

**TODDLER-AGE EXTERNALIZING BEHAVIORS AND SCHOOL-AGE ACADEMIC
ACHIEVEMENT: INDEPENDENT ASSOCIATIONS AND THE IMPACT OF
PARENTAL INVOLVEMENT**

by

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**Toddler-age Externalizing Behaviors and School-age Academic Achievement:
Independent Associations and the Impact of Parental Involvement**

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University of Pittsburgh, 2010

The aim of this project was to examine independent associations between multiple dimensions of externalizing behaviors (i.e., aggression, oppositionality, inattention, and hyperactivity/impulsivity) during the toddler-age period and academic achievement at school-age in a sample of 495 high-risk children and families followed longitudinally from age 2 through 7.5. The study also investigated potential mediating effects of specific components of externalizing behavior assessed at ages 4 and 5, as well as potential moderating effects of parental involvement on the toddler-age-externalizing to school-age-achievement association. The results demonstrated that toddler-age aggression was the externalizing dimension most consistently associated with academic achievement at age 7.5, albeit modestly. In multivariate analyses, age 2-3 levels of inattention, hyperactivity/impulsivity, and oppositionality were unrelated to school-age academic achievement scores. Moreover, findings showed that relationships between externalizing behaviors in toddlerhood and age 7.5 academic achievement were not moderated by level of parental involvement. The results suggest that in toddler-aged children, aggression is a more reliable predictor of school-age academic achievement than inattention, hyperactivity/impulsivity, or oppositionality.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	LITERATURE REVIEW	4
2.1	BACKGROUND AND SIGNIFICANCE	4
2.2	COMPONENTS OF EXTERNALIZING BEHAVIOR AND ACADEMIC ACHIEVEMENT.....	6
2.3	INDEPENDENT CONTRIBUTIONS OF EXTERNALIZING DIMENSIONS TO ACADEMIC ACHIEVEMENT	9
2.4	PARENTING AND ACADEMIC ACHIEVEMENT.....	13
2.5	PARENTING INTERVENTION AND ACADEMIC ACHIEVEMENT.....	15
3.0	STATEMENT OF PURPOSE.....	16
4.0	HYPOTHESES	18
5.0	METHOD.....	22
5.1	PARTICIPANTS	22
5.2	PROCEDURE.....	24
5.2.1	Assessment Protocol.....	24
5.2.2	Interventional Protocol: The Family Check-Up (FCU).....	25
5.3	MEASURES.....	26
5.3.1	Demographics Questionnaire	26

5.3.2	Child Behavior Checklist 1 ½ - 5 & 6 - 18 (CBCL).....	26
5.3.3	Eyberg Child Behavior Inventory (ECBI)	27
5.3.4	Externalizing behavior factors	27
5.3.5	Parent Involvement.....	28
5.3.6	Academic achievement.....	29
5.4	DATA ANALYSIS	29
6.0	RESULTS.....	31
6.1	DESCRIPTIVE STATISTICS	31
6.2	1A. DIRECT ASSOCIATIONS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND LATER ACADEMIC ACHIEVEMENT.....	32
6.3	1B. INDEPENDENT ASSOCIATIONS BETWEEN EARLY COMPONENTS OF EXTERNALIZING AND SCHOOL-AGE ACADEMIC ACHIEVEMENT	35
6.4	2. INDIRECT EFFECT OF EARLY AGGRESSION/OPPOSITIONAL BEHAVIOR ON LATER ACADEMIC ACHIEVEMENT.....	38
6.5	3. MODERATING EFFECT OF INVOLVEMENT ON BEHAVIOR- ACHIEVEMENT ASSOCIATION	40
6.6	4. HIGHER LEVELS OF PARENTAL INVOLVEMENT FOR FAMILIES IN THE INTERVENTION GROUP	41
7.0	DISCUSSION.....	42
7.1	DIRECT PATHWAYS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND SCHOOL-AGE ACADEMIC ACHIEVEMENT	43

7.2	INDIRECT PATHWAYS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND SCHOOL-AGE ACADEMIC ACHIEVEMENT	46
7.3	PARENTING AND ACADEMIC ACHIEVEMENT.....	47
7.4	LIMITATIONS.....	49
7.5	CLINICAL AND SOCIAL POLICY IMPLICATIONS AND FUTURE DIRECTIONS.....	51
	APPENDIX.....	54
	BIBLIOGRAPHY.....	57

LIST OF TABLES

Table 1. Internal Consistencies of Externalizing Dimensions (Cronbach's alphas)	28
Table 2. Descriptives and Pearson Correlations between Externalizing Variables and W-J Academic Achievement	34
Table 3. Multivariate Results of Externalizing Variables Predicting Overall Academic Skills....	36
Table 4. Multivariate Results of Externalizing Variables Predicting Letter-Word Identification	37
Table 5. Multivariate Results of Externalizing Variables Predicting Calculation.....	37
Table 6. Multivariate Results of Externalizing Variables Predicting Spelling.....	38
Table 7. DSM-IV-based Externalizing Behavior Factors	54

LIST OF FIGURES

Figure 1. Multivariate Model of Externalizing Behaviors and Academic Achievement.....	19
Figure 2. Mediation Models of Externalizing Behaviors and Academic Achievement	19
Figure 3. Moderation of Externalizing-Achievement Relationship by Parental Involvement	20
Figure 4. Intervention Effects on Parental Involvement and Externalizing-Achievement	21

1.0 INTRODUCTION

A large body of research has demonstrated a link between externalizing behaviors and academic achievement. It is estimated that between 10-50% of children who exhibit externalizing behaviors also demonstrate low academic achievement (Hinshaw, 1992). This relationship has been a major focus in the literature because of the severity of its predicted consequences, which include: continued underachievement, receipt of special services, deviant peer affiliation, delinquency, and school dropout. However, the behaviors referred to as “externalizing” are quite heterogeneous, spanning from core symptoms of ADHD such as inattention, impulsivity, and hyperactivity, to symptoms associated with ODD and CD, such as oppositional and aggressive behavior. The extent to which specific dimensions within the externalizing construct independently predict academic achievement remains unclear.

Although research has established that aggression, oppositionality, inattention, and hyperactivity/impulsivity during early childhood are each associated with later achievement problems, it is also known that they are highly comorbid (Biederman, Newcorn, & Sprich, 1991). This high rate of comorbidity leaves open the possibility that the predictive nature of one externalizing behavior is accounted for by another covarying behavior. Although sparse, particularly those using a longitudinal design, research that has examined the independent contributions of aggression, oppositionality, and ADHD symptoms in relation to achievement have typically found that ADHD behaviors account for the association between childhood

aggressive and oppositional behavior and underachievement (Fergusson & Horwood, 1995; McGee, Williams, & Silva, 1985; Rapport, Scanlan, & Denney, 1999). However, these studies have failed to partition the individual components of the ADHD cluster of symptoms, treating both inattention and hyperactivity/impulsivity as one broad-band factor. Although inattention and hyperactivity/impulsivity are moderately correlated, it is possible that a clearer picture of the association between aggression, oppositionality, and academic achievement would be derived by partitioning ADHD into its symptom clusters.

In addition to understanding the relationship between different components of child disruptive behavior and academic achievement, it may also be important to understand potential moderating influences on these associations. For example, it has been shown that dimensions of parenting, such as involvement, structuring, and positive reinforcement, predict both academic achievement and externalizing problems (Gardner, Sonuga-Barke, & Sayal, 1999; Jeynes, 2007; Mattanah, Pratt, Cowan, & Cowan, 2005). However, there is a dearth of literature investigating the potential moderating role parenting factors play in the association between early and different components of externalizing problem behavior and later achievement, including whether attenuation of this relationship would be more pronounced among families randomly assigned to a family-based intervention designed to improve parenting.

The current study seeks to contribute to the literature by examining the independent contributions of multiple components of early externalizing behavior to later academic achievement in an ethnically diverse sample of 495 low-income children followed from toddlerhood to school-age. In addition, the study investigated the potential moderating effect of parental involvement and the effect of a parenting-focused intervention on the externalizing behavior-achievement relationship. The following review will examine several domains of

literature relevant to externalizing behaviors and academic achievement including research detailing what is known of the relationship in early childhood and how individual components of externalizing are independently related to academic performance. Literature focusing on the associations between parenting practices and both behavior and achievement will then be presented. Research that elucidates the independent contribution of different components of early externalizing problem behavior on achievement and the potential moderating role of parenting would likely have important implications for basic and intervention research.

2.0 LITERATURE REVIEW

2.1 BACKGROUND AND SIGNIFICANCE

Externalizing behaviors have been the focus of much research in recent decades. Data suggests that these behaviors account for over 50% of childhood clinic referrals (Waschbusch, 2002) and are among the most commonly reported reasons for parental concern (Schroeder & Gordon, 2002). While it is normative for externalizing behaviors to emerge in children between 2 and 3 years of age, high levels of such behavior are worrying because they are known to be moderately stable throughout childhood and to predict more severe forms of antisocial behavior into adolescence and adulthood (Caspi, Henry, McGee, Moffitt, & Silva, 1995; Shaw, Bell, & Gilliom, 2000). Furthermore, toddlers who do not exhibit elevated levels of disruptive behavior are much less likely to begin displaying problem behaviors later (Shaw & Gross, 2008).

The presence of externalizing behaviors is additionally concerning because they predict an array of negative outcomes from childhood through adulthood, including depression and anxiety (Lee, Lahey, Owens, & Hinshaw, 2008; Masten et al., 2005), peer rejection (Dodge, 1983), antisocial behavior and criminality (Moffitt, 1993), substance abuse (Wilson & Marcotte, 1996), and academic underachievement (Hinshaw, 1992). Following up on research demonstrating predictive validity between early forms of externalizing problems and later multiple problematic outcomes, many researchers have focused on the specific relationship

between early disruptive behavior and academic achievement because this association also emerges early (Doctoroff, Greer, & Arnold, 2006), remains evident throughout elementary and high school levels (Massetti et al., 2008; Wilson & Marcotte, 1996), demonstrates reciprocity over time (Masten et al., 2005; Moilanen & Shaw, 2010) and places children at risk for other adverse school outcomes such as grade retention and the need for special services (Tremblay et al., 1992; Vitaro, Brendgen, Larose, & Tremblay, 2005).

A plethora of research has been conducted on childhood behavior problems and both concurrent and future academic achievement. This literature has consistently found that children who demonstrate higher levels of externalizing behavior assessed as early as age 2 are at increased risk of experiencing academic difficulties during the elementary, middle, and high school periods (Campbell, Spieker, Burchinal, Poe, & The NICHD Early Child Care Research Network, 2006; Fergusson & Horwood, 1995; Massetti et al., 2008; McGee et al., 1985). Although it is known that both externalizing problems and academic difficulties are consistently, albeit modestly associated with intelligence and socioeconomic status, these factors and others such as gender and ethnicity have not been found to account for the relationship between externalizing and academic achievement (Rapport et al., 1999; Tremblay et al., 1992). While the relationship between externalizing and academic achievement seems well-established, less is known about the ways in which specific dimensions within the externalizing construct are independently related to achievement.

2.2 COMPONENTS OF EXTERNALIZING BEHAVIOR AND ACADEMIC ACHIEVEMENT

Aggression, oppositionality, inattention, hyperactivity and impulsivity, assessed during the preschool (i.e., ages 3-5) and school-age periods, have each been demonstrated to be both concurrently and longitudinally associated with academic performance at school-age and adolescence (McGee et al., 1985; Rabiner, Coie, & Conduct Problems Prevention Research Group, 2000; Saudino & Plomin, 2007; Trzesniewski, Moffitt, Caspi, Taylor, & Maughan, 2006). Specifically, high levels of inattention, hyperactivity, and impulsivity in school-age children, are well-known predictors of subsequent levels of achievement in elementary and middle school (Fergusson, Horwood, & Lynskey, 1993; Merrell & Tymms, 2001). A large literature has implicated early symptoms and/or diagnoses of ADHD to be one of the most salient correlates of academic achievement (Hinshaw, 1992). In fact, ADHD behaviors assessed in children 3 to 7 years of age are repeatedly associated with lower concurrent reading, math and spelling performances, the presence of a learning disability, and failure to attain a high school diploma (Anderson, Williams, McGee, & Silva, 1989; Capano, Minden, Chen, Schachar, & Ickowicz, 2008; Frick et al., 1991; Vitaro et al., 2005). However, the diagnostic category of ADHD encompasses different symptom dimensions of inattention, hyperactivity, and impulsivity. Factor analytic studies often show that hyperactive and impulsive dimensions cluster into a single factor (i.e., hyperactive/impulsive or undercontrol) and will henceforth be treated as such (Hinshaw, 1987).

Although evidence clearly indicates that ADHD is associated with academics, it may be valuable to distinguish ADHD by inattentive or hyperactive/impulsive subtype, as other predictors and correlates of ADHD have been shown to vary as a function of symptom presentation (Barnard, Stevens, To, Lan, & Mulsow, 2009; Masetti et al., 2008).

Studies that have examined inattention and hyperactivity/impulsivity separately have demonstrated a link between both behaviors in school-age children and later academic achievement. For example, measures of inattention in children between 5 and 7 years of age have demonstrated modest to moderate longitudinal associations (i.e., zero-order correlations ranging from $-.28$ to $-.46$) with academic performance at elementary and high school levels (Breslau et al., 2009; Rabiner et al., 2000). In a recent meta-analysis, inattentive behavior at school entry was found to be a robust predictor of elementary school academic functioning even after accounting for early academic abilities, gender, race, and SES (Duncan et al., 2007). Further support for the influence of attention skills on subsequent academics stems from the finding that decreases in ratings of inattention from early to late elementary school predict improvements in academic achievement from elementary to late high school (Breslau et al., 2010). It is clear that there is an association between attention and academic outcomes throughout school-age and adolescence, but the relationship between other types of externalizing behaviors and academic achievement is less clear.

Hyperactive/impulsive behaviors in 5- to 7-year olds have also been found to be associated with academic achievement both concurrently and longitudinally during school-age (McGee, Williams, & Silva, 1984; Merrell & Tymms, 2001; Saudino & Plomin, 2007). Furthermore, hyperactive/impulsive school-age children have been found to demonstrate concurrent academic deficits similar in severity to their inattentive peers (Capano et al., 2008;

Marshall, Hynd, Handwerk, & Hall, 1997). In sum, research demonstrates that each of the core dimensions of ADHD measured in the school-age period is related to academic achievement; however, many studies have failed to account for the high rate of comorbidity between ADHD behaviors, making it difficult to determine the degree to which specific ADHD symptoms are uniquely associated with academic achievement. In addition, because most existing studies often do not begin to measure initial levels of ADHD behaviors until school age, when the developmental courses of inattention and hyperactivity/impulsivity are known to converge, it is difficult to separate the unique contributions of inattention and hyperactivity/impulsivity to achievement. While ADHD behaviors are known to emerge in children between 2 and 3 years of age, they are also known to have the greatest overlap during the school-age period (Barkley, 2003; Lahey et al., 1994). Thus, to determine the relative influence of early ADHD behaviors on later academic achievement, it would be important to measure initial levels of inattention and hyperactivity/impulsivity at an age when behaviors are present but more distinguishable from one another. Unfortunately, there is a dearth of research examining the longitudinal relationship between early measures of dimensions of ADHD behaviors in toddlerhood (i.e., 1.5-3 years) and academic achievement at school-age.

It is also known that aggression, even when measured prior to school entry, is correlated with a host of subsequent negative school outcomes. Aggressive behavior in toddlerhood, preschool, and kindergarten has been shown to be associated with important school-related factors ranging from early literacy and math skills (Dobbs, Doctoroff, Fisher, & Arnold, 2006; Doctoroff et al., 2006), to academic achievement in elementary school (Stipek & Miles, 2008), and high school completion (Vitaro et al., 2005). For example, in a large, predominantly middle-class sample followed longitudinally, children who were found to be aggressive at age 2 and to

remain aggressive relative to peers at follow-up demonstrated lower academic achievement in middle school than those children who reliably exhibited very few or no aggressive behaviors (Campbell et al., 2006). However, a consistent element shared by the aforementioned studies linking aggression to academic outcomes is their failure to account for comorbid externalizing behaviors such as inattention and hyperactivity/impulsivity.

In addition, although not much work has been conducted to investigate the independent association between early oppositional behavior and later achievement, oppositionality is known to frequently co-occur with inattention, hyperactivity/impulsivity, and aggression (Waschbusch, 2002). Moreover, oppositional behavior is particularly prevalent in early childhood and may be accounting for a large proportion of variance in early measures of broad-band externalizing constructs that have been repeatedly associated with subsequent academic functioning (Bub, McCartney, & Willett, 2007; Fergusson & Horwood, 1995; Hinshaw, 1992). The pattern of findings suggests that aggressive and oppositional behaviors, beginning in early childhood, are associated with later impairments in academic achievement, but the extent to which each association is independent of other correlated disruptive behaviors remains unclear.

2.3 INDEPENDENT CONTRIBUTIONS OF EXTERNALIZING DIMENSIONS TO ACADEMIC ACHIEVEMENT

Theories linking early externalizing behaviors to low academic achievement at school-age often point to deficits in executive functioning (EF) capacity as having a key role in the relationship (Diamantopoulou, Rydell, Thorell, & Bohlin, 2007). For example, deficits in core features of EF, such as working memory, motor control, and goal-directed persistence, are

known to underlie many behavioral features such as inattention, hyperactivity, and impulsivity (Barkley, 1997) and may shed some light on why ADHD children often suffer academically. Consistent with this is the notion that inattentive children, who are unable to attend to the most relevant stimuli in the classroom may be less likely to acquire important academic skills in the early school years (Spira & Fischel, 2005). Subsequently, these children are unlikely to have the requisite foundational skills to understand and apply later instruction.

Children who exhibit hyperactive/impulsive behaviors are also known to demonstrate executive deficits, particularly in the areas of behavioral inhibition and planning (Barkley, 1997). Consequently, hyperactive/impulsive children are less likely to formulate well-planned responses and remain on task in the classroom. Similarly, aggressive children are known to exhibit deficits in inhibition, which may interfere with their ability to remain engaged academically (Kimonis et al., 2006). Although it is suggested that children, whose primary deficit is an inability to inhibit behavior, may suffer somewhat academically, it is also likely that these behaviors will be less pervasive and detrimental to future learning than for children who are challenged in their ability to focus and sustain attention. Lastly, oppositional behavior does not appear to be uniquely associated with deficits in executive function (Oosterlaan, Scheres, & Sergeant, 2005; Thorell & Wahlstedt, 2006). While it is possible that oppositional children will perform more poorly in the classroom as a consequence of refusing to comply with instruction, it is not expected that oppositionality will result in the long term deficits seen in children who have difficulties with inattention, who fail to attend to and encode material.

Research has established that aggression, oppositionality, inattention, and hyperactivity/impulsivity at school-age are each associated with concurrent and future underachievement, but their high rate of comorbidity makes it plausible that only a subset of

these behaviors contribute directly to variation in academic performance. As an example, estimates in clinical settings suggest a substantial degree of overlap in symptoms for children with ADHD or ODD/CD, ranging from 30%-90% (Biederman et al., 1991; Hinshaw, 1987). A small number of studies have examined the independent contributions of school-age aggression, oppositional behavior, and ADHD symptoms to concurrent and longitudinal academic achievement. The few existing longitudinal studies indicate that ADHD behaviors in 7- and 8-year olds account for the association between aggression and oppositionality and underachievement in 15- and 16- year olds (Fergusson & Horwood, 1995; Rapport et al., 1999). Although this is an important first step, because of the heterogeneous components of ADHD that include inattention and hyperactivity/impulsivity, it is still not possible to determine if the association between aggression and oppositionality, and later academic achievement is accounted for by inattention, hyperactivity/impulsivity, or both. Furthermore, the relationship between independent dimensions of externalizing behavior measured in toddlerhood and longitudinal academic outcomes has yet to be investigated.

To date, the few studies that have explored the *independent* contributions of inattention and hyperactivity/impulsivity to academic achievement have tended to find that only school-age inattention is significantly associated with both concurrent and future elementary and high school levels of academic achievement (Diamantopoulou et al., 2007; DuPaul et al., 2004; Johnson, McGue, & Iacono, 2005; Rabiner et al., 2000). For example, in a recent longitudinal study that followed clinic-referred 3- to 6-year-olds for 8 years, the authors showed that only children with the inattentive subtype of ADHD were performing consistently below their peers academically throughout elementary school, including those with the hyperactive/impulsive subtype of ADHD (Masseti et al., 2008). A small number of cross-sectional studies have investigated associations

between aggression, oppositionality, inattention, hyperactivity/impulsivity, and academic achievement and have found mixed results. In one such study conducted on emotionally disturbed adolescents, it was shown that inattentive behavior alone accounts for the association between conduct problems and academic achievement (Barriga et al., 2002). On the other hand, a study focusing on a sample of diverse, high-risk 3-year-olds, demonstrated that only mothers' reports of hyperactive/impulsive behavior were independently associated with concurrent academic skills (Friedman-Weieneth, Harvey, Youngwirth, & Goldstein, 2007).

These findings suggest that when independent contributions of behaviors are taken into account, an inconsistent picture of the association between ADHD behaviors and primarily concurrent academic achievement emerges. However, more research is needed in this area as many of the existing studies rely on clinical diagnostic categories to predict academics when sub-threshold dimensional relationships are known to exist and apply to a larger population (Loe & Feldman, 2007). Furthermore, most studies tend to be cross-sectional, making it challenging to examine mediational processes, and the few longitudinal studies that exist often begin at ages when children have already been attending formal schooling (Fergusson & Horwood, 1995), making it difficult to interpret the directionality of associations between disruptive behavior and academic functioning. Moreover, few studies have included diverse high-risk populations (Friedman-Weieneth et al., 2007), who are particularly important to consider when examining behavior and achievement difficulties because of their elevated risk of developing both (Brooks-Gunn & Duncan, 1997; Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006).

2.4 PARENTING AND ACADEMIC ACHIEVEMENT

In addition to child factors that predict academic achievement, it may also be useful to understand potential moderating influences on the behavior-achievement relationship, which could include child, family, or broader community level factors (e.g., neighborhood adversity). For example, multiple dimensions of parenting such as warmth (Deater-Deckard, Ivy, & Petrill, 2006; Mattanah et al., 2005), harshness (Campbell, Shaw, & Gilliom, 2000; Shumow, Vandell, & Posner, 1998), autonomy-support (Baumrind & Black, 1967), and involvement (Jeynes, 2005), measured in preschool and elementary school children, have been shown to predict a host of child outcomes, including externalizing behavior and academics. Such parenting factors could be posited to amplify or attenuate direct paths between individual types of early externalizing behavior and school-age academic achievement. Theoretically, highly involved parents may be more in tune with the abilities and limitations of their children and therefore be better equipped to anticipate and respond to potential problematic situations in which their children are likely to become distracted, frustrated, and confused. Thus, highly involved parents would be expected to be more likely to prevent their children from becoming increasingly discouraged and behind with their school-work, ultimately increasing their ability to function in the classroom. As a result, interventions designed to improve parenting skills, such as parental involvement, would be expected to play a protective role in the relationship between early behavior problems and subsequent academic difficulties.

Although no studies could be identified that have directly addressed the potential moderating role parental involvement at home may play in relation to different types of externalizing behavior in early childhood and later academic functioning, several studies have established concurrent or longitudinal associations between parenting practices, including

parental school involvement, and academic achievement at school-age (Mattanah et al., 2005; Shumow et al., 1998). For example, a longitudinal study that followed low-income children from kindergarten through fifth grade demonstrated that parental school involvement was associated with increased literacy performance over time (Dearing, Kreider, Simpkins, & Weiss, 2006). Furthermore, when comparing children of low and high educated mothers, there was a noticeable achievement gap that disappeared when parental involvement in school was high, suggesting that involvement is most beneficial for those children at risk for low achievement. Although the connection between parental involvement at home and school-age academic achievement is less clear, it is possible that a similar protective effect of parental home involvement on risk for low achievement would be observed.

Several parenting behaviors individually linked to achievement, including involvement, have previously been connected to improvements in child externalizing behavior (Dishion et al., 2008) *and* language development from ages 2 to 4 (Lunkenheimer et al., 2008). In fact, involvement was part of a larger cluster of parenting behaviors (i.e., positive behavior support) that was found to promote language development in the current sample; however, consistent with the broader literature the moderating role of parental involvement on early externalizing and later language skills was not investigated. Thus, despite several studies documenting consistent associations between parental involvement and school achievement, there is a lack of research examining whether involvement moderates the association between individual components of externalizing during early childhood and school-age academic achievement, especially among samples of high-risk children. In sum, in addition to basic research studies demonstrating links between parental involvement and academic achievement, prevention and intervention studies have also demonstrated success in modify parenting to improve academic functioning.

2.5 PARENTING INTERVENTION AND ACADEMIC ACHIEVEMENT

Building upon the goal of assessing the potential moderating effects of parental involvement on the association between early externalizing and later achievement, this project also has the unique opportunity to examine parenting effects within the context of a longitudinal experimental trial that focuses on reducing early problem behavior by modifying caregiving practices. Random assignment to intervention in the current sample was associated with parents' greater use of positive behavior support (PBS), which includes involvement and proactive anticipation of child behavior, at a two-year follow-up (Dishion et al., 2008). In addition, in an earlier randomized control trial of the same parenting-focused parenting intervention, one dose of the Family Check-Up was associated with growth from ages 2 to 4 in the same measure of parental involvement used in the current study (Shaw, Dishion, Supplee, Gardner, & Arnds, 2006). Based on the study's experimental design, the final goal of the project is to test whether random assignment to the Family Check-Up is again related to higher levels of parental involvement, and consequently, greater attenuation of the relationship between early dimensions of externalizing problem behavior and school-age academic achievement.

3.0 STATEMENT OF PURPOSE

Research linking different types of early externalizing problem behaviors to future academic difficulties could contribute to basic and intervention research and may inform policy makers in their efforts to target young children at the greatest risk for struggling in academic and behavioral domains. Although many studies have been conducted on the association between broad-band factors of externalizing problem behaviors and academic achievement, few studies have examined the independent contributions of individual components of externalizing in relation to academics beginning in early childhood, or employing a longitudinal, much less, an experimental design. In addition, there is a dearth of literature examining the potential moderating role of parental involvement on the association between early externalizing behaviors and school-age academic achievement. Determining the role parenting may play in attenuating the relationship between externalizing and academics, particularly within the context of an experimental trial of a family-centered preventive intervention, has the potential to advance our understanding of both basic and applied processes.

The goal of this project was to examine independent associations between multiple components of externalizing behavior during toddlerhood and academic achievement in the early school-age period, including potential mediating effects of specific components of externalizing behavior assessed at ages 4 and 5, as well as potential moderating effects of parenting on this association. The design of this study included several methodological strengths, including the use

of an ethnically- and geographically-diverse sample of children, the use of multiple informants and methods including observations and standardized assessments, a longitudinal design that has followed children's development from ages 2 to 7.5, and the use of a high-risk sample screened on the basis of socioeconomic, family, and child risk factors for early externalizing problems and subsequent academic difficulties.

4.0 HYPOTHESES

In accordance with current literature and theory, the following hypotheses were tested.

1a. Direct associations between early externalizing behaviors and later academic achievement.

It was hypothesized that there would be significant univariate associations between inattention, hyperactivity/impulsivity, aggression, and oppositional behavior, measured during early childhood, and school-age academic achievement.

1b. Independent associations between early components of externalizing and school-age academic achievement. Consistent with prior research demonstrating that the relationships between aggressive and oppositional behavior and academic achievement are accounted for by ADHD symptoms (Fergusson & Horwood, 1995; Rapport et al., 1999), it was hypothesized that in a multivariate analysis, only early inattention and hyperactivity/impulsivity would contribute unique variance to later academic achievement (see Figure 1).

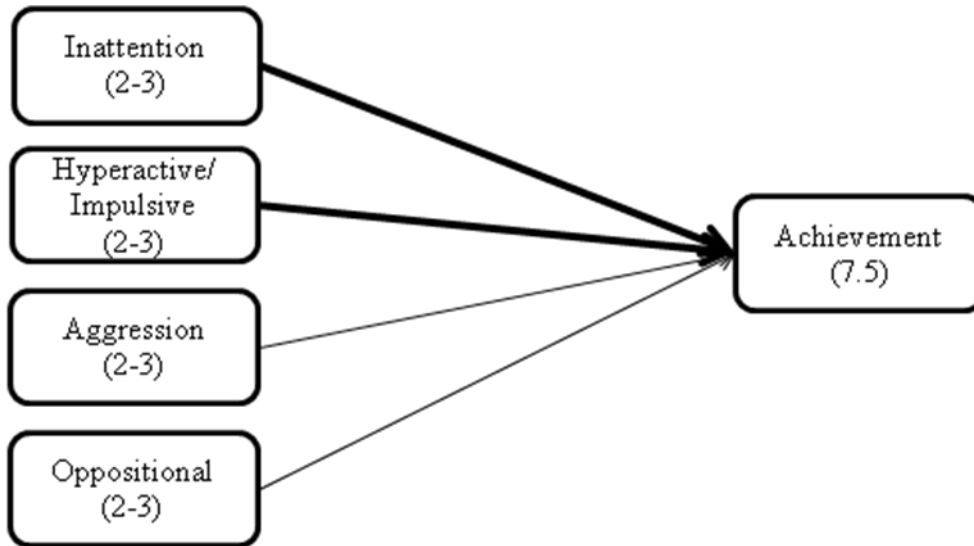


Figure 1. Multivariate Model of Externalizing Behaviors and Academic Achievement

2. *Indirect effect of early aggression/oppositional behavior on later academic achievement.* It was expected that the associations between early aggression and school-age academic achievement and early oppositional behavior and school-age academic achievement would each be mediated by inattention and partially mediated by hyperactivity/impulsivity (see Figure 2).

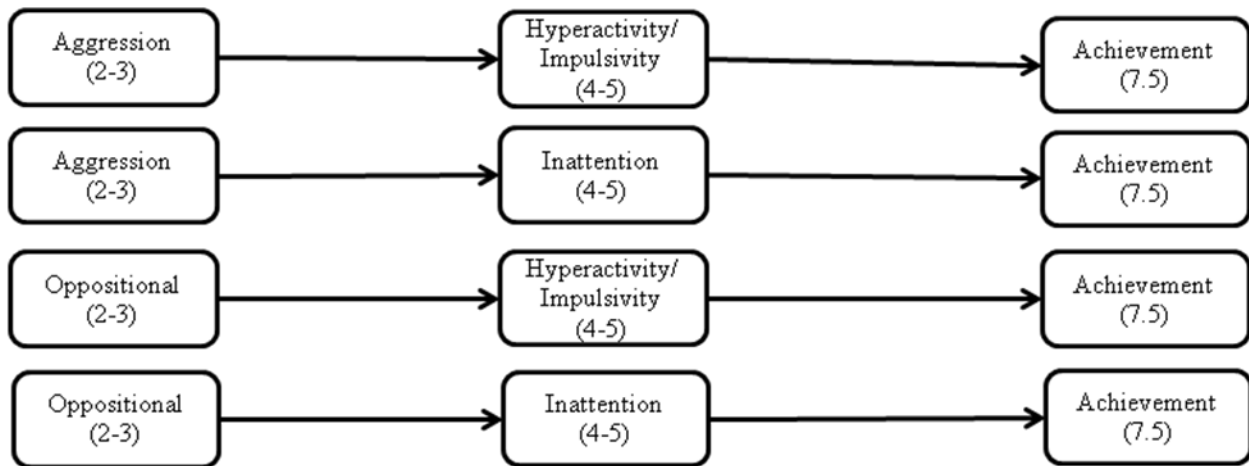


Figure 2. Mediation Models of Externalizing Behaviors and Academic Achievement

3. *Moderating effect of involvement on behavior-achievement association.* Based on research demonstrating that positive parenting practices such as involvement are associated with higher levels of academic achievement (Dearing et al., 2006; Mattanah et al., 2005) and have been theorized to be more critical to academic outcomes in the context of child behavior problems, it was hypothesized that the negative associations between early inattention and hyperactivity/impulsivity and later academic achievement would be attenuated (i.e., lessened in magnitude) in the context of high parental involvement (see Figure 3).

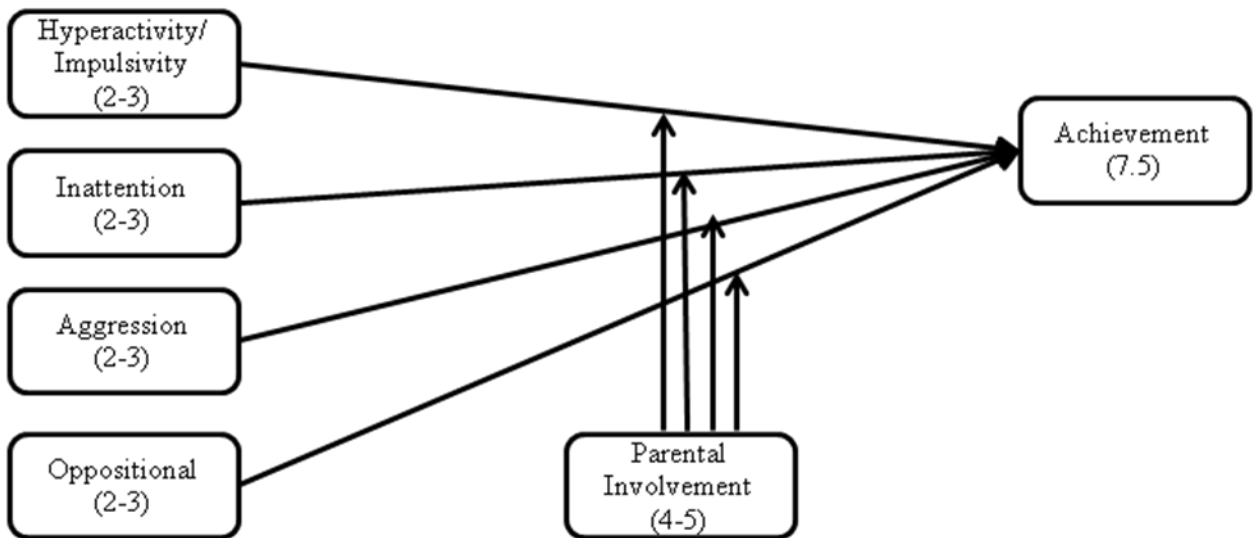


Figure 3. Moderation of Externalizing-Achievement Relationship by Parental Involvement

4. *Higher levels of parental involvement for families in the intervention group.* Following up on findings that random assignment to a parenting-focused intervention, the Family Check-Up, was related to increases in several positive parenting techniques (Dishion et al., 2008), it was expected that levels of parental involvement would be higher for intervention versus control families (see Figure 4).

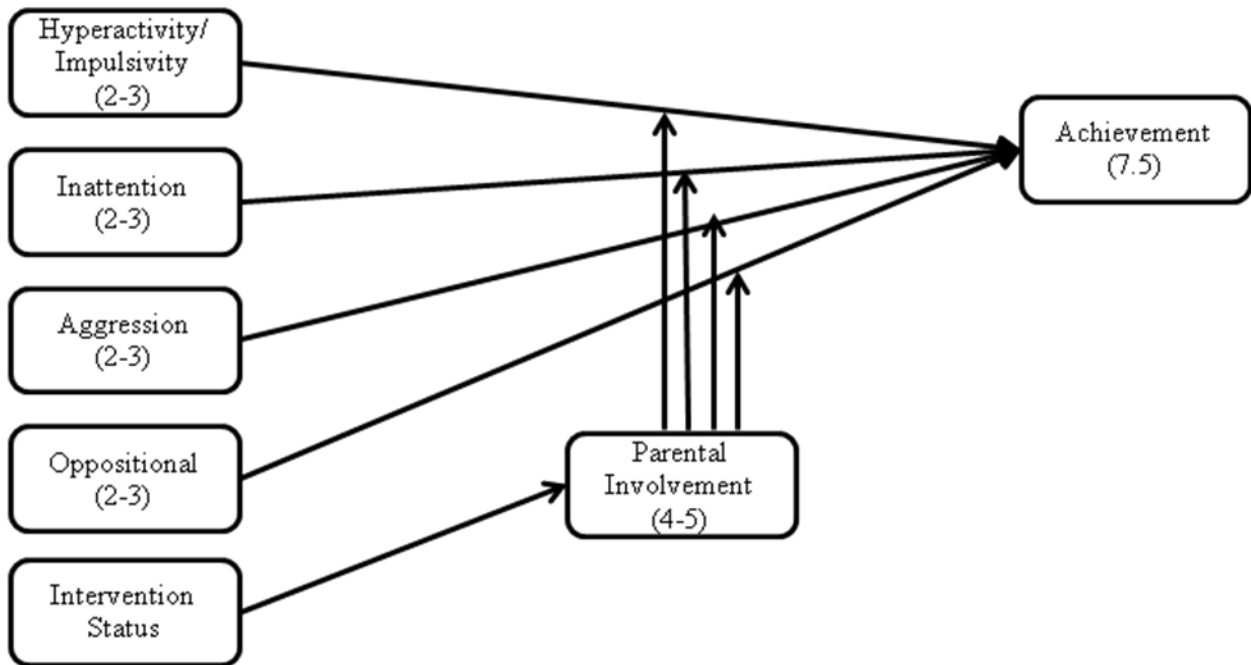


Figure 4. Intervention Effects on Parental Involvement and Externalizing-Achievement

5.0 METHOD

5.1 PARTICIPANTS

Participants included approximately 495 children and families recruited between 2002 and 2003 from Women, Infants, and Children Nutrition Programs (WIC) in the metropolitan areas of Pittsburgh, PA, and Eugene, OR, and in and outside the town of Charlottesville, VA. Families were contacted at WIC sites and invited to participate if they had a son or daughter between age 2 years 0 month and 2 years 11 months, following a screen to ensure that they met the study criteria by having socioeconomic, family, and/or child risk factors for future behavior problems (Dishion et al., 2008). Risk criteria for recruitment were defined at or above 1 SD above normative averages on several screening measures in the following three domains: (a) child behavior (conduct problems, high-conflict relationships with adults), (b) family problems (maternal depression, daily parenting challenges, substance-use problems (yes/no self-report question), teen parent status (i.e., first child born when parent was 19 years old or younger), and (c) sociodemographic risk (low education achievement and low family income, relevant to WIC criterion). To qualify for a given domain, families had to meet criteria for at least one scale within that domain. Two or more of the three risk domains were required for inclusion in the sample. In the case of children not qualifying on the criterion of child conduct problems, all

participants were required to have at least above-average scores to increase parent motivation to reduce child problem behavior.

Of the 1,666 families who had children in the appropriate age range and who were contacted at WIC sites across the three study sites, 879 met the eligibility requirements (52% in Pittsburgh, 57% in Eugene, and 49% in Charlottesville) and 731 (83.2%) agreed to participate (88% in Pittsburgh, 84% in Eugene, and 76% in Charlottesville). The children in the sample had a mean age of 29.9 months ($SD = 3.2$) at the time of the age 2 assessment. Of the 731 families (49% female), 272 (37%) were recruited in Pittsburgh, 271 (37%) in Eugene, and 188 (26%) in Charlottesville. Across sites, primary caregivers self-identified as belonging to the following ethnic groups: 28% African American, 50% European American, 13% biracial, and 9% other groups (e.g., American Indian, Native Hawaiian). Thirteen percent of the sample reported being Hispanic American. During the 2002-2003 screening period, more than two thirds of those families enrolled in the project had an annual income of less than \$20,000, and the average number of family members per household was 4.5 ($SD = 1.63$). Forty-one percent of the population had a high school diploma or general education diploma (GED), and an additional 32% had 1-2 years of post-high school training.

Of the 731 families who initially participated, 659 (90%) were available at the age-3 follow-up, 619 (85%) participated at the age-4 follow-up, and 621 (85%) participated at the age-5 follow-up. This study only used data from families who have participated in the ongoing age-7.5 follow-up. Once all data are collected attrition analyses will be conducted to assess for differences at age 2 between retained and attrited participants. To date, selective attrition analyses comparing age-2 study variables for participants retained versus attrited at ages 3, 4, and 5 have revealed no significant differences with respect to project site, children's race,

ethnicity, or gender, maternal depression, children's externalizing behavior, or intervention status.

5.2 PROCEDURE

At child ages 2, 3, 4, 5, and 7.5, the target child (TC), primary caregiver (PC) and when available, alternate caregiver (AC), participated in annual 2-3 hour assessments at the family's home. These assessments consisted of a battery of self-report measures, observational interaction tasks and a child testing session. This study used a subset of the collected data, which is described below. Families who participated in the age 2, 3, 4, 5, and 7.5 assessments were reimbursed \$100, \$120, \$140, \$160, and \$180, respectively.

5.2.1 Assessment Protocol

Age 2 assessments began by having an adult stranger (i.e., undergraduate videographer) approach the child, introduce him/her to an assortment of age-appropriate toys, and then allow him/her to play for 15 min. while the primary caregivers completed questionnaires. After the free play (15 min.), each primary caregiver and child participated in a cleanup task (5 min.), followed by a delay of gratification task (5 min.), four teaching tasks (3 min. each, with the last task being completed by alternate caregiver and child), a second free play (4 min.), a second cleanup task (4 min.), the presentation of two inhibition-inducing toys (2 min. each), and a meal preparation and lunch task (20 min.). Similar procedures were used to assess child behavior and parent-child interaction at ages 3, 4, and 5, with minor modifications made to adjust for the developmental

status of the child (e.g., wait task lasting 5 vs. 3 minutes at age 5). Although the age 7.5 assessments also included similar parent-child interactive tasks, only data from the Woodcock-Johnson test were used in the current study, which was administered at the end of the assessment.

5.2.2 Interventional Protocol: The Family Check-Up (FCU)

The FCU is a brief, typically three-session, intervention based on motivational interviewing techniques and modeled after the Drinker's Check-Up (Miller & Rollnick, 2002; for a complete description, see Dishion et al., 2008). Families who were randomly assigned to the intervention condition were scheduled to meet with a parent consultant for two or more sessions, depending on the family's preference. The three meetings in which families are typically involved include an initial contact meeting, an assessment meeting, and a feedback session (Dishion & Kavanagh, 2003). For research purposes, the sequence of contacts was assessment, randomization, initial interview, and feedback session with the option for follow-up sessions. Families in the feedback session received a \$25 gift certificate for completing the FCU and feedback session.

After the first meeting, (the assessment described above), the second visit called the "get to know you" (GTKY) meeting consisted of the parent consultant meeting with the parent or parents and discussing their concerns with a focus on current family issues that were most critical to their child's and family's functioning. For the third meeting, the feedback session, parent consultants utilized motivational interviewing to summarize the results of the assessment and highlight areas of strength and areas in need of attention. The parent was given the choice to participate in additional follow-up sessions that were focused on parenting practices as well as other family management and contextual issues (e.g., co-parenting, child care resources, or housing). Parent consultants were also able to recommend community service organizations that

may be of assistance to the family. Parents in the intervention group received the FCU after each year's assessment at child ages 2, 3, 4, and 5.

5.3 MEASURES

5.3.1 Demographics Questionnaire

A demographics questionnaire was administered to the mothers during the age 2, 3, 4, 5 and 7.5 visits. This measure included questions about family structure, parental education and income, parental criminal history, and areas of familial stress.

5.3.2 Child Behavior Checklist 1 ½ - 5 & 6 - 18 (CBCL)

The CBCL (Achenbach & Rescorla, 2001; Achenbach & Rescorla, 2000) for ages 1.5 to 5 and for ages 6-18 are 99-item and 118-item questionnaires, respectively, that assess behavioral problems in children falling within the respective age groups. Mothers completed the CBCL 1 ½-5 at the ages 2, 3, and 4 visits and the CBCL 6-18 at the age 5 assessment. The CBCL has two broad-band factors, internalizing and externalizing. Individual items from the externalizing factor were combined with items from the Eyberg Child Behavior Inventory to create individual factors of inattention, hyperactivity/impulsivity, aggression, and oppositionality (see Table 7 and description below).

5.3.3 Eyberg Child Behavior Inventory (ECBI)

The ECBI is a 36-item parent-report behavior checklist also administered at the ages 2, 3, 4, and 5 assessments (Robinson, Eyberg, & Ross, 1980). The ECBI assesses conduct problems in children between 2 and 16 years of age via two factors, one that focuses on the perceived intensity of behavior and another on the degree the behavior is a problem for caregivers. As the intensity factor is similar in structure, and complementary in content, to the CBCL externalizing factor, items from this were used to supplement items from the CBCL in creating DSM-based factors of inattention, hyperactivity/impulsivity, aggression, and oppositionality (see Table 7 and the following description).

5.3.4 Externalizing behavior factors

To create externalizing behavior composites, ECBI items were initially rescaled from a 7-point Likert scale to match the 3-point scale of the CBCL. Scores were recoded so that values reflecting conceptually similar behavior frequencies were equated (i.e., 1, or “Never,” on the ECBI was equal to 0, or “Not True,” on the CBCL; 2-4, or “Sometimes,” on the ECBI was equal to 1, or “Somewhat or Sometimes True,” on the CBCL; and 5-7, or “Always,” on the ECBI was equal to 2, or “Very True or Often True,” on the CBCL). Individual items from the externalizing factor of the CBCL were then combined with rescaled items from the ECBI and matched with DSM-IV criteria for ADHD-Inattentive, ADHD-Hyperactive/Impulsive, Oppositional Defiant Disorder, and the aggressive items from the CD diagnosis to create four factors of inattention (INATT), hyperactivity/impulsivity (H-I), aggression (AGG), and oppositionality (OPP), respectively (see Table 7). These factors were then composited across the

age 2-3 and 4-5 assessments to obtain a more stable indicator of child problem behaviors. Internal consistencies for the composites of INATT, H-I, AGG, and OPP factors were .79, .69, .82, and .85 at ages 2-3, respectively, and .87, .71, .84, and .90 at ages 4-5, respectively (see Table 1).

Table 1. Internal Consistencies of Externalizing Dimensions (Cronbach's alphas)

Age	INATT	H-I	AGG	OPP
2	.705	.555	.726	.752
3	.778	.706	.811	.869
4	.817	.731	.834	.885
5	.791	.614	.775	.867
2-3	.787	.688	.820	.848
4-5	.871	.708	.840	.895

5.3.5 Parent Involvement

Three observationally-based items from the Involvement subscale of the Infant/Toddler Home Observation of the Environment Inventory (HOME; Caldwell & Bradley, 1984) were used to measure parental involvement. The HOME was completed by an examiner at the end of each in-home assessment in reference to the primary caregiver. The Involvement subscale included three items either observed or not observed, resulting in a score of 0 (none present) to 3 (all present): “Parent keeps child in visual range, looks often,” “Parent talks to child while doing household

work,” and “Parent structures child’s play periods.” Involvement scores were then averaged and summed across ages 4 and 5 to form the Parental Involvement composite used in the current study. Internal consistency for the age 4-5 composite Parental Involvement scale was found to be .60.

5.3.6 Academic achievement

Academic abilities were assessed at the age 7.5 home visit by administering the Academic Skills Cluster of the Woodcock-Johnson Tests of Achievement III (W-J), which consists of an aggregate, age-standardized composite of the subtests Letter-Word Identification, Math Calculation, and Spelling (Woodcock, McGrew, & Mather, 2001). It uses a standard score scale based on a mean of 100 and standard deviation of 15 and has a median reliability of .95.

5.4 DATA ANALYSIS

To carry out the study’s objectives, correlations (hypothesis 1) and hierarchical multiple regressions (hypotheses 1-4) were utilized. In multivariate analyses, child gender, child race and ethnicity, primary caregiver education, and monthly household income, as measured at age 2, were included as covariates because of gender, ethnic, and socioeconomic differences in rates of externalizing behavior (Allhusen et al., 2005; Epstein et al., 2005; Lavigne et al., 1996), although no differences based on these factors were expected in the magnitude of associations between early externalizing or parental involvement and academic achievement. Intervention status was examined as part of hypothesis four.

In terms of measurement, previously described factors of early externalizing, derived from the CBCL and ECBI at ages 2-3 and 4-5, were used to assess inattention, hyperactivity/impulsivity, aggression, and oppositionality. Parental involvement was assessed using examiner impressions of parenting at ages 4-5, and academic achievement was assessed using the Academic Skills composite of the W-J at age 7.5. In addition, follow-up analyses examined individual components of the W-J Academic Skills composite separately. Therefore, results are initially presented examining age 7.5 W-J Academic Skills as the outcome, followed by a summary of results of analyses using raw scores from the three W-J subtests: Letter-Word Identification, Calculation, and Spelling. Only individuals with age 7.5 data were included in analyses. For those with data at only one of two assessment points, composite scores consisted of the available data point (e.g., if data were missing at age 3, only age 2 scores were used). In addition, to ensure that multicollinearity was not problematic in regression analyses, variance inflation factor (VIF) and tolerance statistics were calculated. Below are described the statistical procedures used and the ensuing findings for the four primary hypotheses.

6.0 RESULTS

6.1 DESCRIPTIVE STATISTICS

Although this sample was screened for child aggressive behavior at age 2, *t*-scores from the original CBCL factors indicated that participants showed similarly elevated scores on both the broad-band externalizing factor and the narrow-band aggressive behavior factor (mean *t*-scores of 59.49 and 60.17, respectively). In addition, average *t*-scores on narrow-band DSM-based factors for attention problems and oppositional defiant behaviors were 57.82 and 59.15, respectively, demonstrating that at age 2 these children were struggling in multiple externalizing domains.

Table 3 contains descriptive statistics for the study's primary independent and dependent variables. The externalizing behavior composites were created specifically for this study and, therefore, are difficult to compare to other samples. Paired samples *t*-tests between externalizing composites at age 2-3 and 4-5 demonstrate that caregiver ratings of AGG, OPP, and H-I all significantly decreased over time, while INATT did not change significantly across time points. The parental involvement mean indicates the average number of parent involvement behaviors observed by examiners (0-3) during the age 4 and 5 home visits. The remaining variables represent W-J performance; the raw W-J scores indicate number of items correct while the overall Academic Skills score has been age-standardized. This sample's Academic Skills mean

of 100.69 is consistent with the mean of the W-J standardization sample, but greater than the mean Academic Skills score (97.95) from data collected when the same children were 5 years old.

6.2 1A. DIRECT ASSOCIATIONS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND LATER ACADEMIC ACHIEVEMENT

To test the hypothesis that early INATT, H-I, AGG, and OPP would be negatively associated with school-age academic achievement, a series of Pearson correlation coefficients were computed using composites of disruptive behavior from ages 2-3 and the W-J Academic Skills standardized score at age 7.5. Additional correlations were computed to elucidate specific relationships between age 2-3 externalizing behaviors and the age 7.5 W-J individual scales of the Academic Skills composite (i.e., Letter-Word Identification, Calculation, and Spelling).

As shown in Table 2, hypothesis 1a was partially supported as age 2-3 AGG was significantly negatively correlated with the age 7.5 W-J Academic Skills composite, albeit modestly ($r = -.093, p < .05$). There was also a significant negative, yet modest, relationship between age 2-3 H-I and overall Academic Skills ($r = -.090, p < .05$). However, in contrast to expectations, age 2-3 INATT and OPP were not significantly related to the Academic Skills composite at school-age. Correlations between age 2-3 externalizing behaviors and individual W-J subtests at age 7.5 demonstrated similar results, with only age 2-3 AGG being significantly correlated with Letter-Word Identification ($r = -.123, p < .01$) and a trend between age 2-3 AGG and Spelling ($r = -.084, p < .10$). Age 2-3 H-I was also related to age 7.5 Letter-Word Identification at a trend level ($r = -.076, p < .10$). There were no other significant or trend-level associations between early externalizing behaviors and the W-J subtests.

Table 2. Descriptives and Pearson Correlations between Externalizing Variables and W-J Academic Achievement

	N	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12
1. AGG composite ages 2-3	730	.582 (.31)												
2. OPP composite ages 2-3	731	1.09 (.32)	.564**											
3. H-I composite ages 2-3	731	1.23 (.37)	.511**	.607**										
4. INATT composite ages 2-3	731	1.01 (.34)	.356**	.479**	.620**									
5. AGG composite ages 4-5	656	.454 (.31)	.678**	.442**	.446**	.317**								
6. OPP composite ages 4-5	656	1.04 (.41)	.494**	.661**	.467**	.355**	.639**							
7. H-I composite ages 4-5	656	1.14 (.46)	.344**	.412**	.614**	.499**	.509**	.573**						
8. INATT composite ages 4-5	656	1.02 (.42)	.323**	.366**	.497**	.575**	.493**	.530**	.744**					
9. Parental Involvement ages 4-5	625	2.24 (.77)	-.060	-.002	-.109**	.015	-.095*	-.019	-.066	.003				
10. W-III: Letter Word Identification	490	36.27 (9.25)	-.123**	-.035	-.076	-.048	-.129**	-.098*	-.055	-.096*	.133**			
11. W-III: Calculation	494	8.29 (3.03)	-.054	-.027	-.068	-.010	-.061	-.053	-.080	-.107*	.104*	.585**		
12. W-III: Spelling	483	22.68 (5.09)	-.084	-.020	-.054	-.043	-.129**	-.093	-.070	-.088	.158**	.838**	.560**	
13. W-III: Academic Skills	479	100.69 (14.71)	-.093*	-.023	-.090*	-.045	-.124**	-.077	-.067	-.093*	.137**	.928**	.718**	.893**

** . Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed).

6.3 1B. INDEPENDENT ASSOCIATIONS BETWEEN EARLY COMPONENTS OF EXTERNALIZING AND SCHOOL-AGE ACADEMIC ACHIEVEMENT

To assess the independent contribution of dimensions of early externalizing behaviors and later academic achievement, a multiple regression analysis was utilized in which the age 7.5 W-J Academic Skills score was regressed simultaneously on the age 2-3 INATT, H-I, AGG, and OPP composites. The results demonstrated that, when examined in a multivariate framework, none of the age 2-3 externalizing behaviors were significantly associated with the Academic Skills composite at age 7.5. However, there was a modest trend-level relationship between age 2-3 AGG and overall Academic Skills ($\beta = -.093, p < .10$). Follow-up analyses between age 2-3 INATT, H-I, AGG, and OPP composites and subscales of the W-J demonstrated that there was only one other significant relationship between early externalizing variables and individual W-J subtests, that between age 2-3 AGG and Letter-Word Identification ($\beta = -.143, p < .05$). There was also a trend between age 2-3 AGG and Spelling ($\beta = -.101, p < .10$).

All multiple regressions were then re-analyzed initially entering child gender, child race/ethnicity, parental education, and family income as covariates. Detailed results are presented in Tables 3 through 6. As Table 4 demonstrates, once child and family demographic variables were accounted for, including a significant association for primary caregiver educational attainment ($\beta = .127, p < .01$) and monthly household income ($\beta = .113, p < .05$), only the relationship between age 2-3 AGG and the age 7.5 Letter-Word Identification subtest

remained significant ($\beta = -.117, p < .05$). In addition, R^2 change statistics revealed that, after accounting for covariates, the inclusion of externalizing behavior dimensions as a group in the regression models did not contribute significant variance to the age 7.5 W-J scores (R^2 change values between .003 and .011). In some cases, although no externalizing behaviors were significant, age 2 primary caregiver education level, monthly household income, and child gender emerged (i.e., being female was associated with higher Calculation and Spelling scores) as significant predictors in expected directions (e.g., higher income and education related to higher W-J scores) of academic performance at age 7.5. In summary, contrary to hypothesis 1b, no age 2-3 externalizing behaviors were significantly related to the overall Academic Skills outcome. Furthermore, only early aggression rather than inattention or hyperactivity/impulsivity (or oppositionality) was significantly associated with lower Letter-Word Identification at school-age.

Table 3. Multivariate Results of Externalizing Variables Predicting Overall Academic Skills

Variable	B	Std. Error	β
Child gender (Female = 1)	2.361	1.356	.081
PC education level	1.767	.611	.135**
PC gross monthly income	.715	.363	.094*
Minority status	-.859	1.397	-.029
AGG age 2-3	-3.151	2.758	-.067
OPP age 2-3	1.870	2.879	.043
H-I age 2-3	-1.642	2.755	-.042
INATT age 2-3	-.337	2.682	-.008

* $p < .05$, ** $p < .01$

Table 4. Multivariate Results of Externalizing Variables Predicting Letter-Word Identification

Variable	B	Std. Error	β
Child gender (Female = 1)	.602	.852	.033
PC education level	1.048	.381	.127**
PC gross monthly income	.547	.229	.113*
Minority status	-.527	.881	-.028
AGG age 2-3	-3.517	1.742	-.117*
OPP age 2-3	1.140	1.812	.041
H-I age 2-3	.141	1.744	.006
INATT age 2-3	-.682	1.693	-.024

* $p < .05$, ** $p < .01$

Table 5. Multivariate Results of Externalizing Variables Predicting Calculation

Variable	B	Std. Error	β
Child gender (Female = 1)	.571	.282	.095*
PC education level	.088	.126	.033
PC gross monthly income	.062	.076	.039
Minority status	-.008	.291	-.001
AGG age 2-3	-.263	.577	-.027
OPP age 2-3	.084	.599	.009
H-I age 2-3	-.533	.578	-.066
INATT age 2-3	.403	.560	.044

* $p < .05$, ** $p < .01$

Table 6. Multivariate Results of Externalizing Variables Predicting Spelling

Variable	B	Std. Error	β
Child gender (Female = 1)	1.467	.473	.144**
PC education level	.457	.213	.100*
PC gross monthly income	.290	.126	.109*
Minority status	-.055	.487	-.005
AGG age 2-3	-1.061	.965	-.064
OPP age 2-3	.272	1.003	.018
H-I age 2-3	.566	.963	.042
INATT age 2-3	-.616	.936	-.040

* $p < .05$, ** $p < .01$

6.4 2. INDIRECT EFFECT OF EARLY AGGRESSION/OPPOSITIONAL BEHAVIOR ON LATER ACADEMIC ACHIEVEMENT

To test the hypothesis that the association between AGG and later academic achievement and OPP and academic achievement would be mediated by INATT and/or H-I, the following steps, recommended by Baron & Kenny (1986), were applied: 1) age 7.5 Academic Skills was regressed onto the age 2-3 AGG score, 2) age 4-5 INATT score was regressed onto age 2-3 AGG score, and 3) age 7.5 Academic Skills was regressed on to the age 2-3 AGG score and the age 4-5 INATT score, simultaneously. The same procedure was repeated replacing the age 4-5 INATT score with the age 4-5 H-I score. The indirect or mediating effects of INATT and H-I were then tested using Sobel's (1982) product of coefficients test. Finally, to ensure the specificity of

findings with respect to directionality, all possible reverse combinations of externalizing behaviors, including the ages at which they were assessed, were analyzed (i.e., age 2-3 AGG was replaced with age 2-3 INATT and age 4-5 INATT was replaced with age 4-5 AGG).

The results demonstrated that neither INATT nor H-I at age 4-5 accounted for the relationship between age 2-3 AGG and overall Academic Skills at school-age. Subsequent analyses with W-J subtests revealed a significant indirect effect of age 2-3 AGG through age 4-5 INATT on Calculation at age 7.5 (Sobel z -statistic = -1.98, $p < .05$). This effect, however, became a trend after covarying for child gender, child race/ethnicity, primary caregiver education, and family income (Sobel z -statistic = -1.75, $p < .10$). Further analyses with other combinations of externalizing behaviors revealed multiple indirect effects on W-J outcomes, primarily through age 4-5 AGG. It should be noted that in bivariate correlations between age 4-5 externalizing behaviors and age 7.5 academic achievement scores, age 4-5 AGG and INATT were each correlated with three school-age achievement outcomes compared to one correlation for OPP and zero for H-I. Thus, it was more likely significant indirect effects would be observed through aggression and inattention than through oppositionality or hyperactivity/impulsivity, as the latter were largely unrelated to age 7.5 academic achievement scores. Of 12 possible indirect effects tested for each externalizing behavior composite at age 4-5, nine were significant through age 4-5 AGG while only one was significant through any other dimension of externalizing, age 4-5 OPP. Indirect effects through age 4-5 INATT and H-I were not significant. Of the 38 indirect effect pathways that were not significant, the “a” path between the independent variable and mediating variable was significant in every case, while the “b” path between the mediator and dependent variable was never significant. Thus, when indirect effects of toddler-age externalizing dimensions on school-age academic achievement were not observed, it was due to

the lack of association between the dimension of preschool-age externalizing behavior and the school-age achievement score. In summary, the vast majority of results do not support the hypothesis that the effects of early aggression and oppositionality on later academic outcomes are accounted for by ADHD behaviors (inattention and hyperactivity/impulsivity). However, the results demonstrated that there are indirect pathways between different types of externalizing problem behavior at age 2-3 and school-age academic achievement that are primarily accounted for by levels of age 4-5 aggressive behavior.

6.5 3. MODERATING EFFECT OF INVOLVEMENT ON BEHAVIOR- ACHIEVEMENT ASSOCIATION

To examine the hypothesis that parental involvement would moderate the association between early externalizing behaviors and later academic achievement, hierarchical multiple regression analyses were computed in which the age 7.5 Academic Skills score was regressed onto either the age 2-3 INATT, H-I, AGG, or OPP score, age 4-5 Parental Involvement, and the interaction term between either INATT, H-I, AGG, or OPP and Parental Involvement. Independent variables were centered before interaction terms were created.

Findings showed that there were no significant interactions between any of the early externalizing variables and Parental Involvement at age 4-5 for academic outcomes at age 7.5. Thus, contrary to expectations, the relationships between age 2-3 externalizing behaviors and later academic performance do not appear to differ by level of parental involvement.

**6.6 4. HIGHER LEVELS OF PARENTAL INVOLVEMENT FOR FAMILIES
IN THE INTERVENTION GROUP**

To test the hypothesis that levels of parental involvement would be greater for those families in the intervention group, a simple regression analysis was computed in which the dummy coded intervention variable was used to predict age 4-5 Parental Involvement. Contrary to hypotheses, results demonstrated that Parental Involvement at age 4-5 did not significantly differ for those in the treatment and control groups.

7.0 DISCUSSION

Based upon the extant literature and theory it was expected that ADHD behaviors, namely inattention and, to a lesser extent, hyperactivity/impulsivity at age 2-3 would be significantly negatively associated with school-age academic achievement. Furthermore, it was expected that inattention and to a lesser extent, hyperactivity/impulsivity assessed at ages 4-5, would mediate direct pathways between toddler-age oppositional and aggressive behavior and school-age academic achievement. However, the findings demonstrated that age 2-3 aggression was more consistently associated age 7.5 academic performance than inattention or hyperactivity, albeit modestly. In addition, mediation analyses revealed that none of the relationships between early aggression and school-age academic performance were significantly mediated by age 4-5 inattention or hyperactivity/impulsivity. On the other hand, several indirect associations were found on school-age academic achievement involving age 2-3 oppositionality, inattention, and hyperactivity/impulsivity, and age 4-5 composites of disruptive behavior (10 of 48 were significant). Nine of the ten significant indirect effects occurred through age 4-5 aggression (75% of possible indirect associations through age 4-5 aggression were significant), while the remaining indirect effect occurred through age 4-5 OPP.

Although it was also expected that higher levels of parental involvement would attenuate relationships between early dimensions of externalizing and age 7.5 academic achievement, the findings did not support this hypothesis. Hierarchical multiple regression analyses of age 2-3

externalizing behaviors, age 4-5 parental involvement, and age 7.5 academic achievement demonstrated that the relationships between early aggression, oppositionality, hyperactivity/impulsivity, inattention, and academics did not differ by level of parental involvement. In addition, intervention group status was unrelated to levels of parental involvement at ages 4-5.

7.1 DIRECT PATHWAYS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND SCHOOL-AGE ACADEMIC ACHIEVEMENT

In both univariate and multivariate analyses, age 2-3 aggression emerged as a significant predictor of age 7.5 academic performance. Specifically, levels of aggression at age 2-3 were significantly negatively, albeit modestly, correlated with scores in Spelling, Letter-Word Identification, and overall Academic Skills at school-age. Moreover, age 2-3 aggression continued to be a significant predictor of age 7.5 Letter-Word Identification after accounting for other early externalizing factors and demographic characteristics. The findings suggest that during the toddler period, aggressive behavior might be a more reliable predictor of later academic achievement than other forms of early disruptive behavior, including inattention and hyperactivity/impulsivity. A potential explanation for this finding is that aggression might be more reliable than inattention or hyperactivity/impulsivity when these dimensions are assessed at age 2-3. The reliability of toddler-age aggression has been previously demonstrated by longitudinal research in both community and at-risk samples (Shaw et al., 2000; Tremblay et al., 2005). For example, Tremblay and colleagues' research with a nationally representative Canadian sample has shown that, while a majority of children exhibited moderate levels of

aggression that declined throughout childhood, a subset of children with the highest levels of physical aggression at age 2 were likely to be the same children exhibiting physical aggression into pre-adolescence (Cote, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006). In contrast, many studies examining inattention and hyperactivity/impulsivity longitudinally do not begin until children are of school-age (Lee et al., 2008; Massetti et al., 2008). Perhaps one reason for this is that it is difficult to gauge behaviors related to activity and sustained attention before children are placed in situations requiring such behavior (i.e., school). Indeed, Campbell (2002) noted that a significant proportion of parents of preschoolers in epidemiological and community samples rate their children as having problematic levels of ADHD-like behaviors.

In addition, it is possible that aggression in toddlerhood is more likely to compromise other domains of functioning (e.g., instrumental functioning) than inattention, oppositionality, and hyperactivity/impulsivity when measured at the same age. One explanation for this finding might be the relatively extreme nature of many behaviors captured by the aggression composite at age 2-3 (versus those included in the other three externalizing factors, e.g., physical cruelty to people vs. being easily distracted for the inattention factor), which likely has broader implications than items included on the other disruptive factors for socioemotional domains at school-age that are not specific to academic achievement (e.g., social skills). This explanation would be consistent with the findings of Campbell et al. (2006), which demonstrated that persistent and high trajectories of aggression are associated with aspects of social and emotional functioning in middle school, in addition to being related to academic achievement outcomes at the same age. Moreover, follow-up regression analyses conducted on the current sample between age 2-3 externalizing dimensions and age 7.5 teacher-rated factors from the Achenbach Teacher Report Form (TRF; Achenbach & Rescorla, 2001) scores revealed that preschool-age aggression

was significantly associated with the greatest number of TRF internalizing and externalizing factors at age 7.5 (i.e., aggression was significantly related to four narrow-band TRF factors vs. hyperactivity/impulsivity and inattention, which were each associated with one). In addition, multivariate regressions between age 2-3 externalizing dimensions and aftercare provider ratings on the Social Skills Rating Scale (Gresham & Elliot, 1990) at age 7.5 revealed that age 2-3 aggression was again the externalizing behavior significantly related to the greatest number of outcomes (e.g., higher aggression at 2-3 was associated in expected directions with Cooperation, Assertion, and Self Control at age 7.5 while only one other behavior, age 2-3 inattention, was associated with age 7.5 Assertion). Thus, it seems that when aggression, oppositionality, inattention, and hyperactivity/impulsivity are measured at age 2-3, aggression might be the more reliable predictor of several dimensions of academic and socioemotional functioning at school-age.

Despite the presence of similar levels of oppositional behavior and aggression on the CBCL at age 2, age 2-3 oppositionality was, as expected, not significantly related to the overall Academic Skills composite or any of the subscales of the W-J. In addition, contrary to a large literature connecting ADHD behaviors and academic performance, hyperactivity/impulsivity at age 2-3 was only modestly related to age 7.5 overall Academic Skills. Moreover, once analyzed in a multivariate framework, the relationship between hyperactivity/impulsivity and school-age achievement was no longer evident. A similar pattern was observed for the relationship between age 2-3 inattention and age 7.5 academic achievement. Contrary to expectations, early inattention was not related to W-J performance at school-age. The findings suggest that hyperactivity/impulsivity and inattention, at least assessed as early as age 2-3, may not be reliable indicators of future academic achievement. Perhaps, as stated above and previously by

others, caregivers' perceptions of hyperactivity/impulsivity and inattention in their 2-to-3-year-old children are difficult to differentiate from age-appropriate behaviors and therefore relatively unreliable (APA, 2000; Campbell, 2002), particularly in relation to caregivers' ratings of aggression at the same age.

7.2 INDIRECT PATHWAYS BETWEEN EARLY EXTERNALIZING BEHAVIORS AND SCHOOL-AGE ACADEMIC ACHIEVEMENT

Although it was hypothesized that associations between early aggression and oppositionality and school-age academic achievement would be accounted for by ADHD behaviors, a different pattern of findings emerged. The results showed that age 2-3 oppositionality, hyperactivity/impulsivity, and inattention were most consistently indirectly associated with age 7.5 W-J performance through their relationships with age 4-5 aggression (i.e., nine of 12 possible indirect pathways significant). Only one out of the other 36 indirect pathways analyzed was significant, which was through age 4-5 OPP. One explanation for the number of significant indirect paths could be the high magnitude of correlations between externalizing behaviors at ages 2-3 and 4-5 (i.e., all age 2-3 externalizing behaviors were significantly related to all age 4-5 externalizing behaviors).

While overlapping variances may provide a partial explanation for understanding the relationship between externalizing behaviors at ages 2-3 and 4-5, the findings related to age 4-5 aggression and age 7.5 academic achievement are still informative because aggression continued to be a significant predictor of school-age academic achievement at age 4-5. The continuity in the aggression-achievement relationship at ages 2-3 and 4-5 could be seen as further support of

the aforementioned theory that age 2-3 aggression is a more reliable predictor of school-age academic achievement and other dimensions of child functioning than other measures of disruptive behavior in toddlerhood. In conclusion, the results showed that early externalizing behaviors were often indirectly associated with academic achievement at school-age, but only by way of their relationships with aggression at age 4-5. The findings are consistent with the notion that caregiver perceptions of aggression at age 2-3 are more reliable measures of later academic functioning than caregiver perceptions of inattention and hyperactivity/impulsivity (or oppositionality) at that age.

7.3 PARENTING AND ACADEMIC ACHIEVEMENT

In contrast with this study's hypotheses, a measure of parental involvement at age 4-5 neither moderated the relationship between externalizing problems at 2-3 and academic achievement at 7.5 nor was it significantly predicted by intervention group status, although direct effects of parental involvement in the expected direction (i.e., higher parental involvement scores associated with higher W-J Spelling scores at 7.5) were observed. Perhaps global examiner ratings of involvement in the home are not sufficient to capture the combination of parenting qualities that would be important in attenuating the externalizing-achievement relationship (Grolnick & Slowiaczek, 1994; Jeynes, 2007). Previous longitudinal research with this sample has shown a link between a parenting measure encompassing both involvement and additional aspects of parenting quality (e.g., proactivity, responsivity) and improvements in both preschool-age externalizing behavior and language development (Dishion et al., 2008; Lunkenheimer et al., 2008). Thus, it is possible that a more comprehensive assessment of parenting would be

necessary to observe its hypothesized protective effects on the relationship between early behavior problems and school-age academic achievement. Unfortunately, coding of these additional observations of parenting are still ongoing and will likely not be completed for another year, but could be investigated once complete.

Additionally, this study did not find an intervention effect on level of parental involvement at age 4-5, despite the fact that intervention families had the opportunity to receive two or three doses of the intervention by the time parental involvement was assessed at ages 4 and 5, respectively. The lack of association between FCU group status and parental involvement is in contrast to prior findings demonstrating an increase in parental involvement for those assigned to the same intervention with a pilot sample using the same measure to assess involvement as the current study (Shaw et al., 2006) and another study with this sample showing improvements on a global measure of parenting, which included parental involvement, for those in the intervention group (Dishion et al., 2008). While it is possible that the intervention failed to influence parental involvement directly, it is also plausible that the results would differ if intervention participation were taken into account. That is, differentiating families within the intervention group by those who did and did not participate in annual family check-ups at child ages 2, 3, 4, and/or 5 might result in a more realistic evaluation of intervention effects on parental involvement. In fact, a recent follow-up of intervention effects indicates a reduction in child disruptive behaviors at age 5 comparing families (42.5%) who participated in the FCU at ages 2, 3, and 4 in comparison to those who participated in two or fewer annual family check-ups (i.e., defined by having at least a check-in and feedback session each year; Dishion et al., submitted). Thus, it is possible that a comparable re-analysis of intervention effects on parental

involvement comparing engagers to nonengagers might yield similar results as was found for reductions in child disruptive behavior.

7.4 LIMITATIONS

In addition to this project's numerous methodological strengths, which included a longitudinal prospective design following a high-risk, low-SES sample from early childhood, this study also had several noteworthy limitations. First, child intelligence was not assessed in early childhood. This is an issue because previous work has established a link between both verbal and performance dimensions of IQ in early childhood and later externalizing problems (Hinshaw, 1992), and between early intellectual abilities and later academic achievement (Kaplan, 1996). It has been postulated that depressed IQ underlies the externalizing-achievement relationship (Hinshaw, 1992). Unfortunately, as IQ was not assessed during early childhood, it is not possible to rule out child intelligence as a possible confounding factor underlying associations between dimensions of toddler-age externalizing problem behavior and school-age academic achievement. However, prior research has demonstrated that associations between school-age externalizing behaviors and subsequent school-age academic achievement remain evident after accounting for child IQ (Rappport et al., 1999; Tremblay et al., 1992).

Second, at the age 5 assessment the 1 ½-5-year-old CBCL measure was replaced with the 6-18-year-old version, which resulted in a loss of items from all externalizing behavior composites. As a result, it was not possible to utilize identical composites at ages 2-3 and 4-5. Instead, the age 4-5 externalizing composites consisted of only those items that appeared on both the preschool-age and school-age versions of the CBCL (i.e., items that were not included on the

6-18-year-old form were not included in the age 4-5 composites). However, the decrease in item numbers did not appear to adversely affect the internal consistencies of externalizing behavior composites at age 4-5 (e.g., Cronbach's alpha values between .71 and .90).

Third, content overlap between CBCL and ECBI items was greater for the aggression composites than the other measures of externalizing behavior (e.g., at age 2-3, four items from the CBCL and ECBI assessed the same symptom of aggression vs. three for oppositional, two for inattention, and zero for hyperactivity/impulsivity), which could have artificially inflated the internal consistencies of the aggression measures. However, as Table 2 demonstrates, the Cronbach's alpha values for aggression were not significantly higher than the values of the other three externalizing behavior dimensions.

Fourth, academic achievement was measured through a standardized achievement test administered by project examiners. While the W-J is a well-validated assessment of academic achievement (McGrew & Woodcock, 2001), it is possible that a child's performance on this measure would not translate to the classroom or to other standardized achievement tests administered in the school setting. To corroborate the relationship between W-J performance and actual school performance, it would be important to also examine school grades, absences, and standardized test scores administered at school. Such information might elucidate additional mechanisms that could be interfering with child functioning, particularly for children who apparently possess adequate academic skills but do not carry them over to the school setting.

Finally, the sample used in this study was recruited for being at an elevated risk of developing externalizing behavior problems based upon parent-report questionnaires when the children were 2 years old. Although it is crucial to study the relationship between child externalizing behaviors and school-age academic achievement in a population at high-risk of experiencing difficulties in

both domains, in part because it is a population likely to benefit greatly from intervention (Brooks-Gunn & Duncan, 1997), it is also important to note that these findings may not generalize to other lower-risk samples. For example, the relationships between early dimensions of behavior problems and later academic achievement could play out differently for children whose families have greater economic and psychosocial resources to draw upon. However, longitudinal research with community samples from predominantly middle-class families has revealed similar associations between early externalizing behaviors and school-age academic achievement (Bub et al., 2007; Campbell et al., 2006), suggesting that these results could be applicable to the broader population.

7.5 CLINICAL AND SOCIAL POLICY IMPLICATIONS AND FUTURE DIRECTIONS

This study builds upon what is known of the relationship between preschool-age externalizing behavior problems and school-age academic achievement by extending this link to toddlerhood. The results not only fill a gap in the literature pertaining to the predictive utility of toddler-age behavior problems for school-age academic achievement but also reveal unique associations between different dimensions of externalizing behaviors at this age and later academic achievement in an at-risk, albeit nonclinical, sample. The findings have potential clinical implications for which children could be targeted for intervention programs as early as age 2. Specifically, the results suggest that when aggression, oppositionality, inattention, and hyperactivity/impulsivity are assessed at ages 2 and 3, aggression might be the more reliable indicator (albeit modest) of future school-age academic achievement. In contrast, as others have

argued (APA, 2000; Campbell, 2002), caregiver perceptions of toddlers' ADHD-like behaviors appear to be relatively unreliable at ages 2-3, at least in relation to later academic achievement. Such findings have significant implications for prevention and intervention programs designed to target young children at risk for later academic, and potentially socioemotional, difficulties. Namely, early academic intervention programs would be served best by screening toddlers based upon caregivers' perceptions of aggression, rather than oppositionality, inattention, or hyperactivity/impulsivity. Furthermore, child and family demographic variables such as male gender, primary caregiver education level, and monthly household income should be taken into account when policymakers are considering factors that may confer risk for lower academic achievement at school-age. In summary, the results of this study suggest that early academic intervention programs could benefit by targeting aggressive toddlers, particularly males whose caregivers are of lower socioeconomic status.

Future studies should examine whether the predictive utility of age 2-3 aggression is limited to academic achievement or if it is a better predictor of overall socioemotional functioning at school-age than other externalizing dimensions in toddlerhood. In addition, it is possible that specific combinations of externalizing behaviors (e.g., aggression and hyperactivity) in toddlers would have a uniquely detrimental effect on school-age academic achievement and other socioemotional domains. Other researchers have found that young children who exhibit patterns of disruptive behavior with co-occurring symptoms are at high risk of experiencing long-term adjustment difficulties (Campbell et al., 2000). Thus, it is plausible that examining interactions between dimensions of early externalizing behaviors would lead to increased predictive utility of toddler-age disruptive behaviors for school-age functioning.

Lastly, although this study did not demonstrate a link between parental involvement and the externalizing-achievement relationship, future work should evaluate whether other proximal factors, including other dimensions of parenting (e.g., proactive parenting), could play a protective role in the relationship between toddler-age behavior problems and school-age academic achievement.

APPENDIX

DSM-IV-BASED EXTERNALIZING FACTORS

Table 7. DSM-IV-based Externalizing Behavior Factors

Factor	DSM-IV-TR Criteria	CBCL 1 ½ to 5 (6-18)	ECBI
Hyperactivity/ Impulsivity			
	Fidgets with hands or feet or squirms in seat		#35 – overactive/ restless
	Leaves seat in classroom or in other situations	#6 (#10) – can’t sit still	
	“On the go” or acts as if “driven by a motor”	#36 - gets into everything	
	Difficulty awaiting turn	#8 – can’t stand waiting	
	Interrupts/intrudes on others (butts into conversations)		#29 – interrupts

Table 7 (continued)

Factor	DSM-IV-TR Criteria	CBCL 1 ½ to 5 (6-18)	ECBI
Inattention			
	Difficulty sustaining attention in tasks/activities	#5 (#8) – can't concentrate	#31 – short attention span
	Does not seem to listen when spoken to directly	#23 – doesn't answer when spoken to	
	Does not follow through on instructions/finish tasks		#32 – fails to finish tasks/projects
	Avoids/dislikes tasks that require sustained mental effort	#59 – quickly shifts from one activity to another	#34 – difficulty concentrating on one thing
	Easily distracted by extraneous stimuli		#30 – is easily distracted
Aggression			
	Often bullies, threatens, intimidates		#23 – teases or provokes
	Initiates physical fights	#35 (#37) – gets in many fights	#26 – physically fights with friends
		#53 (#57) – physically attacks people	#27 – physically fights with sibs
	Physically cruel to people	#40 – hits others	#18 – hits parents
	Physically cruel to animals	#14 (#15) – cruel to animals	

Table 7 (continued)

Factor	DSM-IV-TR Criteria	CBCL 1 ½ to 5 (6-18)	ECBI
Oppositional			
	Often loses temper	#85 (#95) – Temper tantrums or hot temper	#13 – Temper tantrums
	Often argues with adults		# 11 – Argues with parents about rules #14 – Sassses adults
	Often actively defies/refuses to comply with adults’ requests or rules	#15 (#28) – Defiant #20 (#22) – Disobedient #88 – Uncooperative	#10 – Acts defiant when told to do something
	Often touchy or easily annoyed	#29 – Easily frustrated	
	Often angry and resentful	#44 – Angry moods	#12 – Angry when doesn’t get own way

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