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Examining Academic Functioning in Young Women with ADHD: How Do Girls  
Diagnosed in Childhood Fare Across Development?

By

Maya Miriam VanPutten

A dissertation submitted in partial satisfaction of the  
requirements for the degree of

Doctor of Philosophy

in

Education

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Susan Holloway, Chair

Professor Stephen Hinshaw

Professor Frank Worrell

Spring 2010

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## Abstract

## Examining Academic Functioning in Young Women with ADHD: How Do Girls Diagnosed in Childhood Fare Across Development?

by

Maya Miriam VanPutten

Doctor of Philosophy in Education

University of California, Berkeley

Professor Susan Holloway, Chair

This investigation examined measures of academic functioning in one hundred eighty young women between the ages of 17 and 22. Data were drawn from an ongoing, 10-year longitudinal study of girls with attention-deficit/hyperactivity disorder (ADHD), originally diagnosed in childhood, using the all-female dataset of Hinshaw (2002) and Hinshaw, Owens, Sami, and Fargeon (2006). Results suggest young women in the ADHD group ( $n = 107$ ), when compared to the comparison group of young women of matched age and ethnicity ( $n = 73$ ), had lower achievement test scores; showed higher incidences of grade failures, suspensions, and expulsions; received fewer school-based honors and awards; and used school special services in greater numbers. Effect sizes between the ADHD and comparison groups ranged from medium to large. All group differences withstood control of demographic, cognitive, and comorbidity-related covariates. Contrary to prediction, the students with ADHD had graduated from high school and enrolled in some form of postsecondary education in numbers similar to their peers without the disorder. However, the students with the disorder showed a greater tendency to enroll in community colleges or trade schools rather than four-year colleges or universities and demonstrated a pattern of dropout following postsecondary institution enrollment different from that of their peers without the disorder. Overall, this investigation provides strong evidence for the association between ADHD in girls and a long-term outcome of impairment in the educational domain in adolescence and early adulthood, as has been found in parallel research using largely male samples.

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## **Examining Academic Functioning in Young Women with ADHD: How Do Girls Diagnosed in Childhood Fare Across Development?**

In recent years, attention-deficit/ hyperactivity disorder (ADHD) has attracted a tremendous amount of research attention in the psychiatric, psychological, and pediatric realms, as well as in the mainstream media. Such a bounty of research is logical, given that ADHD involves substantial, ongoing impairment in the children it affects, and it is considered to be the most commonly diagnosed psychiatric disorder of childhood, with estimated prevalence rates that typically range from 5% to 8% (Barkley, 2006). To date, the majority of the research has focused on boys with ADHD, with little attention paid to how the disorder may affect girls (Gaub & Carlson, 1997; Gershon, 2002). However, in recent years, the relatively small body of work that examines how ADHD affects girls has begun to grow. Key findings from these studies suggest that girls demonstrate considerable impairment in terms of behavioral, social, cognitive, personal, psychological, and achievement-oriented domains of functioning, suggesting that ADHD is a significantly impairing disorder for girls as well as it is for boys (Abikoff et al., 2002; Barkley, 2006; Biederman et al., 1999; Biederman et al., 2006; R. W. Greene et al., 2001; Hinshaw, 2002; Hinshaw et al., 2006; Mikami & Hinshaw, 2006; Newcorn et al., 2001).

Research has found that problems in school functioning and academic underachievement are hallmarks of ADHD; indeed, the presence of such problems is one of the most reproducible findings in the ADHD literature (Barkley, Fischer, Edelbrock, & Smallish, 1990; Faraone et al., 1993; Pfiffner, Barkley, & DuPaul, 2006; Semrud-Clikeman et al., 1992). Much of the research has focused on boys, but the studies examining academic achievement variables in girls with ADHD have yielded similar results. Girls with ADHD demonstrate academic impairment and lower cognitive and achievement scores than do girls without the disorder (Biederman et al., 1999; Hinshaw, 2002; Hinshaw et al., 2006; Luman, Oosterlaan, & Sergeant, 2005).

Long-term follow-up studies of exclusively or largely male samples suggest that boys and young men with ADHD continue to struggle in a variety of areas related to schooling and achievement as they enter adolescence and young adulthood. Negatively affected areas include noncompletion of secondary school, poor grades, higher dropout rates, and reduced enrollment and retention in higher education (Fischer, Barkley, Edelbrock, & Smallish, 1990; Mannuzza, Klein, Bessler, Malloy, & Hynes, 1997; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993). Because research examining long-term achievement variables in females with ADHD is lacking, in this dissertation study, I investigated how females with ADHD function academically as they move from childhood into late adolescence and young adulthood.

The source of data for this dissertation study was an ongoing longitudinal follow-up study of the largest sample of preadolescent girls with ADHD known to exist in the literature (see Hinshaw, 2002; and Hinshaw et al., 2006). The participants have taken part for approximately 10 years in a larger study examining how ADHD affects girls, and have been assessed at three time intervals or waves: at baseline, when they were between the ages of 6 and 12 years (Wave 1); five years after baseline, when they were between the ages of 11 and 18 years (Wave 2), and now, 10 years after baseline, when they were



between the ages of 17 and 22 (Wave 3). This dissertation study examined measures of academic functioning in young women with ADHD who are now between the ages of 17 and 22. Specific measures examined as part of this study were standardized achievement test scores; completion of high school; rates of grade failure, suspension, or expulsion; receipt of possible academic honors; use of special services in school; and enrollment in any form of postsecondary educational program.

Through this investigation, I seek to answer three questions. Do females with ADHD demonstrate impairment in academic and achievement realms in later adolescence and young adulthood, specifically between the ages of 17 and 22? Do deficits in academic functioning exist for these young women with ADHD after demographic factors and comorbidity have been statistically controlled? What is the magnitude of such effects, and what are the clinical and educational implications?

In the following introductory pages, some basic information about ADHD is presented, including what it is and why the literature is male-referenced. Having established this foundation of information, I then examine the research that investigates how ADHD affects academic functioning in children, adolescents, and young adults. Following this general description of the condition and its impact, I review the research that examines how ADHD affects females, including the limited data on the subject of academic functioning in girls and young women with ADHD. The chapter concludes with a summary of the information presented, followed by a presentation of hypotheses that were designed to answer the three primary research questions stated above.

### **ADHD and Academic Functioning in Male and Female Study Samples**

**What is ADHD?** ADHD is the current term for a pervasive and specific neurodevelopmental disorder that is characterized by developmentally inappropriate deficits in behavioral inhibition, sustained attention, resistance to distraction, and the regulation of one's activity level in accordance with the demands of a situation. The condition is one of the most well-researched and prevalent psychiatric disorders; expert opinion currently estimates that 5- 8% of the childhood population has ADHD (Barkley, 2006). From an educational perspective, these prevalence numbers typically suggest that, on average, at least one child in every classroom is affected by ADHD. Of children with the disorder, up to 70% will continue to manifest impairing symptoms of ADHD into adolescence and young adulthood, although the hyperactivity symptoms often diminish considerably (Mannuzza et al., 1993; Weiss & Hechtman, 1993).

**Why ADHD research is male-referenced.** The majority of the research conducted to date has focused on boys with ADHD, with little attention paid to how the disorder may affect girls (Gaub & Carlson, 1997; Gershon, 2002). Also, of the scarce research that is devoted to girls, a good deal of it has focused on sex differences in ADHD, with less attention paid to examining how ADHD affects girls in their own right. This disproportionate focus is probably due to several factors, including the predominance of the disorder in boys, with the occurrence of ADHD in boys being reported at a rate 3 to 10 times more frequently than girls. It is estimated that ADHD occurs in boys versus girls at

a rate of between 6:1 to 10:1 in clinically referred samples, and 3:1 in community or epidemiological samples, suggesting that actual prevalence numbers are strongly affected by referral source (Biederman et al., 2002; Gaub & Carlson, 1997; Gershon, 2002; Hinshaw & Blachman, 2005).

Although ADHD causes serious impairment in girls as well as in boys (Gaub & Carlson, 1997; Gershon, 2002), most of the prominent prospective studies of ADHD have focused on examining the effects of ADHD in predominately male or all-male samples (Barkley, Murphy, & Fischer, 2007; Biederman et al., 1996; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998). In general, the large volume of research on ADHD suggests the disorder negatively influences major life activities and is associated with impairments in essential domains of functioning, including social relationships, family functioning, independence and self-sufficiency, occupational functioning, and educational outcomes (Barkley, 2006).

**Academic functioning problems and ADHD.** Academic functioning problems, including problems in academic performance and achievement, are among the most prominent features associated with ADHD. Given that ADHD disrupts a child's ability to sit still, attend, listen, obey, inhibit impulsive behavior, cooperate, organize actions, and follow through with instructions, as well as to share, play, and interact appropriately with other children, it is not surprising that difficulty in school is common in children with ADHD (Barkley, 2006). The disorder has received a great deal of attention, in part because it is associated with problems of academic achievement and school failure.

As many as 90% of children with ADHD are reported to perform inadequately in schoolwork, usually due to reduced productivity (Barkley, 2000). Underachievement, defined in terms of lowered grades and test scores, is a problem for approximately 50% of students with ADHD; such performance is believed to be the result of their inattentive, impulsive, and restless behavior in the classroom. It has been estimated that 30% of children with ADHD may repeat a grade in school, 56% may receive academic tutoring, and 30-40% may receive special education services (Barkley, Fischer, et al., 1990; Faraone et al., 1993; Pfiffner et al., 2006). Research suggests the association with academic problems appears to be specific to ADHD-related symptoms and is not explained by comorbid aggression or conduct disorders (DuPaul et al., 2004; Frick et al., 1991; Hinshaw, 1992; Rapport, Scanlon, & Denney, 1999). Again, it is essential to note that nearly all of such data emanate from research on males with this condition.

In terms of school-based disciplinary consequences, it has been estimated that 46% of children with ADHD are suspended at some point in their elementary school academic careers. Similarly, research suggests between 10% and 20% of children with ADHD are expelled at some point during their academic career. However, there is some suggestion in the research that such disciplinary actions are more closely linked to comorbid conduct problems than they are to ADHD alone (Barkley, DuPaul, & McMurray, 1990; Barkley, Fischer, et al., 1990; Fischer, Barkley, Smallish, & Fletcher, 2004; Szatmari, Offord, & Boyle, 1989).

In addition to demonstrating general school and achievement problems, children with ADHD have also been found to have higher rates of comorbid learning disabilities

than comparison children. Depending on the criteria used to define the learning disability, studies suggest that between 16% and 40% of children with ADHD are likely to have a reading disability, and between 21% and 55% are likely to have a math disability (Barkley, DuPaul, et al., 1990; Barkley, Fischer, et al., 1990; Frick et al., 1991; Semrud-Clikeman, Guy, Griffin, & Hynd, 2000).

Children with ADHD have been found to demonstrate lower cognitive and achievement scores than children in the general population, and a meta-analysis suggests that such lowered scores are consistent across studies (Frazier, Demaree, & Youngstrom, 2004). In terms of achievement, children with ADHD score between 10 and 30 points lower than their classmates on various standardized achievement tests, including tests of reading, spelling, and math (Barkley, Fischer, et al., 1990; Brim & Whitaker, 2000; Semrud-Clikeman et al., 2000). In a meta-analysis that examined both achievement and IQ scores in children with ADHD, 24 studies found a significant difference between children with ADHD and control participants in reading achievement, with a medium effect size (weighted  $d = .64$ ), and 21 studies found a significant difference between the two groups in math, with a large effect size (weighted  $d = .89$ ; Frazier et al., 2004).

Children with ADHD have also been found to demonstrate lower scores on standardized intelligence tests. In a meta-analysis by Frazier et al. (2004), children with ADHD were found to have significantly lower full-scale IQ (FSIQ) scores than control participants, with a medium effect size (weighted  $d = .61$ ). Research suggests that such IQ decrements remain after learning disabilities are controlled for, suggesting that comorbid learning disabilities do not fully explain the lowered IQ scores often found in children with ADHD (Barkley, DuPaul, et al., 1990). Researchers have speculated on the source of this IQ discrepancy, with some suggesting reduced IQ and test scores are a core characteristic of ADHD, and others suggesting the reduced scores are due more to the fact that IQ tests rely heavily on the executive functions, which are widely believed to be deficient in those with ADHD (Hervey, Epstein, & Curry, 2004; Hinshaw, Morrison, Carte, & Cornsweet, 1987). Still others have suggested that the lowered IQ scores are related more to undercontrolled symptoms of the disorder (Seidman et al., 2006). Regardless of the causal mechanism behind the IQ discrepancy, there now appears to be general agreement in the literature that children with ADHD repeatedly perform at lower levels than comparison children on both achievement and IQ tests (Frazier et al., 2004).

### **Academic Functioning in Adolescent and Young Adult Students with ADHD**

How does ADHD affect academic functioning as children move into later adolescence and beyond? Prospective studies of all-male or largely male adolescents and young adults with ADHD suggest the realm of academic performance continues to be negatively affected. According to Faraone et al. (1993), such problems “plague ADHD children throughout adolescence, creating fertile soil for chronic psychological and social disability in adulthood” (p. 616). Similar to the findings regarding the impact of ADHD in childhood, follow-up research with adolescents and young adults has generally found that ADHD groups achieved lower academic grades, failed more of their courses, were more often retained in grade, used a higher number of special services, were more likely to have been suspended and/or expelled, were less likely to graduate from high school, were less

likely to enroll in college, and had overall fewer years of education than their peers without ADHD (Barkley, 2006; Fischer et al., 1990; Lambert, 1988; Mannuzza et al., 1997; Mannuzza et al., 1993). Of those with ADHD who did enroll in college, only 5- 10% were found to complete their college degree, (Barkley, 2006; Mannuzza et al., 1997) and significantly smaller numbers were found to enroll in graduate school following college graduation, when compared to comparison samples (Mannuzza et al., 1997).

Noteworthy specifics from the research that examines educational functioning in adolescents and young adults with ADHD are sobering. In terms of how ADHD affects high school graduation rates, research estimates as many as 25- 34% of students with ADHD do not graduate from high school, despite controlling for demographics (Barkley, 2006; Lambert, 1988; Mannuzza et al., 1997; Mannuzza et al., 1993; Weiss & Hechtman, 1993; Weiss, Hechtman, Milroy, & Perlman, 1985). These figures are compared to census data and other research that suggests, nationwide, between 15% and 30% of students fail to graduate from high school (Balfanz & West, 2006; Stoops, 2004). Failure to graduate from high school is correlated with unemployment and economic difficulties later in life, and the unemployment rate of high school graduates is almost three times that of college graduates (Leonhardt, 2009).

In addition, students with ADHD have also been found to use more special school services and to be suspended more often than their peers without ADHD. In terms of grade failure, Barkley (2006) found 42% of ADHD probands versus 13% of controls had been retained, and Faraone et al. (1993) found 30% of those with ADHD versus 13% of controls had been retained. In terms of special services required, Faraone et al. found 35% of those with ADHD were placed in special classes, and Barkley, Fischer, Smallish, and Fletcher (2006) found 44% of the ADHD group was enrolled in special education classes in high school versus 10% of controls. Similarly, Lambert (1988) found that students with ADHD were likely to attend special schools, such as continuation or residential schools; 13% of those with ADHD were in such programs versus none from the comparison group. In terms of suspension, Lambert (1988) found that 14% of students with ADHD had been suspended by age 14, compared to 2% of controls, and Barkley (2006) found, by a mean age of 20, 60% of students with ADHD had been suspended, compared to 18% of controls.

Research examining the effects of ADHD on adolescents and young adults also suggests overall levels of educational achievement are lower in ADHD groups. Mannuzza et al. (1997) and Mannuzza et al. (1993) prospectively examined the long-term academic outcomes of children with ADHD. When those children had reached their mid-20s, the ADHD probands were found to have had significantly less schooling than controls when followed up 15- 21 years later. The students with ADHD had completed approximately two or fewer years of school than controls. Additional analyses suggested that this finding was not attributable to group differences in intellectual functioning. These studies also found that whereas over half of the comparison participants had completed a college degree, only 12% to 15% of students with ADHD had done so. Other prospective studies on adults corroborate these findings, with reports of significant long-term educational disadvantages for adults with ADHD (Lambert, 1988; Mannuzza et al., 1993; Weiss et al., 1985).

### **How Does ADHD Affect Girls and Young Women?**

In recent years, the relatively small body of work examining how ADHD affects girls specifically has grown considerably. The key findings from these studies suggest that girls demonstrate considerable impairment in terms of behavioral, social, cognitive, personal, psychological, and achievement-oriented domains of functioning. These findings suggest broadly that ADHD is a substantially impairing disorder for girls as well as it is for boys (for key citations, see Abikoff et al., 2002; Barkley, 2006; Biederman et al., 1999; Biederman et al., 2006; R. W. Greene et al., 2001; Hinshaw, 2002; Hinshaw et al., 2006; Mikami & Hinshaw, 2006; Newcorn et al., 2001).

### **ADHD and Academic Functioning in Girls and Young Women**

A review of the literature found only two studies that examine how girls and young women with ADHD function academically. First is the study investigated by Biederman et al. (1999), in which female participants were 6- 17 years of age when diagnosed with ADHD. Second is the study of 140 preadolescent girls with ADHD examined by Hinshaw (2002) and Hinshaw et al. (2006).

In their ongoing investigation of 262 girls and young women (140 with ADHD and 122 comparison participants without ADHD), Biederman et al. (1999) found that girls and young women with ADHD demonstrated clear impairments in academic domains. These girls and young women had significantly lower IQ and achievement scores than comparison study participants, although their scores still fell within the normal range. The participants with ADHD also showed higher levels of school dysfunction, as evidenced by their significantly higher rate of in-school tutoring, placement in special classes, and repeated grades.

A similar study by Hinshaw (2002) included 228 girls (140 with ADHD and 88 comparison girls) between the ages of 6 and 12 years. Hinshaw found girls with ADHD demonstrated impairment in both cognitive and achievement domains. Specifically, girls with ADHD produced significantly lower IQ and achievement scores than the comparison girls, with effect sizes that ranged from medium to large. Similar to the findings reported by Biederman et al. (1999), Hinshaw found that although the scores of the girls with ADHD were below those of the comparison group, the mean scores of the ADHD group still fell within the normal range. Additionally, Hinshaw found that the girls with ADHD had noteworthy histories of grade retentions and special education support.

Prospective studies of girls with ADHD are rare; the studies by Hinshaw et al. (2006) and Biederman et al. (2006) serve as exceptions. Both of these studies found significant, continuing impairment in their all-female samples, providing clear evidence that ADHD in girls is related to considerable impairment into midadolescence. Of note, both studies retained over 90% of their samples. Of these two studies, only Hinshaw et al. examined effects in the academic domain. Controlling for covariates, these researchers found that girls and female adolescents (the sample had by then progressed from early childhood into midadolescence) with ADHD experienced significant problems on 11 of 11 outcome variables examined, suggesting that ADHD in females predicts continuing, serious problems in adolescence across multiple areas of symptoms and functional impairment. In terms of academic functioning, the ADHD sample produced lower math

and reading achievement scores than the comparison girls, with a large effect size. Participants with ADHD were also found to utilize school services, such as special education and tutoring, at a much higher rate than did their peers; approximately 80% of the girls with ADHD had received additional school services, compared to 12% of the comparison girls (Hinshaw et al., 2006).

In summary, emerging research on ADHD in females suggests the disorder is one of public health significance for girls as well as for boys. Because school constitutes a major life activity for children and adolescents, and because higher education has become increasingly material for predicting economic self-sufficiency, persisting maladaptive academic functioning is a major sign of functional impairment. It may well be that educational policies must change to better accommodate the needs of youth with ADHD in adolescence and beyond.

Still, no study of females classified with ADHD as children has examined academic outcomes at the end of secondary education—a crucial time for understanding the long-term effects of this condition on achievement and school functioning. The adolescent years in general are some of the most difficult for those with ADHD in terms of school functioning, because the work required in middle school, high school, and beyond becomes more complex, and demands skills in the areas of multistep planning and note-taking, as well as high levels of focus and organization, skills that are especially problematic for those with ADHD.

### **The Current Study**

Research using largely male samples clearly suggests that ADHD negatively affects the academic functioning of children, adolescents, and young adults (Barkley, 2006; Barkley, Fischer, et al., 1990; Faraone et al., 1993; Fischer et al., 1990; Frazier et al., 2004; Lambert, 1988; Mannuzza et al., 1997; Mannuzza et al., 1993; Pfiffner et al., 2006). Emerging research examining how ADHD affects girls has yielded similar findings, suggesting the academic realm is negatively affected in both sexes (Hinshaw, 2002; Hinshaw et al., 2006). However, no research exists that examines academic variables in adolescent girls and young women with ADHD. The key aim of this study is to assess the ongoing effects of childhood ADHD status in young women 10 years after being classified. Initially identified when they were between 6 and 12 years old, the young women are now between the ages of 17 and 22. Outcome variables include important academic and school-related criterion variables.

**Hypotheses.** The overarching hypothesis is that young women with ADHD will demonstrate lower and more impaired levels of academic and school functioning than will comparison young women without ADHD. I predict that this difference will remain robust even after controlling for comorbidity (with anxiety and conduct disorder [CD] and/or oppositional defiant disorder [ODD]) and maternal education. The presence of a baseline reading learning disability and IQ will also be controlled for, when appropriate (see Covariates section for more details). Individual hypotheses are as follows, with reference to Wave 3 outcomes.

**Hypothesis 1.** Young women with ADHD will demonstrate significantly lower reading and math achievement test scores than comparison young women.

**Hypothesis 2.** Young women with ADHD will have a cumulative record of having received fewer academic or other school-based honors and awards than comparison participants, in adolescence and young adulthood, when such data were collected.

**Hypothesis 3.** Young women with ADHD will have a cumulative record of having failed, repeated, or withdrawn from a grade in greater numbers than will comparison participants.

**Hypothesis 4.** Young women with ADHD will have utilized more school support services (such as special education, speech therapy, in-school counseling, and tutoring) than comparison participants in young adulthood.

**Hypothesis 5.** Young women with ADHD will have a cumulative record of being suspended and/or expelled more often than comparison participants.

**Hypothesis 6.** Young women with ADHD will have a lower rate of high school graduation than will comparison participants.

**Hypothesis 7.** Those young women with ADHD who have completed high school will have enrolled in college or trade school in lower numbers than will comparison participants.

**Hypothesis 8.** Compared to comparison participants, young women with ADHD will be more likely to be attending community colleges or trade schools versus four- year universities or colleges.

**Hypothesis 9.** Young women with ADHD who have graduated from high school and enrolled in some type of postsecondary education institution will be less likely to remain continuously enrolled (for more than one semester) in school than comparison participants. In other words, study participants with ADHD will be more likely to demonstrate a fragmented pattern of enrollment, in which they enroll in and complete only some school, and then drop out.

## Method

### Participants

Baseline data (Wave 1) were first collected in the spring and summer of 1997, 1998, and 1999, through an NIMH- funded research program that involved girls with ADHD, as well as age- and ethnicity-matched comparison girls. All of the girls participated in five weeks of naturalistic, summer enrichment day camps held on a school campus in Berkeley, California. Before being accepted as participants, all girls underwent a thorough diagnostic and clinical evaluation. At baseline, girls were aged 6- 12 ( $M = 9.1$  years). The diversity of the San Francisco Bay Area, combined with a wide range of referral sources (see Recruitment, below) produced a sample at baseline that contained 228 girls, 140 with ADHD (93 with ADHD-C, the more common combined type of the disorder, characterized by both symptoms of inattention and hyperactivity/impulsivity, and 47 with ADHD-PI, the primarily inattentive type of the disorder) and 88 in the comparison group. All participants were from diverse ethnic backgrounds (53% White, 27% African American, 11% Latina, and 9% Asian American) and socioeconomic strata (families ranged from receiving social welfare to the highest economic stratus; the average family income was between \$50,000 and \$60,000, with 13% receiving public assistance).

Maternal education levels were identified according to how participants completed the self-report, demographic questionnaires. According to the information provided, most mothers had completed “some college,” on average. The summer camp programs were provided at no charge, thus further encouraging a diverse sample to participate. No differences between the ADHD and comparison samples were found on maternal education, family income, child race, or child age (Hinshaw, 2002).

**Recruitment.** The initial recruitment process involved a multigated screening and diagnostic procedure (see Hinshaw, 2002, for details). Girls with ADHD were recruited through direct advertisement, schools, pediatricians, and mental health centers. Comparison girls were recruited through similar formats, including direct advertisement, schools, pediatricians, and community centers. For purposes of inclusion, preliminary rating criteria on parent and teacher scales were set with low, sex-specific thresholds for ADHD symptoms to prevent early exclusion of potentially eligible girls. However, final inclusion in the study required ADHD participants to meet full DSM-IV criteria for ADHD through the Diagnostic Interview Schedule for Children, Version 4 (DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000), as well as through parent ratings of ADHD symptoms on the Swanson, Nolan, and Pelham rating scale (4th ed.; SNAP-IV; Swanson, 1992).

**Comorbidities.** Common comorbidities that are often found with ADHD were permitted, including depression, anxiety disorders, learning disorders, ODD, and CD. At baseline, 63% of the girls with ADHD also had ODD, 21% had CD, 27% had an anxiety disorder, 8% had a depressive disorder, and 12% had a reading disorder. Participating comparison girls did not meet diagnostic criteria for ADHD on parent or teacher rating scales or structured interview criteria. However, to prevent the presence of a “super-normal” comparison group, anxiety, oppositionality, or depression were allowed.



Exclusion criteria for all participants consisted of evidence of psychosis, pervasive developmental disorder, or overt neurological disorder, mental retardation, lack of English spoken at home, and medical problems preventing participation at the summer camp.

**Wave 2 follow-up.** At the 5-year follow-up (Wave 2), assessments were performed on 209 of the 228 participants (92%), who were between the ages of 11 and 18 ( $M = 14.2$  years). Participants were invited to participate in the prospective follow-up investigation between four and five years following their summer camp (i.e., baseline) experience. The evaluations took place over the course of two half-day, clinic-based assessments. Participants were compensated for their time.

Reasons for nonparticipation included loss of the family to tracking efforts ( $n = 4$ ), refusal of the family to participate ( $n = 5$ ), and difficulty in scheduling assessment sessions ( $n = 10$ ). Comparison of the retained sample with the girls who were lost to attrition suggested minimal differences between the two groups (i.e., within the realm of chance findings, and with small effect sizes). Thus, the follow-up sample appears to be representative of the total sample (see Hinshaw et al., 2006, for details).

**Wave 3 follow-up.** At the 10-year follow-up (Wave 3), the objective was to perform assessments on at least 90% of the follow-up sample, for a total of at least 190 participants. Young women from the original study were recruited to the lab to participate in two 4-hour testing sessions, and participants were again compensated for their time. Given the representative nature of the five-year follow-up sample, the 10-year follow-up sample will be similarly representative of the initial, diverse sample at baseline. The timing constraints involved in this study allowed for examination of the data that had been collected, entered, and analyzed by fall 2009, when data were available for 180 girls, 107 of whom had been diagnosed in childhood as having ADHD (74 = ADHD-C and 33 = ADHD-PI) and 73 of whom were control participants. It is anticipated that the final retention rate for the larger study will surpass 90%.

## Measures

Each wave of data collection yielded a wide range of data on both symptoms and impairment; a review of the measures used to collect data for this study are discussed in more detail in Assessment and Data Collection (Waves 1 and 2) and Assessment and Data Collection, 10-Year Follow-up (Wave 3). At each wave, assessments were performed by highly trained BA-level research assistants and Ph.D. students in psychology. Different staff members participated in each wave of data collection, and staff members at the 5- and 10-year follow-ups were not informed of participants' baseline diagnostic status. Although some responses to questions posed during follow-up assessments (e.g., about stimulant medication usage) could suggest the presence of ADHD, many data are objective, and diagnostic status had changed for some girls at each follow-up, suggesting that data are unlikely to be biased by the breaking of blinds (Hinshaw et al., 2006).

The majority of the participants in the ADHD group had taken psychotropic medication either at the time of the data collection or in the past. As a result, parents were asked to report on their daughters' unmedicated behavior whenever possible. Additionally,

currently medicated individuals participated in at least one of the follow-up assessment visits on a day when they had not taken their stimulant medication.

### **Assessment and Data Collection (Waves 1 and 2)**

Relevant constructs assessed at all points of data collection included multimethod and multi-informant assessments of ADHD. CD, ODD, anxiety disorder, and cognitive and achievement functioning were also assessed. Additionally, demographic data and data about school functioning and achievement were collected via parent report.

**Baseline ADHD assessment and diagnosis (Wave 1).** A multimethod, multi-informant process was used to determine diagnosis at baseline (Hinshaw, 2002). For a complete description of the ADHD and comparison diagnostic criteria, please refer to Hinshaw (2002). In terms of the measurement tools used for diagnosis, girls who were diagnosed with ADHD met diagnostic criteria for ADHD, according to the SNAP-IV (Swanson, 1992) and the DISC-IV (Shaffer et al., 2000) parent reports. The DISC-IV (Shaffer et al., 2000) is a well-validated, highly structured diagnostic interview that provides symptom counts and psychiatric diagnoses for the major disorders in the *Diagnostic and Statistical Manual of Mental Disorders* ([DSM-IV], American Psychiatric Association, 1994).

The DISC-IV (Shaffer et al., 2000) is computer-based and entails a participant (in this case, a parent of the participant) being asked questions by a researcher, who sits near the parent and records his or her answers. Parents completed the DISC-IV (Shaffer et al., 2000) at baseline to assess the girls' ADHD and other psychiatric symptoms prior to participation in the summer camps. Girls assessed as having ADHD met full criteria for ADHD (either ADHD-PI or ADHD-C) on the DISC-IV. As with the DSM-IV (American Psychiatric Association, 1994) diagnostic criteria, the DISC-IV (Shaffer et al., 2000) requires at least six inattentive symptoms for a diagnosis of ADHD-I or at least six inattentive and six hyperactive-impulsive symptoms for a diagnosis of ADHD-C, along with the full set of additional criteria (e.g., age of onset before 7 years, impairment present in two or more settings). Comparison girls did not meet diagnostic criteria for ADHD, according to the DISC-IV (Shaffer et al., 2000).

The SNAP-IV (Swanson, 1992) is a rating scale completed by a parent using a paper and pencil. The rating scale includes a checklist of the nine DSM-IV (American Psychiatric Association, 1994) items for ADHD and ODD, with each scored on a 4-point rating scale from 0 (*not at all*) to 3 (*very much*). It has been used extensively in ADHD treatment and assessment research, and was the primary scale used in the MTA study (MTA Cooperative Group, 1999). The SNAP-IV has acceptable to excellent internal consistency, test-retest reliability, and validity statistics (Swanson, 1992) and was administered to girls' parents at baseline to assess the girls' ADHD symptoms prior to participation in the camps. Again, for eligibility in the ADHD group, girls also had to meet full criteria for ADHD-PI or ADHD-C on the parent SNAP-IV (Swanson, 1992).

**Externalizing behavior (CD/ODD) and anxiety disorder (Wave 1).** Data from the parent DISC IV (Shaffer et al., 2000) were also used to diagnose the presence of an

anxiety disorder and the presence of an externalizing disorder (either CD or ODD) in the girls. In keeping with the DSM-IV (American Psychiatric Association, 1994) designations, diagnoses of ODD and CD were grouped into one variable as disruptive behavior disorders. In terms of anxiety diagnosis, one or more of the following—social phobia, agoraphobia, panic disorder, separation anxiety disorder, generalized anxiety disorder, posttraumatic stress disorder, or obsessive-compulsive disorder—constituted the presence of an anxiety disorder. In order to avoid spuriously inflating this category, additional specific phobias were not included in this group.

**Cognitive functioning (Wave 1).** The third edition of the Wechsler Intelligence Scale for Children ([WISC-III] Wechsler, 1991) has excellent psychometric properties and was the most current edition available at the time of the Wave 1 assessments. As with all assessments given, trained psychology graduate students or post-BA research assistants administered the full WISC (except for the supplemental Mazes test) to all participants, at baseline only. The factor scores were then calculated for verbal comprehension, perceptual organization, freedom from distractibility, and processing speed (Wechsler, 1991). A full scale IQ score (FSIQ) was also calculated for each participant.

**Achievement functioning (Wave 1).** The Basic Reading and Mathematics Reasoning subsections of the Wechsler Individual Achievement Test ([WIAT] Wechsler, 1992) were administered to all participants at Wave 1. The WIAT is an individually administered, multiple-subject test that is normed on the same sample as the WISC-III (Wechsler, 1991); it is a psychometrically sound, widely used test of academic achievement. The WIAT was designed for children and adults between the ages of 5 and 19 years. Test-retest reliabilities for the reading and math scores range from .85- .92 (Wechsler, 1992). The Basic Reading subtest assesses lower level reading skills ranging from matching words that begin or end with the same sound to pronouncing individual words presented in isolation. The Math Reasoning subtest, which is presented orally with pictures or printed copies of the items, assesses math abilities, such as counting, reading number symbols, and solving simple arithmetic sentence problems (Sattler, 2001; Wechsler, 1992).

**Demographic data and school functioning (Waves 1 and 2).** Primary caregivers, most often the mother of the girls, completed a detailed questionnaire, adapted from the Multimodal Treatment Study of Children with ADHD (Hinshaw et al., 1997) which captured demographic and historical information. Items included the following demographic variables: child's age, family annual gross income, highest level of maternal education, family's receipt of public assistance, child's ethnicity, and single versus two-parent household. Additional questions pertained more specifically to education and inquired about history of special education placements, grade failure, or retention, and use of special services in school, such as in-school counseling, tutoring, or special education.

### **Assessment and Data Collection, 10-Year Follow-up (Wave 3)**

**Achievement functioning (Wave 3).** In Wave 3, the majority of the young women were given the WIAT Basic Reading and Mathematics Reasoning subsections (Wechsler, 1992). In order to match the older age of the participants at Wave 3, and to use more current measures, the WIAT II (Wechsler, 2001) was used to examine the achievement of the majority of the young women in Wave 3. A small portion (21) of the Wave 3 young women were given the WIAT, first edition (Wechsler, 1992), before the switch to the more current test was made.

In this investigation, the scores on the WIAT (Wechsler, 1992) and WIAT II (Wechsler, 2001) tests are considered to be equivalent and are analyzed as one group. The WIAT II is designed for children and adults between the ages of 4 and 85 years. Similar to the WIAT, first edition, the WIAT II is an individually administered, multiple-subject test normed on the same sample as the WISC-III (Wechsler, 1991); it is a psychometrically sound, widely used test of academic achievement. Test-retest reliabilities for the reading and math scores range from .85- .92 (Wechsler, 2001). The Math Reasoning and Basic Reading subtests of the WIAT-II assess the same subject areas as described earlier for the WIAT, first edition.

**Demographic data and school functioning (Wave 3).** Primary caregivers of the study participants completed a detailed questionnaire to gather information on demographics, and historical and school-related information at Wave 3. For the purposes of the study, this selection of questions is referred to as the Family Information Packet (FIP). Relevant data collected through administration of the FIP included whether or not the student had received honors or awards in school or for school activities, and whether or not she had dropped out of school, had failed or been retained in grade, or had been suspended and/or expelled. Additionally, the FIP included questions to identify whether the student had graduated from high school, had begun college or trade school, and, if she had begun college or trade school, the name of the school or program. Additional questions in the FIP focused on the daughter's receipt of special services in school, including placement in a special day class or special education boarding school, the use of tutoring to supplement regular education, speech or occupational therapy, individual or group mental health counseling at school, and other special services provided at school that were not specified in the provided questions.

**Covariates.** Covariates included Wave 1 measures of Full-scale WISC IQ (FSIQ) comorbidity with ODD/ CD or an anxiety disorder, level of maternal education, and the presence of a reading learning disability. Girls' full-scale IQ at baseline was measured using the WISC III (Wechsler, 1991), a psychometrically sound, widely used measure of cognitive ability that is age-normed. Given that comorbidity is common in children with ADHD, baseline diagnosis of CD/ODD (63% of the girls with ADHD also had ODD, and 21% had CD) and anxiety disorder (27% of the girls with ADHD had an anxiety disorder), according to the DISC-IV parent report (Shaffer et al., 2000), also served as a covariate. As noted, the DISC-IV is a well-validated, highly structured diagnostic interview that

provides symptom counts and psychiatric diagnoses for the major disorders in the DSM-IV (American Psychiatric Association, 1994).

Because level of maternal education has been shown to be strongly correlated with children's educational functioning and attainment, the effects of maternal education on the outcomes were also examined (Rosenzweig & Wolpin, 1994). Additionally, because the outcome variables included academic functioning, and because learning problems are common in children with ADHD, the presence of a baseline reading disability also served as a covariate (at baseline, 12% of the girls with ADHD had a comorbid reading disability). The designation of reading disability was made on the basis of standard scores on the Reading Recognition subtest of the WIAT (Wechsler, 1991) below 85 (Hinshaw, 2002). The rationale for using the absolute cutoff as designation, rather than an IQ versus achievement discrepancy, is discussed further in Hinshaw (2002) and in Lyon (1996).

## Results

All statistical analyses were performed using SPSS for Windows Version 16 (SPSS, 2007). Chi-squares and *t* tests were conducted to determine whether the group of respondents lost to attrition or not yet 17 years of age ( $n = 48$ ) differed significantly on baseline diagnostic status and demographic variables (e.g., age, race, mother's education level) from the group of respondents who were retained in the Wave 3 data collection ( $n = 180$ ). The findings indicate that the group lost to attrition did not differ significantly from the group that remained in terms of diagnostic status, age, race, and maternal education. Thus, the sample described herein can be considered reasonably representative of the total sample.

### Associations Among Dependent Variables

Because all variables except for WIAT reading (Wechsler, 1991), WIAT math (Wechsler, 1991), and the number of school awards received were measured on ordinal scales, Spearman Rank correlations were computed to examine the associations between most dependent variables. Pearson correlations were also conducted as appropriate and are reported below. The Spearman correlation coefficients are shown in Table 1. As predicted, the WIAT II (Wechsler, 1992) reading and math scores were significantly and positively correlated ( $r = .64, p < .01$ ). Because the dependent variables were substantially correlated, multivariate analysis of variance and covariance procedures were used to determine the relationship between ADHD and performance in the WIAT II (Wechsler, 1992) reading and math tests.

Table 1

#### *Spearman Rank Correlation Coefficient Between Dependent Variables*

Variable	1	2	3	4	5	6	7	8	9
WIAT II reading									
WIAT II math	.67**								
School awards	.29**	.35**							
Failures	-.30**	-.29**	-.24**						
Special services	-.31**	-.27**	-.13	.12					
Suspensions/expulsions	-.14	-.13	-.22**	.07	.22**				
Graduated high school	.16	.07	.08	-.10	.00	.03			
Trade school/college	.12	.04	.15	-.08	-.11	-.07	.72		
School type	.27	.22	.25	-.12	-.18*	-.11	.66**	.90**	
School pattern	.15	.10	.22**	-.11	-.10	-.08	.63**	.89**	.85**

*Note.* School type= College, trade school, or community college. School pattern= Pattern of postsecondary school enrollment, including no enrollment, some enrollment but stopped taking classes or did not complete a course, and continuous enrollment in which one or more semesters has been completed.

\*  $p < .05$ . \*\*  $p < .01$ .

As expected, performance in the WIAT II (Wechsler, 2001) reading test was significantly and positively correlated with number of school awards ( $r = .22, p < .01$ ), graduation from high school, and school type. WIAT II (Wechsler, 2001) reading test

scores were significantly and negatively correlated with number of failures and number of school special services used. Similarly, performance on the WIAT II (Wechsler, 2001) math test was significantly and positively correlated with number of school awards ( $r = .17, p < .01$ ) and school type, and it was significantly and negatively correlated with number of failures and the number of school special services used. Note, however, that although statistically significant, the effect sizes were small and explained only between 3 and 5% of the variance.

The number of school awards received was significantly and negatively associated with number of failures, and number of suspensions and expulsions; it was significantly and positively associated with the two measures of postsecondary school education: school type and school pattern. The number of school special services used was significantly and positively related to number of suspensions and expulsions, and negatively correlated to school type. As shown in Table 1, all the measures of postsecondary school education were significantly and highly correlated with each other, with medium to large effect sizes. Positive correlations ranged from .63 - .90.

### **Correlations Between IQ and Dependent Variables**

Pearson correlation procedures were conducted between WISC III FSIQ (measured at Wave 1) and the dependent variables that were measured on an interval or ratio scale. IQ was significantly correlated with the Wave 3 WIAT reading standard score ( $r = .57, p < .001$ ) and the Wave 3 WIAT math standard score ( $r = .64, p < .001$ ) and modestly correlated with the number of school-based honors and awards ( $r = .22, p < .01$ ), and the cumulative record of failures or withdrawal from a course ( $r = -.32, p < .01$ ). Accordingly, IQ was entered as a covariate in tests with these variables.

Spearman Rho correlation procedures were computed between IQ and the dependent variables that were measured on a nominal or ordinal scale. IQ was correlated with the failures or withdrawal from a course ( $\rho = -.32, p < .01$ ), and the number of special services received ( $\rho = -.20, p < .01$ ). Thus, IQ was entered as a covariate in tests with these variables.

### **Major Analyses**

Results relative to each hypothesis are presented in this section. For each hypothesis, two sets of analyses were conducted. The first examines outcome differences between ADHD and comparison participants; the second examines outcome differences according to ADHD subtype. As described, participants with ADHD include young women who were originally classified as either ADHD/C ( $n = 74$ ) or ADHD/PI ( $n = 33$ ). Because prior research on female samples with ADHD did not find a difference according to subtype on most outcome measures (with no difference found on achievement outcomes), no differences were expected in the second set of analyses. However, because research examining girls, young women, and women with ADHD is still emerging, and because some suggest that the inattentive type of ADHD is especially meaningful for females (Hinshaw and Blachman, 2005), it appears worthwhile to examine whether subtype effects exist in this older female sample (Biederman et al., 1999; Hinshaw, 2002; Hinshaw et al., 2006). Therefore, as specified, each analysis also considers whether girls

with ADHD-C versus ADHD-PI performed differently on any of the outcome variables. For each hypothesis, I examine the effects of ADHD subtype on outcomes and compare differences between participants with ADHD-C, and participants with ADHD-PI. For all hypotheses, given that this study involves the first examination of academic variables in females with ADHD in this age group, the required analyses were interpreted using a critical alpha of .05. This liberal interpretation was chosen to ensure that new and meaningful findings are not excluded.

**Hypothesis 1: ADHD and achievement test performance.** A multivariate analysis of variance (MANOVA) was conducted to assess group differences in WIAT (Wechsler, 1992) reading and math achievement standard scores between the comparison group and the ADHD group. The multivariate finding indicated that the comparison group differed significantly from the ADHD group in terms of performance in reading and math, Wilk's lambda  $F(2,148) = 21.29, p < .001$ . The ANOVAs revealed that the comparison group had significantly higher scores in reading ( $M = 109.61; F(1,149) = 34.87, p < .001$ ) and in math ( $M = 105.91; F(1,149) = 31.97, p < .001$ ) than the ADHD group ( $M_{\text{reading}} = 97.47; M_{\text{math}} = 92.00$ ), with large effect sizes for each (Cohen's  $d_{\text{reading}} = -1.00$ , and Cohen's  $d_{\text{math}} = -.94$ ).

To determine whether the reading and math scores of the comparison group would still differ significantly from the scores of the ADHD group after controlling for baseline maternal education, CD/ODD, anxiety disorder, reading learning disability, and IQ, a multivariate analysis of covariance (MANCOVA) was conducted. Baseline maternal education, CD/ODD, and anxiety disorder, however, were not significantly related to academic performance. Therefore, these covariates were not included in the analysis.

Baseline reading disability and IQ were found to be related to academic performance, so the effect of these variables was examined. The multivariate analysis of covariance (MANCOVA) was significant and Wilk's lambda  $F(2,144) = 6.72, p < .01$ , indicating that the reading and math scores of the comparison and ADHD groups differed significantly, even when controlling for baseline reading disability and IQ. The univariate findings with only the significant covariates and the ADHD variable are presented in Table 2. After covarying reading learning disability and IQ, the comparison group had significantly higher scores in reading,  $F(1,145) = 11.33, p < .001$ , and in math,  $F(1,145) = 7.15, p < .01$ , in contrast to the ADHD group. The effects, however, were small; only 7% of the variance in WIAT reading was accounted for by the ADHD variable and only 5% of the variance in WIAT math was accounted for by the ADHD variable.



Table 2

*Univariate ANCOVA Results, WIAT Reading and Math Standard Scores*

WIAT	<i>df</i>	<i>F</i>	Sig.	$\eta^2$
Reading				
Reading disability	1	23.47	.000	.14
WISC IQ	1	33.73	.000	.19
Comparison vs. ADHD	1	11.33	.001	.07
Error	145			
Math				
Reading disability	1	2.41	.123	.02
WISC IQ	1	63.46	.000	.30
Comparison vs. ADHD	1	7.15	.008	.05
Error	145			

**ADHD subtypes and achievement test performance.** A MANOVA was conducted to assess group differences in WIAT (Wechsler, 1992) reading and math standard scores between the two types of ADHD participants: those with ADHD-PI and those with ADHD-C. The multivariate findings indicate that those with ADHD-PI ( $M_{\text{Reading}} = 96.07$ ;  $M_{\text{Math}} = 91.28$ ) did not differ significantly from those with ADHD-C ( $M_{\text{Reading}} = 98.20$ ;  $M_{\text{Math}} = 92.38$ ) in terms of performance in reading and math, Wilk's lambda  $F(2,82) = .19$ , *NS*.

**Hypothesis 2: ADHD and school-based honors and awards.** An ANOVA was conducted to assess group differences in the number of school-based honors and awards received by members of the comparison group and the ADHD group. Awards were coded as a continuous variable, and all reported awards were counted. The findings indicate that the comparison group differed significantly from the ADHD group in terms of the number of school-based honors and awards,  $F(1,178) = 16.74$ ,  $p < .001$ . Specifically, the comparison group had significantly more school-based honors and awards ( $M = 4.63$ ;  $SD = 3.63$ ) than the ADHD group ( $M = 2.62$ ;  $SD = 2.95$ ), with a medium effect size (Cohen's  $d = .61$ ). To determine whether the number of school-based honors and awards for those in the comparison group would still differ significantly from the scores of the ADHD group after controlling for the effects of baseline maternal education, CD/ODD, and IQ, a univariate analysis of covariance (ANCOVA) was conducted. However, none of these covariates were found to be significantly related to the number of school-based honors and awards.

**ADHD subtype and school-based honors and awards.** An ANOVA was conducted to assess group differences in the number of school-based honors and awards between the two types of ADHD participants: ADHD-PI ( $N = 33$ ;  $M = 1.81$ ) and ADHD-C ( $N = 74$ ;  $M = 2.70$ ). The findings reveal these two subgroups did not differ significantly with respect to school-based honors and awards,  $F(1,105) = .20$ .

**Hypothesis 3: ADHD and failures/withdrawals from school.** An ANOVA was conducted to assess group differences in the cumulative number of failures and/or withdrawals from school, between the comparison group and the ADHD group. These data were coded as 0 = *never*, 1 = *once*, 2 = *twice*, 3 = *three times*, and 4 = *four times or more*. The findings indicate that the comparison group differed significantly from the ADHD group in terms of the number of failures and withdrawals,  $F(1,226) = 15.81, p < .001$ . Specifically, the comparison group had significantly fewer failures and withdrawals ( $M = .19; SD = .58$ ) than did the ADHD group ( $M = .63; SD = .92$ ) with a medium effect size (Cohen's  $d = -.57$ ).

To determine whether the number of failures and withdrawals for those in the comparison group would still differ significantly from the scores of the ADHD group after controlling for the effects of baseline maternal education, CD/ODD, anxiety disorder, and IQ, an ANCOVA was conducted. The presence of CD/ODD and an anxiety disorder, however, were not significantly related to the number of withdrawals and failures. Thus, these covariates were not included in the analysis. Baseline maternal education and IQ were found to be related to academic performance, and the effect of these variables was examined. After controlling for baseline maternal education and IQ, the comparison group still differed significantly from the ADHD group in terms of the number of failures and withdrawals,  $F(1,219) = 8.44, p < .01$ . Note, however, that the effect was relatively small; the ADHD variable accounted for only 4% of the variance. Refer to Table 3 for details.

Table 3

*Univariate ANCOVA Results, Number of Failures and Withdrawals*

Source	<i>df</i>	<i>F</i>	Sig.	$\eta^2$
Baseline maternal education	4	3.09	.017	.05
WISC IQ	1	4.15	.043	.02
Comparison vs. ADHD	1	8.44	.004	.04
Error	219			

**ADHD subtypes and failures/withdrawals from school.** An ANOVA was conducted to assess group differences in the number of failures and withdrawals between the two types of ADHD participants: those with ADHD-PI and those with ADHD-C. The univariate findings revealed the two types of ADHD participants did not differ significantly with respect to the number of failures and withdrawals,  $F(1,105) = 2.32$ .

**Hypothesis 4: ADHD and use of school support services.** The percentage of girls who used school support services is presented graphically in Figure 1. As shown in this figure, the ADHD group appeared to use school support services more frequently than the comparison group. These data were coded as 0 = *no services used*, 1 = *one service used*, 2 = *two services used*, 3 = *three services used*, 4 = *four services used*, and 5 = *five or more services used*. This method of coding was chosen to allow for an examination of the intensity of special school services required. An ANOVA was conducted to assess group differences in the number of school support services used between the comparison group

and the ADHD group. The findings indicate the comparison group differed significantly from the ADHD group in terms of the number of school support services used,  $F(1,175) = 32.65, p < .001$ . Specifically, the comparison group used the school support services significantly less often ( $M = .31; SD = .69$ ) than did the ADHD group ( $M = 1.26; SD = 1.29$ ), with a large effect size (Cohen's  $d = .92$ ).

To determine whether the number of school support services used by those in the comparison group would still differ significantly from the scores of the ADHD group after controlling for the effects of baseline maternal education, CD/ODD, anxiety disorder, and IQ, an ANCOVA was conducted. The presence of CD/ODD, anxiety disorder, and IQ, was not found to be significantly related to number of school support services used. Thus, these covariates were not included in the analysis. Maternal education was found to be related to the number of school support services used. The findings indicate, after controlling for the effect of baseline maternal education, that the comparison group still differed significantly from the ADHD group in terms of the number of school support services used,  $F(1,171) = 40.31, p < .001$ .

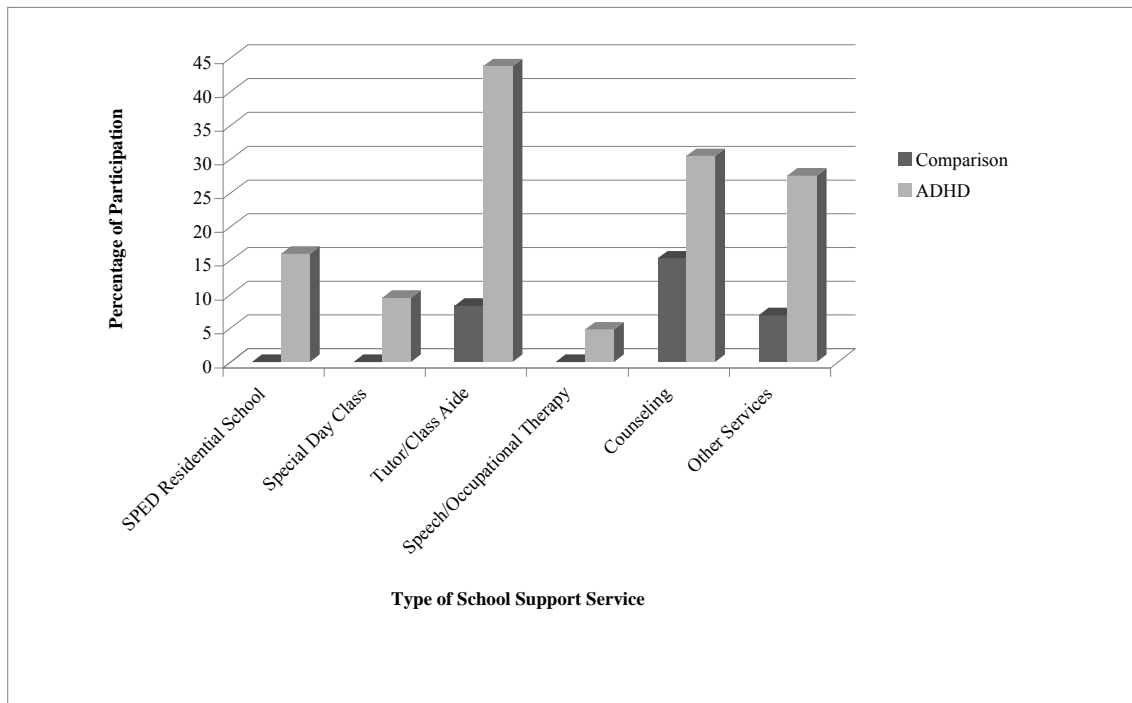


Figure 1. Percentage of participation in school support services, ADHD vs. comparison groups.

**ADHD subtypes and use of school support services.** The percentage of girls with both subtypes of ADHD who used each of the school support services is presented graphically in Figure 2. As shown in Figure 2, young women classified with combined ADHD appeared to use special day class services, to attend a special education residential school, and to use other services more than women classified with the inattentive type of ADHD. But young women classified as inattentive appeared to use tutors, occupational

therapy and counseling services more often than women classified as having combined ADHD. An ANOVA was conducted to assess group differences in the number of school support services used between the two types of ADHD participants: those with ADHD-PI and those with ADHD-C. The findings indicate participants with the two types of ADHD did not differ significantly in terms of the number of school support services used,  $F(1,105) = .01$ . This non-significant finding was probably due to the fact that the differences in percentages cancelled each other out; as noted above, the inattentive group used some services more than the combined group, while the combined group used other services more than the inattentive group.

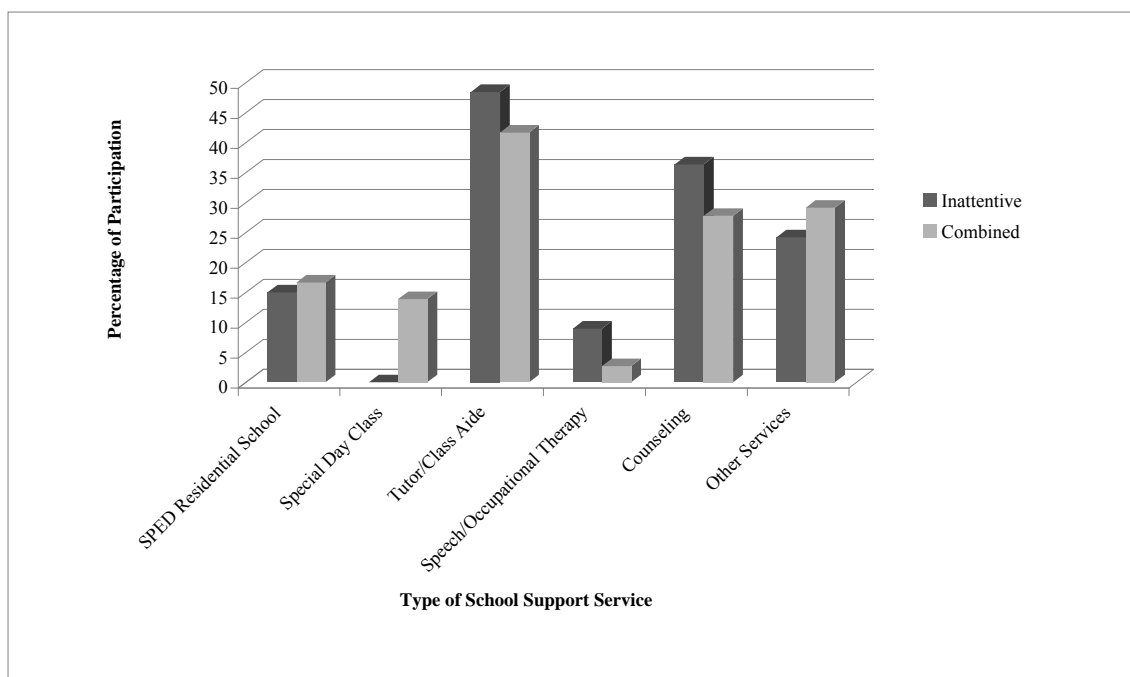


Figure 2. Percentage of participation in type of school support services, by ADHD subtype.

**ADHD and use of any school support service.** An additional analysis was conducted with Wave 3 data to examine if participants used *any* school support services. A logistic regression procedure was conducted to determine whether the likelihood of using any school support service varied between the comparison group and the group with ADHD. The findings indicate the likelihood of using any school support service varied significantly between the groups,  $Wald(1) = 29.99, p < .001$ . In comparison to someone without ADHD, the likelihood of using any school support service increased by 6.98 for someone with ADHD.

To determine whether the likelihood of using any school support service would still vary significantly across groups after controlling for the effects of baseline maternal education, CD/ODD, anxiety disorder, and IQ, a second logistic procedure was performed. Because CD/ODD, anxiety disorder, and IQ did not significantly predict use of any school support service, these variables were not included in the analysis. Maternal education level was found to be related to the use of any school support services. The findings reveal,

after controlling for the effects of baseline maternal education, the likelihood of using any school support service still varied significantly between the comparison group and the ADHD group,  $Wald(1) = 32.05, p < .001, OR = 8.45$ . In particular, in contrast to the comparison group, the likelihood that women with ADHD would use any school support service increased by 8.45.

**ADHD subtypes and use of any school support services.** A logistic regression procedure was conducted to determine whether the likelihood of using *any* school support service varied across the subgroup with ADHD-PI and the subgroup with ADHD-C. The findings indicate the likelihood of using any school support service did not vary significantly between the subgroup with ADHD-PI and the subgroup with ADHD-C,  $Wald(1) = 1.32, p < .05$ .

**Hypothesis 5: ADHD and suspensions and expulsions.** An ANOVA was conducted to assess group differences in the cumulative number of suspensions and expulsions between the comparison group and the group with ADHD. These data were coded as 0 = *never suspended or expelled*, 1 = *suspended or expelled once*, 2 = *twice*, 3 = *three times*, and 4 = *four times or more*. The findings indicate the comparison group differed significantly from the group with ADHD in terms of the number of suspensions and expulsions,  $F(1,226) = 16.50, p < .001$ . Specifically, the comparison group had significantly fewer suspensions and expulsions ( $M = .17; SD = .72$ ) than did the ADHD group ( $M = 1.21; SD = 2.32$ ), with a moderate effect size (Cohen's  $d = -.61$ ).

To determine whether the number of suspensions and expulsions for those in the comparison group would still differ significantly from the scores of the group with ADHD after controlling for the effects of baseline maternal education, CD/ODD, and anxiety disorder, an ANCOVA was conducted. Baseline maternal education and the presence of anxiety disorder, however, were not significantly related to number of suspensions and expulsions. Thus, these covariates were not included in the analysis. The presence of baseline CD/ODD was found to be related to the number of suspensions and expulsions. The findings indicate that, after controlling for the effects of CD/ODD, the comparison group still differed significantly from the group with ADHD in terms of the number of suspensions and expulsions,  $F(1,224) = 4.29, p < .05$ .

**ADHD subtype and suspensions and expulsions.** An ANOVA was conducted to assess group differences in the number of suspensions and expulsions between the two subtypes of ADHD: ADHD-PI and ADHD-C. The findings reveal that the two subtypes of ADHD participants did not differ significantly with respect to number of suspensions and expulsions,  $F(1,105) = 2.37$ .

**Hypothesis 6: ADHD and high school graduation.** Participants who were still in high school were excluded from the analysis. These data were coded as yes if either graduation or a GED was achieved. Of the 54 young women in the comparison group who were no longer in high school, 50 (92.5%) had graduated and four had not. Of the 81 young women with ADHD, 75 (92.5%) had graduated and six had not. To ensure that no

statistical differences existed between the two groups, a logistic regression procedure was conducted to determine whether the likelihood of graduating from high school varied across the comparison group and the group with ADHD. The findings indicate the likelihood of graduating from high school did not vary significantly between the comparison group and the group with ADHD,  $Wald(1) = .00$ .

**ADHD subtypes and high school graduation.** A chi-square analysis was conducted to determine whether the likelihood of graduating from high school varied across the subgroup with ADHD-PI and the subgroup with ADHD-C. The findings indicate there was a non significant relationship between type of ADHD and graduating from high school,  $\chi^2(1) = 3.06, p < .08$ , in which the subtype with ADHD-PI was somewhat more likely to graduate.

**Hypothesis 7: ADHD and enrollment in higher education after high school.** Of 54 comparison participants, 45 (83%) enrolled in trade school or college and nine did not. Of 80 participants with ADHD, 60 (75%) enrolled in trade school or college and 20 did not. A chi-square analysis was conducted to determine whether the likelihood of attending any form of higher education school after high school varied across the comparison group and the group with ADHD. The findings indicate the likelihood of attending some form of higher education school after high school did not vary significantly between the comparison group and the group with ADHD,  $Wald(1) = .11$ .

**ADHD subtypes and enrollment in higher education after high school.** A logistic regression procedure was conducted to determine whether the likelihood of attending higher education school after high school varied across the subgroup with ADHD-PI and the subgroup with ADHD-C. The findings indicate there was a small but still significant relationship between subtype of ADHD and attending trade school or college after high school,  $\chi^2(1) = 4.79, p < .05$ . In comparison to participants with ADHD-PI, the likelihood of attending school after high school dropped by .36 for those participants with ADHD-C.

**Hypothesis 8: ADHD and type of higher education school attended.** A multinomial regression procedure was conducted to determine whether the likelihood of attending different types of schools varied between the comparison group and the group with ADHD. The dependent variable consisted of four categories: no enrollment, trade school, community college, and 4-year college or university. The reference category was the no-enrollment group. The findings indicate type of school attended varied significantly between the comparison group and the group with ADHD,  $\chi^2(3) = 27.26, p < .001$ . In particular

1. In contrast to the comparison group, the likelihood of attending trade school (versus not enrolling) increased by .14 for participants with ADHD,  $Wald(1) = 3.32, p < .06$ . One percent of the comparison participants attended trade school compared to none percent of the participants with ADHD. While this difference was not statistically significant, it may suggest a possible trend.

2. In contrast to the comparison group, the probability of attending community college (versus not enrolling) increased by .39 for participants with ADHD,  $Wald(1) = 4.11, p < .05$ . 11% of the comparison participants attended community college, compared to 28% of the participants with ADHD.
3. In contrast to the comparison group, the chances of attending a four-year college or university (versus not enrolling) decreased by 3.02 for participants with ADHD,  $Wald(1) = 8.14, p < .01$ . 45% of the comparison participants attended a four-year college, compared to 15% of the participants with ADHD.

To determine whether the relationship between ADHD and type of school attended would still hold after controlling for the effects of baseline maternal education, CD/ODD, and the presence of anxiety disorder, a second multinomial procedure was conducted. None of the covariates, however, were significantly related to the dependent measure. The frequencies for type of school attended after high school are presented in Table 4.

Table 4

*Frequencies, Postsecondary School Type Attended After High School*

Group	Postsecondary school type			
	None (%)	Trade (%)	Community (%)	4-Year (%)
Comparison	9 (73%)	1 (1%)	8 (11%)	33 (45%)
ADHD	20 (19%)	10 (9%)	31 (28%)	16 (15%)

**ADHD subtypes and type of higher education school attended.** The frequencies for type of school attended by ADHD subtype are presented in Table 5. A multinomial regression procedure was conducted to determine whether the likelihood of attending different types of schools varied between the subgroup of ADHD-PI and the subgroup of ADHD-C. The dependent variable consisted of four categories: no enrollment, trade school, community college, and 4-year college or university. The reference category was the no-enrollment group. The multinomial regression results for type of school attended after high school are presented in Table 6. The findings indicate that type of school attended varied across the two subtypes of ADHD participants,  $\chi^2(3) = 6.43, p < .10$ , although differences did not reach the level of statistical significance. In particular

1. In contrast to the subgroup with ADHD-PI, the likelihood of attending trade school (versus not enrolling) decreased by 5.10 for participants with ADHD-C,  $Wald(1) = 5.09, p < .05$ . 15% of participants with the inattentive type of ADHD attended trade school, compared to 6% of participants with the combined type of ADHD.
2. In contrast to the subgroup with ADHD-PI, the probability of attending community college (versus not enrolling) decreased by 2.55 for participants with ADHD-C,  $Wald(1) = 3.05, p < .09$ . 36% of participants with the inattentive type of ADHD attended community college, compared to 26% of participants with the combined type of ADHD.

Table 5

*Frequencies, Postsecondary School Type Attended After High School, by ADHD Subtype*

ADHD subgroup	Postsecondary school type			
	None (%)	Trade (%)	Community (%)	4-Year (%)
ADHD-PI	2 (6%)	5 (15%)	12 (36%)	6 (18%)
ADHD-C	18 (24%)	5 (6%)	19 (26%)	10 (14%)

Table 6

*Multinomial Regression Results, Postsecondary School Type Attended After High School, by ADHD Subtype*

Variable	B	SE	Wald	df	Sig.	Odds ratio
Some vs. none						
ADHD-PI vs. ADHD-C	1.63	.72	5.09	1	.024	5.10
Just enrolled vs. none						
ADHD-PI vs. ADHD-C	.94	.54	3.05	1	.081	2.55
Continuous vs. none						
ADHD-PI vs. ADHD-C	.84	.64	1.72	1	.190	2.32

**Hypothesis 9: ADHD and continuous enrollment in higher education.** A multinomial regression procedure was conducted to determine whether the likelihood of being continuously enrolled in higher education varied between the comparison group and the group with ADHD. The dependent variable consisted of four categories: 1 = *no enrollment*; 2 = *some enrollment but stopped taking classes or did not complete a course*; 3 = *continuous enrollment, in which one or more semesters have been completed*; and 4 = *enrolled to begin shortly, just started school, and/or has completed fewer than one semester of school* when data were collected. The reference category was the no-enrollment group. The overall findings indicate enrollment patterns varied significantly between the comparison group and the group with ADHD,  $\chi^2(3) = 8.94, p < .05$ . Forty one percent of comparison participants were continuously enrolled, compared to 21% of participants with ADHD. However, the differences between patterns did not reach the level of statistical significance. For example, in contrast to the comparison group, the chances of continuous enrollment (versus not enrolling) decreased by 1.88 for participants with ADHD,  $Wald(1) = 2.91, p < .09$ .

To determine whether the overall group differences would remain in terms of the pattern of school attended, while controlling for the effects of baseline maternal education, CD/ODD, and the presence of anxiety disorder, a second multinomial logistic regression was conducted with covariates entered in Step 1. None of the covariates, however, were significantly related to the dependent measure. The frequencies for postsecondary school enrollment pattern are presented in Table 7. The differences between the comparison group and the group with ADHD are presented in Table 8.



Table 7

*Frequencies, Pattern of Postsecondary School Attendance After High School*

Group	Attendance			
	No enrollment (%)	Some, but stopped (%)	Just enrolled (%)	Continuous enrollment (%)
Comparison	9 (12%)	5 (7%)	10 (14%)	29 (40%)
ADHD	20 (19%)	18 (17%)	19 (18%)	23 (21%)

Table 8

*Multinomial Regression Results, Pattern of Postsecondary School Attendance After High School*

Variable	B	SE	Wald	df	Sig.	Odds ratio
Some but stopped vs. no enrollment						
Comparison vs. ADHD	-.84	.56	2.23	1	.136	.43
Just enrolled vs. no enrollment						
Comparison vs. ADHD	-.30	.46	.43	1	.511	.74
Continuous vs. no enrollment						
Comparison vs. ADHD	.63	.37	2.91	1	.088	1.88

**ADHD subtypes and continuous enrollment in higher education.** The frequencies for postsecondary school enrollment pattern, by ADHD subtype, are presented in Table 9. A multinomial regression procedure was conducted to determine whether the likelihood of being continuously enrolled varied across the two subtypes of ADHD. The dependent variable consisted of four categories: 1 = *no enrollment*; 2 = *some enrollment but stopped taking classes or did not complete a course*; 3 = *continuous enrollment*, in which one or more semesters have been completed; and 4 = *enrolled to begin shortly, just started school, and/or has completed fewer than one semester of school* when data were collected. The reference category was the no-enrollment group. The findings indicate postsecondary school enrollment pattern did not vary significantly across the two ADHD subtypes,  $\chi^2(3) = 5.33$ .

Table 9

*Frequencies, Pattern of Postsecondary School Attendance After High School, by ADHD Subtype*

ADHD subtype	Attendance			
	No enrollment (%)	Some but stopped (%)	Just enrolled (%)	Continuous enrollment (%)
ADHD-PI	2 (6%)	7 (21%)	8 (24%)	9 (27%)
ADHD-C	18 (24%)	11 (15%)	11 (15%)	14 (19%)

**ADHD status and dropping out of school.** As an adjunct to Hypothesis 9, which examined the pattern of attendance in postsecondary school after high school, I examined whether participants dropped out of school. Specifically, I examined whether participants dropped out of either high school or any postsecondary school attended after high school (only one participant reported dropping out prior to high school). However, given that 93% of the participants in this sample, in both groups, graduated from high school, the dropout numbers apply largely to dropping out from postsecondary schools.

The frequencies for dropping out of either high school or college were identified for both the comparison group ( $n = 72$ ) and the group with ADHD ( $n = 105$ ). Of the comparison group, four participants (5.6%) reported dropping out and 68 reported not having dropped out. Of the group with ADHD, 20 (23.5%) reported dropping out and 85 reported not having dropped out. A logistic regression procedure was conducted to determine whether the likelihood of dropping out of school varied between the comparison group and the group with ADHD. The findings indicate the likelihood of dropping out of school varied significantly between the comparison group and the group with ADHD,  $Wald(1) = 5.89, p < .05$ . In contrast to the comparison group, the likelihood of dropping out of school increased by 4.00 for the group with ADHD. To determine whether the association between ADHD status and the likelihood of dropping out would still hold after controlling for the effects of baseline maternal education, CD/ODD, and the presence of anxiety disorder, a second logistic regression procedure was conducted. None of the covariates, however, were significantly related to the dependent measure.

**ADHD subtypes and dropping out of school.** A logistic regression procedure was conducted to determine whether the likelihood of dropping out of school varied across the subgroup with ADHD-PI and the subgroup with ADHD-C. The findings indicate the likelihood of dropping out of school did not vary significantly between the two ADHD subtypes,  $Wald(1) = 1.45$ .

## Discussion

In this section, I discuss the findings that answer the three guiding research questions, beginning with a brief review of the study's purpose and design, followed by an overview of the central discoveries. The summary is followed by a discussion of the findings on specific academic functioning measures, including achievement test scores, school awards, grade failure, use of special school services, and disciplinary consequences. Following this review of findings, the participants' performance in terms of high school graduation and beyond is discussed, including rate of graduation, enrollment in postsecondary education, type of postsecondary school in which enrolled, and pattern of retention in such schools. The discussion of postsecondary school performance is followed by a discussion of limitations. Reporting of this study concludes with a section that examines the clinical and educational implications of these research findings.

In this study, I examined measures of academic functioning in young women with ADHD and comparison young women who were not diagnosed with ADHD. Study participants were between the ages of 17 and 22. The purpose of this study was to investigate, through a prospective longitudinal design, how girls with ADHD (diagnosed in childhood) function academically as they move from childhood into late adolescence/early adulthood and beyond.

The academic functioning data included reading and math achievement test scores, receipt of school awards, the use of school support services, grade failure, suspension and expulsion, high school graduation, enrollment in postsecondary education, and both the type of postsecondary school in which enrolled (college versus trade school, for example) and the pattern of attendance or retention (versus dropout) at such schools. Data were collected as part of a longitudinal study that has been following these young women for 10 years. The data points used in this study were collected through parent questionnaires, standardized tests, and meetings with participants and parents; diagnostic and demographic data had been collected at baseline.

This investigation was guided by three questions. (1) Do young women with ADHD demonstrate impairment in academic and achievement realms in later adolescence and adulthood, specifically between the ages of 17 and 22? (2) Do deficits in academic functioning exist for these young women with ADHD after demographic factors and comorbidity have been statistically controlled? (3) What is the magnitude of such effects, and what are the clinical and educational implications?

As predicted, findings indicated that young women with ADHD had lower reading and math achievement test scores, and higher numbers of grade failures, suspensions, and expulsions than their comparison peers, with effect sizes that ranged from medium to large. Also as hypothesized, participants with ADHD were found to have received fewer school-based honors and awards, and to utilize school-based special services in greater numbers than their peers without ADHD, again with effect sizes that ranged from medium to large. Group differences were significant after controlling for covariates, such as demographic variables, baseline comorbidity, maternal education, and IQ.

In examining the participants' academic performance in the area of high school graduation and beyond, some interesting and sometimes unexpected patterns emerged. Contrary to prediction, participants from both groups graduated from high school in similar

(high) numbers. Following high school graduation, the two groups were also found to *enroll* in some form of postsecondary educational program at similar rates. However, the participants with ADHD enrolled in different *types* of tertiary programs than their peers in the comparison group. Specifically, young women with ADHD were more likely to attend trade school and community college, and were less likely to attend four- year colleges or universities. Also as predicted, participants with ADHD demonstrated a more fragmented pattern of enrollment in the colleges or trade schools they attended, meaning they were less likely to be continuously enrolled, and they were more likely to drop out than were comparison participants. All of these significant group differences described above remained after controlling for covariates.

Most contrasts between the ADHD subtypes (ADHD-PI versus ADHD-C) were not significant. However, I did find (unexpectedly) participants with ADHD-C were less likely to enroll in any form of higher education school than were girls with ADHD-PI. Also, in terms of the type of postsecondary schooling in which enrolled, participants with ADHD-C were less likely to enroll in trade school than were those from the ADHD-PI subtype. Findings specific to these two subtypes are discussed in greater detail in their respective sections.

### **Academic Functioning**

**Achievement test scores.** As hypothesized, the young women with ADHD demonstrated significantly lower reading and math WIAT (Wechsler, 1992) achievement test scores than comparison participants, with large effect sizes, although the scores of both groups fell within the average range of functioning. Group differences withstood control of the related covariates of baseline reading learning disability and IQ, suggesting the discovered differences may indeed stem from ADHD-related impairment. The finding that young women with ADHD have significantly lower achievement test scores is similar to that found by Biederman et al. (1999), Hinshaw (2002), and Hinshaw et al. (2006) using samples of girls and adolescent females.

The present data extend these findings into late adolescence/early adulthood. Biederman et al. (1999), Hinshaw (2002), and Hinshaw et al. (2006) found that the achievement scores of the participants with ADHD, while discrepant from the comparison group, fell within the normal range of functioning. The current finding that the female participants with ADHD have lower achievement test scores is also in agreement with those from the largely male-referenced literature in the area of ADHD and achievement, which finds that children and young adults with ADHD score between 10 and 30 points lower than their classmates on various standardized achievement tests, including tests of reading, spelling, and math (Barkley, Fischer, et al., 1990; Brim & Whitaker, 2000; Semrud-Clikeman et al., 2000).

More specifically, these findings are congruent with the meta-analysis of Frazier et al. (2004), which indicated a significant difference between children with ADHD and control participants in reading achievement, with a medium effect size, and found a significant difference between the two groups in math achievement, with a large effect size. The findings of the current study and those in the extant literature indicate that both

boys and girls with ADHD consistently obtain lower achievement test scores than peers without the disorder, and that these differences continue into adulthood. Given that school is compulsory and constitutes a major life activity for children and young adults in this country, the discovery that significant achievement decrements remain in this older sample is a clinically meaningful finding.

**School honors and awards.** As predicted, female participants with ADHD received fewer academic or other school-based honors and awards than comparison girls, with a medium effect size. This difference is magnified by the fact that data collection did not allow for the measurement or ranking of the *quality or significance* of an award. For example, all in-school awards were counted continuously if listed, but an in-class poetry award at a special school is quite different from a National Merit Scholarship, and yet the data collection methods employed in this study counted both honors as being equal.

Informal observations suggest the girls with ADHD received more of the smaller, less prestigious types of awards, such as “student of the week for Room 7,” or best art project for a particular assignment, whereas comparison girls often received more recognizable awards, such as honor roll, varsity letters, and scholarships. Regardless, awards received are a marker of school achievement in the child’s environment. The discrepancy here suggests females with ADHD are being recognized for school achievements in markedly lower numbers than their peers, which could have implications for academic self-concept, school retention, and eventual dropout.

**Grade failure and retention.** As predicted, young women with ADHD had a cumulative record of having failed, repeated, or withdrawn from a grade in greater numbers than comparison girls, with a medium effect size. Group differences remained despite the control of relevant covariates (maternal education and IQ). These findings are similar to those in the female samples of Biederman et al. (1999), Hinshaw (2002), and Hinshaw et al. (2006), and are also similar to findings using largely male samples. Specifically, Barkley (2006) found 42% of ADHD probands versus 13% of controls had been retained, and Faraone et al. (1993) found 30% of those with ADHD versus 13% of controls had been retained. These findings suggest grade failure and retention seem to be a continuing problem for both sexes with ADHD throughout their educational experience. Given the association of grade failure and retention with later dropout, this finding supports the contention that more preventive services should be provided to students with ADHD to avert retention and/or grade failure (Stearns, Moller, Blau, & Potochnick, 2007).

**Use of special services in schools.** As predicted, young women with ADHD utilized more school support services in Wave 3 than did comparison participants, with a large effect size, and such differences remained after controlling for covariates (i.e., maternal education). Overall, 94% of the participants with ADHD reported having used some kind of school special services, compared to 21% of comparison participants, during the interval between mid- adolescence and young adulthood. These findings are similar to those of Hinshaw (2002) and Hinshaw et al. (2006), in which the same sample of girls and

young women with ADHD, by the average age of 14 years, also used school special services at a rate of 80%, compared to 12% of comparison peers. Biederman et al. (1999) also found girls and female adolescents with ADHD had a higher rate of in-school tutoring than did controls, as well as a higher rate of placement in special classes. Such findings are consistent with those from the largely male-referenced literature in this area, which also uncovered high rates in use of special school services (Barkley et al., 2006; Faraone, 1993; Lambert, 1988). Overall, these findings suggest young women with ADHD continue to use school special services in extremely high numbers into adolescence and young adulthood.

**Disciplinary consequences.** Data collection did not allow for the consistent separation of suspension and expulsion, and so the data examined in this study combined both together in one larger category of imposed disciplinary action. As predicted, the participants with ADHD were found to have a cumulative record of being suspended and/or expelled more often than were comparison participants, with a medium effect size. Such findings are similar to those found in largely male samples, which generally estimate 46% of children with ADHD are suspended at some point in their elementary school academic careers, and between 10-20% are expelled. In prior, male-referenced literature, however, such disciplinary actions appear to be more closely linked to comorbid conduct problems than they are to ADHD alone (Barkley, DuPaul, et al., 1990; Barkley, Fischer, et al., 1990; Fischer et al., 1994; Szatmari et al., 1989). Here, the group differences in this area remained after controlling for a baseline diagnosis of ODD or CD. This outcome suggests that the disciplinary consequences imposed on this sample are specifically linked to the attentional, behavioral, and cognitive challenges that are associated with ADHD.

There are several reasons why externalizing comorbidity might lead to more disciplinary actions in males versus females with ADHD. One possibility is that girls with ADHD demonstrate less externalizing, disruptive, and aggressive behavior than boys with the disorder, across both clinical and community samples (Abikoff et al., 2002; Biederman et al., 1999; Biederman et al., 2002; Gaub & Carlson, 1997; Gershon, 2002). If girls with ADHD are, in general, less aggressive than boys with the disorder, this difference would result in fewer disciplinary consequences. Overall, these findings suggest young women with ADHD are suspended and/or expelled in higher numbers than comparison participants, and such disciplinary consequences are largely independent of comorbidity with other disruptive behavior disorders.

### **High School Graduation and Beyond**

**High school graduation.** Contrary to my hypothesis, participants from both the ADHD and comparison groups graduated from high school at an identical rate of 93%. This rate of graduation is considerably higher than the national high school graduation rate for female students of 72% (J. P. Greene & Winters, 2006). This finding suggests the possibility ADHD status does not have the anticipated negative effect on the graduation rates of female students that it appears to have in male students. Research using largely male samples has estimated as many as 25-34% of students with ADHD do not graduate

from high school (Barkley, 2006; Lambert, 1988; Mannuzza et al., 1997; Mannuzza et al., 1993; Weiss & Hechtman, 1993; Weiss et al., 1985). Note, too, census data and other large-scale research suggests between 15% and 30% of students nationwide fail to graduate from high school (Balfanz & West, 2006; Stoops, 2004).

Several possibilities exist to explain why young women with ADHD in the present sample seem to be graduating in markedly higher numbers than males with ADHD. Female students typically graduate from high school in higher numbers than do male students. In a recent national study, 72% of female students graduated high school, compared with 65% of male students (J. P. Greene & Winters, 2006). Similarly, research from the large National Educational Longitudinal Study found that female students had a lower rate of high school dropout than did male students; 25% of girls drop out of high school, compared to 33% of boys (Mishel & Joydeep, 2006). The discrepancy in graduation rates by sex could stem, in part, from the tendency of ADHD symptoms in female students to be subtler and generally less aggressive than they are in male students. This difference may enable young women with ADHD to remain in school in greater numbers, and perhaps to better utilize school special services that encourage staying in school.

The difference in graduation rates by sex does not seem to stem from an unusually high rate of graduation in the state of California, where the majority of the participants for this study reside. California's high school graduation rate is similar to the national average; rates ranged between 67% and 70% for the class of 2003 (J. P. Greene & Winters, 2006). Nonetheless, the finding that this sample of female students is graduating from high school in similar numbers to their female peers without ADHD is a positive discovery. As failing to graduate from high school is correlated with later unemployment and economic impairment, and the unemployment rate of high school graduates is almost three times that of college graduates (Leonhardt, 2009), this finding could bode well for the economic future of the young women with ADHD in this sample.

**Enrollment in higher education.** Contrary to my hypothesis, young women with ADHD who completed high school were found to enroll in college or trade school in numbers similar to those of the comparison group. No significant differences were found between the two groups in terms of their enrollment in higher education. The finding that these young women with ADHD are at least initially enrolling in higher education in strong numbers is another positive finding, and one that differs from the largely male-referenced research in this area, where those with ADHD are less likely to enroll in college than are their peers without the disorder (Mannuzza et al., 1997; Mannuzza et al., 1993).

A difference between participants with different subtypes of ADHD was discovered in this area; female participants with ADHD-C had lower rates of enrollment than did female participants with ADHD-PI, although the effect size was small. This finding suggests that the combined form of ADHD may hinder enrollment in higher education more than the inattentive type of ADHD; this trend should be further investigated in future research. Overall, from an educational systems perspective, the discovery that participants with ADHD are at least enrolling in higher education in strong numbers suggests postsecondary schools are successfully enabling or encouraging such initial enrollment.

**Type of higher education.** As predicted, a significant group difference was found in the type of higher education in which the study participants enrolled after graduating from high school. Compared to their peers without the disorder, the participants with ADHD were found to be more likely to attend community colleges or trade schools versus four-year universities or colleges. How might this tendency affect the young women with ADHD?

Some experts argue that two-year colleges, or community colleges, are a sort of haven for students with learning disabilities. For example, J. Thomas Viall, the executive director of the International Dyslexia Association, suggested such schools have an accepting attitude beneficial to students with learning disabilities, such as ADHD. According to Viall, “Two-year schools are more attuned to providing support,” and have thus developed some expertise in “taking in marginally academic students who need some help,” and encouraging their success (O’Neill, 2003). Others disagree and suggest that community colleges do not offer the flexibility and skill in teaching that learning-disabled students require (O’Neill, 2003). Regardless, data from the National Center for Education Statistics suggests that most learning-disabled students who enter a two-year college intending to transfer eventually to a four-year institution fail to do so (O’Neill, 2003). The finding that the young women with ADHD are less likely to attend a four-year college is in contrast to the research that examines the makeup of students by sex in postsecondary education institutions. Women are slightly more represented in four-year colleges than are men; 55% are female (Goldin, Katz, & Kuziemko, 2006).

In addition to the group differences found in terms of the type of postsecondary education institution attended, a small but significant effect of subtype was also found. Specifically, young women with ADHD-C were less likely to attend trade school than were those with ADHD-PI. This finding suggests the possibility that the combined form of the disorder may be more detrimental than the inattentive form to long-term educational achievement for young women with ADHD. This discovery presents an area that future research might explore in greater depth.

**Pattern of enrollment and attrition in higher education.** As predicted, participants with ADHD were found to have a more fragmented pattern of enrollment in higher education than the comparison group, and they were also more likely to drop out of postsecondary schooling. Specifically, participants with ADHD were less likely to be remain continuously enrolled (for one semester or more) in school than their peers without ADHD, and they were more likely to stop taking classes after one semester, although these between-group analyses did not reach significance (see tables 6 and 7). A related analysis that examined dropout in both groups revealed participants with ADHD were significantly more likely to drop out than their comparison peers. Covariates were not related to the outcomes in these areas, suggesting again that ADHD, per se, may be responsible for the discovered group differences in the area of attrition or retention in higher education. These findings are consistent with the largely male-referenced follow-up studies of young adults with ADHD, which found that of those with ADHD who enroll in college, only 5-10% complete their degree (Barkley, 2006; Mannuzza et al., 1997). Similarly, findings indicate



that adults with ADHD complete fewer years of education than their peers without the disorder (Mannuzza et al., 1997; Mannuzza et al., 1993).

A noteworthy limitation in the area of enrollment and retention in higher education is that data collection did not always capture information on the number or type of classes taken. The implication is that one participant could have dropped a single nonacademic class (say, ceramics), whereas another could have dropped a load of five rigorous academic courses, and the data would have captured both patterns in the same way. Even so, the ability of the participants to remain continuously enrolled in higher education classes, whatever their level of difficulty, is an indication of their ability to juggle some of the demands of independent adulthood, and is therefore likely to be a viable measure of functional impairment. In this sense, the participants with ADHD demonstrated a kind of impairment that may affect their future prospects in terms of career choice, employment, and economic self-sufficiency.

### **Limitations**

As is often the case, this study had several limitations. First, the ADHD and comparison samples used in this study may not be representative of the general population of females; the recruitment strategies were not epidemiological and instead drew from a mixture of clinical and nonclinical referrals (see Hinshaw, 2002, for details). The decision to draw the sample from both referral sources was deliberate, given our understanding of the importance of referral source in affecting the prevalence and severity of ADHD symptoms by gender (Hinshaw and Blachman, 2005; Gaub & Carlson, 1997). Whereas epidemiologic strategies are essential for obtaining unbiased estimates of prevalence, comorbidity, or to clarify male-female differences, the goals of the broader study (from which this study's data are drawn) were to intensively examine patterns of impairment in a large and diverse sample of young women with ADHD.

There are additional limitations in this particular study. Another limitation is also related to the sample. Forty-eight of the participants were lost to attrition (or were not yet scheduled for data collection), although analyses suggest that those not included do not differ significantly from those who were retained. Additionally, the use of grades and school records might have provided additional, useful information in terms of understanding patterns in academic impairment, but such records were not available at the time of this investigation.

The fact that ADHD status and comorbidity were measured at Wave 1, when the participants were children, is another limitation of the study. Concurrent ADHD symptoms or comorbidity were not taken into account. In some respects, the overall goal of this phase of the long-term investigation was to examine the prospective patterns of academic impairment from childhood ADHD status through early adulthood. Still, future analyses that control for current, Wave 3 psychopathology might provide interesting additional information.

Another limitation in this research is that medication status (or any other treatment status) is not controlled for. Medication was not examined in this study for a variety of important reasons. The primary reason is that this dataset involved data collection every five years, and so did not allow for the tracking of specific medication use, year by year.

Another challenge involved in controlling for medication involves the “intervention selection bias,” in which those who received medication often perform worse on outcomes because their disorder was more severe to begin with, thus producing greater outcome dysfunction and making the results difficult to interpret. In other words, it is difficult to know if outcomes are related to the original severity of the ADHD or the actual effectiveness of the medication (or any other treatments used).

Whether medications positively affect academic achievement is a contentious issue. Medication use does have well-documented effects in related domains, such as in improving social skills, homework persistence, academic productivity, or in teacher-reported measures of classroom behavior, which might measure, for example, ability to attend, follow directions, sit still, refrain from shouting out answers, ability to complete assignments in class, and so on (see Barkley, DuPaul, & Connor, 1999; Gillberg et al., 1997; Rapport et al., 1999; Wilens & Spencer, 2000). However, on more traditional, objective measures, such as achievement and cognitive test scores, medication does not seem to have much effect, although a recent investigation does suggest some positive benefits (Scheffler et al., 2009).

## **Conclusions, and Educational and Clinical Implications**

In conclusion, findings of the current research indicate young women with ADHD, when compared to control participants, had lower achievement test scores; higher numbers of grade failures, suspensions, and expulsions; received fewer school-based honors and awards; and used school special services in greater numbers. The findings had effect sizes that ranged from medium to large. All group differences withstood control of related covariates. Contrary to prediction, the young women with ADHD graduated from high school and also enrolled in some form of higher education in numbers similar to those of their peers without ADHD. However, the students with ADHD were found to enroll in different types of postsecondary education institutions, and showed a greater tendency to enroll in a community college or trade school versus a 4-year college or university. Additionally, the students with ADHD demonstrated a pattern of dropout following their enrollment in higher education that differed from their comparison peers. Overall, this investigation provides strong evidence for the association between childhood ADHD in girls and later impairment in the educational domain in adolescence and early adulthood, as has been found in parallel research using largely male samples.

What clinical and educational implications can be drawn from this research? It is positive and noteworthy that the young women with ADHD are graduating from high school and enrolling in higher education in strong numbers that are similar to those of their female peers without the disorder. However, problems emerged in keeping the students with ADHD in these higher education institutions once they enrolled, suggesting the need for increased services to encourage this group of students to remain in school.

The problem of keeping students with learning problems in higher education does not seem to be unique to students with ADHD. In general, students with disabilities have been found to be less likely than those without disabilities to attain a Bachelor's or Associate's degree (U.S. Department of Education, 2000). By some accounts, the number of college students reporting learning disabilities or conditions that interfere with academic performance, like ADHD, have tripled over the last 20 years (Goode, 2003; O'Neil, 2003). Today, 1.2% of the nation's college freshmen self-identify as having learning disabilities (Battista, 1990).

In part due to the Americans with Disabilities Act and similar legislation, special services for these students have improved in lower education (if slowly and fitfully), making higher education a more realistic goal for such students. These changes have been matched by a small revolution at the college level, and the depth of support and accommodations offered have multiplied. Still, it seems the growing need for such services in college has outpaced the ability to provide them, and students with learning problems, like ADHD, frequently struggle to manage the many responsibilities involved with college life (Goode, 2003; O'Neil, 2003).

In today's highly technological society, postsecondary education and advanced training are usually acknowledged as keys to economic success for all populations. As a result, developing effective support services for the increasing numbers of students with learning disabilities, including ADHD, who enter postsecondary education seems essential. Such services may encourage students like the young women with ADHD in this study to

graduate from institutions of higher education, thus increasing their likelihood of economic independence in adulthood.

Overall, the current findings are noteworthy in suggesting longstanding academic impairment for female children who were diagnosed with ADHD and followed into adolescence and young adulthood. Future investigations should continue to follow the sample further into adulthood to determine whether educational decrements remain at later time periods and whether vocational differences emerge as well. Perhaps additional research might also examine what factors, and specifically at what time points, dropout occurs in these young women, so that preventive services can be made more effective for future generations of female students with ADHD.

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