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Literature Review

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Objective: According to the American Psychiatric Association, 3% to 7% of the school-age population has ADHD and many children continue to display significant symptoms throughout adolescences and adulthood. Relative to the childhood literature, less is known about ADHD in adults, especially college students with ADHD. The principle purpose of this review articles is to summarize the major research findings concerning ADHD in the college student population with regard to prevalence of symptoms, neuropsychological and psychological functioning. Overall, findings suggest that college students with ADHD are at greater risk for academic and psychological difficulties, and they perform similar to non-ADHD controls on many neuropsychological tasks. These findings are preliminary, however, and are tempered by the small number of studies that have been conducted as well as the methodological limitations of these studies. **Conclusion:** Future research using larger sample sizes, rigorous assessment criteria, and a longitudinal design is needed to better understand the psychological, academic, and neuropsychological functioning of college students with ADHD. Studies are also needed to elucidate the effects of pharmacological and nonpharmacological effects of treatment on the functioning of college students with this disorder. *(J. of Att. Dis. 2006; 10(1)9-19)*

Keywords: *ADHD; college students; psychological functioning; neuropsychological functioning; treatment*

ADHD is characterized by an inability to sustain attention, impulsivity, and hyperactivity. The American Psychiatric Association (2000) estimates that 3% to 7% of the school-aged population has ADHD, with more males diagnosed than females by a ratio of 2:1 to 9:1. Prevalence studies, however, have reported higher and lower rates of ADHD among children and adolescents, with values ranging from 2.6% to 16% in male adolescents and 0.54% to 3.9% in female adolescents (Barbaresi et al., 2002; Cuffe et al., 2001; Neuman et al., 2005).

Prior to the 1970s, ADHD was believed to be a childhood disorder outgrown with the onset of puberty (DuPaul, Guevermont, & Barkley, 1991). Longitudinal research, however, suggests that the majority of children and adolescents diagnosed with ADHD display symptoms into adulthood, the expression of these symptoms changes over time, and ADHD in adults is indeed a valid disorder (Barkley, 1998; Biederman, Mick, & Faraone, 2000; Goldstein, 2002; Shekim, Asarnow, Hess, Zaucha, & Wheeler, 1990; Spencer, Biederman, Wilens, & Faraone, 1994). Although relatively little information is available concerning ADHD in adulthood, and specifically among college students, it is estimated that ADHD symptoms affect 2% to 4% of the college student population (DuPaul et al., 2001; Heiligenstein, Conyers, Berns, & Smith, 1998; Weyandt, Linterman, & Rice, 1995). As students, individuals with ADHD are entitled by the American Disabilities Act of 1990 to receive educational support services, and according to Gordon and Keiser (1998), increasing numbers of students are seeking these special accommodations. According to the American Council on Education (1995), the percentage of college students with disabilities rose from 2.2% to 8.8% of all students between 1978 and 1991. Relative to the information that is available concerning ADHD in children and adolescents, however, a dearth of information exists about ADHD in the college student population. The purpose of this review is to summarize research findings concerning ADHD in college students based on a review of the literature concerning (a) the prevalence of ADHD symptoms in this population and (b) the results concerning the psychological and neuropsychological functioning of college students with ADHD. To locate studies, major search engines were used (e.g., MEDLINE and Psych-INFO). Studies meeting the following criteria were included in the review: (a) published in a peer-

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reviewed journal between 1985 and 2004, (b) focused on college students diagnosed with ADHD (or earlier diagnostic terms such as ADD or hyperactivity) or displaying symptoms of ADHD, (c) included data regarding prevalence of symptoms and/or functioning in one or more areas (e.g., behavioral, academic, neuropsychological, and social-emotional), and (d) did not exclusively focus on treatment response or outcomes (analysis of treatment effects is beyond the scope of this review).

Given that no reviews have been published regarding the general functioning of college students with ADHD, we included all studies that met the previous criteria regardless of methodological rigor. Twenty-three studies were identified through this search and were included in this review.

Results

Prevalence of ADHD and ADHD Symptoms in College Students

As reported by Wolf (2001), nearly 25 years of disability and special education laws, such as the Americans with Disabilities Act, the Individuals With Disabilities Act, and Section 504 of the Rehabilitation Act, have mandated special education services for students with disabilities, and as a result, increasing numbers of students with disabilities are successfully completing high school and attending college. Wolf also reported that the greatest increase in disabilities on college campuses is in students with "hidden disabilities," such as ADHD. Students with ADHD are not required to report to disability support services, however, and therefore, the actual number of college students with ADHD is speculative. Henderson (1999) and Guthrie (2002) reported that nearly two in five college students with disabilities have ADHD or a learning disability and that approximately 42% of these students are females. The actual percentage of college students receiving disability support services for ADHD varies across universities and is likely influenced by factors such as the size of the university and the types of services provided. In general, approximately 25% of students receiving disability support services receive services for ADHD, and this percentage has increased substantially since 1975 (HEATH, 1993; Wolf, 2001).

Recent studies have attempted to identify the percentage of college students who report clinically significant levels of ADHD symptoms. For example, Weyandt et al. (1995) were among the first to investigate the self-reported prevalence of ADHD symptoms in 770 college students. The study was conducted in two phases; in Phase 1, students completed three rating scales—Adult Rating Scale (ARS; Weyandt et al., 1995), Brief Symptom Inventory (BSI; Deragotis, 1992), and the Wender Utah Rating Scale (WURS; Ward, Wender, & Reimherr, 1993)—and in Phase 2, a subset of participants were administered neuropsychological tests. Results revealed that 7% and 8% of participants reported significant ADHD symptoms on the ARS and WURS, respectively (1.5 standard deviation or more) and 2.5% on both scales. When a criterion of 2 standard deviations was used, ratings dropped to 4%, 3.8%, and 0.5% reported significant symptoms on both scales. No gender differences were found. Similar findings were reported by Heiligenstein et al. (1998), who administered a version of the ADHD Rating Scale (DuPaul, 1991) to 468 college students (slightly more than 1% of the student population at the university) who were recruited from a variety of settings, such as residence halls, classroom, and athletic team meetings. Using six out of nine symptoms for inattention and hyperactive-impulsive symptoms, approximately 4% of the students, based on self-report ratings, met *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) criteria for ADHD. Heiligenstein et al. (1998) reported that the total hyperactivity score declined with increasing age and that no differences were found with respect to gender, ethnicity, and educational level on the inattention score.

Cross-cultural comparisons of ADHD symptom prevalence rates have also been investigated. DuPaul et al. (2001), for example, explored the prevalence of self-reported ADHD symptoms in 1,209 college students from three countries: the United States, Italy, and New Zealand. Using the Young ARS, results indicated that Italian students reported significantly more inattention and hyperactivity-impulsivity symptoms than students from the United States and that students from New Zealand reported more inattention symptoms than students from the United States. Using *DSM-IV* criteria, participants were classified as having an ADHD inattentive subtype if they endorsed six or more inattentive symptoms and fewer than six hyperactive-impulsive symptoms. Similarly, participants were classified as having the hyperactive-impulsive subtype if six or more hyperactivity-impulsivity symptoms were reported and fewer than six inattention symptoms. Results indicated that 2.9% of male students from the United States were classified as having one of the three subtypes, whereas 7.4% of male Italian students and 8.1% of male students from New Zealand reported significant ADHD symptoms. In the majority of these cases, the males were identified as hyperactive-impulsive type. Female students from the

United States, however, reported significantly higher ADHD symptoms than female students from Italy or New Zealand (3.9%, 0%, and 1.7%, respectively). Similar to the male students, most of the female participants who met *DSM-IV* criteria were categorized in the hyperactive-impulsive subtype.

Collectively, these studies suggest that approximately 2% to 8% of college students self-report clinically significant symptoms associated with ADHD, although these numbers do not reflect the actual percentage of college students with documented ADHD. Studies are needed to identify the number of students with documented ADHD across college campuses, including those that do and do not receive disability support services.

Academic and Psychological Functioning

Academic performance. With regard to academic and psychological functioning of college students, the literature is scant. Preliminary studies, however, have reported that college students with ADHD tend to have significantly lower grade point averages (GPAs) and report more academic problems than students without the disorder (Heiligenstein, Guenther, Levy, Savino, & Fulwiler, 1999). Studies also reveal that college students with ADHD are more likely to be on academic probation (Heiligenstein et al., 1999) and are less likely to attend and graduate from college than control participants (Murphy, Barkley, & Bush, 2002; Wolf, 2001). The underlying factors that contribute to academic failure in college students with ADHD are poorly understood but may be related to impaired organizational skills, study skill deficits, deficits in executive function, and other cognitive deficits. Although methodologically sound studies comparing these cognitive processes in college students with and without ADHD are lacking, Turnock, Rosen, and Kaminski (1998) found that students who self-reported high symptoms of ADHD used significantly fewer academic coping behaviors, that is, were less organized, less methodical, employed fewer self-control or self-disciplinary behaviors, and procrastinated significantly more than their low-symptoms peers as measured by their ratings on the Coping Strategies Measure (developed by the researchers) and the Survey of Study Habits and Attitudes (Brown & Holtzman, 1965). Weyandt et al. (2003) recently found that college students with ADHD reported significantly higher levels of internal restlessness than students without the disorder, and other studies have reported that college students with a history of ADHD in childhood report more intrusive thoughts and task-unrelated thoughts than control participants (e.g., Hines & Shaw, 1993; Shaw & Giambra, 1993). Although speculative, one might hypothesize that high levels of internal restlessness and intrusive thoughts are associated with compromised attention skills and academic performance.

Not all studies indicate that college students with ADHD are at an increased risk for academic problems, however. For example, Sparks, Javorsky, and Philips (2004) reported that the conventional assumption is that college students with ADHD will experience difficulties with foreign language because of their generally low academic achievement and study skill deficits. Sparks et al. (2004), however, studied 37 students with ADHD and 31 with ADD who all were receiving disability support services. Results indicated that 76% of the participants majored in arts and sciences, 17% in business, 3% in engineering, 3% in fine arts, and 1% in the school of education. The mean GPA for students with ADHD/ADD was 2.7 (B to B–) (range from 2.0 to 3.6) compared to the typical graduating senior whose GPA was 2.9. In addition, this study found that foreign language courses were a graduation requirement for 88% of the 68 students with ADHD and that only 32% had requested and used disability support services for the foreign language courses (13 different types of instructional accommodations were used), even though all of the students with ADHD were eligible for special services. The most common accommodation was a distraction-free room and extra time on tests. During a 5-year period, 83% of the students with ADHD earned grades of C or higher, only 4 students failed (2% of sample), and 8% withdrew from the course. The authors concluded that students with ADHD are able to fulfill foreign language requirements and many apparently do so without disability support services.

In summary, preliminary studies suggest that students with ADHD are at an increased risk for academic problems, lower GPA, and compromised academic coping skills. At least one study, however, questions the notion that students with ADHD will have difficulty fulfilling certain coursework, such as foreign language courses. Clearly, more research is needed to better understand the academic functioning of students with ADHD as well as factors that may contribute to their academic failure or success at the college level.

Psychological functioning. A handful of studies have compared the psychological functioning of college students with and without ADHD, and several studies have compared the psychological functioning of students with and without self-reported ADHD symptoms. In general,

the findings have been inconsistent, with some studies reporting that college students with ADHD experience greater psychological distress and problems whereas other studies have not supported these findings. For example, Heiligenstein and Keeling (1995) conducted a systematic chart review of 42 college students with ADHD (29 males, 13 females) who sought services from the university's health and counseling center. Results revealed that 45% of the sample had no evidence of comorbidity problems; however, 26% of the sample had depressive disorders, 5% anxiety disorders, 26% drug and alcohol dependency or both, 2% comorbid learning disabilities, and 2% eating disorders. In a later study, Heiligenstein et al. (1999) compared the charts of 26 students with ADHD and 28 control students with respect to academic and psychosocial functioning. Findings indicated that although students with ADHD had significantly lower GPAs and were more likely to be on academic probation, they did not differ from control students with regard to psychosocial functioning. Specifically, students with ADHD did not report greater problems with depression, anxiety, substance use, or relationships than control students.

In contrast, Richards, Rosen, and Ramirez (1999) compared college students with and without ADHD on the Symptom Checklist–90–Revised (SCL-90-R; Deragotis, 1975) and found that the overall score was significantly higher for the ADHD group than control students. Specifically, the ADHD group reported significantly higher ratings than controls on somatization, obsessive compulsive disorder, interpersonal sensitivity, depression, anxiety, hostility, paranoid ideation, and psychoticism. No significant gender effects were found. These findings were consistent with those reported by Weyandt, Rice, Linterman, Mitzlaff, and Emert (1998), who found that college students with ADHD (n = 21) reported greater psychological distress than control students on the Global Severity Index of the BSI (Deragotis, 1992).

Kern, Rasmussen, Byrd, and Wittschen (1999) were interested in exploring whether lifestyle personality attributes were related to ADHD symptoms and compared self-report ratings on the Basic Adlerian Scales for Interpersonal Success scale (BASIS-A; Wheeler, Kern, & Curlette, 1993) of 21 college students previously diagnosed with ADHD (M age = 14.3 when diagnosis was made), 88 controls, and 8 college students with current ADHD symptoms but no formal diagnosis. All participates completed the BASIS-A scale, which measures constructs related to lifestyle, such as belonging-social, taking charge, wanting to win the approval of others, and personality characteristics such as striving for perfection, harshness, and entitlement. Results indicated that those with diagnosed ADHD compared to control participants had atypical BASIS-A ratings, that is, they endorsed items that suggested they were (a) less rule focused, (b) more independent, (c) more prone to confrontational and aggressive behavior under stressful situations, and (d) less likely to be influenced positively or negatively by constructive or critical feedback from others. Based on their findings, Kern et al. (1999) suggested that college students with ADHD are likely to have more difficulties in the areas of time management, monitoring personal stress, organizational skills, and accessing social support from others. None of the students with documented ADHD were on academic probation, that is, they were in "good standing," which is inconsistent with results reported by Heiligenstein et al. (1999). The results also revealed the ADHD and ADHD symptom group had similar scores on several of the BASIS-A subtests and suggests that those with ADHD symptoms are at an increased risk for difficulties experienced by students with documented ADHD.

Although a few studies have looked at global psychological functioning using instruments such as the BSI and SLC-90, very little research has been conducted with specific aspects of psychological well-being such as self-esteem and college students. The only published study that addressed self-esteem in college students with ADHD was conducted by Dooling-Litfin and Rosen in 1997. Specifically, the researchers compared self-esteem ratings (Rosenberg Self-Esteem Scale; Rosenberg, 1965) in college students with a childhood history of ADHD to controls and those with a positive history for ADHD reported significantly lower self-esteem ratings compared to controls. Results, based on multiple regression, also indicated that ADHD students with higher social skills and fewer current ADHD symptoms had higher self esteem and that treatment history, having a special talent, or having had a mentor were not associated with self-esteem in college students with a history of ADHD. The authors speculated that early identification and symptom control may help students to develop better social skills, which in turn may lead to higher levels of self-esteem. Although this study is correlational in nature and does not reveal causal relationships, it does raise questions about the potential mitigating effects of social skills training and symptoms management on the self-esteem of college students with ADHD.

Psychological functioning of college students with ADHD symptoms. Several studies have compared the

psychological functioning of college students who self-report high and low ADHD symptomatology. For example, Richards, Deffenbacher, and Rosen (2002) recruited 59 college students (35 males, 24 females) from introductory psychology courses and based on self-report ratings created high and low ADHD symptom groups. Richards et al. (2002) then compared the groups with respect to self-report ratings on several driving-related inventories and anger-related inventories as well as the SCL-90-R. Results revealed the high ADHD symptom group compared to the low symptom group reported greater psychological distress on SCL-90-R Global Severity Index as well as the Obsessive-Compulsive, Anxiety, Hostility, and Paranoid subscales. The high symptom group also reported greater total driving anger, greater anger toward others driving slowly, and more anger in response to police presence, and they reportedly engaged in more hostile and aggressive anger behaviors (gesturing, physical aggression, and use of headlights) than the low symptom ADHD group. The researchers were unable to examine potential gender effects as there were too few high-symptom females. In summary, Richards et al. concluded that individuals with high ADHD symptoms experience more driving anger and tend to express this anger in socially unacceptable ways. These findings were consistent with Woodward, Fergusson, and Horwood (2000), who studied the association between attentional difficulties at age 13 and driving outcomes at age 21 in individuals from New Zealand. Results revealed that young adults with attention difficulties were at greater risk for a number of driving-related problems, including accidents, drinking while driving, and traffic violations. It is interesting that Barkley, Murphy, DuPaul, and Bush (2002) recently reported that a community sample of young adults with documented ADHD self-reported significantly more traffic citations, vehicular crashes, and license suspensions than young adults without the disorder.

Ramirez et al. (1997) also examined differences in anger and anger expression in college students who self-reported high and low ADHD symptoms. Similar to Richards et al. (2002), Ramirez et al. found that the high-symptom group reported higher levels of trait and state anger and socially inappropriate ways of expressing anger than the low-symptom group. The high symptom group also reported more symptoms of psychological distress and more labile anxious and depressed moods than the low-symptom group.

Theriault and Holmberg (2001) questioned whether ADHD symptoms were related to the use of aggression in a close relationship and whether ADHD symptoms were related to physical, psychological, or sexual aggression. Theriault and Holmberg recruited 157 college students (89 females, 68 men) who had been involved in a dating or marital relationship within the past 12 months and administered several self-report rating scales—for example, ARS (Weyandt et al., 1995), Revised Conflict Tactics Scale (Straus, Hamby, Boney-McCoy, & Sugarman, 1996), and WURS (Ward et al., 1993). Results indicated that the high ADHD symptom group was more likely to engage in physical and sexual aggression but not psychological aggression compared to the low-symptom group. Findings also revealed that participants who rated themselves as verbally impulsive (e.g., blurt out responses, interrupt their partner) were more likely to engage in relationship aggression.

Kass, Wallace, and Vodanovich (2003) examined the extent to which proneness to boredom and sleep disturbances were related to ADHD symptoms and administered four self-report surveys—Adult Behavior Checklist (Barkley, 1998), Athens Insomnia Scale (Soldatos, Dikeos, & Paparrigopoulos, 2000), Boredom Proneness Scale (Farmer & Sundberg, 1986), Epworth Sleepiness Scale (Johns, 1992)—to 148 undergraduate students. Findings revealed that boredom proneness and sleep disorders scores were predictive of hyperactivity subscale scores on the Adult Behavior Checklist (Barkley, 1998). The authors noted that the results supported previous findings with children and adults with documented ADHD and suggested that sleep problems and desire for external stimulation may be characteristics of ADHD. Hines and Shaw (1993) reported a higher level of sensations seeking and a greater use of drugs among college students who self-reported high ADHD symptoms relative to those who self-reported low symptoms. Kirsch and Sapp (2000) compared the hypnotizability of college students with self-reported high ADHD symptoms relative to those who were low in ADHD symptoms and found that the groups did not differ with respect to hypnotic susceptibility as measured by the Harvard Group Scale of Hypnotic Susceptibility (Shor & Orne, 1962). Obviously, these finding are only relational in nature, and future studies are needed with college students who have been diagnosed with ADHD to explore the replicability and generalizability of the findings.

Interpersonal relationships in college students with ADHD or ADHD symptoms. To explore heterosocial relational outcomes in college students, Canu and Carlson (2003) administered a number of rating scales to sixty-four 17- to 22-year-old heterosexual undergraduates. Based on self-report ratings on ADHD scales, groups were divided into an ADHD primarily inattentive group,

ADHD combined type, or a control group. Results indicated that those college students with the inattentive subtype differed significantly on several scales and evidenced heterosocial impairment. For example, the average age of dating was age 14 for the ADHD combined type, 15 for the control group, and 16 for the inattentive group. The inattentive group also reported being less comfortable than the control group in assertive relevant situations and based on 1-minute interactions with confederates were rated most negatively. The authors suggested that young men with ADHD inattentive type may be more likely to experience rejection by female peers. College students in the ADHD combined group reported a significantly greater sexual drive than controls. It is important to note that only male participants were included in this study and the participants were ADHD-symptomatic and were not diagnosed as having ADHD.

Given the body of research that suggests that families of children with ADHD tend to be characterized by conflict, a more negative emotional climate, higher levels of stress, and more punitive childrearing techniques, Grenwald-Mayes (2002) explored the relationship between family of origin dynamics and current quality of life in college students diagnosed with ADHD. Thirty-seven undergraduate students with ADHD and 59 control students participated in the study and were administered the Quality of Life Questionnaire (Evans & Cope, 1989), Family Environment Scale (Moos & Moos, 1994), and the Family Adaption and Cohesion Scale II (Olson, Porter, & Bell, 1982). Overall, results revealed that college students with ADHD reported a lower quality of life. They also reported significantly poorer parent-child relations, had less success with personal growth, had less interest and involvement in political behavior, and experienced less material and physical well-being. Statistical differences were not found on a number of quality of life scales, however, including those such as occupational relations, sports activity, marital relations, altruistic behavior, creative/aesthetic behavior, and others. No differences were found between groups on the family of origin scales, suggesting that those with ADHD did not perceive the dynamics of their family of origin differently than the control group. Only one group difference was found on the Family Environment Scale, the Active-Recreational subscale, with the ADHD group scoring higher than the control group. Factor analysis of the family of origin scales followed by multiple regression using these factors revealed that three factors were significant predictors of quality of life among participants with ADHD, including positive emotional climate, activities, and organization. These factors were not predictive of quality of life for participants without ADHD, leading the author to suggest that "family variables may be more important to the academic and life success of individuals with ADHD than for their counterparts without ADHD" (Grenwald-Mayes, 2002, p. 216).

Neuropsychological Findings

Similar to other areas of research with college students with ADHD, the literature concerning neuropsychological functioning of college students with ADHD is sparse. Weyandt et al. (1998) were among the first to investigate the neuropsychological performance of young adults with ADHD relative to a clinical comparison group (developmental reading disorder) and a control group. Sixty-four participants were included in the study (21 with documented ADHD, 19 with documented developmental reading disorder, and 24 control participants), and participants were administered several rating scales, as well as the Wisconsin Card Sorting Test (Grant & Berg, 1948), Tests of Variables of Attention (Greenberg, 1990), a computerized version of the Tower of Hanoi, and the Ravens Standard Progressive Matrices (Raven, Court, & Raven, 1992). Results indicated that the group with developmental reading disorders committed more errors on the Wisconsin Card Sorting Test (WCST) than the control group, but differences were not found between the groups on the remaining neuropsychological tasks. In a later study, Weyandt, Mitzlaff, and Thomas (2002) compared the performance of 17 college students with and without ADHD on the Test of Variables of Attention (TOVA; Greenberg, 1990) as well as the freedom from distractibility factor on the Wechsler Adult Intelligence Scale–Revised (WAISR; Wechsler, 1981). Findings indicated that college students with ADHD made more errors of omission on the TOVA than control participants and between-group differences were not found on the remaining tasks (i.e., freedom from distractibility factor, TOVA errors of commission, mean correct response time, and variability). Furthermore, Pearson product moment correlations revealed that none of the correlations between the Full Scale IQ on the WAISR and TOVA variables were significant. The authors questioned the clinical utility of the neuropsychological tasks in the assessment of ADHD in college students. Similar null findings were reported by Linterman and Weyandt (2001), who examined the divided attention performance of 18 college students with ADHD and 18 college students without the disorder on a computerized neuropsychological divided attention task. Results indicated that contrary to the popular belief that those with ADHD may have superior divided attention skills, col-

lege students with and without ADHD performed similarly on this task.

Neuropsychological functioning in college students with ADHD symptoms. Several studies have compared the neuropsychological functioning of college students who self-report high and low ADHD symptoms. For example, Buchsbaum et al. (1985) screened 400 college men on a continuous performance task and based on their performance created two groups: good and poor attention (the upper and lower 5% of the continual performance test [CPT] distribution). The participants were then compared on multiple measures of cognitive, physiological, and psychiatric functioning. Similar to Gregg, Coleman, Stennett, and Davis (2002) and Weyandt et al. (2002), results revealed similar WAIS performance between those with good and poor attention skills. Those in the poor attention group reported higher ADHD ratings on a self-report instrument but did not report significantly more psychiatric problems. Reaction times were slower in the poor attention group, and this group performed more poorly on serial learning and memory tasks. Weyandt et al. (1995) compared the neuropsychological performance of 17 students with self-reported high ADHD symptoms to control participants on the WCST (Grant & Berg, 1948), Visual Search Attention Test (Trennery, Crosson, DeBoe, & Leber, 1998), and Stroop Neuropsychological Screening Test (Trennery, Crosson, DeBoe, & Leber, 1987), and no significant group or gender differences emerged.

In summary, little information is available concerning the neuropsychological functioning of college students with ADHD. Preliminary studies suggest that college students with the disorder perform similar to control participants on intelligence tests and the findings are mixed with respect to performance on specific neuropsychological tests. Additional studies with larger samples are needed to further explore whether college students demonstrate neuropsychological deficits relative to those without the disorder. Additional studies are also needed that control for assessment parameters. A thorough assessment of ADHD symptoms in a college student should include clinical interviews with the student and significant others, self-report questionnaires, behavioral questionnaires completed by parents, review of school records, and intellectual and achievement testing (Barkley, 2006). The overall objective is to determine the extent to which a student's symptoms meet *DSM-IV* criteria for ADHD while also carefully considering alternative diagnostic options (e.g., learning disabilities).

Treatment of college students with ADHD includes pharmacological and nonpharmacological interventions. Stimulant medications such as methylphenidate and d-amphetamine that are used to treat children with ADHD are often effective for young adults with ADHD (Wender, 1998) and are considered first-line therapy for this population (Wilens, Spencer, & Biederman, 1998). Also, several nonstimulant medications (e.g., atomoxetine) have been found to significantly reduce ADHD symptoms in adults (Wilens, 2003). Although few studies have examined stimulant medication response specifically in college students, those investigations that have been conducted (e.g., Heiligenstein, Johnston, & Nielsen, 1996) have found a positive treatment response for a majority of students treated with these compounds.

Academic accommodations vary across universities but typically include strategies such as books on tape, note-taking services, distraction-free rooms and extra time for examinations, alternative forms for examinations, and more recently use of adaptive equipment and technology (Javorsky & Gussin, 1994; Jones, Kalivoda & Higbee, 1997; Mull & Sitlington, 2003). Although many of these accommodations and adaptations may make intuitive sense, most lack rigorous empirical studies to investigate their effectiveness at enhancing the performance of students with ADHD.

Summary and Future Research Directions

Although the empirical study of ADHD in the college student population is in its relative infancy, this review of the extant literature supports several tentative conclusions. First, approximately 2% to 8% of college students in the United States report clinically significant levels of ADHD symptoms. The prevalence of these symptoms varies across genders and fluctuates depending on what criteria for clinical significance (e.g., 1.5 vs. 2 standard deviations above the mean) are employed. Furthermore, there is preliminary evidence that self-reported symptoms may vary across countries; however, this is based on the results of a single study (DuPaul et al., 2001). Second, it is unclear how many college students with disabilities have diagnosed ADHD, although preliminary estimates place this figure at about 25%, and the number of students with ADHD is likely to vary significantly across universities. Third, college students with significant ADHD symptoms obtain a lower GPA and are less likely to graduate than their non-ADHD peers. Preliminary findings indicate that their poor academic performance could be mediated by inattention, inadequate academic coping

strategies (e.g., organizational skills), and higher levels of internal restlessness and intrusive thoughts.

Equivocal findings have been obtained regarding the psychological functioning of college students with significant ADHD symptoms. Most studies have found these students to have greater levels of psychological distress and aggression than their peers, whereas several investigations have not found group differences. It should be noted, however, that the studies finding psychological difficulties in this population were methodologically stronger (e.g., used psychometrically sound measures) than those studies with null results. Similarly, several investigations have indicated that college students with ADHD have difficulties with personality style variables (e.g., accessing social support) and interpersonal relationships. The nature of interpersonal difficulties may vary across ADHD subtypes. Finally, college students with ADHD perform similarly to non-ADHD controls on many neuropsychological tests (e.g., IQ tests); however, differences in performance on measures of attention and impulse control have emerged in some studies, as would be expected given the nature of this disorder.

Conclusions based on the available literature are tempered by the small number of studies that have been conducted as well as significant limitations of those investigations that have been completed. A few studies have compared college students with and without ADHD, but most studies have been conducted with nonreferred, nondiagnosed students who report clinically significant ADHD symptoms, and in both cases, students have not undergone a comprehensive evaluation of this disorder. In addition, some investigations have relied on retrospective chart review and/or measures that have not been standardized for use with this age group or population. Furthermore, samples have not been large enough to examine possible differences in functioning across gender or ADHD subtype. This is particularly important given that important gender and subtype differences have been found for children with this disorder (Barkley, in press). Finally, all available studies have been cross-sectional, thereby limiting our understanding of how academic, psychological, and interpersonal functioning may change across the college years for students with this disorder.

Given the limitations of the current literature, several important directions for future research with this population can be identified. First, studies need to be conducted with larger samples, preferably across multiple universities. This would allow examination of differences in functioning across critical variables such as gender, university type, and socioeconomic status. Second, detailed investigations of students with diagnosed ADHD (rather than relying solely on self-report of symptoms) are needed. Clinical diagnoses from community providers and disability support service offices need to be confirmed using *DSM-IV* criteria based on a multifaceted assessment approach, including self-report, parent report, review of historical data (e.g., school records), and possibly tests of intellectual functioning and academic achievement. Third, studies of students meeting diagnostic criteria for ADHD should focus on differences in functioning across subtypes. For example, there is preliminary evidence that heterosocial functioning may be more difficult for students with ADHD predominantly inattentive type (Canu & Carlson, 2003). Finally, although several large-scale, longitudinal investigations have followed children with ADHD into adulthood (e.g., Barkley, Fischer, Smallish, & Fletcher, 2002; Mannuzza, Gittelman-Klein, Bessler, Malloy, & LaPadula, 1993), no study, to date, has examined changes in functioning of students with ADHD across their college careers. Longitudinal studies could examine many clinically relevant issues, such as factors that may predict or mediate successful college outcomes, differential impact of educational accommodations over time, and differences in trajectories across gender, subtype, and socioeconomic status.

By far the most important direction for future research is to elucidate the effects of treatment on the functioning of college students with ADHD. Although college students are considered young adults and medication studies conducted with this age group support the use of stimulants and other psychotropic compounds in treating ADHD symptoms, it is unclear what effects medications have on academic, interpersonal, and psychological outcomes among college students. Furthermore, there is little information on side effects of various drugs as well as their potential for abuse in this population. Preliminary studies suggest that nonmedical use of stimulants among college students ranges from 0 to 25% at individual colleges (McCabe, Knight, Teter, Wechsler, 2005). In similar fashion, almost no studies have investigated the effects of educational accommodations and psychosocial interventions for college students. Clearly, well-controlled, carefully conducted investigations of nonmedical interventions are sorely needed to guide practice with this growing population of college students.

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