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Health Risk Factors and Children with Behavior Disorders: An Examination of Linear and Quadratic Effects

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Health Risk Factors and Children with Behavior Disorders:

An Examination of Linear and Quadratic Effects

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Abstract

The outcomes for students with emotional and behavioral disorders (EBD) are poor across a variety of domains, including educational achievement, social skills, physical health outcomes, and adaptation into adulthood. Further, early childhood risks put youth at-risk for developing later behavioral difficulties. The accumulation of risk factors, rather than any one risk factor, has been shown to be more predictive of outcomes (Flouri & Kallis, 2007). Historically, research has primarily relied on a linear approach in order to capture the cumulative effect of risk factors. However, the quadratic approach may allow for an examination of the worsening of outcomes as risks interact with each other (Everhart, Fiese, & Smyth, 2008; Gerard & Buehler, 2004).

The present study examined the extent to which socioeconomic status and linear and quadratic cumulative health risk predicted parent, teacher, and self-report of behavioral symptoms in a sample of children experiencing behavioral difficulties. Additionally, the study compared the linear and quadratic effects of cumulative health risks in the prediction of behavioral symptoms across raters. Results indicated that the full model, which included socioeconomic status and the linear and quadratic effects of the cumulative health risk, significantly predicted parent, teacher, and self-reported behavioral symptoms. In particular, the full model accounted for approximately 10% of the variability in the parent report of emotional and behavioral symptoms. Additionally, the full model, which included the quadratic effects, was determined to better capture the data when compared to a reduced model. Thus, the findings supported the inclusion of the quadratic effects in risk factor models. Implications of the findings and suggestions for future research are discussed.

CHAPTER I. INTRODUCTION

The Surgeon General reported that mental health is second to cardiovascular disease in terms of cost burden to the national economy each year (Child and Adolescent Health Measurement Initiative, 2003). Approximately 4 to 6 million children and adolescents in the United States have a serious emotional disturbance, which accounts for 3 to 6% of all children (Kauffman, 2001). The U.S. Department of Education (2009) reported that in the 2004 academic year, 7.9% of special education students were receiving services under the category of emotional disturbance. Additionally, in 2003 the National Survey of Children's Health reported that in a sample of children and youth, 8.8% had attention-deficit/hyperactivity disorder (ADHD) and 6.3% had behavior difficulties (Centers for Disease Control and Prevention, 2007). In particular, it is estimated that 5% of children will experience "extreme functional impairment" due to mental illness (Child and Adolescent Health Measurement Initiative, 2003). Although varied in range, estimates indicate that the median prevalence of functionally impairing child and adolescent psychiatric disorders is 12% (Costello, Egger, & Angold, 2005).

Outcomes for Children with Behavior Disorders

Research on students with emotional and behavioral disorders (EBD) has consistently revealed poor outcomes across a variety of domains (Knitzer, Steinberg, & Fleisch, 1990; Wagner & Cameto, 2004). For example, in terms of disciplinary actions, the results of a longitudinal research study indicated that among all disability groups, children with EBD had the most school disciplinary actions, unexcused absences, and suspensions (Bradley, Henderson, & Monfore 2004; Brook & Newcomb, 1995; Tremblay et al., 1992). Specifically, 70% of students with EBD had school suspension or

expulsions over a given academic year; however, 30% of all students with disabilities and 22% of general education students received suspensions or expulsions (Skiba, Peterson, & Williams, 1997; Wagner, Kutash, Duchnowski, Epstein, & Sumi 2005). Additionally, students with EBD have retention rates and placements in the most restrictive settings at twice the national average (Bradley et al., 2004). At the secondary levels, 34.8% of students with EBD had arrest records and over 50% dropped out of school (Bradley et al., 2004; Wagner et al., 2005). Additionally, externalizing disorders have been associated with school difficulties, including learning delays, poor achievement, social rejection, and aggressive behavior and misconduct in the classroom, as well as dropping out of school (Roeser, Eccles, & Strobel, 1998).

Typically, children with EBD experience academic failure and may struggle given their limited task completion, academic skill deficits, and lack of content knowledge (Lane, Wehby, Little, & Cooley, 2005). Although the rates vary, it is estimated that 25% to 97% of students with EBD have co-morbid academic challenges (Reid, Gonzalez, Nordness, Trout & Epstein, 2004). In fact, academic underachievement is part of the identifying criteria in the federal definition for emotional disturbance (IDEIA, 2004). DiPerna and Elliott (2002) reported that behavioral difficulties including anxiety, disruptiveness, noncompliance, and attention problems are detrimental to learning. Children with EBD have even greater deficits in academics than their peers in other high-incidence disability groups, including lower graduation rates, lower reading and math scores on standardized tests, and a lower probability of attending postsecondary school than any other disability group (Kauffman, 2001).

Difficulties in reading and written language tend to be stable over time, and mathematical deficits tend to broaden over time (Anderson, Kutash, & Duchnowski, 2001; Nelson, Benner, Lane, & Smith, 2004). In a meta-analysis of the academic status, students with EBD had significantly lower academic achievement levels than students without disabilities across academic subjects and settings, including math, reading, reading comprehension, vocabulary, and written language (Lane, Barton-Arwood, Nelson & Wehby, 2008; Lane, Carter, Pierson, & Glaeser, 2006; Nelson et al., 2004; Reid et al., 2004). In the National Adolescent and Child Treatment Study, Greenbaum and colleagues (1996) investigated outcomes over seven years for children ages 8 to 18 years who had a serious emotional disturbance who were being served by either mental health or public school systems. They found that among children with EBD under age 18 years and enrolled in high school at the end of the data collection period, 85.1% performed below grade levels in reading and 94.3% performed below grade level in math. In the 2003-2004 school year, 54.5% of all students with disabilities graduated with a standard high school diploma; however, only 38.4% of students with emotional disorders graduated with a standard high school diploma (U.S. Department of Education, 2009). Moreover, students with EBD are more likely to drop out of school than other students with disabilities (U.S. Department of Education, 2005). Specifically, 52.3% of students with EBD dropped out compared with of 31.1% of students with other disabilities (U.S. Department of Education, 2009).

Social skill deficits identified in students with EBD include limited positive social interactions, an increased tendency to misinterpret neutral social cues as hostile, and behaviors that limit teachers' abilities to effectively deliver instruction (Lane et al.,

2006). Students with EBD are more likely to experience peer rejection and less likely to be accepted than students without disabilities or students with learning disabilities (Sabornie, Kauffman, & Cullinan, 1990). Students with EBD are often in restrictive placements that limit their peer interactions. For example, over half of students with EBD between the ages of 12 and 17 years spend at least 60% of their day outside of general education classrooms (Cullinan & Sabornie, 2004). In the National Longitudinal Transition Study (NLTS-2; 2006), teachers and parents rated 48% of students with emotional disturbances at or below the 16th percentile on their social skills. Indeed, social competence deficiencies is often a primary reason that students are referred and subsequently classified as students with emotional and behavioral difficulties (Forness & Knitzer, 1992; Gresham, 2002).

Children and adolescents with EBD are also at increased risk for later health and social emotional difficulties. For example, children with EBD in middle childhood are at increased risk for substance abuse in early adolescence (Lynskey & Fergusson, 1998). Early behavior problems can affect adaptation in adulthood, as these students with a history of EBD have high rates of unemployment and criminal behavior and low rates of postsecondary education, as well as sustained issues with social and emotional adjustment (Caspi, Wright, Moffitt, & Silva, 1998; Fergusson & Horwood, 1998; Fergusson & Lynskey, 1998; Kratzer & Hodgins, 1997; Wagner et al., 2005; Zigmond, 2006). Further, students with behavior disorders are also at risk for difficulties with substance abuse and often require a high need for mental health services (Bullis & Yovanoff, 2006). In a 25-year follow-up study of adults who were part of the Christchurch Health and Development Study (CHDS), Fergusson, Horwood, and Ridder

(2005) found statistically significant associations between childhood conduct problems at ages 7-9 years and adverse outcomes across various domains of functioning, including crime, substance use, mental health, and sexual/partner relationships, even after controlling for confounding factors (i.e., socioeconomic disadvantage, family instability and conflict, parental adjustment problems, history of child abuse, attention problems at age 7-9 years, anxiety/withdrawal at ages 7-9 years, intelligence, male gender, and ethnicity). Specifically, physical aggression has been shown to be the best predictor of adolescent substance use and risky sexual behavior from childhood onwards (Timmermans, van Lier, & Koot, 2008).

Adolescents with externalizing behavior difficulties have also been shown to engage in risky sexual behavior or experience teenage pregnancy (Bennett & Bauman, 2000; Fergusson & Woodward, 2000; Woodward & Fergusson, 1999). When compared to a matched sample of adolescent girls without conduct difficulties, adolescent girls who exhibited antisocial behaviors reported poorer overall health, greater physical and emotional discomfort/physical limitations, and more health risk behaviors, as well as an earlier start of sexual intercourse and an earlier onset of adult reproductive behaviors and had their first pregnancy at significantly younger ages even when controlling for demographic factors and pre-existing health history (Pajer, Kazmi, Gardner, & Wang, 2007).

Research has shown that behavior patterns established during middle childhood are linked to physical health outcomes in adulthood (DeGenna, Stack, Serbin, Ledingham, & Schwartzman, 2006). Maternal childhood aggression may lead to health risk in adolescents, such as alcohol use, regular drug use, daily smoking, and teenaged

motherhood, and these behavior patterns may continue as these adolescents become parents. For example, in a sample of mothers, a history of childhood aggression and/or social withdrawal predicted health risk behaviors of their own, as well as in their preschool children (DeGenna et al., 2006).

Unmet Health Burden

In the 2001 National Survey of Children with Special Health Care Needs, children with chronic EBD had an increased likelihood of experiencing poorer health and quality of life and having difficulties accessing and receiving necessary care than children with special healthcare needs (CSHCN) who did not have EBD (Bethell & Read, 2005). For example, parents of children with EBD reported more often that their child missed more than 11 days of school during the past year, and they had more unmet healthcare needs, difficulty obtaining referrals, no health insurance or inadequate insurance and incurred $1000 or more in annual out-of-pocket medical expenses. Additionally, they were less likely to have a personal physician or receive family-centered care. Further, parents reported that children with EBD were more likely to have health conditions that interfered with daily activities and affected their family. These children were more likely to have family members experience financial difficulties related to children's health, had to reduce their work hours or stop work to care for their children, and spend more than 11 hours per week in the provision or coordination of care for their children (Bethell & Read, 2005).

Numerous variables have been hypothesized to be associated with the increased health risks of children with EBD, including difficulty accessing mental health treatments, lack of a well-defined evidence-base for treatments, and receiving a diagnosis

of EBD at an older age (Bethell & Read, 2005; Hoagwood, Burns, Kiser, Ringeisen, & Schoenwald, 2001; U.S. Department of Health and Human Services, 1999). A later diagnosis of a behavior problem may mean that children do not receive early intervention that may be effective in preventing the worsening of symptoms. The existence of co-morbid conditions, including chronic physical conditions (e.g., asthma, allergies, diabetes, and frequent headaches) and associated disorders (e.g., attention deficit hyperactivity disorder, learning disability, depression, anxiety, and pervasive developmental delay) may also contribute to the increased health risks in children with EBD (Bethell & Read, 2005). Thus, there seems to be an interface between behavior problems and health issues for children with EBD.

Overall, research findings indicate that the needs of students with EBD continue to be unmet across multiple domains, including educational achievement, social skills, physical health outcomes, and adaptation into adulthood. In general, these difficulties are stable and persist over time, despite intensive and potentially restrictive interventions. The individual and societal costs associated with EBD call attention to the importance of understanding the role of early life experiences in the development and prevention of behavioral difficulties.

Childhood Health Risk Factors

The effects of early childhood health risk factors on later behavioral functioning have been extensively investigated. In particular, research has shown that genetic factors, prenatal or early developmental exposure to toxins, early perinatal problems, and physical damage to brain structures contribute to the development of aggression and violence (Burke, Loeber, & Birmaher, 2002). Furthermore, research has demonstrated the

profound effects child maltreatment and abuse can have on later emotional and behavioral functioning (Burnam et al., 1988; Kaplow & Widom, 2007; Kaufman, 1991). Although studies may employ a multi-dimensional approach to measure a single health risk factor (e.g., birth complications), research has not examined the effects of the accumulation of health risk factors (e.g., birth complications, child maltreatment) on the emotional and behavioral functioning of children. Furthermore, although many studies have utilized parent reported outcomes, few studies have examined teacher- or self-reported outcomes of emotional and behavioral functioning. The proposed study seeks to address these limitations through the examination of multiple variables conceptualized as health risks and their relationship to multiple reports of behavioral outcomes in children and adolescents experiencing emotional and behavioral difficulties.

Specifically, the accumulation of risk factors has been shown to be more important than any one risk factor regardless of the child's environmental context because it overwhelms the capacities of the child (Flouri & Kallis, 2007). Additionally, risk factors are transactional in that they result from the bi-directional effects of the interaction of child and context over time (Sameroff & Chandler, 1975). Cumulative risk models, which are usually composed of a variety of types of risk, capture the natural co-variation of the factors and consistently explain more variance in children's outcomes than single factors (Atzaba-Poria, Pike, & Deater-Deckard 2004; Deater-Deckard, Dodge, Bates, & Pettit, 1998). Given that risk factors interact with each other, researchers examine cumulative risk using linear or quadratic approaches (Everhart, Fiese, & Smyth, 2008). In a linear approach, the variable increases in a straight line with the addition of risk factors. However, in a quadratic approach, as the risk factors are added, the slope of

the line changes. Typically, researchers have focused solely on the linear approach, which assumes that adverse outcome results from a steady increase in risk. However, a linear approach does not allow an examination of the worsening of outcomes that may be present as risks interact with each other, which is reflected in the quadratic effect (Dickstein et al., 1998; Evans & English, 2002; Gerard & Buehler, 2004; Seifer Sameroff, Dickstein, Keitner, & Miller, 1996). Much of the cumulative risk research ignores the quadratic effect, despite its ability to show individuals who are likely to experience the most adverse outcomes (Jones, Forehand, Brody, & Armistead, 2002). The proposed study addresses these limitations through the examination of the linear and quadratic effects in order to determine which effect more accurately captures the relationship between health risks and later behavioral functioning.

Purpose of the Current Study

The current study makes a unique contribution to the literature through the investigation of health risk factors and their relationship to multiple informant ratings of behavioral outcomes for students with intensive behavior and emotional problems. The purpose of the present study was to examine different statistical effects in order to determine if a linear or quadratic model best captures the relationship between cumulative health risk factors and social and emotional functioning of children at-risk for behavioral difficulties.

The specific research questions of the proposed study are:

(1) Do socioeconomic status and the linear and quadratic effects of the cumulative number of health risks predict the severity of serious behavioral and emotional problems as measured by parent and teacher report of Behavioral

Symptoms Index of the BASC/BASC-2 and the student report of Emotional Symptoms Index on the BASC/BASC-2?

(2) Which is a better predictor of the severity of serious emotional and behavioral problems, the linear or quadratic effect of the cumulative health risk index?

The hypotheses for the research questions are: (1) It was hypothesized that the cumulative number of health risk factors (linear and quadratic effects) and SES would account for a significant amount of variance in behavioral symptoms across raters. Based on existing research findings that determined cumulative risk factors predict negative outcomes for children and adolescents, as well as psychopathological disorders and lower satisfaction with life (Deater-Deckard et al., 1998; Flouri & Kallis, 2007; Hooper Burchinal, Roberts, Zeisel, & Neebe, 1998; Sameroff, Seifer, Baldwin, & Baldwin, 1993), it was hypothesized that the SES and the cumulative number of health risk factors would be significantly associated with students' overall level of problem behavior, as rated by the parent, teacher, and student; 2) Given research supporting the importance of testing quadratic effects to capture the worsening of outcomes with increasing risks (Everhart et al., 2008), it was hypothesized that the model including the quadratic effect of cumulative risk factors would be the optimal model for data interpretation.

CHAPTER II. LITERATURE REVIEW

Overview of Risk Factors

Risk factors are defined as measurable predictors (i.e., attributes of people, relationships, or contexts) of negative outcomes for individuals, families, and communities (Masten & Gewirtz, 2006; Masten, Morison, Pellegrini, & Tellegen, 1990). Protective factors are variables that have a greater effect under hazardous conditions than they do under benign conditions; they decrease the probability that a person will suffer harm (Masten & Gewirtz, 2006). Because risk factors are not considered static variables, their predictive value changes depending on when they occur in a young person's development, in specific social contexts (e.g., neighborhood crime or neighborhood disorganization), and under particular circumstances (e.g., poor parent-child relationships, low socioeconomic status) (U.S. Department of Health and Human Services, 1999).

Prevention and intervention efforts strongly rely on the identification of risk and protective factors and their course of development. Prevention programs that occur in early childhood may target different variables than those programs that are designed for adolescents (Greenberg, Domitrovich, & Bumbarger, 2001). For example, the Surgeon General Report (U.S. Department of Health and Human Services, 1999) summarized risk factors for violence at age 15 to 18 years. Results indicated that early risk factors (ages 6-11 years) with large effect sizes (i.e., $r>.30$) were general offenses and substance use, while later risk factors (ages 12-14 years) with large effect sizes were weak social ties, antisocial behaviors, delinquent peers, and gang membership. This suggests that interventions targeting peer groups may be more effective in older children than younger

children. In the current study, if researchers were able to identify children who are most at risk, then intervention efforts could be targeted toward those children in order to prevent later difficulties.

Risk Factors for Externalizing Difficulties

In the etiology of specific behavior patterns, a single risk or protective factor is not likely to be responsible for outcomes (Greenberg et al., 2001; Greenberg, Speltz, & DeKylen, 1993). Previous research studied groups of children prospectively in efforts to identify causes of poor developmental outcomes; however, those studies often resulted in wide variations in outcomes and a tendency for risk factors to accumulate such that the effects of any one risk factor were difficult to discern (Garmezy & Masten, 1994; Masten, Best, & Garmezy, 1990; Rutter, 1979; Sameroff, 2000; Sigman & Parmelee, 1979). It is the number of risk factors, rather than any single risk factor, that increases the likelihood of poor outcomes (Rutter, 1979).

Crews and colleagues (2007) analyzed the risk and protective factors of students with emotional and behavioral disorders in 18 meta-analyses and found that the risk factors most highly correlated with externalizing behaviors were having a poor connection to school, delinquent peers, and a co-morbid internalizing disorder. The three greatest protective factors for externalizing behaviors were age at first commitment to the juvenile justice system (i.e., older age indicating lowered risk); adequate academic achievement; and positive play activities with peers. In terms of internalizing behaviors, having a chronically ill sibling and a co-morbid externalizing disorder were the risk factors most highly correlated with poor outcomes, while popularity, an internal/stable attributional style, and positive play activities were the most highly correlated protective

factors. Aside from being a victim of abuse and abusing substances, health risk factors were not included in any of the studies analyzed in the meta-analysis. Additionally, history of child maltreatment and substance abuse had low correlations to externalizing behaviors and were not included in examinations of internalizing behaviors. Although no single risk factor can account for children's behavioral or emotional functioning and not all risk and protective factors are of equal importance, the identification of the risk and protective factors with the greatest influence on negative and positive outcomes remains a challenge (Nash & Bowen, 2002; Crews et al., 2007).

Environmental factors. Risk does not simply reside within a child but may be a characteristic of the environment. Specifically, risk may be considered a hazardous constellation of factors (Doll & Lyon, 1998). Environmental factors have shown to be important influences on intervention effectiveness and the development of conduct problems (Ringeisen, Henderson, & Hoagwood, 2003; Sameroff, Peck, & Eccles, 2004). Numerous factors have been identified at the child level (e.g., early antisocial behavior), family level (e.g., inconsistent discipline), school level (e.g., academic failure, multiple transitions), and community level (e.g., high population density) that are associated with the development of severe emotional and behavioral difficulties in children (Burke et al., 2002; Deater-Deckard et al., 1998).

Numerous ecological risk factors, such as living in poor and disadvantaged neighborhoods, have been identified that increase the likelihood for a diagnosis of oppositional defiant disorder (Burke et al., 2002). Specifically, living in public housing has been shown to counter the impact of individual protective factors present in children at-risk for behavior difficulties (Wikstrom & Loeber, 2000). Other community factors

predictive of later violence include social disorganization (e.g., crime), availability of drugs, and presence of adults involved in crime (Herrenkohl, Maguin, Hill, Hawkins, Abbott, & Catalano, 2000). Additionally, poverty, lack of structure, exposure to racial prejudice, and community violence, as well as coercive family processes, lack of parental supervision, lack of positive parental involvement, inconsistent discipline practices, or child abuse, have all been implicated in the development of disruptive behavior (Burke et al., 2002; Patterson, 1982).

Research has well documented the influence of impaired parent-child interactions and family distress on children with attention and behavior difficulties (Barkley, 2006; Chronis et al., 2003). In a meta-analysis examining the association between parenting and delinquency in 161 published and unpublished manuscripts, Hoeve et al. (2009) found that parental monitoring, psychological control, and negative aspects of support (i.e., rejection and hostility) accounted for 11% of the variance in delinquency. These findings support previous research indicating that parental rejection and poor supervision were among the best predictors of delinquency (Loeber & Stouthamer-Loeber, 1986). Other parenting behaviors, such as child abuse and lack of positive involvement, are also considered risk factors for the development of problem behaviors (Frick et al., 1992; Pfiffner, McBurnett, Rathouz, & Judice, 2005). Additionally, parental psychopathology and antisocial behavior have been shown to impact child functioning (Pfiffner et al., 2005). For example, children with a mother who has depression are at an elevated risk for developing a range of psychopathology, including ADHD and depression (Beardslee, Versage, & Gladstone, 1998). Parental substance abuse, low socioeconomic status, and

oppositional behaviors were key factors in the early progression of conduct problems in boys (Loeber, Green, Keenan, & Lahey, 1995).

At the psychosocial level, several risk factors have been associated with severe behavioral and emotional difficulties. Peer-related issues. especially peer rejection and association with deviant peers, may influence the development and maintenance of behavior difficulties (Burke et al., 2002). Deviant peer groups, the presence of a co-morbid psychological disorder, being the victim of trauma, assault, family and community violence, and sexual abuse, prior delinquent activity, and substance abuse have been related to behavioral difficulties (Burke et al., 2002). Specifically, chronic physical aggression in elementary school has been shown to increase risks for delinquency and physical violence in adolescence (Broidy et al., 2003). Risk factors for youth violence and other forms of antisocial behavior also include male gender, hyperactivity, inattention, early antisocial behavior, parental attitudes favorable to violence, low academic performance, involvement with antisocial peers, low family income, availability of drugs, and low neighborhood attachment (Herrenkohl et al., 2000). In a predominantly low socioeconomic African-American population, a cumulative risk model, which included marital and poverty statuses, maternal education and intelligence score, household size, stressful life events, depressed affect, mother-infant attachment, quality of the home environment, and the quality of the day care environment, predicted infant language, although not cognitive performance at one year of age (Hooper et al., 1998).

Health Risk and Later Behavior Problems

Undeniably, there is an abundance of research on a scope of risk factors that affect later behavioral functioning. Although environmental and psychosocial risk factors are important, an analysis of risk factors specifically related to health and development is important because it allows for a targeted examination of health factors that are preventable early in a child's life.

Behavior difficulties in preschool and school-age children are associated with multiple risk factors. Although severe psychosocial adversities have been shown to have a major impact on the child, more biologically determined variables have also been shown to uniquely contribute to the development of health and behavior problems, especially when influenced by a range of predisposing psychosocial risk factors (Ruchkin, Gilliam, & Mayes, 2008). Child biological risk factors that contribute to the development of aggression and violence include contributions of genetic factors, prenatal or early developmental exposure to toxins, other prenatal and perinatal problems (e.g., maternal smoking, parent substance abuse, pregnancy and birth complications, and low birth weight), neurotransmitters, under-arousal of the autonomic nervous system, and physical damage to brain structures (Burke et al., 2002).

Relevant risk factors will be briefly reviewed with an emphasis on the health risk factors that will be examined within the study. Specifically, research on the following health risks will be examined: maternal behaviors during pregnancy; child health; and history of abuse. By considering both environmental and child-level factors related to health and development, clinicians can better ensure that at-risk children are identified and referred for early intervention services.

Maternal behaviors during pregnancy. Numerous studies have investigated the effects of prenatal exposure to alcohol and illicit drugs on the cognitive and emotional

development of children (Yumoto, Jacobson, & Jacobson, 2008). During pregnancy, the use of alcohol, tobacco, and illegal substances is a major risk factor for low birth weight and other poor infant outcomes (Stratton, Howe, & Battaglia, 1996). Specifically, the use of alcohol is linked to fetal death, low birth weight, growth abnormalities, mental retardation, and fetal alcohol syndrome, and smoking during pregnancy is linked to low birth weight, preterm delivery, sudden infant death syndrome (SIDS), and respiratory problems in newborns (Stratton et al., 1996).

Prenatal and perinatal exposures may result in outcomes that are undetected until later in the child's development (Dombrowski & Martin, 2007). For example, prenatal exposure to influenza and gestational exposure to smoking and stress have been shown to be related to adverse cognitive, learning, psychological, and behavioral outcomes (Dombrowski, Martin, & Huttunen, 2003; Fried, Watkinson, & Gray, 1992; Mednick, Machon, Huttunen, & Bonett, 1988; Shenkin, Starr, & Deary, 2004). Indeed, many of the perinatal risk factors are the result of maternal behaviors. The effects of alcohol use during pregnancy and later effects on children have been largely investigated. In fact, children with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAEs) have been well examined (Mattson, Schoenfeld & Riley, 2001). Maternal stress and emotional status during the perinatal period has also been examined as a significant risk factor for later childhood adjustment (Anhalt, Telzrow, & Brown, 2007). As part of the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care, Anhalt et al. (2007) indicated that perinatal maternal adjustment is associated with children's emotional and behavioral functioning years later. In particular, they found that maternal stress and emotional status at one month after their child's birth accounted for

4% of the variance in parent reporting of child externalizing behavior problems in first grade.

On the other hand, other research has found limited associations with prenatal and perinatal risk factors and child behavior. Specifically, O'Callaghan, Williams, Andersen, Bor, and Najman (1997) conducted a prospective study examining a variety of prenatal and perinatal risk factors and child behavior at age five years. After controlling for social economic disadvantage, they found that male gender, more perinatal hospital admissions, and cigarette smoking during pregnancy were associated with externalizing behavior difficulties. However, the use of a modified measure of child behavior may have limited the authors' ability to detect further results. Other studies have retrospectively examined the role of adverse pre- and perinatal events, such as premature birth and prenatal stress, to psychopathology in adolescents (Allen, Lewinsohn, & Seeley, 1998), yet the parents were asked to recall developmental history occurring 14 to 18 years previously.

Minick-Vanhorn, Titus, and Dean (2002) examined the effects of perinatal complications on educational placement. Using the Maternal Perinatal Scale (MPS; Dean, 1985), a self-report measure of children's perinatal experience (e.g., maternal medical history, pregnancy, delivery, and child's early infancy), they reported that children were 6.35 times more likely to be placed in special education when they had a combination of 11 perinatal complications. Significant perinatal factors included the mother's weight before pregnancy (i.e., > 151 lbs.), use of saddle block anesthesia, number of months of pregnancy (i.e., < 8 months), stress throughout pregnancy, initial physician consultation after third trimester, use of medications other than vitamins, occurrence of an unplanned pregnancy, hypoxia, and maternal cigarette smoking during pregnancy.

The MPS has been used to evaluate the relative risk of common childhood disorders, including learning disability, autism, attention-deficit hyperactivity disorder (ADHD), and mood and anxiety disorders (Davis & Dean, 2007). Specifically, in a study of 170 children who were diagnosed with ADHD and matched to a control sample without an ADHD diagnosis, Linnet et al. (2005) investigated the relationship between maternal smoking during pregnancy and later diagnosis of ADHD. Results indicated that children whose mothers smoked during pregnancy were three times more likely to be diagnosed with ADHD than the children of mothers who did not smoke during pregnancy, even after controlling for socioeconomic status and co-morbid disorders. Amor et al. (2005) compared perinatal complications in children with ADHD to their unaffected siblings and found that children with ADHD had an overall greater number of perinatal complications than did their unaffected siblings, and the degree of perinatal complications was also associated with the severity of ADHD.

The experience of maternal distress during infancy may lead to generalized maternal and child distress and child behavior difficulties during preschool in low and middle socioeconomic status families (Essex et al., 2006). In a review of biosocial studies of antisocial and violent behavior in children and adults, Raine (2002) identified 39 studies that illustrated interactions between biological and social factors in relation to antisocial and violent behavior. Specifically, minor physical anomalies at birth, fetal exposure to alcohol and nicotine, and obstetric factors, such as birth complications, were shown to interact with psychosocial risk factors in relation to adult violence.

Child health. Among other factors at the child-level, medical problems in childhood have been linked to later poor behavioral outcomes (Lavigne & Faier-

Routman, 1992). In general, more medical problems at birth have been correlated with elevated externalizing behaviors, particularly aggression (Deater-Deckard et al., 1998). Children who had more birth complications (i.e., measured by hospital records), malnutrition, and psychosocial adversity, were more likely to develop externalizing behavior problems as indicated by parent ratings at age 11 years (Arsenault, Tremblay, Boulerice, & Saucier, 2002; Beck & Shaw, 2005; Liu, Raine, Wuerker, Venables, & Mednick, 2009). Birth complications are hypothesized to be especially likely to result in emotional and behavioral difficulties when combined with psychosocial risk factors, such as a disadvantaged family environment and poor parenting (Beck & Shaw, 2005; Hodgins, Kratzer, McNeil, 2001; Piquero & Tibbetts, 1999). Limitations of these studies included their failure to utilize multiple informant and self-report ratings in determining outcomes, lack of measurement of a variety of health risk factors, and lack of generalizability. Although other studies have reported a lack of predictive relationship between perinatal variables and later behavior problems (Laucht et al., 2000), gestational and perinatal exposures are often associated with externalizing difficulties in children (Allen et al., 1998; Linnet et al., 2005; Raine; 2002).

History of abuse. Further, child maltreatment has been shown to have profound effects on later functioning in terms of anxiety, depression, post-traumatic stress disorder (PTSD), dissociation, somatization, antisocial personality disorder, and drug and alcohol abuse (Burnam et al., 1988; Dubowitz, Black, Harrington, & Verschoore, 1993; Kaplow & Widom, 2007; Kaufman, 1991; Luntz & Widom, 1994; Pelcovitz et al., 1994; Widom, 1999; Widom, Ireland, & Glynn, 1995). In a sample of 1,849 ninth grade students, the addition of each form of child maltreatment (i.e., emotional, physical, and sexual abuse)

increased the odds of being classified as a violent delinquent (i.e., youth who reported engaging in two or more violent behaviors) by 2.24 times, even after accounting for other individual-level risk factors (Crooks, Scott, Wolfe, Chiodo, & Killipo, 2007).

Thus, research on individual health risk events that occurred during early development has shown to be linked to later outcomes and behavioral functioning. Although many studies have examined a multi-dimensional nature of an isolated area of risk (e.g., birth complications as measured by hospital records, malnutrition, and psychosocial adversity data), these studies have not examined an accumulation of various health factors, such as birth complications, exposure to alcohol or other drugs during prenatally, and child maltreatment and abuse. A cumulative model of health risk may more accurately capture the effects of the summative impact of these factors on emotional and behavioral functioning.

Measuring Risk: Linear versus Quadratic Effects

Historically, the majority of research on risk factors has identified and measured each risk factor's predictive values separately without considering the influence of other risk factors. According to Hooper et al. (1998), there have been three common strategies for analyzing developmental risk. Analytic strategies for prediction have utilized multiple regression or analysis of variance techniques. Specifically, predictor models may be viewed as multiplicative or additive. In a multiplicative model, there is an assumption that the combination of risk factors can be disproportional, or non-additive, while an additive model assumes that each risk factor contributes independently to developmental risk. Both of these types of predictive models examine the unique impact of each variable on development separate from the other predictor variables. Although these approaches

allow for an evaluation of the relative importance of each variable, the overlap or correlations among predictors can deflate parameter estimates (Hooper et al., 1998).

The third strategy is a cumulative risk perspective, which utilizes a single variable model. Although a cumulative risk model is also a form of regression, it is distinctive in that the underlying assumption is that the number of risk factors, rather than the weighting of factors, impacts developmental outcome (Hooper et al., 1998; Breitmayer & Ramey, 1986; Rutter 1979; Sameroff et al., 1993).

Studies examining multiple risk factors have found that risk factors have independent, additive effects such that the greater number of risk factors that a child has experienced the greater likelihood of deleterious outcomes (Flouri & Kallis, 2007; U.S. Department of Health and Human Services, 1999). Typically, risk gradients are constructed through counting well-established risk factors and plotting risk level against a variety of indicators of healthy development. The accumulation of risk factors has been shown to be more important than any one risk factor regardless of the context because it overwhelms the adaptive capacities of the child (Flouri & Kallis, 2007). Further, risk factors are thought to be synergistic and transactional, such that they result from joint influences and bi-directional effects of the interaction of child and context over time (e.g., Sameroff & Chandler, 1975). Typically, risk factors exist in clusters, rather than in isolation (U.S. Department of Health and Human Services, 1999). Therefore, researchers frequently utilize cumulative risk models to predict adverse outcomes through capturing the natural co-variation of risk factors (Sameroff et al., 1993; Seifer et al., 1996). Cumulative risk models are composed of various risk factors, such as poverty, single-parent status, ethnic or racial minority status, household density, major life events, and number of moves,

which co-occur and aggregate in the lives of children. These models have been shown to be more reflective of child outcomes and are consistently found to explain more variance in children's outcomes than single factors (Atzaba-Poria et al., 2004; Deater-Deckard et al., 1998; Masten et al., 1990; Masten & Gewirtz, 2006; Rutter, 1979; Sameroff et al., 1993; Sameroff, Seifer, & Bartko, 1997). Further, they are thought to be more explanatory proximal measures (Hooper et al., 1998; Sameroff et al., 1993; Sameroff et al., 1997). Although cumulative risk variables models that include various broad domains may be more parsimonious (Sameroff et al., 1993), individual differences in the presence and absence of particular risk factors are vital in predicting externalizing behavior problems (Deater-Deckard et al., 1998).

Sameroff and Rosenblum (2006) illustrated the importance of risk constellations such that the combination of risk factors was less important than the cumulative number of risk factors. Risk factors tended to cluster, and an increase in the number of risk factors for each individual family resulted in major differences on mental health and intelligence. For example, children without any environmental risks scored more than 30 points higher on measures of intelligence than children with 8 or 9 risk factors. On average, each risk factor resulted in a 4 point drop in a child's IQ score (Sameroff & Rosenblum, 2006; Sameroff et al., 1997). Additionally, in a longitudinal study of risk factors for youth violence, a 10-year-old child exposed to five or more risk factors was 10 times as likely to be violent by age 16 than a child exposed to only one or zero risk factors (Herrenkohl et al., 2000). Family level contextual risk and poverty have been shown to relate independently and selectively to child adjustment in school (Ackerman, Brown, & Izard, 2004). The accumulation of risk factors present at age five has been shown to predict

one-third to almost one-half of the variance in externalizing problems in middle childhood (Deater-Deckard et al., 1998).

Furthermore, researchers can examine cumulative risk in two ways. In a linear approach, the variable increases in a straight line with the addition of risk factors. However, in a quadratic approach, as the risk factors are added, the slope of the line changes. According to Everhart, Fiese, and Smyth (2008) researchers typically examine the total number of risk factors that a child or family experiences and its relation to a particular outcome. This method utilizes a linear approach and assumes that adverse outcomes result from a steady increase in risk. A limitation of previous research is the lack of studies that examine the predictive value of the interaction of risk, as well as traditional additive effects (i.e., merely adding variables to the other terms in a model to determine its effect on the independent variable). Linear models ignore the potential worsening of outcomes that may be present as a function of increasing risks, which may be better reflected in the quadratic effect (Dickstein et al., 1998; Evans & English, 2002; Gerard & Buehler, 2004; Seifer et al., 1996).

Indeed, much of the cumulative risk literature in child development ignores the quadratic effect (Dickstein et al., 1998; Evans & English, 2002; Gerard & Buehler, 2004; Seifer et al., 1996). If researchers ignore the quadratic model and assume a linear decline in the outcome occurs, then they may potentially overlook individuals who are most at-risk (Jones, Forehand, Brody, & Armistead, 2002). An alternative test of quadratic effects is able to identify individuals who are likely to experience the most adverse outcomes (Everhart et al., 2008; Jones et al., 2002). For example, Everhart, Fiese, and Smyth (2008) examined the relationship between a cumulative risk model and caregiver quality

of life in a sample of 193 families of children with mild to severe asthma. Additionally, they examined whether caregiver quality of life was better predicted by a linear or quadratic model of cumulative risk. Results indicated that the cumulative risk model significantly predicted caregiver quality of life as a quadratic function, and caregivers with numerous risk factors experienced a dramatic worsening of quality of life demonstrated within the quadratic effect. They concluded that the quadratic effect, rather than the linear effect, was the best predictor of caregiver quality of life (Everhart et al., 2008). Although evidence suggests that the interactions between or among factors produces only small effects, future research is necessary to explore these relationships (U.S. Department of Health and Human Services, 1999).

Importance of Prevention Early Intervention

The role of the early health and developmental risk factors in the development of behavior difficulties in children underscores the importance of prevention and early intervention efforts. Decades of developmental research have supported the effectiveness of prevention and early intervention strategies (National Research Council Institute of Medicine, 2000). Targeted interventions can help reduce antisocial behavior in young children at risk (Conduct Problems Prevention Research Group, 2007; Webster-Stratton, Reid, & Hammond, 2004). For example, the Fast Track program (Conduct Problems Prevention Research Group, 2007) utilized parent behavior-management training, child social-cognitive skills training, reading tutoring, home visiting, mentoring, and a universal classroom curriculum in order to prevent antisocial behavior and psychiatric disorders among various high-risk groups. Significant interaction effects between intervention and initial risk level were strongest after 9th grade. These results were also

clinically meaningful, as the effects at grade 3 were robust through grade 9. However, the results were limited for children with only moderate levels of risk. Thus, the intervention highlighted the importance of early intervention and screening in order to better target resources at individuals with the greatest risk, as well as the importance of matching intervention to risk level. A study by Kern and colleagues (2007) provided further evidence that parent-training and behavior management strategies can significantly reduce the problem behaviors of preschoolers at high risk as measured by symptoms of ADHD. In order to prevent serious behavior problems in schools, efforts generally have to focus beyond the school environment (Christensen, 2004). Collaboration among the school, parents, community systems (e.g., hospitals and health care providers), and local organizations will make supports most effective (Shapiro, DuPaul, Barnabas, Benson, & Slay, 2010). However, future research is necessary to examine the behavioral outcomes of children who have experienced multiple health risks.

Given unfavorable outcomes that are too often the typical experience of children with behavior difficulties, the identification of potential risk and protective factors is essential in order to design prevention programs. In particular, a substantial proportion of referrals for assessment and intervention in child psychiatry and social services are for children with aggressive or antisocial behaviors (Garland et al., 2001), and students with EBD represent a diverse population with varied needs, including academic and social problems and a broad array of family and community risk factors (Kern, Hilt-Panahon, & Sokol, 2009). It is essential to identify the children and families at highest risk for continued difficulties in order to provide evidence-based treatments and intervention efforts that are varied and matched to each individual student's needs (Kern et al., 2009).

Further, the consideration of risk and protective factors may be important in moderating a child's response to intervention (Sugai & Horner, 1999; Walker et al., 1997).

Contributions of the Proposed Study

It is clear that additional research is needed to broaden the scope of research examining the effects of multiple health risk factors on later behavioral functioning. This study is innovative in that it utilizes parent, teacher, and self-reported perceptions of emotional and behavioral functioning in a sample of children who were identified as at-risk for behavioral difficulties. Further, this study is one of the few studies to examine whether the cumulative risk associated with childhood health of children with behavioral difficulties is better conceptualized as the interaction, rather than the summation of risk factors. Finally, this study responds to calls for the examination of multiple aspects of risk factors (Masten, 1999) and to identify factors in early childhood that may assist in developing more effective interventions delivered early rather than late in childhood (Yates, Egeland, & Sroufe, 2003).

CHAPTER III. METHODS

Participants and Setting

Participants in the study were 113 students (85% male; 15% female) identified as at-risk for emotional and behavioral difficulties, ranging from 5 to 14 years old at enrollment, their caregivers (i.e., parents), and teachers. Participants were enrolled in kindergarten through 9th grade (54% elementary; 45% high school). Tables 1-3 provide additional demographic information for the student, caregiver/parent, and teacher participants.

Insert Tables 1-3 here

The sample was part of Project REACH (Kern & Gresham, 2003), a four-year longitudinal study funded by the Office of Special Education Programs to research practices and long-term outcomes for students with intensive social, emotional, and behavioral needs. The project was a collaborative effort between researchers at Lehigh University and the University of California-Riverside in order to determine the long-term effectiveness of interventions consistent with best practice and to evaluate the role of risk and protective factors on student outcomes. The students' parents and teachers completed assessments concerning the participants.

Participant Recruitment and Characteristics

Project REACH was approved by the Institutional Review Board at Lehigh University and the University of California, Riverside. In diverse districts throughout each state, administrators were contacted and provided consent for participation in the

project. In order to recruit students with the most intensive needs, meetings were arranged between Project REACH staff and key school district personnel, including the Director of Special Education, in collaborating districts in northeast Pennsylvania and southern California. At this meeting, the purpose of the grant was reviewed, eligibility criteria were discussed, and demographic information was obtained regarding students in the district and the number of students labeled with behavior disorders. All teachers in classrooms for students with emotional and behavioral difficulties with eligible students were given the opportunity to participate. Teachers and school administrators were encouraged to identify and refer their most challenging students. Project REACH staff met with teachers to explain the project, review eligibility criteria, and answer any questions. Special education and general education teachers nominated potential participants in California, while only special education teachers nominated students in Pennsylvania.

All participating teachers were asked to identify a minimum of two students in their classroom who had the most intensive needs and exhibited significant behavioral concerns, including both internalizing and externalizing difficulties. One student from each classroom was then randomly selected to participate in the study. Teachers could only participate in one teacher-student dyad so teachers who taught multiple classes could only have one student participate. Administrators nominated students with most intensive needs in out of district placements. Out of district sites were then contacted to determine their willingness to participate in the project. Participants from out of district sites were included in the same proportion as the school district's referral to out of district

sites. In the event that a site and/or parent did not want the student to participate, then the other nominated student was contacted to participate in the study.

Parents of the students selected for the study were notified by letter of the study purposes and procedures, and they were asked to return a permission form to their child's teacher if they agreed to be contacted about participation in the study. The research coordinator met with referred families in order to obtain informed consent. After parental consent was received, students were given a verbal and written description of the study and assent was obtained from students.

Assessment Measures

Risk factors interview. The risk factor profile of each student was obtained through parent report via a semi-structured interview. Graduate student research assistants, who were assigned a specific caseload of children, conducted face-to-face semi-structured interviews with the caregiver for each student. The risk factor interview was developed based on a mega-analysis of the literature (Crews et al., 2007) in which 36 risk factors emerged. A mega-analysis is used to synthesize findings from multiple meta-analyses. Although each of the 36 risk factor items was designed to measure a unique risk factor, items that were conceptually similar were grouped into four domains: child health and developmental history, home environment, community and social relationships, and school environment. These groupings were based on results of the mega-analysis, a conceptual understanding of risk, and an expert in the field of EBD; a factor analysis was not conducted. For the purposes of this study, items from the child health and developmental history were examined as risk factors. The child health and developmental history was comprised of 17 dichotomous items in which parents indicated the presence

or absence (i.e., yes or no) of each risk factor. Risk factor items that included a health or developmental risk factor were included in the calculation of a Total Health Risk score (See Table 4). Items included in the scale are the following risk factors: prematurity; hospitalization; maternal health during pregnancy; maternal illness during pregnancy; exposure to maternal smoking during pregnancy; use of alcohol or illegal substances during pregnancy; exposure to smoke; child experience of significant illness or injury; child treatment for psychological condition; history of physical abuse; history of sexual abuse; history of emotional abuse or neglect; receiving health care and treatment; and having a primary care physician.

In order to obtain a total score for each domain, the total number of "yes" responses endorsed was counted and recorded. On the child health and developmental history domain, two items (i.e., has a primary care physician and receives the healthcare and treatment he/she requires) were reverse scored. Items with missing responses were examined in order to determine reasons for missing data. If the respondent indicated that the item was unknown, then the item was scored as not present.

Behavior Assessment System for Children (BASC-2). The BASC-2 is well-researched behavior rating system that allows for analysis of the child's behaviors from the teacher, parent, and child perspectives. Given differences in the timing of enrollment, some participants completed the Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1992), while others completed the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) at the first data collection period. Although changes in items and a broadening of content for the adaptive skills domains existed, there were very high correlations between the composites and the

scales on the BASC and BASC-2. Construct validity has also been shown to be adequate across scales (Reynolds & Kamphaus, 2004; Tan, 2007).

The BASC-2 Teacher Rating Scales (TRS) measure both adaptive and problem behaviors in the school settings. The preschool (ages 2 through 5), child (ages 6 through 11) and adolescent (ages 12 through 21) versions were administered. The forms contain descriptors of behaviors on a four-point scale of frequent, ranging from *Never* to *Almost Always.* The TRS provides a broad composite, the Behavioral Symptoms Index, which provides a reasonable estimate of the student's overall level of functioning. It is comprised of the Hyperactivity, Aggression, Depression, Attention Problems, Atypicality, and Withdrawal subscales. The composites and individual scales have high reliabilities. In particular, the coefficient alpha reliabilities of Behavior Symptoms Index range from .96 to .97 across age ranges for the general sample. Test-retest reliabilities for the composite scales are generally in the middle .80s to the low .90s with an interval of 8 to 65 days between ratings. Adjusted correlations, which were used to remove the bias from the imperfect sampling of the general population, ranged from .87 to .93 across age ranges. Median inter-rater reliability estimates are .65, .56, and .53 for the preschool, child, and adolescent levels, respectively. Because the BASC-2 standardization forms included all items from the original BASC TRS and new items written for the BASC-2, the scores from both forms may be derived from the BASC-2 standardization forms. Correlations between the corresponding BASC and BASC-2 scales are extremely high. In particular, the adjusted correlation for the Behavioral Symptoms Index was .93 between the BASC and BASC-2.

The BASC-2 Parent Rating Scales (PRS) measure the parent's perspectives of the child's adaptive and problem behaviors in the community and home settings. The PRS uses the same four choice response format as the TRS, takes 10 to 20 minutes to complete, and is written at approximately a fourth grade reading level. Similar to the TRS, the PRS has preschool, child, and adolescent versions and also contains the Behavioral Symptoms Index. For the general norm samples, the composite scores and individual scale scores were high. Specifically, the coefficient alpha reliabilities of the Behavioral Symptoms Index ranged from .93 to .95 across age ranges. Test-retest reliabilities with an interval of 9 to 70 days between ratings indicated high correlations across the composite and individual scales. In particular, the adjusted correlations ranged from .83 to .93 across age ranges. Inter-rater reliability was evaluated using the ratings from different parents or caregivers. Median inter-rater reliabilities were .74, .69, and .77 for the preschool, child, and adolescent levels, respectively. The BASC-2 contains all items from the original BASC PRS and new items that were written for the BASC-2. Specifically, the adjusted correlation between the Behavioral Symptoms Index scores on the BASC and BASC-2 was .90.

The BASC-2 Self-Report of Personality (SRP) is a personality inventory that contains *True* or *False* response items and items rated on the same four-point frequency scale as the PRS and the TRS, while the original BASC only contained the *True/False* response format. Child (ages 8 to 11) and adolescent (ages 12-21) versions were utilized. Additionally, the BASC-2 Self-Report of Personality-Interview (SRP-I) was utilized for children ages 6-7. The SRP-I is similar to the SRP in content, except there are fewer items and the child responds *Yes* or *No* to statements that are administered in an interview

format. Like the Behavioral Symptoms Index, the Emotional Symptoms Index contains the scales that load highest on the general factor. Specifically, it is composed of four scales from the Internalizing Problems composite (Social Stress, Anxiety, Depression, and Sense of Inadequacy) and two scales from the Personal Adjustment composite (Self-Esteem and Self-Reliance). The scores on the Self-Esteem and Self-Reliance are inverted prior to calculating the Emotional Symptoms Index. Elevated scores on this index indicate the presence of a broad-based emotional difficulty that impacts the thoughts and the feelings of the individual. In general, the internal consistency reliabilities of the composites and individual scales of the BASC-2 SRP are high. In particular, the coefficient alpha reliabilities ranged from .84 to .95 across age ranges for the Emotional Symptoms Index. The test-retest reliability estimates for the composite and individual scales were fairly high over a 13 to 66 day interval. Specifically, the adjusted test-retest reliabilities of the Emotional Symptoms Index ranged from .80 to .92 across age ranges. The adjusted correlation between the BASC and BASC-2 Emotional Symptoms Index was .74.

In order to provide a reasonable estimate of the child's overall level of functioning, the standard score of the Behavioral Symptoms Index was the dependent variable for parent and teacher reports, while the standard score of Emotional Symptoms Index will be the dependent variable for self-report.

Socioeconomic status (SES). SES was measured using the highest level of education that the primary caregiver completed (Hollingshead, 1975). The highest level of education completed was collected when parents completed a demographic information sheet at enrollment in the study. Caregivers reported level of education

according to the following categories: 1 for eighth grade or less; 2 for some high school; 3 for high school graduate or Graduate Equivalency Degree (GED); 4 for some college or post-high school; 5 for college graduate; and 6 for advanced graduate or professional degree. Within these categories, lower values represent lower educational attainment and lower overall SES. Within the present study, SES was represented by selecting the highest level of education (e.g., either mother or father) representing the highest level of SES (e.g., highest educational category). The primary caregiver was the caregiver who completed the rating scales and risk factor interview. Information on parental occupation, although collected, was not incorporated into representations of SES in the current study given the amount of missing data.

Procedures

Data used in this study were drawn from an existing database. Graduate students in school psychology, counseling psychology, and special education programs were employed as consultants for the larger project, and they administered all measures. Prior to administration, the consultants were trained on effective interviewing and administration of rating scales. The Risk Factors Interview was administered verbally to parents during the initial interview at time of enrollment in the study. Interviews took place in the homes or at a commonly agreed meeting place and lasted between 30-45 minutes. Additionally, the demographic information form was completed at the time of enrollment. Graduate students administered the BASC or BASC-2 according to the measures' standard protocol according to age level. When it was deemed necessary (i.e., student's reading level was below a third grade reading level), the graduate students read rating scale items aloud to the participants. Assessment measures (i.e., risk factor

interview and BASC/BASC-2 report) utilized in the study were administered in close proximity to each other during the initial enrollment or year one of the study, which was prior to intervention delivery. Hollingshead (1975) data were collected over the course of the study. The Total Health Risk score was calculated from the Risk Factors Interview. The Behavioral Symptoms Index scores were computed from the BASC and BASC-2 parent and teacher versions, and the Emotional Symptoms Index score was entered from the BASC and BASC-2 student versions. Data were then entered into an SPSS database.

Data Analyses

Missing data analysis. Initially, 125 participants were recruited and consented. Four participants withdrew from the study prior to data collection, and 8 participants were eliminated from the dataset because they were missing parent, teacher, and self-reported BASC or BASC-2 rating scales. Thus, a sample size of 113 was available for the current analysis. After excluding the participants missing all three dependent variables, the total number of missing data for each variable was reported as follows: 22 cumulative risk index; 4 socioeconomic status, 17 parent report on BASC/BASC-2 Behavioral Symptoms Index; 17 teacher report on BASC/BASC-2 Behavioral Symptoms Index; and 16 self-report on BASC/BASC-2 Emotional Symptoms Index.

Traditionally, the most common analytic strategies for handling missing data are deletion and single imputation approaches (Peugh & Enders, 2004). However, these techniques have been criticized for reducing total sample size, producing biased estimates, and failing to account for the variability in hypothetical data value, and producing excessive Type I error rates (Baraldi & Enders, 2010). In fact, in the current

study, listwise deletion would reduce sample size to 50, which eliminates 44.25% of the data.

Multiple imputation and maximum likelihood estimation are two "state of the art" data techniques that have been suggested in the literature (Baraldi & Enders, 2010; Schafer & Graham, 2002). The advantages to these techniques are that they can produce unbiased estimates and they improve the power of the analyses. In the current study, multiple imputation was used to handle missing data. Multiple imputation is most appropriate for missing data that are considered (1) missing at random (MAR), which means that there is systematic missingness where the propensity for missing data is correlated with other study variables in the analysis, or (2) missing completely at random (MCAR), which means that missingness is completely unsystematic and the observed data are considered a random subsample of hypothetically complete data (Baraldi & Enders, 2010). MCAR data may also include data that are missed due to scheduling difficulties, experimenter error, or other unrelated reasons (Baraldi & Enders, 2010). In multiple imputation, there are three phases: imputation, analysis, and pooling. First, several copies of the data set are created with different imputed values. Then, statistical analyses are performed on each data set using the same techniques (i.e., multivariate regression) if the data were complete. Finally, the estimates and their standard errors are averaged into a single set of values (Baraldi & Enders, 2010). SPSS has a feature that was used to conduct these analyses.

The major hypotheses were examined using multivariate regression analysis. This analysis was selected for several reasons. Multivariate regression is appropriate when research aims to predict several dependent variables from one or more predictors

(Stevens, 2009). Specifically, the analysis allows a test of the relationship between the set of predictors (i.e., linear and quadratic effects of health risks after controlling for SES) and a set of outcomes (i.e., severity of behavioral symptoms as rated by the parent, teacher, and student on the BASC/BASC-2). Multivariate regression is similar in logic and computation to univariate multiple regression. However, the simultaneous investigation of relationships between the predictors and a set of dependent variables in a multivariate regression minimizes the risks of experimentwise Type I error that is associated with multiple hypothesis testing. For example, three separate regression analyses, one for each dependent variable (rating by teacher, parent, and self) at the alpha level of .05, could have resulted in the family wise alpha level far larger than .05. In the current investigation, multivariate regression analysis fulfilled the purpose of prediction, as opposed to explanation. The results inform understanding of how the effects of health risk predict behavioral difficulties. That is, the multivariate regression assists in the process of model building in order to identify the proper functional form (i.e., linear only versus linear and quadratic effects of health risks on behavioral difficulties) of the predictive relationship.

Evaluating associated assumptions. The associated assumptions of multivariate regression were tested prior to conducting the regression analysis. The basic assumptions of multivariate regression analyses include the following: 1) independence of observations; 2) multivariate normality; 3) homoscedasticity; and 4) common covariance structure across observations (U.C.L.A. Academic Technology Services, Statistical Consulting Group, 2010). Normality was examined through visual inspection of histograms, visual examination of P-P plots, and skewness and kurtosis statistics.

Homoscedasticity was evaluated through an examination of scatter plot of residuals. The *F* statistic is fairly robust against violations of this assumption (U.C.L.A. Academic Technology Services, Statistical Consulting Group, 2010). In order to meet the assumption of equality in covariance matrices, the number of observations per group was kept equal, which should be effective in ensuring violations of the assumption are not problematic. Independence of observations assumes that no relationship exists between the scores for one person and those of another person (Leech, Barrett, & Morgan, 2005). Sampling design influences the issue of correlated observations. For example, if participants were chosen in groups rather than individuals, then there is a possibility of correlated data. However, teachers could only participate in one teacher-student dyad at enrollment, and students were enrolled in multiple school districts across two states. Therefore, independence of observations should not be an issue (Allison, 1999). After these assumptions were tested and addressed, the hypotheses were evaluated using the following regression models.

Research Question 1. The prediction of cumulative health risks to the severity of emotional and behavioral problems was examined using multivariate regression analyses. The equation for a linear model is $Y = XB + E$, and the equation for a quadratic model would be $Y = XB^2 + E$ (Stevens, 2009). If the independent variable *x* (i.e., SES and cumulative health risk) has a relationship with the outcome that depends on the x^2 then it is quadrative dependence. In order to create the quadratic variable, the cumulative health index was squared or multiplied by itself. The criterion variables were parent, teacher, and self-report standard scores from the BASC and BASC-2. The following variables were entered into the analysis: socioeconomic status (i.e., primary caregiver level of

education), cumulative health risk (linear), and cumulative health risk x cumulative health risk (quadratic) (Cohen, Cohen, West, & Aiken, 2003).

First, a multivariate test of the regression model was obtained using Wilks' lambda to determine if there was a significant relationship between the two sets of variables. Second, if the multivariate test was significant, then univariate *F*-tests of each dependent variable were examined in order to determine if there was a significant relationship between the predictors and each outcome. The multivariate R^2 (R^2 = 1 - Wilks' lambda) was used to establish the degree to which variance in the dependent variables was attributed to the independent variables. Third, for a dependent variable that had a significant univariate result, then the significance of individual predictors for the dependent variable was examined in order to determine if the specific predictor was related to the outcome. The *t*-test was used to determine the significance of the predictor, and beta coefficients were used to identify the magnitude of prediction. For a significant predictor, every one standard deviation unit of increase in the predictor increased or decreased the dependent variable by the number of standardized beta coefficients. Results from the univariate analyses were pooled based on the guidelines outlined by Enders (2010).

Research Question 2. The full or complex model consisted of the following predictors: SES, the linear effects of the cumulative risk index, and the quadratic effects of the cumulative risk index. The reduced or simple model consisted of SES and the linear effects of the cumulative health risk index as predictors. A chi-square deviance test, which is also referred to as a likelihood ratio test, was utilized in order to compare the two models of interest and identify the model that fit the data better.

Model fit was statistically evaluated with a chi-square deviance test because the two models were hierarchically nested (i.e., the more complex model differed from the simple model only by the addition of one or more parameters). Full maximal likelihood estimation method (MLE) was used rather than restricted MLE (or REML) to provide parameter estimates for model comparison (e.g., Tabachnick & Fidell, 2007). The resulting test statistic approximately follows a chi-square distribution, with degrees of freedom equal to the number of additional parameters in the more complex model.

Specifically, the following steps were taken to calculate the chi square deviance test. First, the datasets were arranged in the long or univariate form with one response to each dependent variable in one row for each participant. Given the three dependent variables in the dataset, each participant had three rows in the dataset. The statistical analyses of each of the five imputed datasets were implemented using the SAS PROC MIXED procedure with MLE method. Second, a -2 log likelihood (-2 Log L) was available in the SAS output for each model. Third, the difference between the absolute values of the -2 Log L for each model (i.e., the full and reduced models) were calculated and checked for significance at the alpha level of .05 using a table for chi square critical values (Cohen et al., 2003).

If the deviance test is significant, then the model with a lower -2 Log L is used in subsequent analyses because it is considered to be better fitting the data. Specifically, the model with the lower -2 Log L would explain significantly more variance in the outcome. If the deviance test is not significant, then the addition of the additional term (i.e., the quadratic effect) would not explain significantly more variance in the model and would

not need to be considered in the model (Huelsenbeck & Crandall, 1997; Swofford, Olsen, Waddell, & Hillis, 1996).

Power analysis. A power analysis was conducted in order to determine if an appropriate sample size was available to detect levels of effects within the multivariate regression analyses. Through analysis using Cohen (1988) tables, it was determined there was sufficient power to conduct the analyses. Specifically, for Research Question #1, in order to obtain a medium effect size ($f^2 = 0.15$) with a .05 level of significance, a desired power of 0.80, and three dependent variables, and two degrees of freedom, a sample size of 50 would be necessary (Cohen, 1988). For Research Question #2, in order to obtain a medium effect size ($f^2 = 0.15$) with a .05 level of significance, a desired power of 0.80, and three dependent variables, and one degree of freedom, a sample size of 76 would be necessary (Cohen, 1988). These sample sizes are available using the Project REACH database.

CHAPTER IV. RESULTS

Missing Data Analysis

A missing data analysis was conducted in order to determine the extent of missing data and analyze any patterns to the data. In order to compare the extent of missing data among variables, the percentage of missing data for each variable was calculated. The cumulative health risk index had the greatest number of missing values (19.5%), while the percentage of missing values for BASC/BASC-2 ratings were relatively similar across raters (i.e., 14.2% self-report, 15% teacher report, and 15% parent report). Socioeconomic status, which had 3.5% of missing values, was the lowest percentage of missing values.

Separate-variance *t*-tests were calculated in order to help identify variables whose pattern of missing values were potentially influencing the variables (i.e., subgroup means were significantly different when a variable was present or missing). Computed *t*-values were compared to critical values for the *t*-distribution in order to conclude that the means of the sample with and without the missing variables were similar ($\alpha = .05$) (Fisher & Yates, 1963). When the Behavioral Symptoms Index teacher report on the BASC/BASC-2 was missing, the mean cumulative health index was significantly smaller than when the teacher report was non-missing. However, because the missingness of the teacher reported behavioral symptoms did not affect the means of any of the other quantitative variables, it was determined to be appropriate to proceed with the analyses.

Insert Table 5 here

An analysis of missing data patterns revealed seven different patterns of jointly missing data that occurred in more than 1% of the cases. The variables Cumulative Health Index and parent report on the Behavioral Symptoms Index were missing together more often than any other pair (n = 4), which was not surprising since both relied on reports from the primary caregiver. Considering the descriptive statistics and patterns of missing data, it appeared that the data were missing completely at random. In order to confirm this conclusion, Little's MCAR was conducted (Little, 1988). The Little's MCAR test obtained for the current study's data resulted in a chi-square = 40.832 (df = 42; p = .522), which indicated that the data were indeed missing at completely at random (i.e., no significantly identifiable pattern exists to the missing data) and satisfied the assumption to proceed with the multiple imputation.

Multiple imputation was conducted in order to create several "complete" data sets by generating possible values for the missing values (SPSS Inc., 2010). The following variables were selected for multiple imputation: standard score of Emotional Symptoms Index; standard scores of parent and teacher Behavioral Symptoms Index; socioeconomic status; and the Cumulative Health Index. Using SPSS, the fully conditional specification (FCS) imputation method was chosen. The FCS is an iterative Markov chain Monte Carlo (MCMC) and is used when the pattern of missing data is arbitrary. FCS fits a single dependent variable using all the other variables in the model as predictors. Then, the missing values are imputed for the variable being fit. Five imputations were computed (Peugh & Enders, 2004; Schafer, 1997; SPSS Inc., 2010).

Testing of Assumptions

The associated assumptions of multivariate regressions were tested prior to conducting the regression analysis. The following assumptions were evaluated: independence of observations, normality, homoscedasticity, and common covariance structure across observations.

Independence of observations. In order to ensure that errors associated with one observation were not correlated with errors of other observations, the Durbin-Watson statistic was utilized to test for independence of observations. On the Durbin-Watson statistic, values ranging from 1.5 to 2.5 are generally considered acceptable (Cohen et al., 2003). In the sample, Durbin-Watson values were within the range of 1.636 and 1.875, which indicated the assumption of independence of observations was satisfied.

Normality. Normality was examined through visual inspection of histograms, visual examination of P-P plots, and evaluation of skewness and kurtosis statistics. Visual inspection of histograms and P-P plots of univariate normality and scatterplots of bivariate normality were evaluated and satisfied the assumptions. Skewness and kurtosis statistics were calculated. Leech, Barrett, and Morgan (2005) recommend that if the absolute value of a statistic divided by the respective standard error was 2.5 or less, then the distribution of the variable is accepted as approximately normal. Distributions of the criterion variables generally satisfied the assumption of normality.

Homoscedasticity. The assumption of homoscedasticity or the homogeneity of variances examines the variance of errors across the independent variables (Tabachnick & Fidell, 1996). Homoscedasticity was evaluated through an examination of scatter plot of residuals. Slight heteroscedasticity has little effect on significance tests (Berry & Feldman, 1985; Tabachnick & Fidell, 1996). Analyses of the patterns of residual plots

indicate residual errors were approximately equal across values, which suggested that the assumption of homoscedasticity was fulfilled.

Homogeneity in covariance matrices. Box's *M* statistic was used to test for homogeneity of covariance matrices (Box, 1949). Utilizing Box's test, it was determined that covariance matrices were not significantly different (F (54, 2434) = .692, p = .957), which indicated that the assumption of homogeneity was met.

Descriptive Statistics

Descriptive statistics for the pooled means and standard deviations for predictors and criterion variables are presented in Table 6. Results indicated that the average level of educational attainment, which served as a proxy measure for SES, was equivalent to a high school graduation (M = 3.18, SD = 1.10). Additionally, the average number of health risks was greater than three (M = 3.61, SD = 2.12). Figure 1 displays the number of risk factors that participants endorsed.

Insert Figure 1 here

Furthermore, the mean standard score on parent and teacher report of the Behavioral Symptoms Index fell within the at-risk range, which indicated that most of the sample was at-risk for developing clinically significant problems (Reynolds & Kamphaus, 2004). The mean standard score on the student report of the Emotional Symptoms Index was within the average range. A paired-samples *t*-test was used to compare the means of the dependent variables through computing the differences between values of the two variables for each case and testing whether the average differs

from 0. Significant differences were found between parent and teacher report (t = -1.876, p < .001) and parent and child report (t = -6.476, p < .001) of behavioral symptoms. No significant differences were found between teacher and child report of behavioral symptoms.

Insert Table 6-7 here

The percentage of participants whose caregivers endorsed the child health and development risk factors is presented in Table 8. In particular, greater than one-third of caregivers reported maternal smoking during pregnancy (34.5%) and the child experiencing emotional abuse or neglect (35.3%), experiencing a significant illness or injury (39.5%), and receiving treatment for a psychological condition (58%).

Insert Table 8 here

Bivariate correlations were calculated between socioeconomic status, cumulative risk index, the quadratic cumulative risk index, parent report of behavioral symptoms on the BASC/BASC-2, teacher report of behavioral on the BASC/BASC-2, and self-report of emotional symptoms on the BASC/BASC-2. Results were pooled based on Rubin's (1987) rules for combining estimates. Based on the correlations shown in Table 9, there was a strong relationship between linear and quadratic cumulative health risks (r (111) = .955; p < .001). Additionally, there was a moderate relationship between parent report of

behavioral symptoms and linear (r (111) = .300; $p < .01$) and quadratic (r (111) = .312; $p < .01$) health risks.

Insert Table 9 here

Research Question 1

A multivariate regression was conducted to examine the prediction of socioeconomic status, the cumulative health risk linear effects, and the cumulative health risks quadratic effect on parent- and teacher-reported behavioral symptoms and child self-reported emotional symptoms. The results of the multivariate regression were significant across all of the imputed data sets indicating that socioeconomic status and the linear and quadratic effects of the cumulative health risk were significantly related to parent-, teacher-, and self-reported emotional/behavioral symptoms. Currently, no rules have been defined to aid in the pooling of Wilks' Λ statistics. Thus, the Wilks' Λ statistics for each imputed data set are presented in Table 10.

Insert Table 10 here

Since the multivariate test was significant, univariate F-tests of each dependent variable were examined in order to determine if there was a significant relationship between the predictors and each outcome. The multivariate R^2 (R^2 = 1 - Wilks' lambda), or coefficient of determination, is also reported in Table 11. In general, R^2 values closer to one are more desirable.

The full predictive model (i.e., SES, linear, and quadratic effects of cumulative health risks) explained a small, yet significant amount of variability in parent-reported behavioral symptoms across all five imputed data sets (see Table 11). Approximately, 10% of the variability in the parent-reported behavioral symptoms was significantly explained or accounted for by socioeconomic status and the linear and quadratic effects of the cumulative health risk index. The predictors explained a significant amount of variability (11.2%, F (3,109) = 4.56; p = .005) in teacher-reported behavioral symptoms in the fifth imputation of the data set. Additionally, the predictors explained a significant amount of variability (8%, F (3, 109) = 3.17; p = .027) in student-reported emotional symptoms in the second imputation of the data set. However, no further interpretation will be offered for the teacher reported behavioral symptoms and student reported emotional symptoms, as no other data set had significant results for the variables (see Table 11).

Insert Table 11 here

Finally, using the output from the multivariate regression, the unique prediction to each dependent variable was compared in the following ways. Since parent-reported behavioral symptoms consistently had a significant univariate result, the output was examined in order to determine any significant predictors related to the outcome. Analyses of *t*-tests revealed that there were no significant predictors to parent-reported behavioral symptoms.

Insert Table 12 here

Research Question 2

The full model and the reduced model were compared to identify the model that was a better fit to the data. The full or complex model consisted of the following predictors: SES, quadratic effects of the cumulative risk index, and the linear effects of the cumulative risk index. The reduced or simple model consisted of only the SES and linear effects of the cumulative health risk index as predictors. Thus, the full or complex model had one more predictor, which was the quadratic effect of the cumulative risk index.

A chi-square deviance test (i.e., a log likelihood test;-2 Log L) of a difference between the two nested models was implemented in the SAS PROC MIXED procedure using MLE method. The difference between the absolute values of the -2 Log L in the SAS output for each model (i.e., the full and reduced models) was calculated and checked for significance at the alpha level of .05 using a table for chi square critical values (i.e., 3.84 for 1 degree of freedom in the current study) (Cohen et al., 2003). A chi square above the critical value is considered significant. Results indicated that the chi square was significant across all five imputed data sets. Thus, the complex or full model was considered the optimal model or closer to the best fitting model (i.e., a lower -2 Log L) because the set of predictors (i.e., SES, linear, and quadratic effects) explained significantly more variance in the outcome than the set of predictors without the quadratic effects term.

Insert Table 13 here

CHAPTER V: DISCUSSION

There were two primary purposes of the current study. First, the study examined the extent to which socioeconomic status and linear and quadratic cumulative health risk predicted parent, teacher, and self-report of behavioral symptoms in a sample of children experiencing behavioral difficulties. Second, the study compared the linear and quadratic effects of cumulative health risks in the prediction of behavioral symptoms across raters. Results indicated that the full model, which included socioeconomic status and the linear and quadratic effects of the cumulative health risk, significantly predicted parent, teacher, and self-reported behavioral symptoms. In particular, the full model significantly accounted for approximately 10% of the variability in the parent report of emotional and behavioral symptoms. Further, the full model, which included the quadratic effects, was significantly able to explain more variance in the outcomes when compared to the reduced model. Thus, the findings supported the inclusion of the quadratic effect within the optimal model for data interpretation.

Model Comparison: Linear versus Quadratic Effects

Results indicated that socioeconomic status, the linear effect of the cumulative risk index, as well as the quadratic effect of the cumulative risk index, significantly predicted the emotional and behavioral symptoms across raters. In particular, the predictors explained 10% of the variability in the parent-reported behavioral symptoms. There were no other significant results for the dependent variables. The inclusion of the quadratic effects within the full model (i.e., SES, linear effects, and quadratic effects) significantly improved the fit of the data or accounted for more variance in the outcome. Thus, the model that included socioeconomic status and the linear and quadratic effects,

or the full model, was better able to predict later behavioral functioning. The results were consistent with the hypothesized results, which indicated that quadratic effect was able to capture the worsening of outcomes with increasing risks (Everhart et al., 2008).

One explanation supporting the inclusion of the quadratic effect is that it captures the bi-directional relationship of the interaction of child risk factors (Sameroff & Chandler, 1975). The quadratic effect is able to account for the dramatic worsening of outcomes that is hypothesized to occur as participants experience the compounding effects of risk factors (Dickstein et al., 1998; Evans & English, 2002; Gerard & Buehler, 2004; Seifer et al., 1996), while the linear approach assumes that adverse outcomes result from a steady increase in risk. Specifically, children with multiple health early health and developmental risks present experience a sharper decline or greater compromise in behavioral symptoms than the linear trend would have depicted.

The role of the early health and developmental risk factors in the development of behavior difficulties in children underscores the importance of prevention and early intervention efforts. Given unfavorable outcomes that are too often the typical experience of children with behavior difficulties, it is essential to identify the children and families at highest risk for difficulties in order to provide evidence-based prevention programming, as well as intervention programs that are varied and matched to each individual child's needs (Kern et al., 2009; National Research Council Institute of Medicine, 2000). For example, home visitation programs, such as the Nurse Family Partnership, are prevention-focused efforts that provide early and intensive support to targeted populations (i.e., narrower selection criteria than all families in poverty) and have been shown to have positive family and individual outcomes, such as fewer subsequent

pregnancies, increase maternal employment, higher child cognitive performance, and improved social behavior in preschool children, and fewer arrests in adolescences (Olds, 2006).

Health Risk Factors and Children with Emotional and Behavioral Disorders

Analyses of the percentage of risk factors experienced within the sample revealed a large percentage of health and developmental risk factors in comparison to data from national sources within the general population. Although data are not available of the percentage of these risk factors within a sample of children with EBD, it is likely that the estimates within the sample are higher than expected given the inclusion of students who were considered to be the most challenging or at-risk within the schools. Specifically, approximately 35% of the sample experienced emotional abuse/neglect, 16% experienced physical abuse, and 9% experienced sexual abuse. National rates indicate that the unique victim rate of child abuse is reportedly 9.3 victims per 1,000 children in the population (U.S. Department of Health and Human Services, 2010). This is equivalent to less than 1% of the population. Within the unique number of victims, approximately 78% experienced neglect, 18% experienced physical abuse, 10% experienced sexual abuse, and 8% were emotionally or psychologically maltreated. Additionally, the overall percentage of children experiencing abuse includes an estimated 2% of children who were medically neglected, which was not measured within the current study. Widom and Maxfield (2001) studied longitudinal outcomes of children who experienced child abuse and neglect and found that they are 59% more likely to be arrested as a juvenile, 28% more likely to be arrested as an adult, and 30% more likely to commit violent crime. Since parent reported abuse is often considered underreported in terms of the prevalence

of abuse, high percentage of abuse within the sample has implications for the ecological model of prevention and intervention. Although these data are not representative of a typically developing sample of children or students with EBD, they suggest that interventions focused solely at school outcomes would fail to address for significant risk factors within the home environment.

Sample estimates were compared to national prevalence estimates. Data from the 2004 Pregnancy Risk Assessment and Monitoring System (PRAMS; Center for Disease Control, 2011) indicated that approximately 13% of women reported smoking during the last three months of pregnancy. Maternal smoking within the sample was also higher than national averages with over 34% of the sample being exposed to this risk factor. In terms of alcohol use among pregnant women, the average annual percentage of any alcohol use among pregnant women was 12.2% (Denny, Tsai, Floyd, & Green, 2009), while 21% of the sample experienced maternal use of alcohol and/or illegal substances during pregnancy. Further, approximately 13% of babies are born prematurely, which was similar to 12% of the current sample (Martin et al., 2006). The greater percentages of risk factors experienced within the sample suggest that the sample of children within the study may truly represent the "tip of the triangle," even within the population of students with EBD. Students with EBD are a diverse population who present with varied needs, such as academic failure, social problems, family risk factors, as well as complicated health histories. Thus, it is essential that intervention efforts are as equally varied and matched to these needs, including improving access to healthcare (Kern et al., 2009).

Discrepancies among Multiple Informant Ratings

An examination of correlations revealed no significant correlations among parent, teacher, and self-reported behavioral symptoms on the BASC-2. Further, in general parents rated behavioral symptoms significantly more severe (M = 67, SD = 13) than teachers' reports (M = 64, SD = 11; t = -1.876, $p < .001$) and youths' self-report (M = 55, SD = 12; t = -6.476, $p < .001$). In a study of assessment instruments as predictors of a correct diagnostic category, there were low to moderate correlations among parent, teacher, and children's report in a semi-structured interview (McConaughy & Achenbach, 1996). In a meta-analysis of Pearson correlation coefficients (*r*s) between behavior ratings by parents, teachers, subjects, and other raters (e.g., mental health workers, peers), Achenbach and colleagues (1987) found the mean Pearson *r*s for parent and teacher report was .28 and the mean parent and child correlation was .25. In a study of parents' and teachers' ratings of preschool children's behavior that were enrolled in a low-income day-care center, correlations between parent and teacher report were only .17. Parents and teachers disagreed on whether 22.7% of the children in the sample demonstrated significant behavior problems, and parents typically rated the children with higher behavior problem scores than the teacher (Gross, Fogg, Garvey, & Julion, 2004). Low correlations simply indicate that each informant is knowledgeable about different aspects of the child's behavior and may perceive these behaviors differently (McConaughy, 2005). Additionally, it lends support to the importance of the context (i.e., home versus school) and demand characteristics of those environments that may influence behavioral ratings.

One prevailing view is that informant discrepancies represented unreliability or bias on the informants' reports of behavior (Piacentini, Cohen & Cohen, 1992).

Richardson and Day (2000) hypothesized that informant discrepancies were indicative of the situation specific nature of behavior or that different informants are observing different behaviors. Research in this area has suggested that the ratings may reflect personal perceptions of the individual being rated and that informant's motives and expectations can slant judgment (Smith & Mackie, 1995). However, De Los Reyes and Kazdin (2005) conceptualized the Attribution Bias Context Model that hypothesizes that informant discrepancies exist because of systematic differences on three characteristics: 1) attributions of the cause of the behavior being assessed; 2) biases or decision thresholds about whether specific behaviors warrant treatment; and 3) the contexts behaviors are observed. They suggest that combining informant reports into clinical assessments loses information about the circumstances children display behaviors indicative of dysfunction. In fact, the authors summarized research supporting a general finding that greater informant discrepancies between parents and children predicted poorer youth outcomes across a variety of constructs over periods of 4 months to 4 years (e.g., risky teen driving; poor behavioral, work, and criminal outcomes in childhood and or adulthood; treatment gains0 (De Los Reyes, 2011). Low correlations among different raters of problem behavior may pose challenges for clinical assessment of behavioral difficulties and the identification of intervention targets across settings.

In the current sample, a lack of significant correlation between adult reports and self-reports of behavioral symptoms may reflect youths' underestimates of symptom severity (Cantwell, Lewinsohn, Rohde, & Seeley, 1997; Cole, Martin, Peeke, Seroczynski, & Fier, 1999). Children with EBD may lack insight into the nature of their behavioral difficulties. Further, the lack of significant correlations may also be related to

measurement of different constructs. Specifically, the Emotional Symptoms Index primarily includes subscales related to internalizing difficulties (e.g., Social Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance), while the Behavioral Symptoms Index includes subscales of internalizing and externalizing difficulties (e.g., Hyperactivity, Aggression, Attention Problems, Depression, Atypicality, and Withdrawal). Additionally, it is hypothesized that the lack of correlation between parent and child reports of behavioral symptoms may be representative of parent-child conflicts or a lack of child understanding of parent expectations. Alternatively, parental report of behavioral symptoms may reflect characteristics of the parent (e.g., depression, harsh discipline style), rather than context specific nature of child behavior (De Los Reyes, Henry, Tolan, & Wakschlag, 2009). However, the current study examined prediction to the behavioral symptoms across the raters collectively. Future research is necessary to further understand informant discrepancies and may examine the prediction of cumulative risk to individual raters.

Cumulative Health Risk and Behavior: A Life Course Perspective

Results provided some support for the use of socioeconomic status and cumulative health risk as predictors of behavioral symptoms in childhood and adolescence. The Center on the Developing Child at Harvard University (2010) emphasized four critical ideas in understanding the biology of health in the early years of life. First, early, even prenatal, experiences affect adults through chronic and repeated damage over time (e.g., link between lung disease in adulthood and a history of respiratory illness in childhood). Second, as emphasized in this study, cumulative exposures to adverse childhood events increased the risk for later dysfunction. This

supports the concept of "weathering" of the body under conditions of chronic stress, which accelerates the aging process (Geronimus, Hickern, Keene, & Bound, 2006). Specifically, a "toxic stress response" during early childhood can weaken the developing brain structures and alter the brain's threshold for activation of the stress response system for the rest of the child's life (Shonkoff, Boyce, & McEwen, 2009). Third, physiological disruptions can become biologically embedded (i.e., change the regulation of genes that affect brain and body development) during sensitive developmental periods. Finally, children who grow up with low socioeconomic status seem to be particularly vulnerable to the biological embedding of disease (National Scientific Council on the Developing Child, 2010). Researchers have hypothesized that this association may be the result of excessive stress related to the experience of elevated risk factors associated with living in poverty, which results in repeated physiological and emotional disruptions that may affect brain development (National Scientific Council on the Developing Child, 2010).

A life course perspective considers life as an integrated continuum in which each life stage is influenced by the stages preceding it and thus influences the stages after it (Lu, 2010). This perspective has critical implications for the conceptualization of perinatal outcomes. In the current study, health risk factors were considered within the perinatal period (e.g., maternal tobacco, alcohol, or other drug use), postnatal period (e.g., prematurity or hospitalization at birth), as well as childhood risk factors (e.g., psychological needs, experience of abuse or neglect). However, within the life course model, perinatal outcomes are not solely viewed as the results 9 months of pregnancy. Instead, the life course perspective conceptualizes perinatal outcomes as the product of the pregnancy as well as the entire life course of the mother from conception leading up

to pregnancy (Lu, 2010). It represents a significant shift toward "upstream" conceptualizations of prevention. Specifically, the model emphasizes the importance of early childhood experiences, such as those examined within this study, in influencing outcomes. It also forces prevention scientists to consider the health of mothers prior to pregnancy; therefore, prevention and intervention efforts must expand to begin well before conception. The life course health development model provides a framework for integrating genetic, biological, cognitive, behavioral, and social-cultural factors using the same construct in order to integrate multilevel, multidisciplinary, and longitudinal intervention strategies. Given the prediction of perinatal, postnatal, and early childhood health risk factors to later behavior functioning, the current study provides preliminary support for the life course model of prevention and intervention.

Limitations

Despite efforts to address limitations from previous studies, the current investigation has several aspects that limit interpretation and generalizability. One limitation of the present study is the percentage of missing data. Within a methodological review of educational research, Peugh and Enders (2004) reported that 16% of studies were identified to have missing data; however, they noted that this represented a gross underestimate because missing data were impossible to detect in many of the studies. Although statistical tests indicated that the data were missing completely at random, the broader family and community risk factors within the sample (e.g., lower SES, experience of unsafe neighborhoods, children with the most serious behavior difficulties) may have contributed to the large percentage of missing data. Missing data were attributed to logistical challenges related to a high number of measures and difficulty

contacting parents. In particular, the highest percentage of missing data was on parent-reported measures. Although teachers and students were typically readily accessible within the school environment to complete measures, it was much more difficult to contact parents and arrange data collection. Further, although the use of multiple imputation was able to account for missing data, it complicated the interpretation of the results because of the lack of guidelines for pooling the results of more sophisticated data analyses.

A second limitation is the method used to construct the risk factor index. The key variables that were included in the health and developmental risk index were based on review of the literature (Crews et al., 2007) and consultation with an expert in the area of emotional and behavioral disorders. However, a factor analysis of potential risk factors would have provided stronger support for inclusion of variables in the index. Additionally, the health risk factors were coded as dichotomous variables. For example, if a child was born premature, then it was endorsed as a risk factor on the index. However, this reduces the variability within the data. For example, there are marked differences in long term health and disability outcomes in children who are born from 20 to 27 weeks of gestation, from 28 to 31 weeks, and from 32 to 36 weeks (Lumley, 1993; 2003). Future research should include measurement that allows for more variability in responses than binary variables.

Further limitations are associated with the sample and methods of participant selection. In order to recruit a diverse sample, the participants were recruited from two diverse areas. However, the overall sample is considered a sample of convenience and represented only two states (i.e., Pennsylvania and California). Additionally, females

were underrepresented in the current sample. However, the overrepresentation of males in the EBD population is a common limitation of the research because males are overrepresented within the population of students with behavior problems (McIntyre & Tong, 1998). In the study sample, the percentage of females is similar to the percentage of females within the larger EBD population (i.e., 10-15%) (McIntyre & Tong, 1998). Further, although the two sites utilized the same recruitment strategies (i.e., teacher nominations of students with the most challenging behaviors), the sample included children who were not all formally diagnosed with EBD because of different special education identification processes between the states. Additionally, the recruitment strategies (i.e., teachers identified students with the most challenging students in the schools) resulted in a sample with the most serious behavior problems, which limits the generalizability to other students with EBD. Therefore, these issues, as well as the exclusion of typically developing children, limit the generalizability of the study.

Another limitation is the reliance on parental report of risk factors. Since parents were utilized as the only informants, they may have underreported the occurrence of risk factors to avoid embarrassment or the potential involvement of outside agencies if abuse was reported. Future research could utilize medical chart reviews to provide confirmation of risk factors, such as gestational age at birth, hospitalization, or maternal behaviors, while records from social services may have confirmed reports of abuse. The frequency of risk factors within the sample is also greater than expected for the general population which may increase the likelihood of identifying hypothesized results and limits generalizability of the results. Future research should attempt to replicate this study with a population of typically developing children. Further, the reliance on parental report

could have contributed to shared source variance across variables, partly because predictors only related to parent, not teacher or self-reported, outcomes. Shared source variance could result in inflated associations between variables. Both health risks and behavioral outcomes should ideally be assessed using multiple perspectives and multiple methods.

Additionally, the use of an existing database was a significant limitation because it limited choices in independent and dependent variable selection and study design. Specifically, socioeconomic status data were only collected for the Pennsylvania sample. Thus, the highest educational level served as a proxy for socioeconomic status. However, other metrics utilize other factors to calculate socioeconomic status. For example, the Hollingshead Four-Factor Index of Social Status (Hollingshead, 1975) estimates social status based on the occupation, education, and marital status of the individual. Although educational level is highly correlated with income (White, 1982), its use, as opposed to a more sensitive metric of SES, could add additional error into the analyses. Further, previous research examining the outcomes of cumulative risk indices often includes multiple factors of risk within the index. For example, Rutter (1979) created a risk index across six factors: marital discord, low socioeconomic status, household overcrowding, history of paternal criminality, presence of maternal psychiatric problems, and child involvement with foster care. The current study focused largely on the construct of early health and development in order to examine its unique prediction to the severity of behavioral symptoms. The risk index ignored other risk factors, such as number of moves or ethnic or major life events that co-occur and aggregate in the lives of children. Some early health risk factors tend to co-occur (e.g., mothers who smoke are at increased risk

for birth complications and low birth weight infants), which may limit the variability in the data and reduce the ability to detect a dramatic worsening of effects with the addition of each risk factor.

A final limitation of the research is the failure to include an examination of protective factors. Protective factors are variables that have a greater effect under hazardous conditions than they do under benign conditions and can reduce negative consequences associated with adversities (Masten & Gewirtz, 2006). Some evidence suggests that factors are protective in lower risk contexts while they may not be as powerful in the experience of extreme risk (Silk et al., 2007; Stouthamer-Loeber, Loeber, Wei, Farrington, & Wikström, 2002). Coie et al. (1993) hypothesized that protective factors may work in the following ways: 1) directly decrease dysfunction; 2) interact with risk factors to buffer their effects; 3) disrupt the meditational chain in which risk leads to disorder; or 4) prevent the initial occurrence of risk factors. Prior research has identified a number of factors associated with positive outcomes in the context of high risk, such as child intelligence scores, emotion regulation, low parental discord, advantaged SES, effective schools, and safe neighborhoods (Masten & Reed, 2002). Given the increased risks in children with EBD, the role of protective factors becomes even more important in ameliorating some of the negative academic and behavioral outcomes.

Future Research Directions

Based upon the findings, there are several directions for future studies. Specifically, given the range of other risk factors that are experienced across the life span, future research should examine the influence of early health and developmental risk over time. Additionally, the cumulative health risk index explained a significant amount of

variance within the parent-reported behavioral symptoms. Thus, parents were reporters for both the independent and dependent variables. Future research should incorporate multiple sources of data in creating the health risk index, as well as the inclusion of child report of current health status.

Although the results provided preliminary support for the cumulative health risk index, the importance of continuing this research cannot be overstated given its policy implications. Future studies that replicated the results of the current investigation with a typically developing sample would help formulate more conclusive findings regarding the role of early health risks and development in the progression of behavioral symptoms over time, as well as generalize the results to the larger population. The specific results of the present study provided preliminary support for the role of early health and development as predictors of behavioral symptoms of students with emotional and behavioral difficulties. The inclusion of a larger sample (i.e., 200 to 300 participants) would permit a direct comparison of models using more sophisticated data analytic techniques, which would help to further confirm model selection. For example, structural equation modeling is an analysis that would limit the effects of repeated testing while also allowing for the direct comparison of the two independent models (i.e., socioeconomic status + linear effect versus socioeconomic status + quadratic effect). Additionally, the current study limited its outcome evaluation to behavioral symptoms. Given the significant relationship between socioeconomic status, cumulative health risk, and behavioral symptoms, future research could examine the predictability of the model to other child outcomes, such as social skills or academics.

Finally, future research should broaden the scope of the study to include protective factors within the analyses. For example, teacher behaviors, including ability to engage students in learning and efforts to involve parents, may be particularly important in building family school relationships. The classroom experience, or the quality of everyday classroom interactions in terms of instructional and emotional support, has been shown to moderate the risk for early school failure (Hamre & Pianta, 2005). In particular, students who reported higher teacher support and regard for student perspectives were also more likely to report positive school climate, greater social belonging, and fewer depressive symptoms, which were associated with less personal drug use (LaRusso, Romer, & Selman, 2008; Roeser et al., 1998).

According to data reported from the National Longitudinal Study of Adolescent Health, school connectedness was related to lower levels of student distress and health risk behaviors (e.g., suicidality, violence, tobacco, marijuana, and alcohol use, and delay in sexual intercourse) (Bonny, Britto, Klostermarm, Homung, & Slap, 2000; Resnick et al., 1997). In fact, interventions targeting social inclusion and commitment to education have been shown to be effective in reducing health risk behaviors and improving emotional well-being (Patton et al., 2006). Additionally, parents' perceptions of teacher outreach have been shown to be the strongest predictor of parent involvement, even after controlling for various demographic variables (Patrikakou & Weissberg, 2000).

The identification of school practices that alter academic, social, or behavioral trajectories for children experiencing risk has important implications in terms of prevention of future difficulties. Specifically, when child development is viewed from an ecological theoretical perspective, family school partnership is essential in the physical,

academic, social, and emotional development of the child (Bronfenbrenner, 1979; Epstein, 1995). Decades of research has demonstrated the importance of building strong home-school relationships (Chrispeels, 1996; Christenson, 2004). Increasingly, research has focused on building partnerships with families in order to promote parent participation in education and improve student achievement. Given the multiple difficulties children with behavior difficulties experience, it may be especially important to reach out to these families.

Longitudinal research has demonstrated the positive of impact of parent involvement at school on academic achievement over time, including improved grades and standardized test scores (e.g., Fan & Chen, 2001; Jeynes, 2005; Van Voorhis, 2003), better school attendance (Epstein & Sheldon, 2002), increased expectations of postsecondary enrollment (Trusty, 1998), and increased positive school attitudes (Shumow & Lomax, 2002). However, limited research has been conducted on the protective influence of the school environment on risk factors that the school typically perceives as immutable, such as early child health factors and access to health care.

Conclusions and Implications for Policy

In sum, the current study supported the inclusion of quadratic effects within the effects of cumulative early health and developmental risks on later behavioral functioning and provided further support for the importance of cumulative health risk and socioeconomic status in predicting later behavioral difficulties in youth. Additionally, given the low and non-significant correlations among raters, the current study raised several questions regarding informant discrepancies among teachers, parents, and children with emotional and behavioral difficulties. Given the intense emotional and

behavioral needs of the sample, these findings are vitally important in influencing public policy in regards to the prevention and intervention of behavioral difficulties in children experiencing significant and cumulative health and developmental risks. Specifically, the results support a framework for early childhood policy and practice that is more consistent with a life course perspective. Implications support public policies that address the early childhood origins of lifelong illness and disability, establish a context that nourishes physical and mental well-being, and builds caregivers and community capacities to promote health and prevent disease and disability (Center on the Developing Child, at Harvard University, 2010).

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Table 1

Demographic Information for Student Participants (N = 113)

Demographic variables	Number of students (%)
Gender	
Male	96 (85.0%)
Female	17 (15.0%)
Ethnicity	
Caucasian	46 (40.7%)
Black or African American	39 (34.5%)
Hispanic/Latino	21 (18.6%)
Other	2 (1.8%)
Missing	5 (4.4%)
State	
Pennsylvania	63 (55.8%)
California	50 (44.2%)
Grade	
Elementary (K-5)	61 (53.9%)
Secondary (6-9)	51 (45.1%)
Missing	1 (0.9%)

Table 1 (continued)

Demographic Information for Student Participants (N = 113)

Demographic variables	Number of students (%)
Educational setting	
Regular education classroom public school	32 (28.3%)
Special education classroom in a public school	53 (46.9%)
Special school for children with emotional/behavioral or learning problems within district	8 (7.1%)
Special school for children with emotional/behavioral or learning problems outside district	12 (10.6%)
Missing	8 (7.1%)

Table 2

Parent/Caregiver Demographic Information (N =113)

Demographic variables	Number of families (%)
Relationship	
Mother	78 (69.0%)
Father	5 (4.4%)
Grandmother	7 (6.2%)
Other	6 (5.3%)
Missing	17 (15.0%)
Part of family income comes from public assistance	
Yes	58 (51.3%)
No	49 (43.4%)
Missing	6 (5.3%)

Table 3

Teacher Demographic Information

Demographic variables	Number of teachers (%)
Gender	
Female	56 (49.6%)
Male	35 (31.0%)
Missing	22 (19.5%)

Table 4

Risk Factor Interview Questions

Child Health and Developmental History Items
Was the child considered premature at birth?
Was hospitalization required for the child following birth?
Did the child's mother have any serious medical conditions during pregnancy?
Did the child's mother experience any significant illness or injury during pregnancy?
Did the child's mother smoke during pregnancy?
Did the child's mother use alcohol or illegal substances during pregnancy?
Has the child experienced a significant illness or injury?
Has the child received treatment for a psychological condition?
Has the child been physically abused?
Has the child been sexually abused?
Has the child been emotionally abused or neglected?
Does the child receive the health care and treatment he/she requires?
Does the child have a primary care physician?

Table 5

Separate Variance t-tests for Missing Data Analysis

Measures	SES*	Cumulative Health	BASC-2 Parent	BASC-2 Teacher	BASC-2 Self
Cumulative Health					
t-value	1	--	1.3	.8	.6
Degrees of freedom	34.7	--	20.4	21.5	25.4
BASC-2 Parent					
t-value	-.6	-1.3	--	-.4	-1.3
Degrees of freedom	22.8	8.8	--	13.0	20.9
BASC-2 Teacher					
t-value	-.2	**-2.2**	1.5	--	-.5
Degrees of freedom	23.3	16.0	29.8	--	15.8
BASC-2 Self					
t-value	1.7	-.1	-.3	.4	--
Degrees of freedom	16.7	11	15.8	13.9	--

Note: Bolded t-values are t-values in which the t-value is larger than the tabled t-value (Fisher & Yates, 1963).
*Indicator variables with less than 5% missing are not displayed.

Table 6

Pooled Means and Pooled Standard Deviations for Predictor and Criterion Measures

Measures	Pooled Mean (N = 113)	Standard Deviation (N = 113)
Socioeconomic Status	3.18	1.10
Cumulative Health Risk- Linear	3.61	2.12
Cumulative Health Risk- Quadratic	17.54	18.59
Behavioral Symptoms Index (parent)	67.65	13.04
Behavioral Symptoms Index (teacher)	64.35	11.10
Emotional Symptoms Index (student)	55.88	12.23

Table 7

t-tests of Pooled Means across Parent, Teacher, and Self-Reported Behavioral Ratings

Dependent Variable	1.	2.	3.
1. Behavioral Symptoms Index (parent)	--	-1.876**	-6.476**
2. Behavioral Symptoms Index (teacher)	--	--	4.246
3. Emotional Symptoms Index (student)	--	--	--

**$p < .001$

Table 8

Percentage of Participants Endorsing Risk Factors

Risk Factor	Percentage
Premature at birth	11.8%
Hospitalization required at birth	16.8%
Maternal serious medical condition during pregnancy	15.1%
Maternal serious illness/injury during pregnancy	10.9%
Maternal smoking during pregnancy	34.5%
Maternal use of alcohol/illegal substances during pregnancy	21.0%
Child experienced significant illness/injury	39.5%
Child received treatment for psychological condition	58%
Child experienced physical abuse	16.0%
Child experienced sexual abuse	9.2%
Child experienced emotional abuse/neglect	35.3%
Child has not received the health care and treatment required	13.4%
Child does not have primary care physician	6.7%

Table *9*

Pooled Correlations Among All Predictor and Criterion Variables

Measure	1	2	3	4	5	6
1. SES	--	-.159	-.118	-.001	.134	-.047
2. Health Risk- Linear		--	.955***	.300**	-.203	.038
3. Health Risk- Quadratic			--	.312**	-.190	.101
4. BASC-2 Parent				--	-.019	.042
5. BASC-2 Teacher					--	.157
6. BASC-2 Self						--

Note: *p <.05; **p < .01; ***p < .001

Table 10

Multivariate Results Across Data Sets

Data Set	Wilks' Λ	*F*-value	*p*-value
1	.82	2.44	.01*
2	.79	2.96	.002*
3	.78	3.09	.002*
4	.79	2.95	.002*
5	.77	3.23	.001*

*Results are significant.

Table 11

Results of Univariate Follow-up Analyses

	F-value	R^2	*p*-value
Parent Report			
1	3.06	.078	.03*
2	3.80	.095	.01*
3	4.83	.117	.003*
4	4.92	.119	.003*
5	3.80	.095	.012*
Pooled		.101	
Teacher Report			
1	1.45	.038	.23
2	2.18	.043	.19
3	1.62	.057	.10
4	1.41	.037	.24
5	4.56	.112	.005*
Pooled		.057	
Student Report			
1	2.55	.065	.06
2	2.02	.080	.03*
3	3.17	.052	.12
4	2.13	.055	.10
5	1.46	.039	.231
Pooled		.058	

*Results are significant

Table 12

Univariate Analyses of Predictors of Dependent Variables

	Parent Report			Teacher Report			Self Report		
Predictor	*β*	*t*-test	*p*-value	*β*	*t*-test	*p*-value	*B*	*t*-test	*p*-value
SES									
1	.008	.080	.934	.108	1.13	.263	.011	.112	.911
2	.056	.602	.548	.115	1.21	.229	-.092	-.997	.321
3	.016	.177	.860	.098	1.04	.302	-.095	-1.00	.321
4	.088	.954	.342	.134	1.39	.168	-.151	-1.57	.119
5	.024	.261	.795	.073	.793	.430	-.009	-.095	.924
Pooled	.038			.106			-.067		
Health Risk-Linear									
1	.072	.230	.819	.031	.095	.924	-.784	-2.48	.015
2	.167	.526	.600	-.215	-.662	.510	-.848	-2.66	.009
3	.015	.048	.962	-.224	-.703	.483	-.716	-2.24	.027
4	.043	.143	.887	-.075	-.239	.812	-.550	-1.77	.079
5	-.048	-.155	.877	-.445	-1.46	.148	-.606	-1.91	.059
Pooled	.050			-.186			-.701		
Health Risk-Quadratic									
1	.210	.67	.504	-.181	-.567	.572	.853	2.71	.008
2	.148	.201	.641	.066	.201	.841	.926	2.91	.004
3	.329	1.07	.285	.023	.073	.942	.749	2.36	.020
4	.305	1.03	.306	-.045	-.145	.885	.627	2.04	.044
5	.355	1.16	.250	.140	.460	.646	.655	2.07	.040
Pooled	.269			.001			.762		

Table 13

Likelihood Ratio Test and χ^2 Results across Imputed Data Sets

Data Set	Model	-2 Log L	χ^2	*df*	Significant*
1	Full	2617.8			
	Reduced	2627.2			
			9.4	1	Yes
2	Full	2632.4			
	Reduced	2641.3			
			8.9	1	Yes
3	Full	2616.4			
	Reduced	2623.1			
			6.7	1	Yes
4	Full	2608.6			
	Reduced	2614.2			
			5.6	1	Yes
5	Full	2618.5			
	Reduced	2624.3			
			5.8	1	Yes

**Values are considered significant if they are above the critical value for the chi square distribution with 1 degree of freedom, which is 3.84 (Cohen et al., 2003)*

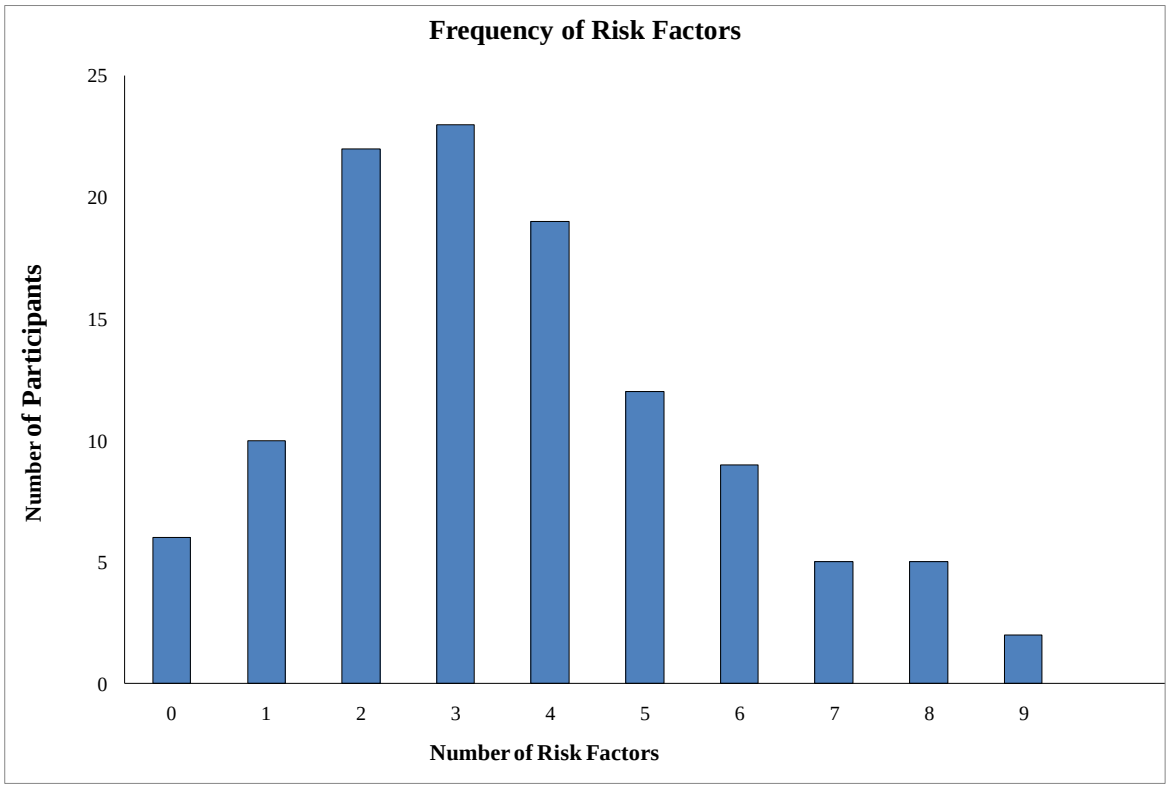

Figure 1. The graph displays the number of participants with each number of risk factor.

Jaime L. Benson

EDUCATION

Pediatric School Psychology Doctoral Degree 2011
Endorsement in Pediatric School Psychology
Lehigh University, College of Education, Bethlehem, PA
APA-accredited, NASP-approved Doctoral Program
Advisor: Edward S. Shapiro, Ph.D.
Dissertation: Health Risk Factors and Children with Behavior Disorders: An Examination of Linear and Quadratic Effects

Master's of Education in Human Development 2007
Lehigh University, College of Education, Bethlehem, PA
Qualifying Project: The Effects of Goal-Setting on a Skill and Performance-Based Math Intervention for Children with Emotional and Behavior Disorders

Bachelor of Arts, Psychology with Honors and Sociology 2005
Minor Education Studies
Syracuse University, College of Arts & Sciences, Syracuse, NY
Cumulative GPA: 3.945
Honors Thesis Advisor: Barbara Fiese, Ph.D.
Honors Thesis: The Relationship Between Psychopathology in Caregivers and their Children with Asthma

CURRENT LICENSURE/CERTIFICATION

- Provisional Licensed Mental Health Practitioner (Nebraska)
- Certified School Psychologist (Pennsylvania)
- Leadership and Education in Neurodevelopmental Disabilities (LEND) Certificate
- Autism Leadership Academy Advanced Practitioner, Maternal Child and Health Bureau

SUPERVISED CLINICAL EXPERIENCE

APA-Accredited Clinical Internship 2010-2011
Nebraska Internship Consortium in Professional Psychology
Munroe-Meyer Institute of Genetics and Rehabilitation
University of Nebraska Medical Center, Omaha, NE
Supervisors: Keith D. Allen, Ph.D. (Behavioral Pediatrics/Stress Related Disorders) & Mark Shriver, Ph.D. (Behavioral Pediatrics/Academic and Educational Interventions)

U.S. Department of Education Leadership Personnel Preparation: Developing Leaders for System-wide Change in Urban Environments for Students with or at risk for Emotional\Behavior Disorders 2007- 2011
Lehigh University, Bethlehem, PA
Supervisors: Edward S. Shapiro, Ph.D., George J. DuPaul, Ph.D., & Thomas J. Power, Ph.D.

- **Supervision of Clinical Experiences** 2009- 2010

University Supervisor: Christine Novak, Ph.D.

- **Sacred Heart Hospital, Allentown, PA** 2008- 2009
  Field Supervisors: Patricia Manz, Ph.D. & Atira Rahman, M.D.
  University Supervisor: Robin Hojnoski, Ph.D.

- **Allentown School District, Allentown, PA** 2008- 2009
  Field Supervisors: Geraldine A. Ifkovits, Ed.S. & Lourdes Sanchez, Ph.D.
  University Supervisor: Robin Hojnoski, Ph.D.

- **Pediatric Feeding and Swallowing Center** 2007- 2008
  The Children's Hospital of Philadelphia, Philadelphia, PA
  Supervisor: Colleen Lukens, Ph.D.
  University Supervisor: Robin Hojnoski, Ph.D.

- **Division of Oncology** 2007- 2008
  The Children's Hospital of Philadelphia, Philadelphia, PA
  Supervisors: Lisa Schwartz, Ph.D. & Lynne Kaplan, Ph.D.
  University Supervisor: Robin Hojnoski, Ph.D.

- **Upper Darby School District, Clifton Heights, PA** 2007- 2008
  Supervisors: Deborah Fineberg, Ed.S. & Brenda Kabler, Ph.D.
  University Supervisor: Robin Hojnoski, Ph.D.

Certified School Psychologist 2010
Midway Manor Early Childhood Center, Allentown School District, Allentown, PA
Supervisor: Geraldine Ifkovits, Ed.S.

School Psychologist 2010
Northampton Community College
Supervisor: Leigh Cundari, Ed.S.

Behavior Consultant/Research Assistant, Project Reach 2005- 2009
National Center for Students with Intensive Social, Emotional, and Behavioral Needs
Lehigh University, Bethlehem, PA
Supervisors: Lee Kern, Ph.D. & Natalie Sokol, Ph.D.

TEACHING EXPERIENCE

Teaching Assistant, University of Nebraska Medical Center 2010
Applied Behavior Analysis Doctoral Program, Omaha, NE
Course: Behavioral Pediatric Psychology
Supervisor: Keith D. Allen, Ph.D.

Teaching Assistant, Lehigh University 2008-2010
School Psychology Program, Bethlehem, PA

Courses: Assessment and Intervention in Educational Consultation; Practicum in Assessment and Intervention in Educational Consultation; Behavioral Assessment; Practicum in Behavioral Assessment

Teaching Internship Program
2004
Syracuse University, Syracuse, NY
Supervisor: Tanya L. Eckert, Ph.D.

TRAINING EXPERIENCE

Trainer, Managing Behavior in the Early Childhood Setting 2011
Millard Public Schools Early Childhood Education Center, Omaha, NE

Presenter, Neurofibromatosis Symposium 2009
The Children's Hospital of Philadelphia, Philadelphia, PA
Supervisor: Lynne Kaplan, Ph.D.

Trainer, Step by Step Learning DIBELS Training 2008
Allentown School District, Allentown, PA
Supervisor: Gini Hampton, Ph.D.

Panel Discussion, Lehigh University 2008-2009
Careers in School Psychology
What is School Psychology? A Career that Makes a Difference
Bethlehem, PA

ADDITIONAL PROFESSIONAL EXPERIENCES

Mental Health Professional, Kid Shape 2009- 2010
Sacred Heart Hospital, Allentown, PA

Child Exercise and Behavior Coordinator, Get Fit! 2007-2010
Sacred Heart Hospital, Allentown, PA

Behavior Consultant, Unconditional Childcare Services, Inc. 2008-2010
Allentown, PA

Therapeutic Staff Support, Safety Net Counseling Center 2005
Honesdale, PA

RESEARCH EXPERIENCE

Research Assistant, Developmental Screening Project 2010-2011
University of Nebraska Medical Center, Munroe Meyer Institute, Omaha, NE
Supervisor: Rachael Valleley, Ph.D.

Research Assistant, Hearing NICU Follow-Up Study 2010-2011
University of Nebraska Medical Center, Munroe Meyer Institute, Omaha, NE
Supervisor: Howard Needelman, M.D. & Barbara Jackson, Ph.D.

Research Assistant, The MOM Program Continuation Study 2009- 2010
The Children's Hospital of Philadelphia, Philadelphia, PA

Supervisors: Jerilynn Radcliffe, Ph.D., ABPP, & Jennifer Mautone, Ph.D.

Research Assistant, Friendship Study 2008
University of Pennsylvania, Philadelphia, PA
Supervisors: Caroline Stanley, Ph.D. & Melissa Alderfer, Ph.D.

Project Coordinator, Lower Nazareth Elementary School Math Study 2006-2008
Lehigh University, Bethlehem, PA
Supervisor: Edward S. Shapiro, Ph.D.

Data Collector, Project LEARN 2005- 2008
Lehigh University, Bethlehem, PA
Supervisors: Karen Gischlar, Ph.D. & Edward S. Shapiro, Ph.D.

Data Collector, Reading Comprehension Study 2007
Lehigh University, Bethlehem, PA
Supervisor: Edward S. Shapiro, Ph.D.

Primary Research Assistant, Behavioral Health Care Line 2005
Syracuse Veterans Affairs Medical Center**,** Syracuse, NY
Supervisors: Larry Lantinga, Ph.D. & Thomas Tomcho, Ph.D.

Primary Experimenter, Writing Project 2003 –2005
Syracuse University, Syracuse, NY
Supervisor: Tanya L. Eckert, Ph.D.

Primary Experimenter/Research Assistant, Math Project 2003 –2005
Syracuse University, Syracuse, NY
Supervisor: Tanya L. Eckert, Ph.D.

Research Assistant, Family Life and Asthma Project II 2003 –2005
Syracuse University, Syracuse, NY
Supervisor: Barbara H. Fiese, Ph.D.

Student Research Project Coordinator, Obesity Mealtime Study 2004
Syracuse University, Syracuse, NY
Supervisor: Barbara H. Fiese, Ph.D.

Research Assistant, Reading Project 2002 –2003
Syracuse University, Syracuse, NY
Supervisor: Tanya L. Eckert, Ph.D.

PRESENTATIONS AND PUBLICATIONS

Manuscripts Accepted for Publication

Shapiro, E.S., DuPaul, G.J., Barnabas, E., **Benson, J.L.,** & Slay, P.M. (2010). Facilitating school, family, and community partnerships: Enhancing student mental health: An overview of the special series. *School Mental Health, 2*, 45-51.

Shapiro, E.S., **Benson, J.L.,** Clemens, N.H., & Gischlar, K. (2009). Academic assessment. In M.A. Bray & T.J. Kehle (Eds.). *The Oxford Handbook of School Psychology.* New York: Oxford University Press.

Kern, L., **Benson, J.L.,** & Clemens, N.H. (2007). Strategies for working with severe, challenging, and violent behavior. In R.A. Ervin, G. Gimpel Peacock, E. Daly, & K. Merrell (Eds.). *The Practical Handbook of School Psychology: Effective Practices for the 21st Century*. New York. The Guilford Press.

Panahon, C.J., Codding, R.S., Hilt-Panahon, A. & **Benson, J.L.** (2009). Addressing mathematics computation problems: A review of simple and moderate intensity interventions. *Education and Treatment of Children, 32*, 279-312.

Benson, J.L., Helwig, J., Hughes, C.L., & Shapiro, E.W. (2009). Facilitating Relationships between Pediatricians and School Psychologists. Paper to published in Communication Matters column in *National Association of School Psychologists Communique*.

Manuscripts In Preparation

Valleley, R.J., Allen, K.D., Hughes, C.L., Benson, J. Gathje, R., & Lieske, J. Developmental screening: Impact on physician detection and treatment. (To be submitted for review Fall 2011 to *Contemporary Pediatrics).*

Shapiro, E.S., **Benson, J.L.,** & Leichman, E.S. Concurrent and predictive validity of mathematics benchmark tools. (To be submitted for review Spring 2012 to the *Journal of Psychoeducational Assessment*).

Paper & Poster Presentations at Scientific Meetings

Benson, J.L. & Hughes, C.L. (2011). Psychology in primary care: Scope of school involvement. Poster presented at the annual Convention of the National Association of School Psychologists, San Francisco, CA.

Benson, J.L. & Hughes, C.L. (2010). *Improving Outcomes for Children who Experienced Child Maltreatment*. Poster presented at the annual Convention of the National Association of School Psychologists, Chicago, IL.

Hughes, C.L., **Benson, J.L.,** & Ash, A. (2010). *Preventing Childhood Obesity: A Preliminary Examination of a Family-Based Program*. Paper presented at the annual Convention of the National Association of School Psychologists, Chicago, IL.

Benson, J.L., & Hughes, C.L. (2009). *Improving Outcomes for Students with Diabetes: The School Psychologist's Role*. Poster presented at the annual Convention of the National Association of School Psychologists, Boston, MA.

Shapiro, E.S., **Benson, J.L.,** & Slay, P.M. (2009). *Issues in Cancer Survivorship*. Paper presented as part of a symposium: Extending School Psychology's Reach: Linking to the Health Care

Community at the annual Convention of the National Association of School Psychologists, Boston, MA.

Shapiro, E.S., **Benson, J.L.**, Leichman, E.S., & Solari, E. (2008). *Validity of CBM Math and Measures Assessing State Standards*. Poster presented at the annual American Psychological Association Conference, Boston, MA.

Hughes, C.L., **Benson, J.L**., & Hojnoski, R. (2008). *Caregiver variables and mathematical development in young children*. Paper presented at the annual Convention of the National Association of School Psychologists, New Orleans, LA.

Benson, J.L., & Shapiro, E.S. (2008). *A Multi-Component Goal-Setting Intervention to Improve Children's Mathematics Skills*. Poster presented at the annual Convention of the National Association of School Psychologists, New Orleans, LA.

Panahon, C.J., Codding, R. S., Hilt-Panahon, A. & **Benson, J.L.** (2007). *Addressing Mathematics Problems Through School-Based Interventions: What Works?* Paper presented at the annual Convention of the National Association of School Psychologists, New York, NY.

Kern, L., **Benson, J.L.**, & Gresham, F. (2006). *Issues Related to Treatment Integrity in Classrooms for Students with Emotional and Behavioral Disorders*. Paper presented at the annual Convention of the Teacher Educators for Children with Behavior Disorders, Tempe, AZ.

Eckert, T., Rosenthal, B., Ricci, L., Jiao, J., Quintero, N., **Benson, J.**, Vance, M., Crawley, S., and Bouchard, K. (2006). *Using Classwide Performance Feedback Interventions to Improve Elementary-Aged Children's Mathematical Skills*. Poster presented at the annual Convention of the National Association of School Psychologists, Anaheim, CA.

Rosenthal, B.D., **Benson, J.L.**, Mirabito, L. and Vance, M.J. (2005). *The Effects of Performance Feedback on Children's Writing Fluency*. Poster presented at the annual Convention of the National Association of School Psychologists, Atlanta, GA.

Benson, J.L., Munoz, S., & Fiese, B.H. (2005). *The Relationship Between Socioeconomic Status, Adherence to Daily-Prescribed Medications and Impact Upon the Family in a Chronically Ill Pediatric Population*. Paper presented at Society of Behavioral Medicine Annual Meeting & Scientific Session, Boston, MA.

Rosenblatt, M.L., **Benson, J.L.**, Dechert, T., Vance, M.J., Vitanza, M., Eckert, T.L., & Rosenthal, B.D. *Examining the Efficacy of Skill and Performance-Based Reading Interventions*. (2004). Poster presented at the annual Convention of the National Association of School Psychologists, Dallas, TX.

AWARDS

- Syracuse University Scholar, Syracuse University (2005)
- Remembrance Scholar, Syracuse University (2004-2005)
- College Marshal, College of Arts & Sciences, Syracuse University (2005)
- Allport Scholar Award, Syracuse University (2005)
- Allport Award for Excellence in Applied Psychology, Syracuse University (2005)
- Eric Gardner Outstanding Psychology Student Award, Syracuse University (2005)

- Ruth Meyer Undergraduate Scholar, Syracuse University (2004)
- Ford Motor Most Outstanding Junior Award, Syracuse University (2003)
- Syracuse University Founder's Scholar, Syracuse University (2001 –2005)
- Certificate of Excellence for Dedication to Psychology, Syracuse University (2002)
- Psi Chi Psychology Honors Society, Syracuse University (2002-2005)
- General Honors Certificate, Syracuse University (2002)
- Dean's List, Syracuse University (2001 –2005)

PROFESSIONAL ACTIVITIES

Professional Affiliations

- National Association of School Psychologists
- American Psychological Association Student Affiliate, Division 16 and Division 54

Scholarly Activities

Guest Reviewer

- Journal of Behavioral Education (2011)
- School Psychology Review (2009; 2010)
- Journal of Applied Behavior Analysis (2010)
- Archives of Pediatrics & Adolescent Medicine (2010)

Committee Membership

2007-2009
Lehigh University: National Association of School Psychologists Student Leader

2006-2007
Lehigh University: Doctoral Program Student Representative, School Psychology Program
Lehigh University: Peer Mentor, School Psychology Program

2005-2006
Lehigh University: Diversity Recruitment Committee, School Psychology Program

2003-2005
Syracuse University: Allport Committee, Department of Psychology
Syracuse University: Academic Committee Member, College of Arts & Sciences