2013

Predictability of ADHD Behavioral Symptoms: A Follow-Up Examination in At-Risk Preschool Children

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Predictability of ADHD Behavioral Symptoms:

A Follow-Up Examination in At-Risk Preschool Children

by

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Presented to the Graduate and Research Committee of

Lehigh University in Candidacy for the Degree of Doctor of Philosophy in School Psychology

Lehigh University

June 4, 2013

Certificate of Approval
Approved and recommended for acceptance as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Acknowledgements

I would first and foremost like to thank my advisor, Dr. Edward Shapiro for his patience and support and mentorship during this journey. His expertise coupled with his encouragement over the years has helped me to achieve this dream during some of the most difficult years of my life. Thank you for never giving up on me! I would also like to thank my committee, Dr. DuPaul, Dr. Kern and Dr. Manz for their support and guidance through the years.

To the members of my cohort and "honorary cohort members" (Clarissa Henry Adekanbi, Milena Keller Margolis, Catherine Kunsch, Ebony Holliday, Lauren Dullum Moulton, Ravit Stein and Charles Barrett), you guys are truly the best. Thank you all for helping to hold my hand and encourage me to keep my eyes on the prize.

I would especially like to express heartfelt thanks to my family and friends who walked with me and supported me on this journey, especially my grandparents Allan and Myra Mullgrav and my aunt Donna Jackson Field. Thank you guys for helping me to keep going even when I thought I couldn't. I could have never gotten through any of this or accomplished so much in life without your guidance and support. Hezerlene Mullgrav is watching down smiling as you all help guide me through the way she would have. To my siblings, let this be an example that no matter what you go through or where you come from, you can achieve anything you want if you work hard enough. I'd also like to thank my husband, Ra Nyantee Tiah. We've endured some tough times on this journey, but together, with God and by faith, we can do great things. Thank you for believing in me when I did not believe in myself and making sacrifices to help me achieve my goal. This dissertation is dedicated to my grandfather, Allan L. Mullgrav Jr., and my sister, Amina Andrea Miller, who looked fear in the face every day and never let it hold her back.

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Abstract

Students with emotional behavioral problems, particularly those with Attention Deficit Hyperactivity Disorder (ADHD), experience a variety of difficulties in the areas of academic achievement and educational outcomes. As early as preschool, difficulties in the attainment of pre-academic skills and appropriate behavioral control are evident. The purpose of the present study was to identify whether there is a point in time at which academic achievement measures and ADHD symptoms become significantly correlated in a sample of preschool children identified as at-risk for ADHD who also received intervention. Correlation and hierarchical multiple regression analyses across three time points found parent ratings of social skills and direct observation variables were moderately correlated with measures of early reading and readiness skills. In addition, these variables best predicted performance on measures of early reading and readiness skills. Support for the hypotheses that differences would be found in the strength of the relationships between the variables as time increased and ADHD symptom variables would account for the greatest amount of variance in the prediction of academic achievement variables over time was not found.

Predictability of ADHD Behavioral Symptoms:

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The term emotional behavioral problem describes an array of difficulties experienced by children who may exhibit problems with emotion, behavior, or a combination of both (Kaufman, 2005). In the year 2010, approximately 4% of children in the United States between the ages of 4 to 7 were reported by a parent to experience serious or minor difficulty with emotions, concentration, behavior or social skills (Federal Interagency Forum on Child and Family Statistics, 2012). Children with emotional behavioral problems have been found to evidence poorer outcomes than students in other disability categories in the areas of education, employment, and social relationships, both within school and subsequent to schooling (Jolivette, Stichter, Nelson, Scott, & Liaupsin, 2000; New Freedom Commission on Mental Health, 2003).

Emotional behavioral problems are prevalent even among children of preschool age. Disparities in prevalence rates were examined by Feil and colleagues (2005) in a large, diverse, at risk sample of children enrolled in Head Start settings. Results revealed prevalence rates to vary depending upon the measures, informant type and cut-off points used. Rates ranged from as low as 1% to as high as 38% (Feil, Small, Forness, Serna, Kaiser, & Hancock et al., 2005). A review of common emotional behavioral problems in preschool children by Egger and Angold (2006) reported the prevalence rates of any disorder type across four studies including non-referred samples to range from 14% to 26.4%. The variation in the aforementioned rates is due, in part, to differences in the definitions, diagnostic criteria and methodology used in defining and diagnosing disorders (Egger, Kondo, & Angold, 2006). Consequently, the examination of E/BD's within preschool age children can be challenging. Nevertheless, these data show that children experience emotional behavioral problems as early as preschool and that such children

are placed at risk for future difficulties in functioning. Given such data, this is an important area to examine in order to improve future outcomes for such children. One particularly prevalent emotional behavioral problem children experience is Attention Deficit/ Hyperactivity Disorder (ADHD).

ADHD: Definition, Prevalence, Comorbidity and Outcome

ADHD is defined as a developmental disorder characterized by a persistent pattern of inattention and/or hyperactivity, impulse control, forgetfulness and distractibility (American Psychological Association, 2000). Estimates for ADHD in school-age children have been reported to range between 3% and 7% (American Psychological Association, 2000). In order to meet criteria for a diagnosis of ADHD, according to the Diagnostic and Statistical Manual of Mental of Disorders, 4th ed., text Revision: (DSM-IV-TR), six or more symptoms of either inattention or hyperactivity must be present for at least 6 months and to a degree that is disruptive and developmentally inappropriate (American Psychiatric Association, 2000). Aside from the requirement that age of onset for the hyperactive impulsive subtype occur prior to age 7, little descriptive information on ADHD in the preschool age population is discussed in the DSM-IV-TR manual (Connor, Edwards, Fletcher, Baird, Barkley, & Steingard, 2003). Despite this lack of detail and guidance specified in the latest version DSM-IV manual on symptom presentation in preschool children, impairment in this age group due to ADHD is evident given the aforementioned prevalence rates.

Research to date has indicated ADHD to be a chronic disorder, typically diagnosed in childhood and often persisting into adulthood (Barkley, 2006). Studies have also suggested 35% to 80% of those diagnosed with ADHD in childhood continue to experience difficulties related to the disorder into adolescence (Barkley et al., 1990; Hinshaw, 2002). It often results in functional

impairment in many areas of life including home, school, work and interpersonal relationships (American Psychological Association, 2000). Follow-up studies of children with ADHD have indicated that by adulthood, such children have had less education, achieved lower grades, failed more courses, were retained more frequently, failed to graduate more often, and received education services more often than peers in control groups (Barkley et al., 2006; DeShazo Barry, Lyman, & Klinger, 2002; Mannuzza et al., 1993, 1997; Weiss & Hechtman, 1993).

In addition to impairment in functioning, comorbidity is also common, with reports of almost one-third children with ADHD also having more than one other condition (Centers for Disease Control, 2011; National Institute of Mental Health, 2012). Many of the co-occurring conditions include other emotional behavioral problems such as oppositional defiant disorder, conduct disorder, anxiety and depressive disorders often (Baxter, 2000; National Institute of Mental Health, 2003).

According to a study examining data from the 2007 National Survey of Children's Health, 46% of children with ADHD were reported by their parents to also have a learning disability, 27% also had conduct disorder, 18% also had anxiety disorder, and 14 % also had depression (Larson, Russ, Kahn, & Halfon, 2011). Studies have shown students with ADHD and comorbid internalizing and externalizing disorders to evidence more homework problems than students with ADHD alone according to parental report (Booster, DuPaul, Eiraldi, & Power, 2012). Data on comorbidity of ADHD in the preschool population has been reported in the findings from the Preschool ADHD Treatment Study (PATS) (Posner, Melvin, Murray, Gugga, Fisher & Skrobala, 2007). As much as 70% of their sample exhibited comorbid disorders, with approximately 52% with Oppositional Defiant Disorder, 24.7% with communication disorders and 17.7% with anxiety disorders (Posner et al., 2007). Clearly, the difficulties associated with

ADHD can profoundly impact future outcomes for children. Among the many areas of functioning impacted by ADHD, academic achievement appears to be most concerning and pertinent area to address given the impact difficulties in this area can have on future outcomes (DeShazo Barry, Lyman & Klinger, 2002; DuPaul, 2001; Frick, Kamphaus, Lahey, Loeber, Christ, Hart, & Tannenbaum, 1991; Lonigan et al.; 1999; Lowe & Feldman, 2007: Massetti et al 2008).

Studies have also examined the existence of learning disabilities (LD) among students with ADHD and found that prevalence rates vary depending on the definition used to characterize LD (Frick et al., 1991). When a strict IQ/achievement discrepancy model was used to determine LD, Hinshaw (1992) found only 15 to 20% of students with ADHD had comorbid LD. This percentage was far less than the 50 to 80% overlap found when a looser definition for LD was used. A study by DeShazo Barry and colleagues also examined LD among students with ADHD. Using a discrepancy model that accounted for regression to the mean, 24% of students with ADHD had a comorbid diagnosis of LD. Even when the sample of participants was examined without a diagnosis of LD, students with ADHD continued to score below predicted levels in all academic areas. These data suggest that despite this variation, a substantial amount of the achievement related impairment in students with ADHD is a result of behavioral disruption, poor attention control, and other aspects of ADHD that interfere with academic learning. Hinshaw (1992) also concluded that during the early and middle childhood years, a sizable and important relationship exists between hyperactivity-inattention and underachievement specifically in the area of reading. Similarly, attention problems also have been found to mediate the relationship between academic achievement and an array of problem behaviors in adolescents (Barriga, Doran, Newell, Morrison, Barretti, & Robbins, 2002). These

findings speak to the unique role that difficulty with attention and hyperactivity have on academic performance. Given the long term outcomes of ADHD and the presentation of symptoms at an early age, a body of research is emerging on the presentation of ADHD within the preschool population with the ultimate goal of tailoring areas of prevention and intervention.

ADHD and Preschool-Aged Children

The majority of children diagnosed with ADHD are referred for services during their elementary school years (American Academy of Pediatrics, 2001), and current treatment guidelines and research focus is primarily on the school age child (Connor, 2002; Pelham, 2004). Despite this focus, it has become quite apparent in the literature that preschool-aged children are experiencing difficulties with ADHD as well as other emotional behavioral problems (Egger, Kondo & Agnold, 2006). Prevalence rates for ADHD in preschool children have been reported to range from 2% (as diagnosed by primary care physicians) to as much as 59% among children in clinical samples (Connor, 2002). Such a wide range in rates speaks to the difference in diagnostic methods used across samples and investigators (Connor, 2002; Egger, Kondo &Agnold, 2006). Pelham (2004) reported prevalence rates for ADHD symptoms in this population across studies to range from 2% to 10%. However, the DSM-IV-TR (APA, 2000) states that the age of onset for the hyperactive-impulsive subtype occurs prior to age 7 and literature has documented the diagnosis of ADHD in children of preschool age to be a valid diagnosis (Lahey et al., 1998; Posner et al., 2007). Therefore, it is without question that a large portion of children exhibiting ADHD symptoms can be identified during the preschool ages and these children are at risk for future difficulties in many areas of functioning (Barkley, 1997; Campbell, 1995; Lahey, 1998; Posner et al., 2007), although diagnosis in this age group is challenging (Connor, 2002).

The preschool years are a period of time where children learn the foundational academic, social, and behavioral skills that set the stage for later learning. Children are expected to acquire beginning skills in literacy, math, and language, to pay attention, interact appropriately with teachers and peers, and follow rules. When children don't master these skills, or exhibit behaviors that interfere with the acquisition of academic skills, they are deemed at-risk for future difficulties in later schooling (Spira & Fischel, 2005). Behavioral symptoms of ADHD in children of preschool age present as restlessness, being up and always on the go, acting as if driven by a motor and frequently climbing on things (Barkley, 2006). While many of these behaviors appear to be typical of the average preschool child, such behaviors in the preschool child with ADHD are much more frequent and disruptive. Teachers of such children often report difficulty managing their behavior, and these children are often asked to leave their preschool, placing them at further risk for future academic difficulties (DuPaul et al., 2001; Weyandt, 2007). It is in these early years that achievement difficulties begin for many children for whom ADHD is a concern.

The diagnosis of ADHD during the preschool years is difficult because such behaviors (i.e. inattention, impulsivity, and overactivity) are common for children of this age group (APA, 2000; Connor, 2002; Palfrey, Levine, Walker & Sullivan, 1985; Pelham, 2004; Posner et al, 2007). However, ADHD symptoms have been found to be stable over time and children diagnosed in preschool have been found to continue to experience functioning impairments into elementary school (Lahey, Pelham, Loney, Kipp, Ehrhardt, Lee et al., 2004). Lahey, Pelham, Loney, Lee and Wilcutt (2005) examined the stability of ADHD subtypes over a period of eight years and found that the number of children who met criteria for ADHD declined over time and there was instability in subtype persistence over time. Results of the assessment of the stability

of ADHD in The Preschool Attention-Deficit/Hyperactivity Disorder Treatment Study (PATS) revealed ADHD be stable with high severity and impairment in children with moderate symptoms within this age group (Riddle, Yershova, Lazzaretto, Paykina,Yenokyan, Greenhill et al., 2013). Further examination of the connections between early behavioral symptoms of ADHD and future outcomes, particularly in the area of academic achievement, is imperative. It is therefore important to examine whether difficulties in early learning serve as a discriminating factor in identifying preschool children who display difficulties associated with ADHD and who may grow up and continue to have difficulties associated with the disorder.

While there is a substantial amount of research that supports the connection between ADHD and academic skills in the elementary school aged population (Frick et al., 1991; Hinshaw, 1992), the literature base examining this relationship in the preschool population is developing (Spira & Fischel, 2005). Studies have shown preschool children who exhibit hyperactive and other problem behaviors to evidence poorer reading skills, lower mathematics achievement, lower scores on measures of overall academic achievement, and are more likely to receive special education services than peers (Lahey et al., 1998; MacDonald & Achenbach, 1999; Massetti, Lahey, Pelham, Loney, Ehrhardt, Lee, et al., 2008; Shelton et al., 1998). Existing studies also demonstrate a link between early ADHD symptoms and poor emergent literacy skills (DuPaul, McGoey & VanBrakle, 2001; Felton & Wood, 1992). For example, various authors have posited that ADHD behaviors in the preschool years impede the ability of preschool children to develop early literacy skills, thus placing them at risk for future reading difficulties, although there have been conflicting results regarding this specific relationship (Lonigan, Bloomfield, Anthony, Bacon, Phillips & Samuel, 1999; Velting & Whitehurst, 1997).

There appears to be a changing pattern of symptom presentation in children with ADHD

as they develop. Symptoms of hyperactivity and impulsivity are more common among preschool aged children, while difficulties with attention tend to become more evident during the formal school age years (Barkley, 1998). This changing pattern has implications for academic achievement in the school setting. Research suggests that preschool children with symptoms of ADHD enter elementary school at risk for academic achievement difficulties (DuPaul et al, 2001; Mariana & Barkely, 1997). These children are more likely to be behind their peers in academic readiness skills and exhibit symptoms that impede their readiness to learn (Barkley, 2006; Barkley, Shelton et al., 2002; Mariani & Barkley, 1997; Shelton et al., 1998). Research by Mariani and Barkley (1997) indicated that children with ADHD had more significant delays in the acquisition of basic academic achievement skills (reading and math) compared to community controls. Investigators in this area have called for further examination into the patterns of emotional and behavioral problems that have the most adverse effects on early learning and adjustment of at-risk preschool populations (Fantuzzo, Bulotsky, McDermott, Mosco, & Lutz, 2002). Understanding the ways in which behaviors associated with ADHD impact functioning in various domains, such as academic achievement, can help practitioners to develop interventions targeted for different age groups. Interventions targeted to the preschool age are critical because research suggests that once ADHD symptoms in a preschool age child become severe enough to warrant diagnosis, there is a higher likelihood that their behavior will develop into a persistent disorder (Barkley, Shelton, Crosswait, Moorehouse, Fletcher, Barrett et al., 2002). Additional research is needed to further clarify the impact of ADHD symptoms in preschool and how these symptoms impact academic skills development and achievement.

Given the prevalence of ADHD among preschool and school age children and the characteristic difficulties of the disorder, future difficulties with academic achievement are

evident for many children within this population. It is apparent that such future risk necessitates further exploration into the mechanisms by which early difficulties associated with ADHD impact academic achievement (Spira & Fischel, 2005). This is particularly important within the preschool population where there is often a focus on early intervention.

ADHD and Academic Achievement

For most students with ADHD, entrance into elementary school initiates an array of difficulties both behaviorally and academically. This transitional period, often from preschool/kindergarten to first grade, brings with it demands and expectations different than those in the previous setting (Campbell, 2000). The school environment has been suggested to have the greatest impact on children's ADHD symptoms (Barkley, 2006). It is at this time that students are expected to demonstrate the ability to sit still, attend to the teacher and peers, obey commands, control impulses, cooperate with others, organize things, as well as share and play with peers. These are all behaviors that may prove difficult for the child with ADHD, due to the unique symptoms of the disorder (Barkley, 2006). In addition to the behavioral demands, students in formal school are faced with increased cognitive and academic demands as they move through elementary school, further compounding the difficulty (Barkley, 2006; Campbell, 2000).

Academic underachievement and poor academic performance are some of the most prominent features associated with ADHD, with up to 80% of students with ADHD exhibiting academic difficulties (Barkley, 2006; Cantwell & Baker, 1991; Hinshaw, 1992; Loe & Feldman, 2007). The literature has indicated such students to experience lower grades, have higher rates of significant academic failure, and lower scores on standardized tests than comparison samples (Barkley, DuPaul & McMurray, 1990; Casey Rourke, & Del Dotto, 1996; DuPaul, McGoey,

Eckert & VanBrakle, 2001; Hinshaw, 1992a, 1992b; Mariana & Barkley, 1997; Rapport, Scanlan & Denney 1999). Studies have also shown that the more severe the symptoms of ADHD the more adverse the educational outcomes (DeShazo, Barry, Lyman & Klinger, 2002). Approximately 20 to 25% of children with ADHD are likely to have a reading disability, (Dykman & Ackerman, 1991; McGee & Share, 1988; Semrud-Clikeman, Biederman, Sprich-Buckminster, Lehman, Faraone, & Norman, 1992) which will be the primary academic area within which the present study focuses.

ADHD has been found to be the most common comorbid disorder among children diagnosed with a reading disability with correlations between measures of ADHD and reading ranging from .20 to .40 in school age samples (Willcutt et al, 2001; Wilcutt & Gaffney-Brown, 2004). Importantly, early studies of school age children with ADHD have found children identified as hyperactive in preschool to have poorer reading scores and significantly higher rates of reading disability at age 15 than the other groups (McGee, 1991). In addition, children with inattentive symptoms at first grade showed poorer reading outcomes in fifth grade (Rabiner et al., 2000). Massetti et al (2008) found that children who met modified criteria for ADHD inattentive type had significantly lower reading scores over an 8 year period than comparison children. Those children who met modified criteria for combined and hyperactive impulsive subtypes did not differ significantly on reading scores from comparison children (children were ages 4-6 when first diagnosed with ADHD). This finding speaks to the differences found in the academic difficulties associated with each of the ADHD subtypes. Also of importance in the discussion is the difference in the strength of the relationship between the different subtypes of ADHD symptoms and reading skills as well as the difference in the strength of the relationship between reading ADHD symptoms and specific reading skills.

Willcutt et al., (2007) examined whether reading weaknesses were more strongly associated with inattention than hyperactivity-impulsivity and whether measures of pre-reading skills related differentially to measures of ADHD for a sample preschool children. Findings based on regression analysis revealed that high inattention scores were independently associated with lower scores on all of the prereading measures and hyperactivity-impulsivity scores were not significantly associated with any of the pre-reading measures. Evidence has shown that academic deficits are more strongly associated with inattention symptoms than hyperactivity (Fergusson & Horwood 1995; Massetti et al., 2008; Rabiner et al 2000).

A substantial amount of the achievement-related impairment in students with ADHD is a result of behavioral disruption, poor attention control, and other aspects of ADHD that interfere with academic learning (Hinshaw, 1992a, 1992b). For students with ADHD, academic intervention is often secondary to behavioral intervention, frequently placing these students at further risk for long-term difficulties (Barton-Arwood, Wehby, & Falk, 2005; Wehby, Lane, & Falk, 2003). Given the prevalence of academic difficulties associated with ADHD and the early presence of such behavioral symptoms, the preschool years are to be an important time to examine and intervene.

Preliminary Research

A study by Kern and colleagues (2007) focused on intervening early for preschool age students who were identified as at-risk for ADHD (Kern, DuPaul, Volpe, Sokol, Lutz, Arbolino et al., 2007). Results of this study showed that both children enrolled in a parent education only and those enrolled in parent education plus home and school interventions showed significant improvement in pre-academic skills and behavior (Kern et al, 2007). No differences over time were found between the two groups. A preliminary investigation examining the relationship

between ADHD behaviors and academic achievement in this same sample at the time of study entry (Freeman, Shapiro, & DuPaul, & Kern, 2006) found negligible to low relationships between behavioral measures and academic achievement measures. Little of the variance in achievement in reading-related skills was explained by the behavioral variables specific to ADHD. These results suggested that for this particular sample of children, ADHD behaviors were not strongly related to early academic outcome measures, particularly in the area of reading. In addition, results suggested that ADHD symptoms in preschool may not predict future reading development. These findings are in contrast to previous research results in which elementary-aged children with ADHD exhibited substantial levels of academic skills difficulties (Barkley, DuPaul & McMurray, 1990; Barriga et al., 2002; Casey Rourke, & Del Dotto, 1996; Frick et al., 1991; Hinshaw, 1992; Massetti et al., 2008).

Possible explanations for the findings include the demands of the preschool environment as well as the instructional contexts in which early academic skills are taught. During daycare and preschool, children often learn through play and songs. Some preschool settings have structured environments that are rich in materials and manipulative items to enhance literacy and learning and they may be less structured in the processes and patterns set up to promote literacy and learning (Roskos & Neuman, 2002) but learning does occur through song and play. Such settings may not require children to sit and attend while learning. Many factors contribute to the connection between symptoms of ADHD and early learning for children of preschool age. Despite the results of the preliminary investigation, there may be a later time when the difficulties associated with the disorder and the development of academic skills impact each other.

Several limitations of this preliminary study warrant mention. First, many of the

assessment measures used in the study did not include children of preschool age in their normative sample, making it difficult to make any assumption about the results (American, Education Research Association, 1999). Second, the recommended sample sizes for the analyses were not met for some of the variables examined. This limited the extent to which the study were be able to detect statistically significant results. Third, the ranges of scores on some of the academic achievement measures were restricted due to low performance by some of the participants, making any results related to these measures questionable. The last limitation concerned the use of a stepwise multiple regression technique. This technique relies on statistical significance rather than theory or empirical judgment when deciding which variables to include in the regression equations. This method of entry has a tendency to inflate the value of *R*-squared as well as bias p-values (Muijs, 2004). Given these limitations, the results of the preliminary study should be interpreted with caution.

Research to date has demonstrated a clear relationship between behavior difficulties and academic achievement, particularly for elementary school age children identified with ADHD. The results of the Freeman et al. (2006) study were inconsistent with other existing literature and suggest a need to further examine this area. In order to gain further insight into the relationship between behaviors related to ADHD and academic achievement and its evolution as children progress from preschool to more formal schooling, it is important to examine the longitudinal relationship between these behaviors as early as preschool age and look more closely at how the relationship develops over time. A longitudinal study would add to the existing literature, provide insight into a developmental pathway of academic skills difficulties for children with ADHD, and help to target prevention and intervention efforts for children deemed at risk.

Purpose and Research Questions

The purpose of the present study was to identify whether there is a point in time at which the relationship between academic achievement and behaviors associated with ADHD become significantly more correlated. This relationship was examined in a sample of preschool children identified as at-risk for ADHD, as they progressed through preschool and kindergarten. This study is a follow-up to the preliminary study conducted by Freeman et al. (2006) using the same sample as Kern et al (2007). One of the major differences in the current study was that the relationship was examined at later time points (six months and one year), in order to provide insight into the developmental progression of this relationship over time

This study (a) compared the relationship between behavioral symptoms of ADHD over time in a sample of children in preschool at the time of study entry; (b) and examined differences in the amount of variance in academic achievement accounted for by behavioral outcome measures at the time one, time two, and time three assessment points. More specifically, the present investigation addressed the following two research questions and accompanying hypotheses.

Research question one. Was there a change in the relationship between behavioral outcome measures and academic achievement measures over time for this sample of preschool children? H1: It was hypothesized that the relationship between behavioral outcome measures and academic achievement would be stronger at time three than at time one and time two, possibly indicating a point along the developmental pathway where these two sets of variables became more strongly correlated. Studies examining academic achievement in elementary aged students with ADHD have indicated that these students experience significant academic difficulties, and moderate correlations between behavior and achievement have been reported (Barriga, Doran, Newell, Morrison, Barbetti & Robbins, 2002; Malecki & Elliot, 2002; Massetti

et al., 2008; Rabiner et al., 2000). It was expected that correlation coefficients would progress from the small to moderate range and from non significant to significant across the time point comparisons.

Research question two. Which single or combination of behavioral outcome measures accounted for the greatest amount of variance in the prediction of academic achievement at time three? H2: It was hypothesized that inattention and hyperactive impulsive variables would account for the greatest amount of variance in the prediction of academic achievement variables at time three. Measures of inattention and hyperactivity were expected to be more significantly correlated with measures of academic achievement at the later time points and inattention would emerge as the strongest predictor, followed by hyperactivity (Fergusson & Horwood, 1995; Rabiner, Coie and The Conduct Problems Research Group, 2000; Massetti, Lahey, Pelham, Loney, Ehrhardt, Lee & Kipp, 2008). It was also expected that the reading achievement variables on which participants in the preliminary study performed low and that were excluded from further analysis would emerge as significantly related to the behavioral outcome measures of ADHD (inattention and hyperactivity variables). In the preliminary study, measures of parent and teacher-rated social skills and direct observation data were found to be the best predictors of reading achievement and school reading. However, due to a restricted range in the performance on many of the reading achievement measures examined, some measures were excluded from the regression analysis. These variables were used in the analysis as criterion variables and result in additional predictors beyond those found in the preliminary analysis study.

Chapter Two

Literature Review

Impairments in academic achievement have been noted in the literature as a secondary symptom of ADHD and are well researched in middle childhood and adolescence. Though a secondary symptom, impairment in the area of academic achievement can have long term negative outcomes for children and adolescents who struggle with symptoms of ADHD. Studies to date have primarily examined the relationship between symptoms of ADHD and academic achievement concurrently (at a single time point) or at multiple points in time using correlation analysis, structural equation modeling, or multiple regression techniques (Arnold, 1997; DuPaul et al., 2004; Fergusson & Hoorwood, 1995; Fergusson, Horwood, & Lynskey, 1993; Fergusson Lynskey & Horwood,1997; Lonigan et al., 1999; Rabiner and the Conduct Problems Research Group, 2000; Velting & Whitehurst, 1997). In addition, the samples examined have been children from non-clinical populations and have used teacher ratings of ADHD symptoms and standardized measures of achievement alone in their analyses. Aside from primarily looking at the magnitude of the relationship between measures of ADHD symptoms and academic achievement, investigators have also been interested in how this relationship changes over time, and the predictive power of symptoms of ADHD in accounting for future educational achievement (DuPaul et al., 2004). Results from these studies have been inconsistent depending on the samples examined and the measures used in the analyses. This chapter discusses the theories posited in examining the behavior-academic relationship, reviews studies that have examined this relationship in children from preschool age through adolescence, and discusses these findings as they relate to the present study.

A number of theoretical models have been proposed to explain the development of the relationship between behavior difficulties and academic achievement, particularly in the area of reading. Four general models have been proposed: (1) behavior difficulties occur because of frustration resulting from academic difficulties (academic difficulties precede behavior difficulties), (2) behavior difficulties are a cause of academic difficulties (behavior difficulties precede academic difficulties), (3) behavior difficulties and academic difficulties are neither a cause nor a consequence of each other, but share a common origin, and (4) lastly, there is a bidirectional or transactional relationship between behavioral difficulties and academic achievement (Spira & Fischel, 2005). Of these models, Spira and Fischel (2005) conclude that the model positing that behavior difficulties are a cause of reading difficulties appears to fit well with ADHD symptoms and preschool-aged children. Many studies in this area have examined the role of ADHD symptoms and their relationship to early reading skills, however, the exact reasons or causes for the relationship remain unknown and research findings have had conflicting results.

The Developmental Course/Pathway of ADHD and Academic Achievement

The stability of ADHD symptoms over time has been examined by some studies, looking specifically at whether early ADHD symptoms are still present at later points in time, as well as whether symptoms of ADHD differ depending upon age and maturation (Barkley, 2002; Campbell, 2000; Rapport, Scanlan, & Denney, 1999; Stauffenberg & Campbell, 2007; Willoughby, 2003). Various authors have examined the stability of symptoms from preschool to adulthood and the symptom presentation of the disorder has been found to differ during these two developmental periods (Biederman, Mick & Faraone, 2000; Lahey et al., 2005; Hart, & Loeber, Applegate, & Frick, 1995). Studies in the area of ADHD have begun to examine the

developmental course and/or the developmental pathway of ADHD, in an effort to better understand later outcomes (Sonuga-Barke, Auerbach, Campbell, Daley & Thompson, 2005; Willoughby, 2003). Researches in the fields of developmental psychology and psychopathology have helped provide insight into the developmental progression of ADHD (Campbell, 2000).

Campbell (2000) also discussed the multiple pathways and developmental course of ADHD from a developmental psychopathological perspective and posited that outcomes for children with early signs of ADHD differ depending on the types of symptoms, age of onset, pervasiveness, severity and other risk factors. This perspective on ADHD and its related difficulties seems necessary if progress is to be made in understanding the different developmental pathways that children with such symptoms follow from childhood to adulthood.

This research has provided some clarification on the previous notion that early display of externalizing behavior difficulties in children of preschool age are at times transitory, and that ADHD-related symptoms may dissipate by adolescence (a discontinuity view) (Hinshaw, 1994). Research focusing on this time point can help provide information on differing outcomes of early symptom presentation of ADHD. If it is indeed the case that a set of factors and symptoms is related to differing outcomes, then specific interventions developed for these differing courses of the disorder would be most appropriate. Hinshaw (1994) also suggested refocusing the discussion towards the predictability or coherence of behavior rather than a strict continuity view, given the saliency of developmental changes in those with ADHD across major life periods (e.g. infancy to childhood to adolescence to adulthood).

Given the long-term outcomes of students experiencing emotional behavioral problems such as ADHD and the comorbid difficulties often experienced by these children, especially in the area of academic achievement, it seems imperative to further examine the pathways by which

emotional behavioral problems such as ADHD develop. It remains unclear as to whether the relationship is unidirectional, bidirectional, or whether common causes underlie the relationship between these variables (Hinshaw, 1992). Few studies have specifically examined the longitudinal relationship between early diagnosed ADHD and later academic achievement. Conversely, there is a body of research indicating that at some point in the early school years of children with ADHD, many start to show academic skill deficits.

The Role of ADHD Symptoms and Pre-Reading Skills Development

In preschool, the acquisition of early readings skills is fundamental for later learning (National Reading Panel, 2000). Many studies that have examined the relationship of symptoms of ADHD and their role in the acquisition of early academic skills in preschool-aged children (Arnold, 1997; Lonigan et al., 1999; Mariani & Barkley, 1997; Massetti et al., 2008; Rabiner et al., 2000; Velting & Whitehurst, 1997 Willcutt et al., 2007). The focus of which has primarily been on the impact of symptoms on the development of critical pre- reading skills.

In a comprehensive review, Spira and Fischel (2005) critically examined the literature on the prevalence and stability of ADHD in the preschool population and its connection between preschool ADHD symptoms and emergent literacy and language skills development. The authors delineated four major conclusions. First, that the preschool age is a time of rapid development of behaviors related to inhibition and attention and a time when problem behaviors begin to emerge. Second, children with behaviors associated with ADHD are at risk for development of negative outcomes and continued difficulty, with ADHD only one of them. Third, studies have developed mixed results about whether preschool ADHD is stable over time. Last, studies show that preschool children with ADHD are more likely to experience academic difficulties in elementary school. While pre- reading skills and behavioral attributes were

predictive of reading improvement in children with existing reading difficulties in kindergarten, Spira, Bracken and Fischel (2005) found that hyperactivity in kindergarten played a role in children's ability to show improvement in reading in the second grade. Though the focus of the Spira et al. (2005) study was not on preschool children, the findings suggested that difficulties with hyperactivity in early schooling can interfere with improvement in reading for children who have both early difficulties in reading and symptoms of hyperactivity. These findings also supported the theory that behavior problems are a cause of reading problems by interfering with future acquisition of skills. Previous research that has examined the impact of learner characteristics on intervention effectiveness and outcomes have shown that attention problems among the primary learner characteristics that can impact the effectiveness of literacy interventions (Nelson, Benner, & Gonzalez, 2003; Otaiba & Fuchs, 2002). Taken together, these studies suggest that even with mediation through intervention, ADHD symptoms impact future achievement in reading.

Continuing to test a derivation of the theory that behavior problems are a cause of reading difficulties in children of preschool age, Velting and Whitehurst (1997) posited that problems with inattentive and hyperactive behaviors act as mediators and impede the acquisition of critical pre-reading skills that lay the foundation for later reading development. Children who have difficulty attending and sitting still during times when critical early reading skills, such as identifying letters and letter sounds are being introduced, may not acquire such skills. They have difficulty paying attention or often display disruptive behavior and miss opportunities to take in what is being taught. Inattention and hyperactivity thus act as risk factors for future reading problems. Using structural equation modeling, these authors examined this relationship in 105 children of low socio-economic status (SES) who attended Head Start. Children were assessed

in the spring of preschool and the spring of kindergarten on a variety of emergent literacy skills. In the fall of first grade, students were also assessed using a number of standardized reading skill subtests. Additionally, teachers completed a shortened version of the Conner's Teacher Rating Scale-Hyperactivity Index at each of the three assessment time points.

The resulting best fitting longitudinal model did not support the authors' original hypothesis that preschool hyperactive behaviors interfered with pre-reading skill development in kindergarten or reading skills in first grade. The paths from preschool and kindergarten hyperactivity to pre- reading and reading skills were not significant and were dropped from the model. However, a significant negative relationship was found in the bivariate correlation between hyperactivity and reading skills in first grade, while no significant correlations were found between inattention-hyperactivity symptoms in preschool and kindergarten and pre-reading skills in those years. The findings from this study suggest that inattentive- hyperactive symptoms are related to reading skills in first grade but not with pre-reading skills in preschool and kindergarten and that such symptoms at that early age do not interfere with pre- reading or emergent literacy skill development.

In order to gain insight into the direction of the relationship between early hyperactivity and later pre- reading and reading skills, these authors also tested alternative models. In one proposed model, paths between hyperactivity in preschool and reading skills in first grade were tested for significance. These proposed paths were not found to be significant and were dropped from the model and did not lend support to the theory of a direct relationship between early hyperactivity and later reading skills development. Also, attention was not found to mediate the relationship between behavior and reading as the authors proposed (Velting & Whitehurst, 1997). Alternately, to test the relationship in the opposite direction, another model was proposed

in which paths from preschool pre- reading skills to hyperactivity in kindergarten and from pre-reading skills in kindergarten to hyperactivity in first grade were also tested for significance. Again, these proposed paths were not found to be significant and found no support for the theory that reading difficulties lead to problems with inattention and hyperactivity.

Overall, the results of this study did not support the hypothesis that early difficulty with hyperactivity was related to the development of pre-reading and reading skills. It appears from these results that a relationship between reading skills and hyperactive behaviors do not emerge until first grade, particularly for this sample of children from low income environments (Velting & Whitehurst, 1997). One such explanation offered by the authors was that pre-reading skills taught in Head Start and kindergarten did not demand high levels of attention and on task behavior and did not impact reading skills acquisition. Pre-reading skills are often taught in the context of free play with songs and toys and simply participating in such activities may help children develop skills. As reading related tasks become more complicated in the higher grades (moving from more perceptual to cognitive) the relationship may strengthen. The latter notion appears to be supported by the study's results; however, there was no assessment of the types of activities in these environments.

Additionally, the shift toward a curriculum that is more developmentally appropriate to preschool and kindergarten classrooms was also discussed by the authors. They posited that the curriculum in these environments may have been focused more on the development of other skills (e.g. social skills) rather than pre- reading skills, and thus if pre- reading skills were not a part of the curriculum, naturally no relationship would exist. Again, the authors did not assess the demands of the environment or curriculum to provide support for this explanation (Velting & Whitehurst, 1997). Limitations of the study included the homogeneity of the sample (only low

income SES) and use of only a single measure of ADHD (used only the Hyperactivity Index of the CTRS based on teacher ratings) which both limit the ability to generalize the results.

Arnold (1997) noted the need for multi-method, multi-dimensional assessment of the relationship between externalizing behaviors and academic skills. The study used direct observations, teacher ratings, global ratings of behavior and standardized tests to assess this relationship in a sample of 3 to 6-year old boys from low income backgrounds who attended day care. The authors' goal was to address limitations of previous literature in this area by examining general academic development rather than using IQ/achievement discrepancy as a measure of academic difficulties. One particular purpose of this study was to examine the potential mechanisms in the relationship between externalizing behaviors and academic problems and the authors further hypothesized that difficulties with attention would mediate the relationship, due to its unique relationship with disruptive behavior problems. Similarly to Velting and Whitehurst, this study focused on a low income sample due to the high risk of both academic and behavior difficulties within this population.

To assess emergent academic skills, children were administered standardized tests of expressive and receptive vocabulary and a letter naming subtest. Measures of externalizing behaviors included a global rating of children's general disruptive behavior as rated by teachers and global rating of children's behavior based on a ten minute observed sample of circle time by trained undergraduate research assistants. In addition, the graduate assistants coded attention by observation of the presence of each child being on- or off- task during a 10-minute observation of circle time, using a 15-second interval coding method. The academic skills measures assessed were combined to form a composite measure of emergent academic skills. The data were then analyzed using three different methods of correlating the data: (1) an aggregate method

(averaging observational and teacher report data for a global measure of externalizing behavior and correlating it with an average of the standardized tests of emergent academic skills and teacher's global ratings of academic skills), (2) correlating observational data with objective tests measures and, (3) correlating teacher ratings of disruptive behavior with standardized test measures. In addition, the authors used a path analytic technique to determine if attention was a potential mediator in the relationship between disruptive behavior and emergent academic skills.

Overall, findings revealed externalizing behaviors were related to emerging academic skills across measures. Examining the results from the different analysis techniques revealed that the aggregate method resulted in global ratings of externalizing behavior and emergent academic skills being moderately correlated in the negative direction (r = -.59). Correlation between observation data of misbehavior and objective test data (standardized measures) was -.34, and the correlation between teacher ratings of disruptive behavior and standardized tests was -.37. An interesting finding was that the relationship between global measures of disruptive behavior and academic skills was stronger for older children than for younger children (e.g. higher correlations for 6 year olds than for 3 year olds). Specifically, the correlation between these measures for children ages 3 to 3.5 was .37 and that for children ages 3.6 to 4.5 was .54. Further, results of the path analysis in which attention was examined as a mediator in the relationship found that attention correlated with both global disruptive behavior (-0.64) and global emergent academic skills (0.31). A model indicating attention as a mediator in the direction from academic achievement to disruptive behavior was supported. However, support was not found for a model in the opposite direction, whereby attention mediates the path from behavior to academics. Contrasting these findings with those of Velting and Whitehurst (1997), it appears that for this sample of low income children ages 3 to 6, early difficulty with emergent

academic skills has the potential to lead to difficulty with disruptive behavior through the mechanism of making it difficult for children to pay attention. Velting and Whitehurst (1997) did not find support for this relationship between inattention-hyperactivity in preschool and kindergarten prereading skills, either concurrently in Head Start or kindergarten or longitudinally.

This study was novel in that it was the first of its kind to examine these variables in a sample of children as young as 3. It gathered multi-method, dimensional measures of constructs, included observational measures, and examined behavior within the daycare setting. Further support for this pattern was evidenced by the increasing relationship between global measures of externalizing behaviors and emergent academic skills with age in the sample examined in this study (from low to strong). Like previous studies, the limits of correlational and cross-sectional analyses apply here, and the results should be taken with caution. Lastly, this study used a low income sample of boys only, which also limits the generalizability of the results. In contrasting the two previously mentioned studies, Arnold (1997), with Velting and Whitehurst (1997), several differences in both procedures and results are evident. Though both studies examined children from low income backgrounds; the findings for the relationship between the behavioral measures and achievement variables was not the same.

In a similar study, Lonigan and colleagues (1999) examined the overlap between problem behaviors and emergent literacy skills in 44 predominantly White (84.1%) preschool children attending a child care center serving middle income families and 41 predominantly Black (95.1%) preschool children attending Head Start and from lower income families. It was hypothesized that lower levels of emergent literacy skills would be more specifically related to behaviors associated with ADHD (inattention) than to more general behavior problems (conduct

problems and overactivity). Informal observations conducted of the two preschool settings indicated that the curriculum of the two settings focused on social skills and basic skill development such as learning letters, numbers and story book reading, however, they differed with regard to the structure of activities. The middle income child care center included more teacher directed activities with children spending more time engaged in academic activities. The lower income center, on the other hand, was more child-focused and children were engaged in less academic tasks (Lonigan et al., 1999). Participants in this study were administered standardized tests of oral language, nonverbal IQ subtests, a variety of phonological skills tests and tests of print knowledge. Additionally, preschool teachers completed two behavior rating scales, the Conner's Teacher Rating Scale (CTRS) and the Kohn Social Competence Scale (Lonigan et al., 1999).

Results showed behavior problems were associated with less well developed emergent literacy skills for children from both income groups. Even after cognitive skills (non verbal IQ) were controlled for; there still existed a pattern of significance between behavior measures and emergent literacy skills, though it was reduced. The CTRS Inattention measure was found to be most highly correlated with scores for both the low and middle income group. However, findings were different for the low and middle income children with regard to the specific emergent literacy skills associated with inattention. Within the middle income group, higher inattention reported by the teacher was associated with lower performance on measures of oral language, phonological memory, and lexical access. For children in the low income group, higher levels of teacher reported inattention was associated with lower phonological sensitivity skills. Overall, the relationship between inattention and other behaviors assessed by the authors (e.g. social competence and rule following behaviors) was lower for the lower income group than

for the middle income group. These results suggested there is a weaker relationship between ADHD behavior symptoms and emergent literacy skills for children of low income backgrounds than those from middle income backgrounds. In addition, this study lends support to the existence of an early relationship between behavior problems and early literacy skills prior to formal education and its presence regardless of socioeconomic status (Lonigan et al., 1999).

These findings are inconsistent with results from previous studies (e.g. Velting & Whitehurst, 1997) that found stronger relationships for the low-income sample examined. These differences may be related to differences in populations studied, differences in the measure of attention used, and early home experiences. The study by Velting and Whitehurst used only the Hyperactivity scale of the CTRS while the Lonigan et al. (1999) study examined the Hyperactivity, Inattention and Conduct Problems scales of the CTRS. In the Lonigan et al. (1999) study, the CTRS Hyperactivity scale was least correlated with the measures of emergent literacy skills.

Despite these findings Lonigan et al. (1999) addressed few limitations. One limitation of note was the lack of structured observations of the preschool environments. As previously stated, the authors provide information that appears to be anecdotal regarding their general impressions of these two environments. Without a better understanding of what occurred in these settings, the ability to generalize is limited. A second limitation noted by the authors is the correlational nature of the study limiting the conclusions made.

Taken together, these studies reveal that within the preschool population, behaviors related to ADHD can indeed impede and impact the acquisition of early literacy development. However, inconsistent results have been found across the studies. In the elementary school population the relationship appears to be strengthened, with higher correlations found for older

aged students. Longitudinal studies with this population are needed to clarify the nature of this relationship.

Longitudinal Studies

Studies that assess the nature of the relationship between behavior difficulties and academic skills over time, rather than at one time point, can provide stronger empirical evidence of the relationship between these variables. Studies in the area of ADHD have examined whether children with ADHD have continued difficulties in the area of academic achievement at later time points. A set of studies by Fergusson and colleagues (1993) using a large sample of participants from New Zealand provided strong support for a model supporting the path between early attention difficulties and later difficulty with academic achievement in early childhood, adolescence and adulthood (Fergusson, Horwood, & Lynskey, 1993; Fergusson & Hoorwood, 1995; Fergusson Lynskey & Horwood, 1997). In a follow-up study (Fergusson & Horwood, 1995) the authors used similar procedures and showed that the path from early conduct problems to later delinquency was only related to achievement through its association with attention problems. Fergusson et al. (1997) showed that these difficulties extend into young adulthood.

Rapport, Scanlan, and Denny (1999) replicated the earlier findings of Fergusson and colleagues using a sample of 325 children between the ages of 7 and 16 in Hawaii, but also examined additional pathways (cognitive and behavioral). Results revealed that the proposed replication model that included the cognitive and behavioral pathway mediated the relationship between ADHD behaviors and academic achievement, with these variables explaining almost twice the variance in the explanation of academic achievement than the model from the Fergusson et al. studies; 48% versus 83% (Rapport et al., 1999).

Rabiner and the Conduct Problems Research Group (2000) longitudinally examined whether early attention problems predicted poorer reading and led to significant impairment for a sample of 387 children. Teachers completed attention and hyperactivity ratings scales in kindergarten, first, and second grade. The Child Attention Problems Scale was used in kindergarten, and the ADHD Rating Scale was used as the measure in first and second grade. Reading achievement in kindergarten was measured using the Letter Word Identification subtest of the Woodcock-Johnson Psychoeducational Battery-Revised and at fifth grade, the Passage Comprehension subtest was administered in addition to Letter Word Identification. Measures of IQ, internalizing and externalizing behaviors, and parental involvement in education were also administered to participants and teachers.

All dependent variables were included in the model, however, only those predicting or predicted by reading achievement were retained in the final model. Teacher rated attention, IQ and parent involvement in first grade remained as predictors. Measures of kindergarten and first grade overactivity and externalizing behaviors were least correlated, although significantly, with reading achievement in fifth grade. Results revealed first grade inattention to be negatively associated with reading achievement, even after controlling for kindergarten inattentiveness, suggesting that having lower reading achievement after kindergarten predicted an increase in attention problems in first grade. However, this same relationship was not found in second grade. Inattention in second grade made an independent contribution (although low) to fifth grade reading achievement. To test the independent contribution of attention ratings, the authors repeated the path analysis without including teacher attention and found attention ratings to account for only 6% more of the variance explained by kindergarten and first grade reading.

Of particular importance was the finding that the relative change in reading achievement between kindergarten and first grade for highly inattentive first graders was statistically significant (mean standardized scores declined from -.52 to -.86) and in fifth grade the average standardized scores for these children was still substantially lower (-.71) than peers. Inattentive first graders were also found to be three times more likely than peers to show a discrepancy between their reading achievement and IQ. The finding provides support for the model that attention problems in kindergarten or early school are predictive of later difficulties with reading achievement.

Limitations of this study include the homogeneity of the sample. Participants in this study were drawn from a larger study of children with conduct problems. No data were collected on whether participants had a clinically significant amount of symptoms or met criteria for ADHD. Also, as mentioned in previous studies, the study did not include data on a control or comparison sample.

In one of the largest studies examining treatment for ADHD, the Multimodal Treatment Study of Children with ADHD has extensively reported on the impact and outcomes of the disorder on children and adolescent functioning. In a study comparing the long term impact of treatment on the various groups of children as compared to peers, Molina and colleagues (2009) reported on the psychiatric, social and academic functioning of adolescents with ADHD compared to comparison peers (Molina, Hinshaw, Swanson, Arnold, Vitiello, Jensen et al., 2009). Using mixed effects regression models examining outcomes at 6 years and 8 years, the researchers reported on the functioning of 579 participants with DSM-IV Combined Type who were a mean age of 8 and a half years old at baseline. Comparison participants included 289 children with a mean age of 10.5 years and were recruited at 24 months into the study. Of

particular importance to the present study were the outcomes related to academic achievement which included standard scores in reading and math on the Wechsler Individual Achievement Test (WIAT), teacher rated academic performance as assessed by the Academic Competence subscale of the SSRS and grade point average, school services and grade retention at the 8 year assessment period. Findings revealed that overall, participants within the treatment groups performed lower than comparison peers on all measures of academic functioning, even after controlling for intelligence (Molina et al., 2009). This longitudinal study comparing outcomes even for children with ADHD receiving treatment speak to the long term impact of the disorder on academic achievement.

Studies Examining the Predictive Nature of ADHD Symptoms

Given the impact of ADHD symptoms on academic achievement, a few studies have examined the degree to which ADHD symptoms and other associated behaviors and skills predict academic achievement. For instance, DeShazo, Barry, Lyman, and Klinger (2002) examined the degree to which executive function (EF) abilities and ADHD symptoms predicted academic achievement in children with ADHD and those without. A sample of 66 children (33 with ADHD and 33 without) between the ages of 8 and 9 years of age, recruited from a variety of settings, participated in the study. Of the students with ADHD, 30 met criteria for ADHD Combined Type and 3 met criteria for ADHD Inattentive Type. All students with ADHD had an independent diagnosis of ADHD and those without ADHD had never received a diagnosis of ADHD or any other emotional behavioral problem. In addition, parent ratings were used to confirm the classification of ADHD or non- ADHD by using clinically significant thresholds on the DSM-IV ADHD Checklist and the Inattentive and Hyperactive-Impulsive subscales and the Inattentive and Hyperactive subscale of the Behavioral Assessment System for Children-Parent

Rating Scale (BASC). These ratings were combined to form an ADHD severity index. The measure used for academic achievement was the Woodcock-McGrew-Werder Mini Battery of Achievement.

Children in the ADHD group, those with a learning disability and without a learning disability showed a greater discrepancy between intellectual ability and achievement than the non-ADHD group. Using hierarchical stepwise multiple regression, the investigators first evaluated the extent to which the ADHD severity index predicted academic achievement above and beyond that of performance on measures of executive function (EF). A second analysis was performed to examine if performance on the EF measures predicted academic achievement above and beyond the ADHD severity index, for each academic area. Results revealed that ADHD symptoms accounted for a significant amount of the variance in all academic areas above and beyond that of EF performance, whereas performance on EF measures only accounted for a significant amount of the variance for the Mathematics and Basic Skills portions of the achievement test used. A reported 15% to 21% of the variance was explained in the prediction of various academic subject areas, with 12% of the variance in the explanation of reading (DeShazo, Barry et al., 2002). However, structural equation modeling was used to examine the extent to which ADHD symptoms and EF were equally effective as predictors of achievement when all variables were included in the model. It was found that the magnitude of the effect for both models was equal, indicating that EF and ADHD symptoms are equally as good predictors of academic achievement (DeShazo, Barry et al., 2002). These findings support the conclusion that as symptom severity increases, the level of academic achievement impairment increases, and also suggest, as the authors note, the utility of examining the severity of problems rather than just the current categorical system (DeShazo, Barry et al., 2002).

Limitations of this study include the predominantly Caucasian and middle class socio-economic sample, which limits the generalizability of these results. Additionally, the majority of the sample of participants with ADHD (30 of the 33) had ADHD Combined Type and therefore there was no potential for examining differences in these relationships by ADHD type. It may have been that there were differences in the relationship between children with ADHD Combined and Inattentive types.

Examining the relationship between attention problems and academic achievement in a sample of students ages 11 to 19, Barriga and colleagues (2002) examined the role of attention problems in mediating the relationship between other problem behaviors and academic achievement. Participants were students referred to an alternative school for a variety of disruptive behavior difficulties and poor interpersonal relations. Students were administered the Wide Range Achievement Test, Third Edition, (WRAT3), approximately one month after admission, and the primary teacher for each student completed the Achenbach TRF within one week of the achievement testing.

The authors used correlations to estimate the extent to which measures of problem behaviors and academic achievement measures were associated. The Withdrawal, Somatic Complaints, Attention Problems, Delinquent Behavior, and Aggressive Behavior subscales of the TRF exhibited significant correlations with academic achievement measures. Multiple regression analyses were conducted to assess the relationships between these behaviors and the academic achievement measures, while controlling for attention problems. Only attention problems were found to be associated with unique variance in each of the academic achievement measures. Consequently, attention problems were found to mediate the relationships between the other four problem behaviors and the academic achievement measures.

Although both the inattention and hyperactive subscales were significantly correlated with the academic achievement measures, multiple regression analyses revealed the Inattentive subscale to be a significant predictor of academic performance while the Hyperactive-Impulsive subscale was not (significant zero-order correlations ranging from -.31 to .39) (Barriga, Doran, Newell, Morrisson, Barbetti, & Robbins, 2002). These results were consistent with previous research by Frick, et al., (1991), but inconsistent with research by Hinshaw (1992), who concluded that for adolescents, attention does not mediate the relationship between delinquent behavior and academic achievement, as it does in childhood.

What seems clear is despite the fact that ADHD symptoms do explain some of the variance in the prediction of academic achievement, there appear to be other variables left unexplained in many of the previous studies. DuPaul, Volpe, Jitendra, Lutz, Lorah, and Gruber (2004) examined variables that would be potential predictors of academic achievement in children meeting research criteria for ADHD. The authors examined the contributions of conduct problems, social skills, classroom behavior, and academic skills above and beyond that accounted for by socio-economic status and ethnicity separately for academic subjects (math versus reading) and definitions of achievement (test scores versus report card grades). They compared the prediction models of students meeting research criteria for ADHD versus non-ADHD students (DuPaul et al., 2004).

Participants in the ADHD group were 136 students in grades one through four with a mean age of 8.5 who were referred by their teachers due to concerns of ADHD symptoms and difficulty in reading and/or math achievement. Participants in the non-ADHD group were 53 students from the same schools, grades, and approximately the same mean age, but different classrooms, who were referred by their teachers as being average in terms of academic

achievement and behavior. Participants in both groups were further assessed to meet research criteria for symptom presence and achievement. To assess ADHD symptoms, the ADHD Rating Scale-IV and Computerized NIMH Diagnostic Interview Schedule for Children (Parent Version) were used. Criterion measures of academic achievement in reading and math were assessed using student scores on the Broad Reading and Broad Math subtests of the Woodcock Johnson III Tests of Achievement and students' report card grades.

The authors conducted separate hierarchical regression analysis for each of the criterion measures (reading and math) and separate analyses for both students with and without ADHD. The predictor variables used included teachers' ratings of ADHD symptoms as measured by the ADHD Ratings Scale-IV Inattentive and Hyperactivity subscales, and conduct problems as measured by the Conduct Problems subscale of the BASC. Other predictor variables used were teacher perceptions of academic skills and achievement related behaviors as measured by the Mathematics, Reading/Language Arts, and Academic Enablers subscales of the Academic Competency Evaluation Scale (ACES) and teacher perceptions of social skills as measured by the Social Skills subscale of the Social Skills Rating System (SSRS). Lastly, a modified version of the Behavior Observation of Students in Schools (BOSS) was used to assess students' classroom behavior during the academic periods in question.

Group differences were revealed in students' achievement and behavior and found that students with ADHD obtained significantly lower scores on the WJ-III measures and report cards, and were also rated lower by teachers on measures of academic and social skills. In addition, students with ADHD were reported to display significantly greater amounts of ADHD symptoms and conduct problems and the two groups differed in some respects on direct observation measures.

Results of the hierarchical regression analysis for each of the academic criterion measures revealed differences as a function of group and academic content area. A better prediction was found for reading than there was for math for both groups of students, with only one of four math models found to be significant, and all four of the reading models were significant. The set of predictors for math accounted for 11% to 15% of the variance and the set of the predictors for reading accounted for 24% to 55% of the variance for both standardized test scores and report card grades. Teacher perceptions of academic skills and academic enablers as measured by the ACES, inattentive symptoms, and direct observations of off- task behavior emerged as the only predictors of academic achievement. Limitations of this study included the sizes of both control samples, which limited the ability to generalize the results of this study to samples of non-referred children. Second, there were differences in SES and ethnicity across groups, though the authors conducted analyses to control for these variables. Third, the cross-sectional design obviously limits the conclusions that can be drawn based on the regression analysis (DuPaul et al., 2004).

Lee and Hinshaw (2006) examined predictors of adolescent functioning in a sample of 140 girls with ADHD and 88 girls without ADHD over a five-year period. At baseline, participants were an average age of 9.5 years and an average of 14.1 years at follow up. It was hypothesized that childhood inattention would predict lower academic achievement. Results of the hierarchical regression analysis revealed inattention (as measured by parent or teacher rating) to significantly predict academic achievement (as measured by a composite index utilizing the Wechsler Individual Achievement Test-Screener reading and math subtests) ($R^2 = .04$, ß = -.32, $p < .01$), while hyperactivity (as measured by parent teacher ratings) did not ($R^2 = .00$, ß = -.05, p

= .68). Correlations between the achievement measure and the hyperactivity and inattention measures were found to be -.39 and -.46, respectively (Lee & Hinshaw, 2006).

A study by Frick and colleagues (1991) compared the presence of academic underachievement in a sample of 177 clinic referred boys ages 7 to 12 diagnosed with ADHD or conduct disorder (CD) (68 with conduct disorder and 111 with ADHD). The authors used the typical regression discrepancy model whereby academic underachievement was defined as a discrepancy between expected level of achievement (indicated by IQ) and actual level of achievement (as indicated by standard scores on a reading and math achievement test) to determine the presence of underachievement. Results for students with ADHD revealed that when using this discrepancy model only the children with attention deficit without hyperactivity (ADD/WO) were similar to the normal control group in the proportion of underachievement. However, when using other discrepancy formulas (a difference of 20 points between full scale IQ and achievement standard scores, or at least one standard deviation below the mean), all groups of children with ADHD showed a higher proportion of children underachieving than those in the control group. For children with comorbid CD and ADHD, only ADHD was found to be associated with academic underachievement, providing further evidence of a unique relationship between academic underachievement and ADHD. Little difference was found in achievement levels for the two subtypes of ADHD (Frick et al., 1991), lending support to the theory that academic achievement is often an area of difficulty for children with both subtypes of the disorder.

In one of the largest studies to date to examine academic outcomes in young children with ADHD, Massetti and colleagues (2008) assessed the predictive validity of ADHD symptoms in a sample of children ages 4 to 6 over an 8 year period. The authors posited that

children meeting modified criteria for ADHD (predominately inattentive and combined types) would have lower academic achievement in reading and math than comparison children. Significant impairment was expected for children with the predominately inattentive subtype (Massetti et al., 2008). Diagnoses of ADHD was based on the NIMH Diagnostic Interview Schedule for Children (administered to the mother) and the Disruptive Behavior Disorders Rating Scale (administered to the teacher) and impairment in one area. Academic achievement was assessed using the Letter Word ID, Applied Problems and Dictation subscales of the WJ-III Psychoeducational Battery. Longitudinal linear regression was used to analyze the data. Results revealed that after controlling for intelligence and other covariates (e.g. age, sex, family income and ethnicity) children with inattentive type had significantly lower reading scores over the 8 year period than comparison children, while children with combined and predominately hyperactive-impulsive type did not differ on reading scores. Contrary to the authors' hypothesis that both children with inattentive and combined type would exhibit problems in academic achievement, only children with inattentive type showed such difficulties (Massett et at., 2008). These results provide important information regarding the differences in the relationship between academic achievement young children with different symptom types of ADHD. The authors highlight the importance of the findings for informing treatment and academic interventions in light of their findings.

Social Skills and Academic Achievement

Strong social skills have been found to be positively related to academic a achievement (DiPerna & Elliot, 1999; Green Forehand, Beck, & Vosk, 1980; Gresham & Elliot, 1990; Wentzel, 1991; 1993), and early theorists have noted the importance of the social process of learning and development of new skills (Bandura, 1997; Vgotsky, 1978). In particular, research

by Wentzel (1993) examined the relationship between social and academic behavior in a sample of sixth and seventh graders. Social skills were measured from peer and teacher ratings of social behaviors and academic achievement measures were based on grade point average and scores on the Stanford Achievement Test. Based on a series of correlation and regression analyses, results revealed the behaviors were significantly related and of importance to the present study was the finding that pro-social behavior was the only significant independent predictor of standardized achievement test scores.

A more recent study by Malecki and Elliot (2002) was based on the previous research of Wentzel (1993) and examined the role of social skills in the prediction of academic achievement. The authors found that social skills were better predictors of academic achievement than were problem behaviors such as inattention and hyperactive behaviors. A sample of 139 third and fourth grade students participated in this study. Teacher ratings of social skills and problem behaviors were based on the Social Skills Ratings System-Teacher form (SSRS-T) and academic achievement was measured using the Iowa Tests of Basic Skills (ITBS).

Correlations found from data collected from fall to spring between the SSRS-T Problem Behavior and the ITBS ranged from -.12 to -.39, with significant correlations found with ITBS Math and ITBS Total scores. When ratings on the SSRS-T-Academic Competence Scale were compared to the ITBS, scores ranged from .49 to .68, with most all measures found to be statistically significant. Of most relevance to the present study, are the correlations between the SSRST Social Skills and the ITBS Total, Reading, Math and Language scores. In the fall scores were moderately strong and ranged from .40 to .54. However, in the spring, moderate correlations were found between the SSRST Social Skills and the ITBS Total, .39 and not the content area scales of the ITBS. Comparison of the fall and spring correlations also revealed

moderate significant correlations between the SSRST Social Skills and the ITBS Math, Reading, and Total score (.37, .31 and .41, respectively). Although exploratory in nature, the regression analysis using fall to fall scores revealed the SSRS-T Social Skills accounted for a significant amount of the variance in the prediction of the ITBS total score, with all three subscales of the SSRS contributing 34% of the variance. When examining the separate academic areas of the ITBS, neither social skills nor problem behaviors as rated by teacher contributed significantly to the variance, however, over 20% of the variance in the prediction of ITBS reading was accounted for by these variables, with teacher ratings of social skills contributing most of the variance.

This study provided some indication of the strength of the correlations between behavioral measures and academic achievement measures in the area of social skills. As with other studies, the authors note a number of limitations. The sample was restricted to fourth and fifth grade students only and an examination of a wider variety of grades would have helped the ability to generalize the results and possibly further examine any developmental trends that might exist in the relationship.

Conclusion

Taken together, quite a few studies have examined behavioral symptoms of ADHD and their impact on various achievement outcomes. Much of the research has focused on the area of early literacy and reading, and in particular with the early elementary population with more recent studies beginning to examine the preschool population. Mixed results have been found with preschool students. The results of the preliminary study by Freeman et al., (2006) are consistent with findings of Velting and Whitehurst (1997), demonstrating a weak relationship between behavior difficulties and emergent literacy skills in preschool and kindergarten, but a

stronger relationship in first grade. The preliminary study results are in contrast to results of Arnold (1997) and Lonigan and colleagues (1999) whose results showed a stronger relationship between these variables. Longitudinal studies and studies examining the predictive nature of ADHD for academic achievement demonstrate that such symptoms do indeed impact later achievement, finding that other behavioral skills such as social skills impact achievement (e.g., Massetti et al., 2008). What remains unclear is research indicating a point in time at which the relationship between behavioral symptoms of ADHD and academic achievement difficulties begin to interact. The present study will add to the literature in this area by following up to examine whether a stronger relationship has developed from a sample of preschool children at risk for ADHD one year later.

Chapter Three

Method

Participants and Setting

Participants in the present study were part of a larger investigation, the purpose of which was to design and implement a comprehensive program to prevent and/or minimize the behavioral and academic consequences typically associated with ADHD in young children, as well as to prevent further difficulties known to emerge during elementary school (Kern, DuPaul, Volpe, Sokol, Lutz, Arbolino et al., 2007). A total of 135 children between the ages of 3 years-0 months and 5 years -11 months and identified as meeting DSM-IV criteria for Inattentive, Hyperactive-Impulsive or Combined Type ADHD were participants in the larger study. The present study included three subsamples of participants from that sample. The time one versus time two comparison included 47 participants with an average age of 50 months, 85.1% male and 14.9% female. The ethnic breakdown was 78.7% White/Non Hispanic, 10.6% Hispanic/Latino and zero percent Black/African American and 10.6% Other. The time one versus time three comparison included 43 participants with an average age of 51 months, 76.7% male and 23.3% female. The ethnic breakdown was 72% White/Non Hispanic, 14% Hispanic/Latino and zero percent Black/African American and 14% Other. Lastly, the time two versus time three comparison included 37 participants with an average age of 52 months, 67.6% male and 32.4% female. The ethnic breakdown was 56.8% White/Non Hispanic, 21.6% Hispanic/Latino, zero percent Black/African American and 21.6% Other.

Children who exhibited significant difficulties with inattention, impulsive behavior and/or overactivity as referred by parents, teachers or physicians were included in the larger study. Additional inclusion criteria were: (a) parent and teacher ratings at or above the 93rd

percentile on an ADHD screening measure, the Conner's Rating Scale (CRS; Conner's, 1997); (b) parent report of symptomatology of ADHD for at least 6 months on the Diagnostic Interview Schedule for Children (DISC; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stowe, 2000); and (c) enrolled in a preschool, nursery school, or group day care at least 2 days a week during the school year. Children beginning kindergarten were also recruited for the study. Upon enrollment, participants were randomly assigned to one of two groups: a multi-component intervention group or a parent education group. A total of 71 participants were randomly assigned to the multi-component intervention group (MCI) and 64 participants were assigned to the parent education group. Participants in the MCI group received group parent education classes as well as individualized assessment based intervention in the home and daycare or school setting.

Measures: Behavioral

Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS consists of forms for both teacher and parent (SSRS-T and SSRS-P, respectively). The scales were designed to assess the social skills, problem behaviors, and academic competence of children from ages 3 through 18 years and yields scores in each of these domains as well as other areas relating to social skill behaviors of children. The normative sample for the scale included teachers' ratings of 1,335 children and parent ratings of 1,023 children (Gresham & Elliott, 1990). There is a version for preschool, elementary school and secondary students. Response ratings are of Likert form and included the following responses: Items: 0= *Never*, 1=*Sometimes*, 2 = *Very Often*. The elementary school version of the SSRS was used as a part of the overall study in order to keep consistent measures across time. The raw score on the Social Skills subtest of the parent and teacher version were used as primary independent variables for the current study.

In terms of reliability, the mean coefficient alpha across all forms and grade levels was reported to be 0.90 for the Social Skills Scale. The internal consistency estimates for all forms ranged from .83 to .95 for the Social Skills Scale. Median internal consistency coefficients across all subscales ranged from .73 to .84. Test-retest reliability obtained after four weeks revealed alpha coefficients of .87 for parent ratings of Social Skills and .85 for teacher ratings of Social Skills.

Validity information for the SSRS included in the manual includes a comparison study of the SSRS Elementary Parent form with the CBCL-Parent Report Form. Correlations between the SSRS Social Skills subscales and the CBCL subscales were low and ranged in the .20's to .30's (Gresham & Elliott, 1990). Stronger correlations were found between the SSRS Problem Behavior subscales and the CBCL subscales (ranging in the .40's to .70's). For the teacher form, the SSRS-T was compared with the Social Behavior Assessment with the Harter Teacher Rating Scale in a separate study, both resulting in correlations between subscales ranging in the .50's to 60's. For the current analyses, raw scores from the Social Skills scales based on teacher reports were be used.

Conners' Rating Scale-Revised Long Form (CRS-RL), (Conners', 1997). The CRS-RL comes in both parent and teacher forms and was devised primarily for the assessment of ADHD in children and adolescents ages 3 to 17. It also includes scales that assess a broader range of related problem behavior. The parent version consists of 80 items and the teacher version consists of 59 items. The two forms contain the same subscales, except for the Psychosomatic subscale which is only included on the parent version. Respondents are asked to consider the child's behavior within the past month and the response format is a Likert form with the following responses: 0 =*not true at all*; 1=*just a little true*; 2= *pretty much true* and 3= *very*

much true. The Conner's DSM-IV Symptoms Scales have been used as the primary outcome measures of examining ADHD in preschool children in previous research studies (Murray, Kollins, Hardy, Abikoff, Swanson, Cunningham et al., 2007; Rabiner, Murray, Rosen, Hardy, Skinner & Underwood, 2010).

The present study will utilize raw scores from four specific subscales from the CRS-RL. These subscales include the Conners' Parent Rating Scale DSM-IV Symptoms Inattention, the Conners' Teacher Rating Scale DSM-IV Symptoms Inattention, the Conners' Parent Rating Scale DSM-IV Symptoms Hyperactive-Impulsive and the Conners' Rating Scale Teacher DSM-IV Symptoms Hyperactive Impulsive. Each contains 9 items that correspond to the DSM-IV symptoms of ADHD. Internal consistency for the 3-5 year old age group on the CPRS DSM-IV Inattentive subscale was reported as .91 for males; .88 for females. For the Hyperactive Impulsive subscale, internal consistency was reported as .89 for males and .86 for females. Internal consistency for the 3-5 year old age group for the CTRS DSM-IV Inattentive subscale was reported as .92 for males and .87 for females. For the Hyperactive Impulsive subscale, internal consistency was reported as .94 for males and .82 for females. Test retest reliability (6-8 weeks) for the CPRS Inattentive and Hyperactive scales was reported as .67 and .81 respectively, and .70 and .47 respectively for the CTRS. Reliability at 6 to 8 weeks appears to be better for the parent form than for the teacher form. It should be noted that age effects were reported in the technical manual for the DSM-IV Symptoms scales. On the long version of the CPRS:R DSM-IV Symptoms Hyperactive-Impulsive subscale, scores decreased with age. On the long version of the CTRS:R DSM-IV Symptoms Inattentive subscale, 3-5 year olds were reported to score significantly lower than older age groups (Conners', 1997).

Direct Observation of Behavior at School. Behavioral symptoms of ADHD were observed through direct observation of children's behavior in their school setting. Observations of participants school behavior was collected using a modified version of the Abikoff and Gittleman (1985) Classroom Observation Code. The code was designed to record behaviors of students that occur during structured teaching or independent seatwork with teacher supervision. This code allowed for the observation of 12 child behaviors, 2 teacher behaviors, and of a comparison peer in large group, small group and individual settings. Behavioral observations were recorded in 15-second intervals over a 30-minute sessions, primarily during a structured school activity such as circle time.

For the present study, only interference, gross motor standing, and out of chair were used. Interference was coded as a discrete non-timed behavior, defined as any behavior that disrupts a teacher or another student during a lesson or quiet work time and can include any verbal or physical behavior or noise. Gross motor standing was defined as the child leaving their seat and standing on one or both legs. Lastly, out of chair behavior, coded as a timed behavior, was defined as the child being out of their chair for an extended period of time (one full interval). All behaviors are reported as the total percentage of intervals in which the behavior occurred and these values were used as dependent measures.

Measures: Academic Achievement in Reading

Dynamic Indicators of Basic Early Literacy Skills, Fifth Edition (DIBELS; Kaminski & Good, 1996) The Dynamic Indicators of Basic Early Literacy Skills (DIBELS) are a set of standardized, individually-administered measures of early literacy development. They are brief (1-minute) fluency measures used to regularly monitor the development of pre-reading and early reading skills. For the present study, the Initial Sound Fluency (ISF) subtest was used

as one of the primary dependent measures. This DIBELS measure is used to assess a child's ability to recognize and produce the initial sound in an orally and visually presented word. The examiner presents the child with four pictures, says the names of each picture, and then asks the child to point to or say the picture that begins with the sound produced orally by the examiner. The child is also asked to orally produce the beginning sound for a word presented orally by the examiner that matches one of the pictures presented. The score on the subtest calculating by the total of initial sounds said correct in one minute, the score that served as the dependent measure for this study.

Each DIBELS measure has been demonstrated to be reliable and valid as indicators of early literacy development, predictive of later reading proficiency, and useful in aiding in the early identification of students who are not progressing as expected (Good, Gruba, & Kaminski, 2002). Single probe reliability of the ISF was reported by Hintze, Ryan and Stoner (2003) to be .86, while multi-probe was reported to be .95. Single probe reliability was also reported as .61 with multi-probe increasing to.89 in a separate study by Good, Kaminski, Shinn, Bratten, Shinn, Laimon, et al (2004). Single probe reliability refers to the use of a single probe to obtain a reliability coefficient, while multiple probe reliability refers to the use of 3 to 4 probes aggregated together to demonstrate a pattern of performance (Good et al., 2004). Alternate form reliability for the earlier version of this measure (onset recognition fluency) was found to be .72 in January of the kindergarten year (DIBELS, 2004). Alternate form reliability was also reported by Hintze and Stoner (2003) to be .86 in March of the kindergarten year and by Good, Kaminski, Shinn, Bratten, Shinn, Laimon et al. (2004) to .61 (median). Median concurrent validity in the winter to spring of kindergarten with Phonemic Segmentation Fluency was .47 and with the WJ-Readiness Cluster standard score was .36 (Good, Kaminski, Shinn, Bratten, Shinn, Laimon et al.,

2004). Concurrent validity with the CTOPP Phonological Awareness and Phonological processing was reported as .60 and .46, respectively (Hintze and Stoner, 2003). The predictive validity of ISF in the winter of kindergarten was reported with the following measures: Nonsense word fluency in the middle of 1st grade at .35; Woodcock Johnson Total Reading Cluster standard score at the end of 1st grade at .37; and end of 1st grade CBM oral reading fluency at .36 (Good, Kaminski, Shinn, Bratten, Shinn, Laimon et al., 2004).

Woodcock-Johnson III Tests of Achievement (WJ-III; McGrew & Woodcock, 2001). The WJ-III was designed to assess student achievement across various academic areas for individuals ranging in age from 2 to adulthood. The Letter-Word Identification (LWID) subtest of the WJ-III was used as one of the primary dependent variables for the present study. This specific subtest was chosen because the focus of the study was on achievement in the area of reading for preschool-aged students. The Letter-Word Identification involves reading decoding skills and requires a student to correctly pronounce the name of the letter or word presented (Woodcock, McGrew, & Mather, 2001). Raw scores from this subtest were used in the current analyses.

Specific technical adequacy information for LWID subtest is limited. Median test reliability was reported to be .94. Criterion related validity was demonstrated with reading composite and cluster scores of the Kaufman Tests of Educational Achievement (correlations ranging from .44 to .81) and the Wechsler Individual Achievement Test (correlations ranging from .63 to .82) (Schrank, McGrew & Woodcock, 2001).

Bracken Basic Concepts Scale-Revised (BBCS-R; Bracken, 1996). The BBCS-R was developed to assess basic concept development in children ages 2 to 7 years of age. The BBRS-R measures comprehension, as well as foundational and functionally relevant educational

concepts through 11 subtests that include: colors, letters, numbers/counting, sizes, comparisons, shapes, direction/position, self/social awareness, texture/material, quantity, and time/sequence. The first 6 subtests of the BBRS-R (colors, letters, numbers/counting, sizes, comparisons, shapes) compose the School Readiness Composite (SRC). This composite is often used to assess children's knowledge of those readiness concepts traditionally taught to children in preparation for formal education.

The BBCS-R has been shown to demonstrate adequate reliability and validity. Internal consistency reliability for the SRC for ages 3, 4 and 5 were reported as.93, .96, and .97, respectively. The range of reliability estimates reported for the subtests and total test were.78 to .99, with a median subtest and total test estimates of.94 and .98, respectively. Test-retest reliabilities at 7 to14 days apart ranged from .78 to .88 with .88 being that of the SRC. Median test-retest and total test estimates were .81 and .94, respectively. In terms of validity, the BBCS-R has been shown to demonstrate adequate criterion validity. The concurrent validity of the BBCS-R was correlated with the original BBS SRC, the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R) Full Scale IQ, and the Differential Ability Scales (DAS) General Conceptual Ability. The correlations of these measures with the BBCS-SR were 0.83, 0.88, and 0.79, respectively, showing strong correlations. The BBCS- SRC has been demonstrated in studies to be a useful predictor of academic success (Sterner & McCallum, 1988). The BBCS-R SRC has also demonstrated adequate construct validity with the Peabody Picture Vocabulary Test-Third Edition and the Preschool Language Scale, with correlations of .69 and .57, respectively (Bracken, 1996). Raw scores from the School Readiness Composite were used for the current study.

Procedures

Recruitment and identification. Pediatric practices, preschools, and community day care programs in the greater Allentown-Bethlehem area were contacted and sent materials to inform their staff and parents of the study. Once the participants were referred by a physician, teacher or parent and all other necessary inclusion criteria were met, study consent was obtained from parents or guardians.

Data collection. Parents and teachers were mailed a packet of rating scales to complete and return by mail. These materials were mailed again at the follow-up assessment phases. Pre-addressed and stamped envelopes were provided to facilitate the return of materials. Upon completion and return of the measures, parents and teachers were compensated $50 for their time. Additionally, a data collector called to schedule a time to complete the observations and assessments. Data for the larger study was subsequently collected every 6 months for 2 years, along with a subsequent follow-up assessment. Data for the present study employed measures taken at the first three assessment time points (baseline, 6 months and 1 year).

Research Design

The present study examined data collected on the entire sample of participants receiving intervention across three assessment time points (baseline = time one, 6 months = time two, and one year = time three). The impact of the independent variables which included the behavioral outcome measures on the dependent variables which include the academic achievement measures were examined using correlation and hierarchical multiple regression analysis. In an effort to ensure consistency in the data across the comparison of time points, listwise deletion of participants was used to control for missing data. This caused a significant reduction in the number of participant data available for both the correlation and regression analyses at the later

time points. Although the study began with as many as 135 participants, the sample size was decreased to as little as 37 for some of the analyses after listwise deletion, which significantly reduced the power of the study (discussed below). Raw scores for all variables were used in both the correlation and regression analyses in order to ensure consistency across analyses.

Data Analyses

The variables used in the analysis included subscales of the Conner's Rating Scale-Revised (CRS; Conners, 1997), the Social Skills Ratings System (Gresham & Elliott, 1990), the Abikoff Observation System (Abikoff and Gittleman (1985), the Dynamic Indicators of Basic Literacy Skills, the Woodcock Johnson Psychoeducational Assessment Battery (McGrew & Woodcock, 2001) and the Bracken Basic Concepts Scaled (Bracken, 1996). Specific behavioral measures used included the parent and teacher DSM-IV Symptoms Inattention and parent and teacher DSM-IV Symptoms Hyperactive-Impulsivity subscales of the CRS-R, the parent and teacher Social Skills subscales of the SSRS, and the Interference, Gross Motor Standing and Out of Chair codes from the Abikoff Observation System. Academic measures included the Initial Sound Fluency subscale of the DIBELS, the Letter Word ID subscale of the WJ-III and the School Readiness Composite score of the Bracken. Raw scores and total percentage of intervals were used in the analyses.

Power analysis. A post hoc power analysis was conducted based on Cohen (1988). Given the small sample size available for this study, consideration of power was important for both the correlation and multiple regression analysis. For the correlation between behavioral outcome variables at time one and the academic achievement variables at time two using a sample of 47 participants, an alpha of .05 and a medium effect size, the power was .54. For the correlation between behavioral outcome variables at time two and the academic achievement

variables at time three using a sample of 37, an alpha of .05 and a medium effect size, the power was .34. For the correlation between behavioral outcome variables at time one and the academic achievement variables at time three using a sample size of 43, an alpha of .05 and a medium effect size, the power was .51

For the three separate multiple regression analyses examining time one behavioral variables with time three achievement variables with a sample size of 43 an alpha of .05 and a medium effect size (f^2=.15), the power was .28. For the three separate multiple regression analyses examining time two behavioral variables with time three achievement variables with a sample size of 37 an alpha of .05 and a medium effect size (f^2=.15), the power was .21.

Research Question One

The first research question asked whether there was a change in the relationship between behavioral outcome measures and academic achievement measures over time (from time one to time three) for preschool children exhibiting symptoms of ADHD. This question was addressed by calculating Pearson product moment correlations between the behavioral outcome measures and academic achievement measures from the time one, time two and time three assessment phases. First, the strength of the correlations was used to determine the degree of the relationships between the two types of measures at each time point. The nine behavioral outcome measures (CPRS DSM-IV Inattention, CPRS DSM-IV Symptoms Hyperactive-Impulsive, CTRS DSM-IV Symptoms Inattention, CTRS DSM-IV Symptoms Hyperactive-Impulsive, SSRSP Social Skills SSRS-T Social Skills, Abikoff Interference, Abikoff Gross Motor Standing, and Abikoff Out of Chair) at time one were correlated with the three academic achievement measures at time two and time three (DIBELS Initial Sound Fluency, WJ-III Letter Naming Fluency and BBSC School Readiness Composite) using listwise deletion of participants.

Two separate sets of correlation coefficients were generated. A third set of correlation coefficients were generated using the behavioral outcome measures listed above from time two assessment and the academic achievement variables from the time three assessment. Listwise deletion was used for the latter analysis as well. Next, the correlations between these variables were compared descriptively by reporting the size of the coefficient, alpha level, and significance level. It was expected that correlation coefficients would progress from the small to moderate range and from non significant to significant across the time point comparisons. A test of the significance of these dependent samples correlations across time was not conducted and results are reported and discussed at a descriptive level only.

Research Question Two

The second research question asked which single or combination of behavioral outcome measures accounted for the greatest amount of variance in the prediction of academic achievement at the one year assessment time point (time three). Two separate sets of hierarchical regression analyses were conducted for each of the achievement measures from time three (DIBELS ISF, WJ-III Letter Naming Fluency and BBCS School Readiness Composite). It was hypothesized that measures of inattention and hyperactivity would account for the greatest amount of variance in the prediction of academic achievement at time three. The first set of regression analyses used the behavioral outcome measures from the time one assessment as predictor variables and the second set of analyses used the behavioral outcome variables from time two as the predictor variables. The predictor variables were six parent and teacher rating scales and the three direct observation variables (totaling nine predictors) and the criterion variables were the DIBELS Initial Sound Fluency, the WJ-III Letter Word ID and the BBSC School Readiness Composite.

The order in which the behavioral outcome measures were entered was determined by the empirical literature. Research suggests that symptoms of inattention are more closely linked to academic achievement than symptoms of hyperactivity (Fergusson & Horwood, 1995; Rabiner, Coie and The Conduct Problems Research Group, 2000; Lonigan et al., 1999; Massetti, Lahey, Pelham, Loney, Ehrhardt, Lee & Kipp, 2008). In addition, research has indicated direct observation of off- task behavior to play more of a role in the prediction of academic skills than other variables (specifically for elementary aged students with ADHD) (DuPaul, Volpe, Jitendra, Lutz, Lorah & Gruber, 2004). Lastly, social skills behaviors have been found to be positively linked to academic achievement (Malecki & Elliott, 2002). Therefore, the behavioral outcome measures were entered in the following order: step one included only variables that assessed inattention, step two added variables that assessed hyperactivity, and step three added variables that assessed social skills and direct observations of classroom behavior.

Chapter Four

Results

Is there a change in the relationship between behavioral outcome measures and academic achievement measures over time for this sample of preschool children exhibiting symptoms of ADHD?

Table 1 displays the demographic information for the entire sample of participants examined at each of the time point comparisons. The means and standard deviations of the variables for parent and teacher rating scales, direct observation data and the academic achievement measures used in the correlation and regression analysis are displayed in Table 2. Separate paired samples *t*-tests across time were computed for each of the predictor variables and criterion variables (time one variables with time two variables; time one variables with time three variables and time two variables with time three variables) and revealed no significant differences.

Pearson product moment correlations were computed between the raw scores on the nine behavioral outcome variables (Conners' Parent DSM-IV Symptoms Inattentive, Conners' Parent DSM-IV Symptoms Hyperactive-Impulsive, Social Skills Rating System Parent Social Skills, Conners' Teacher DSM-IV Symptoms Inattentive, Conners' Teacher DSM-IV Symptoms Hyperactive-Impulsive, Social Skills Rating System Teacher Social Skills, Abikoff Interference, Abikoff Gross Motor Standing and Abikoff Out of Chair) and the three academic achievement variables (DIBELS Initial Sound Fluency, WJ-III Achievement Letter Word Identification and Bracken Basic Concepts Scale School Readiness Composite). Listwise deletion of participants was used in order to ensure consistency of data across the time points examined. Comparisons

were made of correlations between the variables at time one with time two, correlations between variables at time two and time three and correlations between time one and time three.

Table 3 displays the Pearson product moment correlations between the behavioral outcome measures at time one and the academic achievement measures at time two. As expected, results of the comparison among all behavioral variables revealed correlations in the low to moderate range (-.01 to .67). Teacher-rated inattentiveness and parent- and teacher-rated social skills were most significantly correlated with each other. The highest among the correlations were found between the parent-rated inattentiveness and teacher-rated hyperactivity (r=.67, p<.01) and parent-rated inattentive with teacher-rated social skills (r=-.67, p<.01). Among the achievement variables, results revealed correlations in the high range (.65 to .69). Low correlations were found between behavioral outcome measures and academic achievement measures and ranged from .00 to -.24. The highest correlations were found between direct observations of interference behavior with letter word identification and school readiness skills, however, these correlations were not significantly greater than 0.

Table 4 displays the Pearson product moment correlations between the behavioral outcome measures at time two and the academic achievement measures at time three. Results of the comparison of correlations between these two time points again revealed correlations in the low to moderate range (.01 to -.78). At this comparison, parent-rated inattentiveness and teacher- and parent-rated social skills were most significantly correlated. The highest correlations were found between parent-rated inattentiveness and parent-rated hyperactivity (r=.77, p<.01) and teacher-rated inattentiveness with teacher-rated social skills (r=-.78, p<.01). Among the achievement variables, results revealed correlations in the high range (.60 to .69). Low to moderate correlations were found between the behavioral outcome measures and

academic achievement measures and range from .01 to .37. The highest correlations were found between parent-rated social skills with letter word identification skills and school readiness skills, as well as direct observation of interference behavior and initial sound fluency skills and were in the positive direction. More significant correlations were found at this time point comparison, than the previous comparison of time one versus time two.

Table 5 displays the Pearson product moment correlations between behavioral outcome measures at time one and academic achievement measures at time three. Parent- and teacher-rated inattentiveness and teacher-rated social skills emerged as most highly correlated with other behavioral measures; however, the pattern of correlations was not the same as that between time two versus time three comparisons. Correlations fell within the low to moderate range (.00 to -.71). The highest among the correlations was found between teacher-rated inattentiveness and teacher-rated hyperactive-impulsiveness (r=.71, p<.01) and teacher-rated inattentiveness and teacher-rated social skills (r=-.71, p<.01). Correlations among the academic achievement variables again fell in the moderate to high range (.58 to .69). Again, low to moderate correlations were found between behavioral outcome measures and academic achievement measures and ranged from -.01 to -.36. At this time comparison, the direct observation interference variable was most highly correlated with initial sound fluency skills and school readiness skills. A greater number of significant correlations were not found at this time point compared to the previous comparison of time two versus time three variables. Given this finding, support for the hypothesis that there would be stronger correlation coefficients found among the comparison of measures of behavior and academic achievement variables at later time points was not found. This conclusion is tentative, given no direct test of this difference was conducted.

Which single or combination of behavioral outcome measures accounts for the greatest amount of variance in the prediction of academic achievement at time three?

Tests for multicollinearity for the examination of time one and time three variables indicated that a low level of multicolinearity was present due to high correlation between variables. Values of the variance inflation factor all fell below 3 and tolerance values were all above .10, indicating an acceptable level of multicollinearity among these variables. Tests for multicollinearity for the examination of time two and time three variables indicated acceptable levels as indicated by variance inflation factors below 6 and a tolerance values above .10. It is worth noting that the values for the latter analyses between the time two and time three variables were higher and approached levels of concern (Pallant, 2010).

Regression Analysis of Time One Behavioral Outcome Measures and Time Three Academic Achievement Measures

Results of the hierarchical multiple regression analysis predicting performance on the DIBELS Initial Sound Fluency at time three from behavioral outcome measures at time one are presented in Table 6. Two variables, parent and teacher inattention were entered at step one and explained 2% of the variance (F (2, 40) = .41, ns) in performance on DIBELS ISF. In step two, two more variables, parent and teacher ratings of hyperactive-impulsiveness, were entered into the model and only contributed a slight amount of additional variance, 0.3%, (F (4, 38) = .23, ns) bringing the total variance to 2.3%. Lastly, 5 predictor variables were entered at step 3 and added an additional 161% of variance in the explanation of performance on DIBELS ISF. These variables included parent and teacher-rated social skills and the direct observation variables of interference, gross motor standing and out of chair behaviors. Overall, the full regression model with 9 predictors explained a total of 18.4% of the variance in performance on the DIBELS

Initial Sound Fluency. This 9 predictor model was not statistically significant after the addition of social skills and direct observation variables (F (9, 33) = .83, ns).

The results of the hierarchical multiple regression analysis predicting performance on the WJ-III Letter Word ID at time three from behavioral outcome measures at time one are presented in Table 7. At step one, parent and teacher inattention variables were entered and explained 7.1% of the variance (F (2, 40) = 1.53, ns). Next, the entry of two more variables, parent and teacher ratings of hyperactive impulsiveness, at step two, added an additional 2.4% variance bringing the total variance to 9.5%, F (4, 38) = 1.00, ns). Lastly, the entry of 5 additional predictor variables; parent and teacher-rated social skills and the direct observation variables of interference, gross motor standing and out of chair behavior into the model increased the variance in the prediction of performance on the WJ-III Letter Word ID by 10.5% (F (9, 33) = .92, ns). Overall, the full regression model with 9 predictors explained a total of 20% of the variance in performance on the WJ-III Letter Word ID. This 9 predictor model was not statistically significant after the addition of social skills and direct observation variables.

The results of the hierarchical regression analysis predicting performance on the Bracken School Readiness Composite at time three from behavioral outcome measures at time one are presented in Table 8 at time three as the criterion variable and the behavior variables at time one as the predictor variables. The parent and teacher attention variables were entered first, at step one and explained 17.1% of the variance in performance on the Bracken School Readiness Composite F (2, 40) = 4.1, p <.05). Next, the parent and teacher ratings of hyperactive-impulsive behavior were entered into the model at step 2, adding only 1.6% to the variance (F (4, 38) = 2.2, ns). Lastly, the entry of 5 variables; parent and teacher-rated social skills and direct observation variables of interference, gross motor standing and out of chair behavior at step 3

increased the variance explained by 9.8%. Overall, the full regression model with 9 predictors explained a total of 28.5% of the variance in performance on the Bracken Basic Concepts Scale SRC F (9, 33) = 1.5, ns). This 9 predictor model was not statistically significant after the addition of social skills and direct observation variables.

Regression Analysis of Time Two Behavioral Outcome Measures and Time Three Academic Achievement Measures

Results of the hierarchical multiple regression analysis predicting performance on the DIBELS Initial Sound Fluency at time three from behavioral outcome variables at time two are presented in Table 9. The order of entry was identical to that of the first set of analyses. Parent and teacher inattention were entered at step one and explained 6.4% of the variance (F (2, 34) = 1.15, ns) in performance on DIBELS ISF. The addition of parent and teacher ratings of hyperactive-impulsiveness at step two added 5.5 % variance, F (4, 32) = 1.07, ns) bringing the total variance to 11.9%. Lastly, the 5 predictor variables entered at step 3 added an additional 38% of variance in the explanation of performance on DIBELS ISF, F (9, 27) =2.98, $p < .01$. Overall, the full regression model with 9 predictors was found to be statistically significant and explained a total of 49.9% of the variance in performance on the DIBELS Initial Sound Fluency.

The results of the hierarchical multiple regression predicting performance on the WJ-III Letter Word ID from behavioral outcome measures at time two are presented in Table 10. Parent and teacher inattention variables alone explained only 1.9 % of the variance (F (2, 34) = .33, ns). When parent and teacher ratings of hyperactive-impulsiveness were entered at step two an additional 3.9 % variance was explained bringing the total variance to 5.8%, (F (4, 32) = .49, ns). Lastly, the entry of 5 additional predictor variables increased the variance in the prediction of performance on the WJ-III Letter Word ID by 28.2%, F (9, 27) = 1.55, ns). Overall, the full

regression model with 9 predictors explained a total of 33% of the variance in performance on the WJ-III Letter Word ID; however, this model was not statistically significant.

The results of the final hierarchical regression analysis, predicting performance on the Bracken School Readiness Composite at time three from behavioral outcome measures at time two are presented in Table 11. Parent and teacher attention variables alone entered at step one and explained only 0.9% of the variance in performance on the Bracken School Readiness Composite F (2, 34) = .15, ns. The addition of parent and teacher ratings of hyperactive-impulsive behavior were entered at step 2 adding little additional variance, 0.4%, F (4, 32) = .10, ns. The entry of the 5 remaining behavioral predictor variables at step 3 added 24.3% variance F (9, 27) = .10, ns. This overall model with 9 predictors explained a total of 25.6% of the variance in performance on the Bracken Basic Concepts Scale and was not statistically significant.

Chapter Five

Discussion

The purpose of the present study was to examine the relationship between behavioral outcome measures and measures of early academic achievement in a sample of preschool children identified as at-risk for ADHD. Specifically, this study sought to examine whether there was a change in the relationship between these variables over time and which single or combination of variables accounted for the greatest amount of variance in the prediction of early readiness and early reading achievement variables at the one year time point (time three). It was hypothesized that the relationship between behavioral outcome measures and academic achievement would be stronger at time three than at time one and time two and that inattention and hyperactive impulsive variables would account for the greatest amount of variance in the prediction of academic achievement variables at time three.

Overall, these results indicated that for this sample of preschool and early kindergarten children, symptoms of ADHD and measures of early academic and early readiness skills were weakly correlated. Support for the first hypothesis was not found, given correlations between the variables in question did not increase across the time points. In fact, the correlations were quite similar across the time points. One could argue that partial support for this hypothesis was found, given the finding that there were more significant correlations between the comparison of time two with time three and time one with time three, than there were between the comparison of time one with time two (e.g. an increase from zero to three and movement from small to moderate). Though this conclusion is made, a direct test of the difference in correlations across time was not conducted and results were discussed descriptively only and should be interpreted cautiously. Contrary to expectations, parent ratings of social skills and direct observation

variables were more strongly correlated with measures of early readiness and reading. In addition, these variables were better predictors of achievement in reading and readiness than were symptoms of ADHD. The combination of social skills and direct observation variables contributed the most amount of variance in the prediction of early academic achievement at all time points examined. Support for the second hypothesis that inattentive and hyperactive variables would account for the most variance in the prediction or early academic and readiness skills was also not found.

These results add to the existing literature base on the relationships between behavior and academics for preschool children; however, results are in contrast to past research that has indicated a stronger relationship specifically between symptoms of ADHD and early academic achievement for the preschool populations (Arnold, 1997; Lonigan et al., 1999: Rabiner et al, 2000). These findings suggest that the relationship between the primary variables of interest (ADHD symptoms) for this sample of young children in preschool and entering kindergarten were not strongly related and did not change much within the one year time span examined. This conclusion came from the fact that correlations were similar across time (descriptively speaking, since a direct test of change across time was not conducted) and that the combination of social skills and direct observation variables explained most of the variance in the performance on measures of early readiness and reading. In addition, other variables (such as executive functioning skills, teacher perceptions of academic skills and exposure to literacy experiences) that were unexplored in the present study, are likely involved in the relationship between academic and behavior as evidenced by the variance left unexplained from the regression analyses. As a follow-up to the Freeman et al. 2006 study in which measures of ADHD symptoms and academic achievement variables were assessed at one time point, the present

longitudinal study found similar results that ADHD behaviors in preschool and early kindergarten were not predictive of early reading achievement.

Explanation of Findings

The findings from the present study are similar to those found in previous studies that have examined the link between preschool inattention-hyperactivity and measures of pre-reading skills that found a weak relationship between specific measures of ADHD symptoms and early reading skills. Velting and Whitehurst (1997) reported a lack of association between hyperactivity in Head Start and kindergarten and measures of pre-reading and reading skills development. However, an association between these variables was found in first grade. It is likely that measures of inattention and hyperactivity begin to impact reading skills later in formal schooling. As mentioned by Velting and Whitehurst, the nature of the curriculum and the type of tasks taught in these environments is likely to be a reason for this later development. The type of activities used to teach early skills in the preschool environment are often play based and typically occur in the context of songs and games, children are likely to still acquire skills in this type of setting. A switch to a more demanding curriculum that requires more concentrated attention occurs in later grades. In addition, as stated by these authors, social skills rather than academic skills are often more of a focus in early childhood environments. As one of the areas of functioning impacted by ADHD, the stronger relationship between social skills and early readiness and literacy skills, rather than specific symptoms of the disorder could be due to the focus of the curriculum. Neither the current study, nor Velting and Whitehurst (1997) included any assessment or analysis of the classroom environments, so these explanations should be taken with caution.

An alternative explanation for the findings of the present study could be that inattentive type of ADHD is typically detected later in the course of the disorder, while the combined and hyperactive-impulsive subtypes tend to have an earlier age of onset (Barkley, 1997). Additionally, it has been found that preschool children with inattentive type ADHD are at higher risk for academic difficulties, while those with hyperactive-impulsive type are at higher risk for social problems and disruptive behavior (Spira & Fischel, 2005).

One other study in which ADHD symptoms were evaluated in the prediction of academic achievement was that by DuPaul and colleagues (2004). As much as 25% to 55% of the variance was explained by teacher perceptions of student skills and direct observation of student behavior. Similar to the present study, measures of direct observation emerged as important variables in the prediction of academic outcomes, more so than parent and teacher ratings of ADHD symptoms. The authors proposed that all the variables, including those measuring inattention and hyperactivity-impulsivity, would contribute to academic achievement, above the contributions of SES and ethnicity. Unexpectedly, teacher perceptions of academic skills emerged as the strongest predictor of achievement and differences were found for students with ADHD and those without, providing some indication of which variables should be considered in further explanation of the unexplained variance in early readiness and early reading achievement. One possible explanation for the present finding is the lack of control for other variables that may account for performance on the early readiness and reading measures such as differences in SES or ethnicity, as was done in the DuPaul et al. 2004 study.

Results of the present study confirm a similar finding of the role of social skills in their relationship to academic achievement. Malecki and Elliot (2002) found that social skills were better predictors of academic achievement than were problem behaviors such as inattention and

hyperactive behaviors in a sample of upper elementary students. Correlations between teacher ratings of social skills based on the SSRS-T with the ITBS Reading scale fell in the moderate range (.31). In the present study, it was the SSRSP Social Skills that was moderately and positively correlated with the WJ-III Letter Word ID subtest (r =.35) and with the BBSC School Readiness Composite (r = .37). These authors posited that positive social skills can serve as academic enablers in elementary school and results for children the present study suggest the same for social skills within the preschool population. In contrasting the measures and methods used in the present study with Malecki and Elliot (2002), aside from the older aged sample, the use of the ITBS total scale score likely provided more reliable and valid measure of overall academic achievement than the subscale scores used in the present study. Worth noting in this comparison of the two studies is the differences in sample size. Malecki and Elliot used a sample of 139 participants as opposed to the 37 used in the analysis in the present study. Despite the lower powered analysis, the magnitude of the correlations found was nearly identical.

The findings of the present study are in contrast to previous research by Arnold (1997) which indicated a moderate relationship between measures of inattention and emergent literacy skills, demonstrating that the relationship between these variables exists as early as 3 years of age. In addition, Arnold's results provided evidence of the unique role of attention in the relationship between overall externalizing behavior and emergent academic skills for preschool children demonstrating through path analysis that attention problems mediated the path from academics to behavior, but not the reverse from behavior to academics. In contrast, the present sample of preschool children was of mixed SES and mixed gender, whereas the Arnold sample was low income participants and included only boys. Other differences worth noting were Arnold's use of global measures of behavior and direct observation data as the attention measure,

while the current study used formal rating scales to measure attention. The differences in the measurement variables in the two studies and the more sophisticated analysis and larger sample in the Arnold study are likely the reason for the difference in the results. Though the overall conclusions are not the same, correlations found in the present study mimic those found in Arnold (1997) who reported moderate correlations between observations of misbehavior and objective standardized measures of achievement of r = -.34. The present study found moderate correlations between the direct observation measure interference at study entry and the DIBELS ISF measure at time 3 (r = .38). Additionally, a moderate negative correlation was found between the interference variable at the time 2 (6 month) assessment and the DIBELS ISF (r = -.36) and the BBSC School Readiness Composite (r = -.32). Again, the differences in sample size between the Arnold (1997) and the present study are worth noting. Arnold's study used a sample of 74 participants, while the present study included a sample of 37. Despite the lower powered analysis, results of the correlations were similar.

In contrast to the study by Lonigan and colleagues (1999), in which inattentive behavior, as measured by the CTRS Inattentive subscale, was found to have the strongest correlation with emergent literacy skills for both low income and middle income preschool children, the present study found parent ratings of inattention at study entry only to correlate negatively with the BBCS School Readiness Composite (r = -.36), a measure of readiness. Also in the Lonigan et al. study, inattention explained unique variance in the prediction of specific emergent literacy skills, over that of other measures of behavior problems and social skill. Both the present study and Lonigan et al. included attention in the baseline model; however, the current findings did not find attention problems to emerge as the most significant predictor nor contribute to the overall prediction of the early academic outcome measures in question. Similarly, Rabiner and

colleagues (2000) found that both measures of inattention and overactivity were correlated significantly across grades and inattention in particular was more strongly correlated than hyperactivity and predicted reading achievement above and beyond IQ and parental involvement. One possible explanation for the differences in the results is the use of a composite measure as the emergent literacy measure and the use of single measures of early reading and readiness skills in the current study. Overall measures and total measures that are inclusive of more skills are likely to be more closely correlated with behavior due to the larger number of items included on such scales and the wider range of skills assessed making them more reliable and valid. As for the differences with the Rabiner et al. (2000) study, the authors' study design and analysis and sample size lent itself to better able to detect statistical significance. It is also likely that the present study was simply not powered enough to better detect statistically significant differences.

Given the magnitude correlations found between the behavioral outcome variables and early achievement variables and the low power, one would not expect the behavioral outcome measures to account for much, if any, of the variance in the prediction of the criterion measures. However, results of first set of hierarchical regression analyses examining time one behavioral predictors and time three achievement revealed as much as 33% of the total variance was explained by the set of predictors posited for any of the three outcome variables. Results of the second set of hierarchical regression analyses that examined time two behavioral predictors with time three achievement variables explained close to 50% of the variance in the prediction of early readiness academic measures. Specifically, the performance on DIBELS ISF was best predicted by measures of parent-rated social skills and the interference direct observation variable. Similar to the results of the Freeman et al (2006) study, measures of parent and teacher-rated social skills and direct observation variables emerged as the best predictors of early

academic achievement in models examined. Clearly, teacher and parent ratings of social skills and variables that directly measure behavior are important tools in identifying academic skills problems. In a similar study, DeShazo Barry and colleagues (2002) examine the predictability of ADHD symptoms in contrast to executive functioning skills and found that ADHD symptoms indeed predicted achievement above and beyond that of performance on measures of executive functioning in a sample of older elementary and middle school aged children. In addition, severity of ADHD was examined and contributed significantly to the relationship between the variables examined.

Developmental Pathway of ADHD and Early Academic Skills

One of the overall purposes of this study was to possibly add to the literature base in helping to identify whether there was a point at which behavioral symptoms of ADHD become more strongly correlated with measures of academic achievement. As discussed in the literature review, several authors have examined and commented on the developmental pathway of ADHD and discussed the notion of differing developmental patterns for children from preschool through adolescence (Hinshaw , 2002; Rapport et al., 1999; Sonuga-Barke et. al., 2005; Spira et. al., 2005; von Stauffenberg & Campbell, 2007; Willoughby, 2003). A more thorough examination of this pathway or pattern was beyond the scope of this study due to limitations of sample size and power. However, it is worth mentioning that more sophisticated analyses that would have helped to add information to the developmental progression of symptoms would have added to the importance of the present study for the larger literature base within this population. As stated by Hinshaw (2002), further examination in this area is imperative for the empirical base and our understanding of the mechanisms that explain these pathways as well as to inform intervention and treatment.

One possible explanation of the current results as it related to the developmental pathway and functioning concerns the lack of examination of ADHD subtypes as it related to study outcomes. The present study's findings suggest that many other factors are likely to moderate a child's performance on early academic achievement measures. One such factor may be ADHD subtype. The present study did not examine the difference in subtypes or look at the way certain symptoms might manifest for different subtype categories. Similar to the preliminary study, it is likely that for the present sample, which included mostly children with ADHD combined type, academic skills difficulties aren't as evident at this age or that they may be different pathways based on subtype and subsequently might respond differently to treatment (Kern et al., 2007; Sonuga-Barke et al., 2005)

Also of note is the three academic outcome measures chosen as measures of early literacy and readiness skills were highly correlated. Though this author's premise was that choosing these three measures would provide an examination into three distinct skills, it is likely that the age of participants in the sample and ADHD status impacted performance on these measures. This is likely due to the fact that is a measure of overall readiness, rather than early literacy may be more important for this population of students. Given the results of both this study as well as the preliminary study, (Freeman et al., 2006), general measures of school readiness skills, such as those assessed by the Bracken, are likely to be more closely related to behavioral symptoms manifested by ADHD than are more specific measures of reading such as those measured by the DIBELS and WJ-III measures.

Limitations

There are a number of limitations to the present study that warrant caution in interpretation of the findings. First and foremost is the small sample size. Although a total of

152 students were recruited for the overall study and 135 students met inclusion criteria for the study, attrition issues and missing data seriously limited the sample sizes available for the analyses conducted in the present study. With each later assessment phase, the sample size available was smaller. In order to ensure adequate comparison across the assessment points, listwise deletion was used and this decreased the sample size.

Second and related to sample size is the issue of low power. One possible explanation for the limited finding is the low power of the study to detect statistically significant results. The power of the statistical analyses chosen was limited primarily as a result of low sample sizes for both the correlation analyses as well as the regression analysis. The power for the correlation analysis was in the .50 range and allowed the analysis a mere 50% chance of detecting a significant result. The regression analyses were even less well powered than the correlation analysis. These analyses had nearly half the power, .28 and .21 with only a 21% to 28% chance of detecting a significant result. Despite the limitation of power, the magnitude of results mimicked that of previous studies.

Third concerns the appropriateness of measures for the age group in question. The measures chosen for the study were not designed for students of preschool age. The larger study chose some measures in order to keep measurement consistent across time. In particular, the Social Skills Ratings System subscales used, although similar to the preschool version, were designed for elementary aged students. Despite the fact that the items on the elementary and preschool version are similar, the lack of appropriateness of the measure for the population being examined may have impacted the ability of the measure to adequately assess the social skills of the participants and subsequently skewed the results. Related to this is the limitation in the psychometric properties of the variables examined in the current study. Given the

interrelationships among the variables examined and the psychometric limitations of the variables chosen, the results may have been impacted. For example, the use of the preschool version of the SSRS as well as more robust measures of academic skills may have yielded different outcomes. For these reasons, results should be interpreted cautiously.

Fourth concerns the lack of a typically performing comparison group. The present study did not assess the relationship between the variables being assessed in a comparison group who did not receive treatment or did not have ADHD. The addition of a non-treatment and or non-clinical control group would help to assess what the impact of treatment was and also to examine the relationship between the variables in question within the general population.

The correlational nature of this study limits conclusions that can be drawn and the ability to generalize the results to other populations. While correlation analysis allows for the determination that variables are associated or related to each other in some way, this type of analysis cannot determine that there is a causal relationship between the variables examined. Simply conducting correlation analyses alone does not allow for the researcher to rule out alternative explanations for the relationship between the variables being examined (Pallant, 2010). Both the correlation analyses and the regression analysis in the present study did not control for the influence of other variables that are likely to be involved in the relationship between symptoms of ADHD and achievement.

The last limitation concerns the use of the hierarchical multiple regression technique and the order of entry of the variables. This technique relies on empirical judgment and theory in driving the decisions on which variables are included in the regression equations at each step of the analysis. The researcher should make sound decisions regarding the order and method of entry in order to best obtain the variance in the criterion measure (Muijs, 2004). Other variables

are clearly involved in the prediction of early academic achievement for this sample of students at-risk for ADHD. In light of these results, it is likely that the choice of variables and the order of entry of the hierarchical regression may have resulted in a different outcome.

Implications for Practice and Directions for Future Research

Given the present results, future research in this area should examine more closely the environmental variables that impact the relationship between behavioral and academic variables as they relate to ADHD and early literacy and reading development. The low correlations between the variables and the large percentage of variance in the prediction of the early academic measures left unexplained suggests a additional avenues of focus in the examination of this relationship. The present study failed to examine other environmental factors that could be important in the relationships that contribute to long term performance on academic skills measures for students with ADHD, such as executing function skills, teacher perceptions and differences in exposure to early literacy and learning activities.

In addition and as discussed in the previous section, future research should utilize a larger sample of participants that includes a typically developing sample and not treatment sample in order to compare relationships within a more sophisticated design that have the potential to examine questions related to developmental patterns, trajectories, impact of treatment and differences between subtypes within the preschool population.

The results of the current study provide implications for those providing early prevention, intervention and education for preschool children at-risk for ADHD. First, given the findings that symptoms of ADHD are less related and predictive of academic skills outcomes than social skills and direct observation variables, focus on treatment and services for such children could include strategies and tools aimed at teacher and improving social skills and positive interactions

for such children. Specifically, intervention targeted at improving the ability of parents to enhance their child's social skills, give the strong relationship found between parent-rated social skills and achievement measures. As one of the primary areas of functional impairment identified (Barkley, 2006) and the findings of lower parent and teacher-rated social skills into adolescent (Molina et al., 2009), provision of services for the enhancement of social skills is important. Secondly, the current findings show that behavioral difficulties in preschool children related to some facets of overall readiness more so than specific pre-reading skills. Academic interventions aimed at this population may be best aimed at providing such children with skills in the areas of overall readiness. Enhancement of such learning could entail enabling parents with tools so they may assist children in developing such skills through home activities aimed at social skills and readiness skills.

Conclusions

The current study examined the relationship between behavioral measures and early readiness and reading measures in an at-risk sample of preschool children. Results revealed few moderate correlations between measures of ADHD symptoms and academic measures. Unexpectedly, measures of parent-rated social skills and observation variables were moderately correlated with achievement measures. The notion that many factors contribute to the academic achievement of children experiencing difficulty with ADHD highlights the importance of the need to more specifically examine patterns and pathways that mediate and moderate the relationship. Although it was assumed and demonstrated in previous research that variables related to inattention and hyperactivity-impulsivity have a profound impact on academic performance, this study suggests other variables teacher perceptions of skills, child literacy and learning experience and executive functioning skills are likely involved and may contributing

predictors in the relationship between how ADHD impacts functioning and academic achievement, especially for children of preschool age. It was the intention of this study to expand upon the preliminary work to this study (Freeman et al., 2006), however, issues with study attrition across the years spanned decreased the sample size and tremendously impacted this study's ability to more definitively shed further light of the relationships examined.

As previously discussed in the Freeman et al (2006) study, adequate services for young children at-risk for future emotional behavioral problems, especially those at risk for ADHD, it is important that all the potential variables that may impact early learning and skill acquisition are examined. It is important to pinpoint target behaviors for intervention that most closely relate to early academic achievement. Having a clear understanding of how behavior and academic achievement relate and develop over time and impact each other are critical steps to providing early intervention services for at risk children. Counter to expectations, this study does not provide further evidence of a stronger relationship between measures of ADHD symptoms and early academic achievement measures across time. However, it does confirm that there is a stronger relationship between other behavioral correlates of ADHD and academic achievement such as social skills and classroom behavior and further confirms the need to modify environmental and instructional variables and supports. Ideally, future studies in this area would need to include a control/comparison sample, examine environmental factors related to instruction and possible examine ADHD subtypes and utilize a larger sample.

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Table 1

Demographic characteristics for participants at each Time Point Comparison

Measure	Time One-Time Two	Time One-Time Three	Time Two -Time Three
n	47	43	37
Age (in months)	50	51	52
Male (%)	40 (85.1)	33 (76.7)	25 (67.6)
Female (%)	7 (14.9)	10 (23.3)	12 (32.4)
White/Non Hispanic (%)	37 (78.72)	31 (72)	21 (56.8)
Hispanic/Latino (%)	5 (10.64)	6 (14)	8 (21.6)
Other (%)	5 (10.64)	6 (14)	8 (21.6)

Note: Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables. Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables. Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables.

Table 2

Means and Standard Deviations for Variables at Each Time Point Comparison

	Time One -Time Two N=47	Time Two-Time Three N=37	Time One-Time Three N=43
CPRS Inattentive	13.74 (4.78)	12.76 (6.70)	13.77 (4.99)
CTRS Inattentive	12.70 (7.00)	16.11 (5.47)	12.56 (6.90)
CPRS Hyperactive Impulsive	16.96 (5.70)	11.14 (7.42)	16.70 (5.45)
CTRS Hyperactive Impulsive	15.60 (7.55)	15.08 (7.66)	15.53 (7.75)
SSRS Parent Social Skills	44.47 (9.22)	45.86 (9.28)	43.93 (9.39)
SSRS Teacher Social Skills	30.79 (9.03)	31.46 (11.31)	31.05 (8.95)
Abikoff Interference	5.26 (4.92)	5.11 (6.06)	4.77 (4.57)
Abikoff Gross Motor Standing	1.06 (1.89)	1.30 (3.07)	1.14 (2.07)
Abikiff Out of Chair	.98 (2.73)	.19 (.66)	.58 (1.65)
DIBELS Initial Sound Fluency	12.97 (8.94)	19.79 (12.25)	19.91 (10.71)
WJ-III Letter Word ID	15.06 (6.67)	19.97 (10.21)	19.30 (8.40)
BBCS School Readiness Composite	72.19 (14.52)	76.22 (11.20)	77.84 (9.67)

Note: Time One includes the following independent behavior variables: CPRS= Conners' Parent Rating Scale, CTRS= Conners Teacher Rating Scale, SSRS= Social Skills Rating System, Abikoff Interference, Abikoff Gross Motor Standing and Abikoff Out of Chair. Time Two and Time Three include the following criterion academic variables: DIBELS ISF=Initial Sound Fluency, WJ-III= Woodcock Johnson, BBCS=Bracken Basic Concepts Scale. Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables. Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables. Time One-Time Two indicates a comparison of Time One behavior and Time Two academic variables.

Table 3

Correlations: Behavioral Variables Time One and Academic Variables Time Two

n=47	Behavior								Academic			
Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. CPRS DSM-IV Inattentive	-	**.55****	.29	.22	-.26	-.23	.22	.02	-.07	-.13	.04	-.01
2. CPRS DSM-IV Hyperactive- Impulsive		-	.19	**.32***	-.21	-.07	.19	.10	-.01	.01	.20	.05
3. CTRS DSM-IV Inattentive			-	**.67****	**-.34***	**-.67****	-.09	.15	.23	.02	.16	.09
4. CTRS DSM-IV Hyperactive- Impulsive				-	-.20	**-.44****	-.01	.04	.19	.11	.23	.14
5. SSRS Parent Social Skills					-	**.32***	-.04	**-.32***	-.19	.10	.06	.13
6. SSRS Teacher Social Skills						-	-.01	-.17	-.12	.06	.00	.01
7. Abikoff Interference							-	-.05	.14	-.01	-.24	-.24
8. Abikoff Gross Motor Standing								-	.26	-.04	-.04	-.07
9. Abikoff Out of Chair									-	-.01	.04	-.09
10. DIBELS Initial Sound										-	**.65****	**.69****
11. WJ-III Letter Word ID											-	**.68****
12. Bracken BCS School Readiness												-

*** $p < .01$, *$p < .05$ (two tailed)* Note. CPRS= Conners Parent Rating Scale, CTRS= Conners Teacher Rating Scale, SSRS= Social Skills Rating System, ISF=Initial Sound Fluency, WJ-III= Woodcock Johnson, BBCS=Bracken Basic Concepts Scale.

Table 4

Correlations: Behavioral Variables Time Two and Academic Variables Time Three

n= 37	Behavior									Academic		
Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. CPRS DSM-IV Inattentive	-	**.77****	**.39***	.21	**-.42***	**-.47****	.15	-.07	-.14	.21	-.12	-.06
2. CPRS DSM-IV Hyperactive- Impulsive		-	.11	.17	**-.38***	-.17	.25	-.30	-.32	.01	-.13	-.06
3. CTRS DSM-IV Inattentive			-	**.73****	-.20	**-.78****	.01	.10	.28	.21	-.11	.05
4. CTRS DSM-IV Hyperactive- Impulsive				-	-.16	**-.62****	.24	.11	.19	.02	-.21	.00
5. SSRS Parent Social Skills					-	.05	-.05	.07	.16	.20	**.35***	**.37***
6. SSRS Teacher Social Skills						-	.07	-.04	-.22	-.04	.26	.05
7. Abikoff Interference							-	.20	-.04	**.38***	.18	.16
8. Abikoff Gross Motor Standing								-	.20	-.04	-.09	-.03
9. Abikoff Out of Chair									-	.07	.08	.17
10. DIBELS Initial Sound										-	**.68****	**.60****
11. WJ-III Letter Word ID											-	**.69****
12. Bracken BCS School Readiness												-

*** $p < .01$, *$p < .05$ (two tailed)* Note. CPRS= Conners Parent Rating Scale, CTRS= Conners Teacher Rating Scale, SSRS= Social Skills Rating System, ISF=Initial Sound Fluency, WJ-III= Woodcock Johnson, BBCS=Bracken Basic Concepts Scale.

Table 5

Correlations: Behavioral Variables Time One and Academic Variables Time Three

n= 47	Behavior								Academic			
Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. CPRS DSM-IV Inattentive	-	**.55****	**.37***	.30	-.29	-.27	.27	-.07	.05	-.14	-.11	**-.36***
2. CPRS DSM-IV Hyperactive- Impulsive		-	.18	**.35***	-.27	-.07	.27	.00	.13	-.05	.06	-.11
3. CTRS DSM-IV Inattentive			-	**.69****	-.25	**-.71****	-.04	.11	.25	-.01	.19	.07
4. CTRS DSM-IV Hyperactive- Impulsive				-	-.16	**-.57****	.00	.08	.29	.03	.19	.10
5. SSRS Parent Social Skills					-	.28	.-15	-.14	-.08	.18	-.01	.20
6. SSRS Teacher Social Skills						-	-.10	-.13	-.07	.09	.05	.07
7. Abikoff Interference							-	-.12	.13	**-.36***	-.16	**-.32***
8. Abikoff Gross Motor Standing								-	.23	.09	-.03	.10
9. Abikoff Out of Chair									-	.08	.19	.06
10. DIBELS Initial Sound										-	**.58****	**.56****
11. WJ-III Letter Word ID											-	**.69****
12. Bracken BCS School Readiness												-

*** $p < .01$, *$p < .05$ (two tailed)* Note. CPRS= Conners Parent Rating Scale, CTRS= Conners Teacher Rating Scale, SSRS= Social Skills Rating System, ISF=Initial Sound Fluency, WJ-III= Woodcock Johnson, BBCS=Bracken Basic Concepts Scale.

Table 6

Hierarchical Regression for Behavioral Variables at Time One Predicting DIBELS Initial Sound Fluency Performance at Time Three (N=43)

Predictors	B	SE B	β
Step 1			
Intercept	23.49	5.12	-
CPRS DSM-IV Inattention	-.33	.36	-.15
CTRS DSM-IV Inattention	.07	.26	.05
Step 2			
Intercept	22.66	6.18	-
CPRS DSM-IV Inattention	-.36	.44	-.17
CTRS DSM-IV Inattention	-.01	.37	-.01
CPRS DSM-IV Hyperactivity	.05	.40	.02
CTRS DSM-IV Hyperactivity	.09	.33	.06
Step 3			
Intercept	6.38	16.11	-
CPRS DSM-IV Inattention	-.08	.44	-.04
CTRS DSM-IV Inattention	.12	.42	.07
CPRS DSM-IV Hyperactivity	.15	.41	.07
CTRS DSM-IV Hyperactivity	.08	.36	.26
SSRS P Social Skills	.14	.20	.12
SSRS T Social Skills	.23	.29	.19
Abikoff Interference	-.87	.40	**-.37***
Abikoff Gross Motor Standing	.25	.86	.05
Abikoff Out of Chair	.61	1.14	.09

Note. R^2 = .020 for Step 1, Δ R^2= .003 for Step 2, Δ R^2= .161 for Step 3

** p < .05, **p < .01 (two tailed)*

Table 7

Hierarchical Regression for Behavior Variables at Time One Predicting WJ-III Letter Word ID Performance at Time Three (N=43)

Predictors	B	SE B	β
Step 1			
Intercept	20.05	3.92	-
CPRS DSM-IV Inattention	-.34	.28	-.20
CTRS DSM-IV Inattention	.32	.20	.26
Step 2			
Intercept	17.61	4.67	-
CPRS DSM-IV Inattention	.50	.33	-.29
CTRS DSM-IV Inattention	.26	.28	.21
CPRS DSM-IV Hyperactivity	.24	.30	.15
CTRS DSM-IV Hyperactivity	.08	.25	.08
Step 3			
Intercept	7.41	12.52	-
CPRS DSM-IV Inattention	-.39	.35	-.23
CTRS DSM-IV Inattention	.46	.33	.38
CPRS DSM-IV Hyperactivity	.18	.32	.11
CTRS DSM-IV Hyperactivity	.14	.26	.13
SSRS P Social Skills	-.06	.16	-.07
SSRS T Social Skills	.35	.22	.37
Abikoff Interference	-.34	.31	-.19
Abikoff Gross Motor Standing	-.41	.67	-.10
Abikoff Out of Chair	.61	.88	.12

Note. R^2 = .071 for Step 1, ΔR^2= .024 for Step 2, ΔR^2= .105 for Step 3

** p < .05, **p < .01 (two tailed)*

Table 8

Hierarchical Regression for Behavior Variables at Time One Predicting BBCS School Readiness Composite Performance at Time 3 (N=43)

Predictors	B	SE B	β
Step 1			
Intercept	85.54	4.26	
CPRS DSM-IV Inattention	-.85	.30	-.44
CTRS DSM-IV Inattention	.32	.22	.23
Step 2			
Intercept	83.43	5.09	
CPRS DSM-IV Inattention	-.97	.36	**-.50***
CTRS DSM-IV Inattention	.23	.30	.17
CPRS DSM-IV Hyperactivity	.18	.33	.10
CTRS DSM-IV Hyperactivity	.12	.27	.10
Step 3			
Intercept	65.57	13.62	
CPRS DSM-IV Inattention	-.78	.38	**-.40***
CTRS DSM-IV Inattention	.42	.35	.30
CPRS DSM-IV Hyperactivity	.22	.34	.13
CTRS DSM-IV Hyperactivity	.16	.28	.13
SSRS P Social Skills	.11	.17	.11
SSRS T Social Skills	.28	.24	.26
Abikoff Interference	-.51	.34	-.24
Abikoff Gross Motor Standing	.26	.73	.06
Abikoff Out of Chair	-.04	.96	.01

Note. **R^2 = .171 for Step 1, *p< .05**, Δ R^2= .016 for Step 2, Δ R^2= .098 for Step 3

** p < .05, **p < .01 (two tailed)*

Table 9

Hierarchical Regression Behavior Variables at Time Two Predicting DIBELS Initial Sound Fluency Performance at Time Three (N=37)

Predictors	B	SE B	β
Step 1			
Intercept	13.45	4.67	
CPRS DSM-IV Inattention	.29	.33	.16
CTRS DSM-IV Inattention	.24	.30	.14
Step 2			
Intercept	21.17	7.34	
CPRS DSM-IV Inattention	.73	.59	.40
CTRS DSM-IV Inattention	.32	.49	.19
CPRS DSM-IV Hyperactivity	-.66	.67	-.29
CTRS DSM-IV Hyperactivity	-.24	.42	-.15
Step 3			
Intercept	-.35.66	21.41	
CPRS DSM-IV Inattention	1.42	.60	**.78***
CTRS DSM-IV Inattention	.99	.45	**.60***
CPRS DSM-IV Hyperactivity	-1.12	.65	-.50
CTRS DSM-IV Hyperactivity	-.26	.41	-.17
SSRS P Social Skills	.56	.22	**.43***
SSRS T Social Skills	.60	.29	.56
Abikoff Interference	.79	.33	**.39***
Abikoff Gross Motor Standing	-.40	.64	-.10
Abikoff Out of Chair	.19	2.87	.01

Note. R^2 = .064 for Step 1, Δ R^2= .055 for Step 2, Δ **R^2= .380 .for Step 3, **p<.01**

** p < .05, **p < .01 (two tailed)*

Table 10

Hierarchical Regression for Behavior Variables at Time 2 Predicting WJ-III Letter Word ID Performance at Time 3 (N=37)

Predictors	B	SE B	β
Step 1			
Intercept	22.84	3.99	
CPRS DSM-IV Inattention	-.13	.28	-.08
CTRS DSM-IV Inattention	-.11	.25	-.08
Step 2			
Intercept	26.27	6.32	
CPRS DSM-IV Inattention	-.12	.51	-.08
CTRS DSM-IV Inattention	.17	.42	.12
CPRS DSM-IV Hyperactivity	-.07	.58	-.04
CTRS DSM-IV Hyperactivity	-.37	.36	-.23
Step 3			
Intercept	-25.75	20.47	
CPRS DSM-IV Inattention	.58	.57	.38
CTRS DSM-IV Inattention	.61	.43	.44
CPRS DSM-IV Hyperactivity	-.42	.62	-.23
CTRS DSM-IV Hyperactivity	-.22	.40	-.16
SSRS P Social Skills	.50	.21	**.46***
SSRS T Social Skills	.55	.28	.61
Abikoff Interference	.31	.31	.19
Abikoff Gross Motor Standing	-.47	.61	-.14
Abikoff Out of Chair	1.37	2.74	.09

Note. R^2 = .019 for Step 1, ΔR^2= .039 for Step 2, ΔR^2= .282 for Step 3

** p < .05, **p < .01 (two tailed)*

Table 11

Hierarchical Regression for Behavior Variables at Time Two Predicting BBCS School Readiness Composite Performance at Time Three (N=37)

Predictors	B	SE B	β
Step 1			
Intercept	76.67	4.40	-
CPRS DSM-IV Inattention	-.15	.31	-.09
CTRS DSM-IV Inattention	.13	.28	.08
Step 2			
Intercept	77.02	7.10	-
CPRS DSM-IV Inattention	-.22	.57	-.13
CTRS DSM-IV Inattention	.25	.47	.17
CPRS DSM-IV Hyperactivity	.08	.65	.04
CTRS DSM-IV Hyperactivity	-.14	.41	-.10
Step 3			
Intercept	25.16	23.86	-
CPRS DSM-IV Inattention	.34	.67	.20
CTRS DSM-IV Inattention	.57	.50	.38
CPRS DSM-IV Hyperactivity	-.02	.72	.01
CTRS DSM-IV Hyperactivity	-.04	.46	-.03
SSRS P Social Skills	.59	.24	**.49***
SSRS T Social Skills	.41	.33	.41
Abikoff Interference	.25	.37	.14
Abikoff Gross Motor Standing	-.28	.71	-.08
Abikoff Out of Chair	2.42	3.20	.14

Note. R^2 = .009 for Step 1, ΔR^2= .004 for Step 2, ΔR^2= .243 for Step 3

** p < .05, **p < .01 (two tailed)*

Appendix
Curriculum Vita

Tulani M. Tiah
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Education

Lehigh University, Bethlehem, PA
Ph.D, School Psychology, anticipated 2013
Endorsement in Pediatric School Psychology
M.Ed., Human Development, September 2004

Syracuse University, Syracuse NY
B. A., Psychology, Minor in African American Studies, May 1998
Deans Scholar 1994-1998
Psi Chi National Honors Society

Syracuse University International Programs Abroad, Harare, Zimbabwe
January 1997 - May 1997

Licensed School Psychologist, Massachusetts
Certified School Psychologist, Rhode Island

Employment Experiences

Providence School Department (August 2009- Present)
School Psychologist
Samuel W. Bridgham Middle School
Nathan Bishop Middle School
Office of Student Affairs
District Leadership Team: Bullying, Harassment Dating and Sexual Violence

- Provide individual and group counseling to adolescents in both general and special education.
- Participate as member of Evaluation Team: Conduct psychological and social emotional assessments for students enrolled and referred for special education, Assists special education teachers in case management of special education students IEP's, 3 year re evaluation and programming, Provide support to teachers in managing students with challenging behavior.
- Serve as member of School-wide Positive Behavioral Support Team and Targeted Team (Tier II Intervention Team).
- Advisor for Third Eye: Youth Crime Prevention Student Group.

EBS Healthcare (January 2009 – June 2009)

Consultant School Psychologist, Medway School District, Medway, MA

Burke-Memorial School (March 2009 – June 2009)

Medway Middle School

- Provided individual counseling to elementary school students in 3rd and 4th grade.
- Conducted cognitive, behavioral, social-emotional, and academic assessments for students in grades PK, K, 3, 4 and middle school.
- Participated in TEAM meetings for students to present the results of initial and reevaluations as well as for students receiving counseling services.

Consultant School Psychologist, Braintree School District, Braintree, MA

Ross Elementary School (January 2009-March 2009)

- Provided individual and group counseling to elementary students in grades K-5
- Provides general mental health and academic support to students
- Participated in multidisciplinary team meetings as needed

Rhode Island College, Feinstein School of Education and Human Development, School Psychology Program (January 2009 – May 2009)

Adjunct Faculty

- Taught graduate course entitled: Consultation and Collaboration in School and Community Settings. The focus of which is to familiarize students with consultation theory, practice, and research with particular emphasis on case-centered behavioral consultation.

Ossining Union Free School District, Ossining, NY (August 2007- June 2008)

School Psychology Intern: Ossining High School

- Conducted cognitive, behavioral, social-emotional, and academic assessments for students presently enrolled and initially referred to the Committee on Special Education (CSE) for the purpose of appropriate educational placements.
- Participated in a variety of meetings of the CSE in order to present assessment results, make recommendations for educational placement, instructional interventions and testing accommodations.
- Provided consultation services to teachers for individual students with behavioral difficulties as well as classroom management.
- Provided mandated individual counseling to students as part of their individualized education plans.
- Participated in weekly individual supervision with building level psychologist and weekly group supervision with other district interns.
- Served as a member of the building level committee for positive behavior intervention support.

Allentown School District, Allentown, PA (January 2007-August 2007)

School Psychologist

- Conducted cognitive, academic and social emotional and behavioral assessments for students enrolled and referred for special education services within a middle school setting.
- Provided counseling to students in an alternative education program for students at risk for school dropout.
- Assisted special education teachers in conducting reevaluations for special education students.
- Participated in meetings of the Child Study Team and Multidisciplinary Team for students at risk for and in need of special education services.

Supervisor: Gerry Ifkovits

Lehigh Valley Hospital, Allentown, PA (August 2005 to August 2007): Tobacco Research in Adolescents with Depression (TRIAD): Multi-site Randomized Controlled Trial

Research Assistant

- Assisted in the implementation and development of protocols for Institutional Review Board approval.
- Acted as a liaison within primary care practices to develop screening materials for depression and smoking among adolescents.
- Collaborated with primary care staff to establish the mechanisms for implementing various phases of the TRIAD study.
- Conducted qualitative interviews with adolescents and parents regarding the relationship between smoking and depression.
- Involved in the planning and implementation of a randomized controlled trial comparing the effectiveness of various treatments for smoking and depression

Supervisor: Dr. Sarah S. Stevens

Project ACHIEVE, Lehigh University, Bethlehem, PA (August 2001- August 2003)

Project Consultant Multi-Systemic Intervention Group

- Provided assistance in the recruitment of participants through presentations to preschool and day care staff regarding the specifics of the project.
- Assisted in the development and implementation of parent education program and materials
- Performed functional behavioral assessments in home and school settings.
- Developed, monitored, and modified intervention plans in home and school settings.
- Provided assistance to parents and teachers in the implementation of behavior support plans and academic curricula.

Supervisor: Dr. George DuPaul

Spectrum Behavioral Management, Poughkeepsie, NY (August 2000 - August 2001)

Intake Specialist

- Screened patients for mental health or substance abuse treatment referrals over the telephone.
- Assisted in the management of mental health and substance abuse benefits for a major medical insurance company.
- Worked with team to develop and refine the most efficient procedure for triaging and setting up appointments for patients in need of various mental health services.

Anderson School, Staatsburg, NY (June 1998 - December 2000)
Direct Care Worker/Classroom Teaching Assistant

- Assisted in the development of behavioral and academic treatment plans for students with autism and pervasive developmental disorders.
- Implemented residential and academic treatment plans (including community inclusion and activities of daily living).
- Assisted in the day to day care and activity programming for children and adolescents with autism and other developmental disabilities.

Practicum Experiences
Applied Practicum Experiences

Children's Hospital of Philadelphia, Philadelphia, PA, (September 2004-July 2005)
Adolescent Medicine Clinic: Adolescent HIV Initiative
Leadership Training Grant in Pediatric School Psychology Practicum

- Conducted mental health screenings for adolescents with HIV/AIDS
- Primary interviewer for a study examining PTSD symptoms in adolescents with HIV/AIDS. Also assisted in data entry and analysis.
- Consulted with medical team regarding the appropriate medical, psychosocial and community supports for adolescents with HIV/AIDS

Supervisors: Jerilynn Radcliffe, PhD
Linda Hawkins, MSEd

School District of Philadelphia, Philadelphia, PA (September 2004- June 2005):
James Rhoads Elementary School
Leadership Training Grant in Pediatric School Psychology Practicum

- Consulted with general and special education teachers to develop and monitor behavioral and academic interventions to address the needs of students with emotional and behavioral difficulties.
- Partnered with community members and families to develop effective interventions for elementary school-aged children.
- Facilitated reading intervention groups for first grade students at risk for difficulty in reading.
- Conducted individual reading and math assessments for students experiencing difficulty.

Supervisor: Patricia H. Manz, Ph.D.

Leadership Training Grant in Pediatric School Psychology Practicum, Lehigh Valley Hospital, Allentown, PA, Outpatient Pediatrics (September 2003 – August 2004)

- Conducted ADHD evaluations based on pediatrician referrals
- Collaborated with medical professionals, families, and school staff to develop and monitor interventions for children with behavioral difficulties

Supervisor: Patricia H. Manz, Ph.D.

Allentown School District, Allentown, PA, (September 2003 – July 2004)
South Mountain Middle School, Roosevelt Elementary School, Jackson Elementary School and Sheridan Elementary School
Leadership Training Grant in Pediatric School Psychology Practicum

- Conducted psychoeducational evaluations to determine special education eligibility.
- Participated in Multidisciplinary Team meetings, Instructional Support Team meetings for the purposed of academic and behavioral intervention development, and outcome decisions for students experiencing academic, behavioral and social emotional difficulties
- Provided feedback to parents and teachers regarding assessment information and placement recommendations.

Supervisor: Cheryl Bartholomew
Gerry Ifkovits
Cindy Ilgenfritz

Applied Research Experience (Fall 2001-Spring 2006): *Over the years I have assisted various graduate students and university faculty in data collection for their research projects including but not limited to the following activities:*

- Assessed students in grades 1 through 5 using curriculum based assessment reading probes and the Woodcock Johnson-III Word Identification and Passage Comprehension subtests.
- Assisted in conducting functional assessments of behavior and coding direct observations tapes to identify the antecedents, consequences, and functions of problem behaviors of preschool aged children.
- Conducted direct observations of preschool classrooms using a measure developed to assess the cultural responsiveness of the learning environment.
- Interviewed preschool children about their classroom friends
- Administered Individual Growth and Development Indicators (IGDI's) Picture Naming, Rhyming and Alliteration subtests and the Peabody Picture Vocabulary Test (PPVT) and Phonological Awareness Literacy Screening (PALS) pre-k version to preschool aged children in various Head Start classrooms in Allentown.
- Served as on of the primary observer for study examining first grade teachers reading instructional behaviors using an observation code designed to collect information of teacher instructional practices during comprehension and vocabulary portions of reading instructional times.
- Administered subtests of the DIBELS and the Woodcock Reading Mastery Test Revised to first grade students.

Presentations

Freeman, T.F., Shapiro, E.S., DuPaul, G.D. & Kern, L. (March, 2007). *Examining the Behavior-Academic Relationship in Children At-Risk for ADHD.* Poster to be presented at the Annual Conference of the National Association of School Psychologists, New York, New York.

Freeman, T.M. & Henry, C.H. (2005, April). *Health Disparities in African American Children: Asthma and Obesity.* Paper presented at the Annual Conference of the National Association of School Psychologists, Atlanta, GA.

Henry, C.N. & Freeman, T.M. (2005, March). *Where are all the African American School Psychologists?* Paper presented at the Annual Conference of the National Association of School Psychologists, Atlanta, GA.

Radcliffe, J. & Freeman, T.M. (2005, March). *Your Report Makes a Difference: Intervention Strategies for Reading, Math, Writing and Attention Difficulties.* Presentation at the Philadelphia College of Orthopedic Medicine's Best Practices in Psychology Conference, Philadelphia, PA.

Sokol, N. G., Freeman, T.M., & DuPaul, G.J. (2003, May). *Space, place, and pace: Creating a classroom environment that promotes positive behavior.* Presentation at the conference of the Lehigh and Northampton Association for the Education of Young Children, Schnecksville, PA.

Freeman, T. M., & Lemon, A. M. (1997, December). The Effects of Social Dominance Orientation and Empathy on Judgments of Crime. Poster presentation presented at the University Undergraduate Research in psychology poster session, Syracuse, NY.

Professional Organizations:

- American Psychological Association
- National Association of School Psychologists

Additional Activities

Doctoral Program Student Representative (Fall 2004-Spring 2005)

- Served as a liaison between graduate students and program faculty. Worked with Educational Specialist program representative in attending monthly faculty meetings and reporting student concerns as well as providing program news to students. Served as an applicant reviewer during the recruitment of new students and participated in the student interview and selection process for new students.

Recruitment Committee of the School Psychology Diversity Task Force (Fall 2003 to Fall 2005)

- Attended monthly meeting of a committee comprised of a faculty representative and students. Worked with other committee members to enhance program efforts towards recruiting and retaining students from diverse backgrounds. Assisted in the improvement of the program website, and engaged in efforts of assess applicant opinions of the programs interview day activities in order to improve the process.

College of Education's Students of Color Coalition Executive Board Member (Spring 2003 to Spring 2006)

- Assisted in the creation, management, and planning activities for this student group whose mission and goals were to provide a forum and safe atmosphere for students of color that addresses a spectrum of topics relating to religion, sexual orientation, and language and to provide the opportunity for all students to learn about various multicultural perspectives within the field of education and mental health, in a nonjudgmental and safe environment. Activities included discussion seminars and movies and celebratory activities surrounding heritage months.

References Available Upon Request

- Dr. Lawrence Wenz, School Psychologist Ossining School District
- Dr. Edward S. Shapiro, Director and Professor Lehigh University
- Dr. Sarah Stevens, Adolescent Medicine Doctor Lehigh Valley Hospital
- Donna Bonarigo, Elementary School Principal Braintree School District
- Denise Rochlin, Assistant Superintendent of Student Services Brookline School District
- Kadesa McGowen, Assitant Principal Providence Schools
- Amy Battisti, Guidance Counselor, Providence Schools
- Roxanne Archibald, Direct of the Office of Student Affairs, Providence Schools