it is maternal depressive symptomatology that predisposes mothers to perceiving their child as vulnerable. It is possible, however, that a third unknown variable accounts for the relationship between maternal depressive symptoms and perceived vulnerability. Future longitudinal studies are, thus, needed to clarify the relationship between maternal depression symptoms and perceived vulnerability.

The current study's finding that child rehospitalization is significantly associated with perceived vulnerability is also supported by previous studies. Although research examining the role of post-neonatal health factors in maternal perception of child

vulnerability is limited, research examining the impact of child hospitalization on parental distress has found that the number of child hospital admissions is significantly associated with parental distress both in children born preterm (Davis et al., 2003; Miles et al., 2007; Zelkowitz et al., 1994) and in children with cancer (Sloper, 2000). The finding that child rehospitalization is significantly related with parental distress suggests that rehospitalization is a significant stressor for parents. It is possible that for parents of children born preterm, child rehospitalization may not only be a significant stressor but may also serve as a reminder of their child's continued health difficulties and continued health risk. The stress associated with child rehospitalization and the meaning that is placed on the rehospitalization (e.g., my child is still sick) may, in turn, influence parental assessment of their child's vulnerability.

As previously noted, research examining the role of post-neonatal health in perceived vulnerability has been limited. Apart from the current study, no other study has examined the role of post-neonatal health factors in maternal perception of child vulnerability. Only McCormick and colleagues' (1993) study has come close to doing this by examining how post-neonatal health factors influence maternal rating of child's current health (i.e., McCormick et al., 1993). In this study, McCormick and colleagues (1993) examined the relationship between maternal rating of child's current health and post-neonatal health factors (e.g., child rehospitalization in the past year, presence of specific health conditions in the past year) in a sample of middle school-aged children who were hospitalized in the NICU following their birth. In order to assess maternal rating of child's current health, mothers were asked how healthy they thought their child was (i.e., How healthy is your child currently?) and given five response choices (i.e.,

poor, fair, good, very good, excellent). Their findings indicate that maternal rating of child's overall health (e.g., poor/fair health, good/excellent health) was significantly associated with the presence of child hospitalization in the past year and with the presence of specified health conditions in the past year. Although McCormick and colleagues' study focused on maternal ratings of child's current health (i.e., how healthy is my child currently?) rather than maternal perception of child's vulnerability (i.e., how vulnerable is my child to illness and/or injury?), their finding relating child rehospitalization to maternal assessment of poorer child health is congruent with the current study's finding associating child rehospitalization to maternal perception of child vulnerability.

Interestingly, most of the literature on perceived child vulnerability has suggested that the presence of health difficulties early in a child's life has a large and lingering effect on maternal perception of child vulnerability (Bendall et al., 1994; Burger et al., 199; Forsyth & Canny, 1991; Green & Solnit, 1964; Pearson & Boyce, 2004). They suggest that even after the child's health improves, mothers continue to perceive their child as relatively vulnerable because of the significance they place on their child's early health difficulties (Bendall et al., 1994; Burger et al., 199; Forsyth & Canny, 1991; Green & Solnit, 1964; Pearson & Boyce, 2004). Similarly, within the prematurity literature, many have suggested that the health difficulties children born preterm experience early in their life (e.g., during birth and during their NICU hospitalization) continue to influence maternal perception of child vulnerability long after the child's health difficulties have remitted (Culley et al.,1979; Estroff et al., 1994; Perrin et al., 1989). The current study's finding that child rehospitalization has more of an impact on maternal perception of child

vulnerability compared to neonatal illness severity factors, however, may possibly suggest that children's post-neonatal health and more recent health difficulties play a larger role in maternal perception of child vulnerability compared to the early health difficulties experienced by children born preterm. Since the variability between the neonatal illness severity and post-neonatal health factors were similar, variability did not appear to account for the fact that post-neonatal health factors were more associated with perceived vulnerability compared to neonatal health severity factors.

In addition to examining what specific factors place mothers at risk for perceiving their child as vulnerable, the current study also sought to examine which sets of variables accounted for the most variance in perceived vulnerability. By doing this, the study explored the relative importance of neonatal illness severity, post-neonatal health, socio-demographic, and maternal psychosocial variables as a group in order to assess which sets of variables play a larger role in perceived vulnerability. Findings indicated that maternal psychosocial health accounted for the most variance in perceived vulnerability, followed by child's post-neonatal health. These findings are consistent with the finding that maternal depressive symptoms and child rehospitalization are most associated with perceived vulnerability. Although the cross-sectional nature of the current study makes it difficult to fully understand how maternal psychosocial health and child's post-neonatal health influence perceived vulnerability, these findings do suggest that maternal appraisal of child vulnerability may be more associated with post-neonatal health and psychosocial health factors than more distal factors that occurred early in the child's life. The findings also suggest that attending to mothers' current psychosocial health and children's post-neonatal health is important when examining perception of child vulnerability in children

born preterm. Examining the processes by which maternal psychosocial health and children's post-neonatal health are related to maternal perception of child vulnerability will be an important area of future research.

The Role of Health-Related Factors: Neonatal Illness Severity and Functional Health Impairment

Given that previous child vulnerability research failed to comprehensively assess the role of health-related factors in perceived vulnerabilty, the current study examined the role of post-neonatal health, functional health impairment, and neonatal illness severity in maternal perception of child vulnerability. As reported above, compared to other health-related variables, child rehospitalization, a post-neonatal health factor, was most strongly related to perceived vulnerability. As previously discussed, this finding suggests that mothers may place more importance on more recent health events compared to health events that occured early in the child's life.

Contrary to expectations, the current study's measure of neonatal illness severity, duration of child's ventilation, was not significantly and positively associated with maternal perception of child vulnerability. One possible reason why duration of ventilation was not found to be associated with perceived vulnerability is that the child's ventilation during the NICU period may not be meaningful or significant from the parents' perspective. Although duration of ventilation is seen among medical professionals as an indicator of health in infants born preterm and has been used frequently as a measure of neonatal illness severity (Walsh, 2005), many parents may be unaware of their child's ventilation status during the neonatal hospitalization. Many parents, particularly those who are younger and less educated, may be unaware of the

importance of ventilation status with regard to prognosis given the documented relationship between duration of ventilation and future health and developmental outcomes. Many parents report that they are significantly stressed and overwhelmed during their child's NICU hospitalization (Dudek-Shriber, 2004; Franck, Cox, Allen, & Winter, 2005; Hughes & McCollum, 1994). They report that during this period, they are tremendously worried about their child's prognosis and are overwhelmed by the unfamiliar NICU environment (e.g., the technical equipment attached to the incubators, the tubes and monitor attached to their newborn) and the medical procedures performed on their newborn (Dudek-Shriber, 2004; Franck et al., 2005; Hughes & McCollum, 1994). With numerous demands placed on these parents, many may not be attending to their child's ventilation status and may not perceive their child's ventilation, much less its duration, as meaningful. As a result, if their child's duration of ventilation is not perceived as particularly significant by the parents, it will likely not play an important role in how vulnerable a mother perceives her child. Identifying which neonatal illness severity factors are salient and meaningful to parents is possibly a key first step to understanding whether neonatal factors influence future parental perceptions of child vulnerability.

Interestingly, other neonatal-related factors that have been associated with perceived child vulnerability in previous studies, such as length of NICU hospitalization (Allen et al., 2004) and birth weight (Perrin et al., 1989), were not found to be significant in the current study. Only two other studies (i.e., Allen et al., 2004; Perrin et al., 1989) to date have examined the role of neonatal illness severity factors in maternal perceptions of child vulnerability in children born preterm. Allen and colleagues (2004) examined the

relationship between perceived vulnerability and birth weight, gestational age, length of NICU hospitalization, and length of ventilation in a sample of 12-month old infants born VLBW and found that length of NICU hospitalization and perceived vulnerability were significantly related. Perrin and colleagues (1989), on the other hand, examined the relationship between perceived vulnerability and birth weight in a sample of three-year olds born VLBW and found that birth weight was significantly inversely associated with perceived vulnerability. The different findings, as well as the different age range used in each of the studies (i.e., 36-56 months, 36 months, 12 months), however, make it difficult to draw conclusions regarding the role of neonatal illness severity in perceived child vulnerability. Although the current findings found that neonatal illness severity variables were not significantly related to the perceptions of child vulnerability of mothers of preschoolers born VLBW, future studies are needed to clarify the relationship between neonatal illness severity factors and perceived vulnerability and to explore what neonatal illness severity factors are meaningful to the parents. Furthermore, future studies are needed to examine how other factors, such as child age, maternal age, and maternal education, may influence the relationship between between neonatal severity variables and perceived vulnerability.

Contrary to expectations, functional health impairment was also not significantly correlated with maternal perception of child vulnerability. As previously noted, studies have shown that children born preterm are at an increased risk of displaying functional health impairment (Donohue, 2002; Eiser et al., 2005; Fekkes et al., 2000; Jones et al., 2002; Klassen et al., 2004; Msall, 2005; 2006; Saigal et al., 2005; Schiariti et al., 2007; Theunissen et al., 2001). Given that functional health impairment has been found to be

associated with maternal well-being (Eiser et al., 2005) and has been shown to have a significant impact on the daily lives of children and their parents (Donohue, 2002; Eiser, Eiser, Mayhew, & Gibson, 2005; Fekkes et al., 2000; Jones, Guildea, Stewart, & Cartlidge, 2002; Klassen et al., 2004; Msall, 2005; 2006; Msall & Tremont; Saigal et al., 2005; Schiariti, Hoube, Lisonkova, Klassen, & Shoo, 2007; Theunissen et al., 2001), the current study had hypothesized that functional health impairment would be associated with perceived vulnerability.

The lack of findings regarding functional health impairment may be partly related to the functional health impairment scores obtained in the current sample and the sample composition of the current study. The functional health impairment (i.e., HSCS-PS) scores obtained in the current sample were low. Although functional health impairment scores (i.e., HSCS-PS scores) could range as high as thirty-five, the mean score for the current sample was two. Most participants had low scores (e.g., 90% of the sample had scores of five or less) and only three participants had scores of eleven, the highest score obtained. The low functional health impairment scores obtained suggest that, as a whole, the level of functional health impairment in the current sample was low. As a result, the overall low scores and the minimal variability between scores may have impacted the correlation obtained between functional health impairment and perceived vulnerability scores.

It is also possible that children's functional impairment does not influence a mother's perception of their child's vulnerability to illness and injury. Mothers may perceive their child's functional health impairment as separate from and unrelated to their child's vulnerability to illness and/or injury. Since there are no published studies

examining the relationship between perceived child vulnerability and functional health impairment in preterm samples, pediatric samples, or healthy children, additional studies are needed to examine this relationship. Ideally, future studies would include children that have varying levels of functional impairment.

Limitations of the Current Study

Although the current study sought to address some of the methodological issues associated with previous child vulnerability studies, the current study is not without its own methodological issues that limit the generalizability of findings. The cross-sectional nature of this study, for instance, does not allow for interpretations regarding sequencing or causality.

The sizable proportion of eligible families that could not be reached (i.e., 23.5%) may also limit our ability to generalize findings. As previously noted, eligible children and contact information were identified through NICU records, and many of the numbers and addresses were no longer valid. Additionally, attempts at finding updated contact information were usually unsuccessful. Because of the difficulty in obtaining valid contact information, many eligible families could not be reached in order to determine their interest in participating in the study. Given the limited available information on families who could not be reached, it is unclear whether the families who participated in the study differed substantially from those who could not be reached. Most of the families who could be reached were those who were still living in the same residence from the NICU period and who still had the same phone number. Although this does not provide much information regarding sample characteristics, it does suggest some stability in their lives. It is possible that the families who could not be reached were different than

those that could be reached and that our findings may have changed if these families had been included.

Ideally, in addition to examining post-neonatal health factors (i.e., rehospitalization, current medication, current height/weight), the current study would have also included a comprehensive measure of child current health. Although previous studies have used number of rehospitalizations (e.g., Coulibaly et al., 2006, DeMaso et al., 1991; McCormick et al., 1993; Skalicky et al., 2006, van Hooijdonk et al., 2006) and growth attainment (e.g., Hack, Weissman, Breslau, Klein, Borawski-Clark, & Fanaroff, 1993; Saigal, Stoskopf, Streiner, & Burrow, 2001) as measures of current health, these factors do not fully capture child health. Assessing current health in children born preterm is very difficult. Although measures assessing neonatal health have been developed (see Dorling, Field, & Manktelow, 2005 for a review of scoring systems), no measures are available for assessing current health in children born preterm following the neonatal period. In addition, unlike other childhood medical conditions (e.g., rheumatology disorders, pulmonary disorders), no objective disease severity index exists for children born preterm. Future studies are, then, needed to explore how to best assess current health in children born preterm in order to better understand the relationship between perceived vulnerability and child's current health.

Several strengths of this study are worth noting. Unlike previous perceived vulnerability studies, the current study included a comprehensive assessment of children's health-related factors (i.e., neonatal, post-neonatal, functional impairment), maternal psychosocial health factors, and socio-demographic factors when examining the contextual factors associated with perceived vulnerability. Similarly, the study also

included a comprehensive assessment of observed maternal behaviors across different interaction tasks. In addition, the VLBW preterm sample size as well as the ethnically diverse nature of the VLBW preterm sample are also considerable strengths given the difficulty often encountered getting access to at-risk infant populations.

Clinical Implications

Although future studies are needed to address the stability and generalizability of the current findings, these results have potential implications for intervention programs aimed at families of children born preterm. Many hospitals provide neonatal follow-up programs whereby children born preterm are followed during the first years of life by a team of medical professionals (e.g., developmental specialists, social workers, nurses). These programs are aimed at monitoring children's development and at helping parents cope with challenges associated with caring for a child born preterm. For example, through their home-visiting services, follow-up programs help teach parents how to medically care for their infant after the NICU discharge, help coordinate medical care for the child, and provide parental guidance regarding how to support the child's development. Recent research indicates that such follow-up programs improve the developmental outcomes of children born preterm, as well as the mental health outcomes in parents of children born preterm (Als & Butler, 2008; Als et al., 2003; McAnulty et al., 2009).

Recently, more attention has been placed on the importance of monitoring parental perceptions of child vulnerability in clinical settings such as neonatal follow-up programs and pediatric clinics (de Ocampo et al., 2003; Pearson & Boyce, 2004; Samra & McGrath, 2009). Although child vulnerability research is still in its infancy, thereby

limiting the empirically-based recommendations that can be provided for clinical settings, the finding that maternal psychosocial health and post-neonatal health factors are significantly related to perceived vulnerability suggest that such factors should be addressed when assessing maternal perception of child vulnerability. Medical professionals working with mothers of children born preterm should place special attention to mother's overall well-being and to recent health events when assessing how mothers perceive their child's vulnerability.

Conclusion

Overall, this study helps further our understanding of maternal perception of child vulnerability in children born VLBW and preterm, which is of importance given the association between perceived vulnerability and childhood behavioral problems (Allen et al., 2004; Antony et al., 2003; Bendall et al., 2004; Estroff et al., 1994; Forsyth et al., 1996; Mullins et al., 2004; de Ocampo et al., 2003; Perrin et al., 1989; Thomasgard & Metz, 1996). The current findings indicate that perceived vulnerability was not significantly associated with observed maternal overprotection, hostility, and responsiveness in the mother-child interaction tasks. When examining all health-related variables, child rehospitalization was most strongly associated with perceived vulnerability. The findings also indicate that, when a variety of contextual variables are considered, perceived vulnerability is significantly associated with maternal depressive symptoms and with child rehospitalization. As a group, maternal psychosocial variables were most strongly related to perceived vulnerability, followed by post-neonatal health variables. Together these findings provide a better understanding of maternal perception of child vulnerabilty in children born preterm and highlight the need for longitudinal

study designs and comprehensive measures of child current health in future studies examining perceived vulnerability.

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Appendices

Appendix A: Toy List

Mega Block Set

Play Grocery Basket

Play Food Set

Play Cash Register

Play Kitchen Set

Play Dish and Utensil Set

Appendix B: Clean-Up Instruction Card

"Next, I would like you to get your child to clean up the toys. Please have (him or her) put the toys in the basket that I will bring you. You can manage the clean-up however you like, but we want your child to be involved. I will be out of the room during the clean-up and return in 5 minutes."

Appendix C: Diagnostic Information for Regression Analyses

Diagnostic Information Using Original Variables

Examining presence of influential Cases	**Distribution of standardized residuals:** Standardized residuals were normally distributed.
	Standardized DFFIT: None of the standardized DFFIT values are over the conventional cut-off of one based on Field's (2000) guidelines.
	Cook's distance: None of the Cook's values are over the conventional cut-off of one based on Cook & Weisberg's (1982) guidelines.
	DBETA: None of the DBETA values are over the conventional cut-off of two based on Stevens' (1992) guidelines.
	Leverage: There are no high leverage values. All leverage values range from 0.00177 to 0.20855, with a leverage cut-off value of .629 based on Hoaglin & Welsch's (1978) guidelines.
	Covariance of ratios: All covariance of ratio values are within the acceptable range, based on Belsy, Kuth, & Welsch's (1980) guidelines
	Mahalanobis distances: None of the Mahalanobis values are within the acceptable range based on Barnett & Lewis' (1978) guidelines.
Assessing generalizability of the regression models: Checking regression assumptions	**Variable Types**: All variables are either quantitative or categorical and the outcome variable is quantitative, continuous, and unbounded **Non-Zero Variance**: All predictor variables have some variation in value (i.e., they do not have variances of 0) **No perfect Multicollinearity**: -Based on Myers' (1990) guidelines, the variance inflation factor values are not greater then 10. -Based on Menard's (1995), the tolerance statistics are all above .2 -The eigenvalues also suggest that there is no multicollinearity. **Homoscedasticity:** Examining scatterplots and residual plots suggest that heteroscedasticity is not present **Independent of Errors:** The Durbin-Watson test values indicate that the residuals are uncorrelated. **Normally Distributed Errors:** The normality test results (i.e., Shapiro-Wilk, Kolmogorov-Smirnov) indicate that the residuals are normally distributed. **Independence:** All of the values on the outcome variable are independent **Linearity:** Examining plots (i.e., observed versus predicted values, residuals versus predicted values) suggests that the relationships being modeled are linear in nature.
Assessing generalizability of the regression models: Cross-Validation	**Split sample validation for regression examining all health-related variables:** -Stepwise regression results for sample 1: functional health impairment, number of current medications - Stepwise regression results for sample 2: number of child rehospitalizations, current weight **Split sample validation for regression examining health-related, maternal psychosocial, and socio-demographic variables:** -Stepwise regression results for sample 1: functional health impairment, number of current medication -Stepwise regression results for sample 2: child age, number of child rehospitalization, length of ventilation

Diagnostic Information Using Dichotomous Categories for Non-Normal Variables

Examining presence of influential Cases	**Distribution of standardized residuals:** Standardized residuals were normally distributed.
	Standardized DFFIT: None of the standardized DFFIT values are over the conventional cut-off of one based on Field's (2000) guidelines.
	Cook's distance: None of the Cook's values are over the conventional cut-off of one based on Cook & Weisberg's (1982) guidelines.
	DBETA: None of the DBETA values are over the conventional cut-off of two based on Stevens' (1992) guidelines.
	Leverage: There are no high leverage values. All leverage values range from 0.00177 to 0.20855, with a leverage cut-off value of .629 based on Hoaglin & Welsch's (1978) guidelines.
	Covariance of ratios: All covariance of ratio values are within the acceptable range, based on Belsy, Kuth, & Welsch's (1980) guidelines
	Mahalanobis distances: None of the Mahalanobis values are within the acceptable range based on Barnett & Lewis' (1978) guidelines.
Assessing generalizability of the regression models: Checking regression assumptions	**Variable Types**: All variables are either quantitative or categorical and the outcome variable is quantitative, continuous, and unbounded **Non-Zero Variance**: All predictor variables have some variation in value (i.e., they do not have variances of 0) **No perfect Multicollinearity**: -Based on Myers' (1990) guidelines, the variance inflation factor values are not greater then 10. -Based on Menard's (1995), the tolerance statistics are all above .2 -The eigenvalues also suggest that there is no multicollinearity. **Homoscedasticity:** Examining scatterplots and residual plots suggest that heteroscedasticity is not present **Independent of Errors:** The Durbin-Watson test values indicate that the residuals are uncorrelated. **Normally Distributed Errors:** The normality test results (i.e., Shapiro-Wilk, Kolmogorov-Smirnov) indicate that the residuals are normally distributed. **Independence:** All of the values on the outcome variable are independent **Linearity:** Examining plots (i.e., observed versus predicted values, residuals versus predicted values) suggests that the relationships being modeled are linear in nature.
Assessing generalizability of the regression models: Cross-Validation	**Split sample validation for regression examining all health-related variables:** -Stepwise regression results for sample 1: child rehospitalization - Stepwise regression results for sample 2: child rehospitalization **Split sample validation for regression examining health-related, maternal psychosocial, and socio-demographic variables:** -Stepwise regression results for sample 1: maternal depression, child rehospitalization -Stepwise regression results for sample 2: maternal depression, child rehospitalization

Appendix D: Strongest Predictors in Each Category

	B	T	*p value*
Post-neonatal health			
Child rehospitalization	.314	2.359	.022*
Current medication use	.242	1.818	.075
Functional health	.087	.648	.520
Current height	.036	.267	.791
Current weight	.051	.375	.709
Neonatal illness severity			
Length of ventilation	.159	1.119	.269
1-minute Apgar	.047	.233	.817
5-minute Apgar	.300	2.225	.031*
Gestational age	-.041	-.282	.779
Birth weight	-.160	-1.078	.286
Length of NICU stay	.230	1.630	.110
Socio-demographic			
Child age	-.294	-2.172	.035*
Maternal age	-.029	-.211	.834
Child gender	.033	.240	.811
Child ethnicity	-.025	-.185	.854
Maternal education	-.050	-.364	.717
Maternal relationship status	.113	.829	.411
Family SES	-.029	-.213	.832
Maternal psychosocial			
Maternal depression	.415	3.257	.002**
Maternal anxiety	.170	1.194	.238
Maternal sense of social support	-.006	-.046	.964
Maternal sense of parenting confidence	.103	.776	.441

Note.* p <.05, **p<.01; N=54.