

Self-Reported ADHD and Adjustment in College : Cross-sectional and Longitudinal Findings

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Abstract:

Objective: To examine the association between self-reported ADHD and college adjustment. Participants: Study 1 included nearly 3400 undergraduates attending a public and private university. Study 2 included 846 students who participated during freshman and sophomore year. Method: Students completed a web-based survey that assessed diagnostic status and adjustment in multiple domains. Results: Relative to other students, those with self-reported ADHD had lower GPAs and reported more academic concerns, depressive symptoms, social concerns, emotional instability, and substance use. Overall, however, most were making satisfactory adjustments in these domains. Benefits of medication treatment were not found. Freshman year ADHD predicted lower GPA, increased academic concerns and alcohol use, and smoking initiation. Conclusion: Students with ADHD struggled relative to peers but most were adjusting reasonably well across multiple domains. Future research should move beyond the use of self-reported diagnosis and more carefully examine the impact of medication treatment in this population. (*J. of Att. Dis.* 2009; 13(3) 297-309)

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Article:

Although individuals with ADHD are less likely than their peers to complete high school and attend college (Barkley, Fischer, Edelbrock, & Smallish, 1990), recent years have seen an increase in the number of college students with ADHD (DuPaul et al., 2001; Wolf, 2001). Although there are no published studies that have documented rates of ADHD in a college sample using comprehensive evaluation procedures, between 2% and 8% of students self-report clinically significant symptoms of ADHD (Weyandt & DuPaul, 2006) and the percentage of students receiving disability support services for ADHD has risen substantially since 1975 (HEATH, 1993; Wolf, 2001). Although careful epidemiologic work on ADHD in college

populations remains important to pursue, it is evident that ADHD affects a sizeable and perhaps growing number of college students. Studying the functioning of college students with ADHD is thus important for learning how ADHD may affect individuals during this key developmental period and the supports students with ADHD may need to have a successful college experience.

Because ADHD frequently has an adverse impact on individuals' academic, social, and psychological functioning (Barkley, 2005), there is a strong basis for expecting that college students with ADHD would also struggle in these domains. However, some authors have suggested that negative outcomes observed in children and adolescents with ADHD may not apply to college students. This is because the latter are likely to have higher ability levels, have experienced greater success during primary and secondary school, and possess better compensatory skills than individuals with ADHD from the general population (Frazier, Youngstrom, Glutting, & Watkins, 2007). Thus, the degree to which findings from the general population of individuals with ADHD apply to college students is uncertain, and research on this issue is unfortunately limited. In fact, a recent review identified only 23 published studies on this population (Weyandt & DuPaul, 2006), and a number of these focused on students with ADHD symptoms rather than an actual diagnosis. Below, we review studies of students with a confirmed or self-reported ADHD diagnosis.

To date, only two studies have examined academic performance in college students with ADHD, as opposed to students who report high levels of ADHD symptoms. Heiligenstein, Guenther, Levy, Savino, and Fulwiler (1999) used a retrospective chart review to identify 26 students from a large state university with confirmed or probable ADHD. These students had lower GPAs and were more likely to have been on academic probation than 28 students without ADHD who sought career counseling at the same center. Work conducted at another state university yielded conflicting results, however, as 68 students with a documented diagnosis of ADHD graduated with GPAs that did not differ from the overall student body (Sparks, Javorsky, & Philips, 2004). Finally, in a study that examined students' concerns about academic performance rather than their actual GPA, first semester freshmen reporting an ADHD diagnosis expressed greater concerns than their peers (Rabiner, Anastopoulos, Costello, Hoyle, & Swartzwelder, 2008).

Data on the emotional functioning in college students with ADHD are also rather limited. In the study noted above, Heiligenstein et al. (1999) also examined students' psychological functioning; those with and without ADHD did not differ in self-reported depression, anxiety, interpersonal relationships, physical health, or substance use. Students with ADHD who had comorbid disorders were excluded from their sample, however, which may account for these findings. In other research on this issue, students with ADHD have reported poorer social and emotional adjustment to college than matched comparison students (Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005), lower self-esteem (Dooling-Liftin & Rosen, 1997), a lower quality of life (Grenwald-Mayes, 2002), greater psychological distress (Weyandt, Rice, Linterman, Mitzlaff, & Emert, 1998), and higher rates of depressive symptoms during their transition to college (Rabiner et al., 2008). Thus, the balance of existing evidence suggests that college students with ADHD are prone to greater emotional and psychological distress.

In relation to social functioning, Kern, Rasmussen, Byrd, and Wittschen (1999) suggested that college students with ADHD may have difficulty obtaining social support and that this could interfere with their adjustment to college. These authors did not directly examine social relationships in college students with ADHD, however, and in two studies that did (Heiligenstein et al., 1999; Rabiner et al., 2008) there was no evidence that they had greater interpersonal

difficulties. Thus, the strong association between ADHD and social difficulties that has been documented in children (Barkley, 2005) has not been replicated in initial work with college students.

Finally, although adolescents and young adults with ADHD have been found to have higher levels of substance use (Mannuzza & Klein, 2000; Wilens, 2004), the limited data among college students are more equivocal. Although high rates of drug and alcohol dependency were found in one sample of students who sought services at a college counseling center (Heiligenstein & Keeling, 1995), this was not replicated in a second sample obtained from the same university (Heiligenstein et al., 1999). Additionally, in a study that sampled from the entire freshman class at two universities rather than from a university counseling center, Rabiner et al. (2008) did not find higher rates of drug and alcohol use among students with ADHD than among their classmates.

As evident in the above review, data on the functioning of college students with ADHD is limited and findings to date have been mixed. Furthermore, existing studies are generally based on samples that are either small in size and/or drawn from counseling centers rather than the general student population. These limitations prompted Weyandt and DuPaul (2006) to conclude their recent review of ADHD in college students by calling for studies that are conducted with larger samples across multiple universities and that examine changes in the functioning of students with ADHD over time. These authors also described a pressing need to elucidate the effects of treatment on the functioning of college students with ADHD and noted that it is “. . . unclear what effects medications have on academic, interpersonal, and psychological outcomes among college students” (p. 16). Since their review, there has been one published study in which no benefits of medication treatment in college students with ADHD were evident (Rabiner, Anastopoulos, Costello, Hoyle, & Swartzwelder, 2008); we are not aware of additional work on this important issue.

Below we describe two related studies that begin to address these gaps in the literature on ADHD in college students. In Study 1, we report results from a Web-based survey of nearly 3,400 students attending a private and public university in the southeastern United States; included in this sample are more than 150 students drawn from the general student population who reported having ADHD. Our focus was to examine how students with ADHD were functioning in academic, social, and emotional domains. Because more than 25% of students with ADHD were not receiving medication treatment, we were also able to examine how medication treatment was related to students' adjustment.

In Study 2, we report results from a longitudinal investigation in which survey data were obtained from more than 800 students—including 27 with ADHD—during their first and fourth semesters of college. This enabled us to examine the predictive association between ADHD and students' adjustment. To our knowledge, this is the first study in which college students with ADHD have been followed over time.

Study 1: College Adjustment and ADHD: A Cross-Sectional Study

Method

Participants

Participants were 3,379 undergraduate students from one public and one private university located in the southeastern United States who submitted the Web-based survey described below.¹ The institutional review board at each university approved the study protocol and all participating students provided informed consent online. The public university serves primarily in-state students and has a female to male ratio of more than 2 to 1. The private university is highly selective, contains a more geographically diverse student population, and has a female to male ratio of approximately 1 to 1. Data regarding the participation rate and demographics of the sample and both sites are provided below.

Measures

Survey overview. The survey was designed to examine various issues related to the nonmedical use and misuse of ADHD medications among college students. Data regarding these activities were collected from each student who reported taking nonprescribed ADHD medication or misusing their prescribed ADHD medication; these findings are reported elsewhere (Rabiner et al., in press). All participants were asked whether they had a current or past diagnosis of ADHD followed by questions to assess their adjustment in different domains (e.g., academic concerns, social satisfaction, depression, drug and alcohol use, etc.). Those aspects of the survey that are central to the current study are described below.

Demographics. Participants were asked to provide their gender, race, class standing, and academic major.

ADHD and medication status. Participants were asked whether they had a current or prior diagnosis of ADHD made by a medical or mental health professional and classified into one of three mutually exclusive groups— current ADHD, past ADHD, and never ADHD. Students reporting a current diagnosis were asked if they were currently taking prescription medication for their ADHD. Participants were not asked about their ADHD subtype because we expected that most would be unaware of this, even if one had been assigned by their clinician.

ADHD symptoms. We inquired about ADHD symptoms to validate students' report of their diagnostic status. Because ADHD symptoms outlined in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, Text Revision (DSM-IV-TR) may not sufficiently represent the presentation of ADHD in young adults (Barkley et al., 2002), scales were developed to assess inattention and hyperactivity–impulsivity in a college sample. Inattentive symptoms were assessed with a six-item scale selected to reflect attention difficulties in college students (e.g., “It is difficult for me to concentrate on my academic work,” “I believe that most students in my courses can focus on their studies for longer than I can,” “Concentration difficulties keep me from doing as well academically as I am capable of”). Students indicated their agreement with each statement using a 5-point scale, ranging from strongly disagree to strongly agree. The responses were summed and averaged with higher scores reflecting greater self-reported attention difficulties. In a prior study, the coefficient alpha for this scale exceeded .90 and students with self-reported ADHD had scores nearly one standard deviation higher than other students (Rabiner et al., 2008). The coefficient alpha for the current sample was .92. The stability correlation over a 12-month period based on responses from more than 800 students in the longitudinal study was .61.

Hyperactive–impulsive symptoms were assessed using a five-item scale that reflected hyperactive–impulsive difficulties in college students (e.g., “I often do things on impulse,” “I feel restless and fidgety while studying,” “I feel restless and ‘fidgety’ during my classes”). Students responded using the scale described above and their responses were again summed and averaged; higher scores thus reflected greater self-reported hyperactive–impulsive symptoms. In a prior study using this measure, the coefficient alpha was .84 (Rabiner et al., 2008); in the current sample it was .82. Stability over 12 months was .60.

Academic concerns. A four-item scale assessed students’ concerns about their academic performance and ability to succeed academically. Two items were framed positively, for example, “I feel satisfied with how well I am doing academically” and two were framed negatively, for example, “I worry that my grades will not be as good as I need them to be.” Students indicated their agreement with each item based on their feelings for the past 30 days. Positively worded items were reverse scored and the four items were averaged so that higher scores reflect greater academic concerns. In a prior study, the coefficient alpha for this scale was .76 and students with self-reported ADHD had significantly higher scores than other students (Rabiner et al., 2008). The coefficient alpha for the current sample was .80 and the stability of students’ academic concerns over a 12-month period was .48.

Depressive symptoms. Following the Center for Epidemiologic Studies Depression Scale (CES-D), an eight-item scale was derived to assess depressive symptoms (Radloff, 1977). Students responded on 5-point scales ranging from never to most of the time to characterize how often during the past 2 weeks they had experienced various depressive symptoms (e.g., “felt tired and had little energy,” or “felt that things always go or will go wrong no matter how hard you try”). Responses were summed and then averaged with higher scores reflecting greater endorsement of depressive symptoms. Coefficient alpha for the current sample was .90; over 12 months, the stability of students’ reports was .56.

Emotional stability. A two-item scale assessed students’ emotional stability from both the negative and positive poles of the personality domain. Students responded to how well each statement (“I see myself as calm, emotionally stable” and “I see myself as anxious, easily upset”) characterized them on a 7-point scale ranging from disagree strongly to agree strongly. The negatively worded item was reverse scored and the two items were summed and averaged—the correlation between the items was .51. Higher scores reflect greater self-reported emotional stability. Over a 12-month period, the correlation between students’ reports of emotional stability was .60.

Social concerns. A four-item scale assessed students’ concerns/satisfaction with their relationships and social life. Two items were framed positively (e.g., “I have friends that care about me and that I enjoy being with”), and two were framed negatively (e.g., “I have trouble getting along with my close friends and acquaintances”). Positive items were reverse-scored and the four items were averaged; higher scores indicate greater social concerns. In a prior study, the coefficient alpha for this scale was .76 (Rabiner et al., 2008); coefficient alpha for the current sample was .80 and the 12-month stability coefficient was .45.

Alcohol, tobacco, and drug use. Two questions were asked about students' drinking. First, students reported how frequently they consumed alcohol during the past 6 months using the following response scale: (1) never, (2) 1-2 occasions, (3) 3-5 occasions, (4) 6-9 occasions, (5) 10-19 occasions, (6) 20-39 occasions, and (7) 40+ occasions. Students were then asked how many drinks they typically consumed on days when they drank—response options ranged from 1 drink to 25 or more drinks. To assess tobacco use, students reported how many cigarettes they had smoked in the past 30 days using a 7-point scale ranging from none to more than 2 packs per day. Finally, participants were asked how often they had used marijuana or cocaine in the prior 6 months. Although our assessments of alcohol and drug use were based on single items, which is a common procedure in surveys of this issue (Cranford et al., 2008; McCabe, Cranford, Morales, & Young, 2006), the 12-month stability for students' reports of alcohol and drug use was reasonably high for all substances (.57-.72) except cocaine (.09).

Procedure

The survey invitations and directions were submitted via e-mail to students enrolled at the public (n = 5,929) and private (n = 3,896) universities. At each university, data collection occurred over a 5-week period beginning approximately 6 weeks into the spring semester. All sophomores plus a randomly selected 50% of the freshman, junior, and senior classes were selected to participate. We invited all sophomores because they had been previously invited to complete the survey as first semester freshmen (see Study 2 below) and we wanted to maximize the number of students for whom two waves of survey data were available. To protect students' confidentiality, they were assigned a randomly generated ID number to access the survey and assured that the researchers would not link survey responses to individual students. In addition, they were informed that a Certificate of Confidentiality to protect their privacy had been obtained.

Incentives to participate included a \$10 gift card to the students' respective campus bookstore and eligibility to win one of 10 \$100 bookstore gift cards. Students who neither responded nor opted out were sent up to three additional invitations at weekly intervals. A total of 1,750 students from the private university (45% participation rate) and 1,657 students from the public university (28% participation rate) submitted the survey. Across the two schools, the participation rate was 35%. This response rate is comparable with what has been reported in other web-based survey studies with college students (Babcock & Byrne, 2000; Johnston, O'Malley, & Bachman, 2003; Low & Gendaszek, 2002; McCabe, Knight, Teter, & Wechsler, 2005; Teter, McCabe, Cranford, Boyd, & Guthrie, 2005). Although conducting a brief follow-up survey with nonrespondents to determine whether they differed from participants on key study variables would have been desirable, a phone follow-up was not possible because the participating universities did not have phone numbers for the majority of students. We ruled out a brief Web-based follow-up because nonparticipants had already failed to respond to four prior requests and we did not want to irritate them with additional solicitations.

Results

Sample Characteristics

Table 1 shows the demographic characteristics of the final sample of participants in relation to the demographics of those invited to participate. For example, at the private university, 43% of participants were males and 51% of the students invited to participate were male. As can be seen, the demographic characteristics of participants were generally consistent with the characteristics of the overall population that we tried to recruit. Consistent with what has been reported in other Webbased surveys of this issue (Teter et al., 2005), males, seniors, and non-White students were slightly underrepresented among the students who participated; why students in these demographic groups participated at lower rates is unclear.

Overall, 153 students—approximately 4.5% of the respondents—reported a current ADHD diagnosis. Of these, 109 students were from the public university (6.6% of participants) and 44 were from the private university (2.5% of participants); 100 of these students (66%) were female, and 127 (83%) were Caucasian. The high percentage of females with ADHD reflects the fact that the reported rate of ADHD at the public university was more than double the rate at the private university and females comprised 79% of the public university sample. In addition to the 153 students who reported a current ADHD diagnosis, 73 students indicated that they had been diagnosed at a prior time. These respondents are included in the analyses presented below so that adjustment differences between students reporting a current and former ADHD diagnosis could be examined.

Table 1 Percentage Distributions of Sample/Population Characteristics for Study 1

Characteristic	Private (<i>n</i> = 1,740)	Public (<i>n</i> = 1,639)	Total Sample (<i>n</i> = 3,379)
Gender			
Males	43/51	24/31	34/39
Females	57/49	76/69	66/61
Race/ethnicity			
White	58/57	74/67	66/63
Non-White	42/43	26/33	34/37
Class year			
Freshman	24/22	22/20	23/21
Sophomores	41/39	26/25	34/30
Juniors	19/20	26/24	22/23
Seniors	16/19	26/31	21/26

Note: Numbers before “/” indicate percentage of the sample analyzed. Numbers after “/” indicate percentage of sample prior to excluding cases with missing data.

Adjustment in Students With and Without ADHD

Analysis plan. Students’ scores on the different adjustment measures were standardized and analyzed in a series of analysis of covariances (ANCOVAs) where ADHD status was treated as a four-level variable—current ADHD on medication, current ADHD not on medication, past ADHD, and no ADHD; differences between these groups were tested in a series of planned comparisons.² Covariates included site, gender, race (coded as White vs. non-White), and class standing. We also included interactions of group with site, year in school, and gender to see whether any association between ADHD and the outcomes of interest was moderated by these variables.

Results for students reporting a current ADHD diagnosis were examined in two ways. First, students on and off medication were combined into a single ADHD group that was

compared with students in the remaining groups; these results are presented in Table 2. Second, students with ADHD on and off medication were directly compared so that the association between medication treatment and college adjustment could be examined; these results are presented in Table 3. To simplify presentation of the data, and because interactions of group with site, gender, and class standing were rarely significant, Tables 2 and 3 present only the standardized group means adjusted for covariates. Where significant interactions were found, they are discussed below.

Table 2 Standardized Group Means for Students With and Without ADHD

Outcome	Current ADHD (<i>n</i> = 153)	Past ADHD (<i>n</i> = 73)	Never ADHD (<i>n</i> = 3,153)
ADHD symptoms			
Inattention	1.23 ^a	0.88 ^a	-0.05 ^b
Hyperactivity	1.00 ^a	0.73 ^a	-0.02 ^b
Measures of college adjustment			
GPA	-0.50 ^a	-0.09 ^b	-0.04 ^b
Academic concerns	0.60 ^a	0.50 ^a	-0.03 ^b
Depression	0.43 ^a	0.50 ^a	-0.04 ^b
Emotional stability	-0.24 ^a	-0.38 ^a	0.08 ^b
Social concerns	0.25 ^{ab}	0.40 ^a	0.00 ^b
Alcohol use			
Alcohol frequency	0.17 ^a	0.13 ^a	-0.03 ^a
Alcohol quantity	0.16 ^a	0.14 ^a	-0.01 ^a

Note: Within each row, means with different superscripts differ at $p < .05$. Entries represent average standard score adjusted for covariates

Table 3 Standardized Group Means for Students With ADHD On and Off Medication

Outcome	Medication Treatment (<i>n</i> = 113)	No Medication Treatment (<i>n</i> = 40)
ADHD symptoms		
Inattention	1.20	1.31
Hyperactivity	0.95	1.13
Measures of college adjustment		
GPA	-0.47	-0.58
Academic concerns	0.60	0.61
Depression	0.36	0.60
Emotional stability	-0.11	-0.61
Social concerns	0.25	0.23
Alcohol use		
Alcohol frequency	0.14	0.33
Alcohol quantity	0.07	0.47

Note: Entries represent average standard score adjusted for covariates. None of the differences between treated and untreated students were significant at $p < .05$.

Inattentive and hyperactive-impulsive behavior. Students' reports of inattentive and hyperactive-impulsive behaviors were examined as a check on their self-reported diagnostic status. As seen in Table 2, participants indicating a current or past diagnosis of ADHD reported

significantly higher rates of inattentive and hyperactive–impulsive behaviors than students who had never been diagnosed. Differences between students with a current versus past diagnosis approached significance for inattentive symptoms ($p = .07$) and were in the expected direction for hyperactive–impulsive symptoms.

Table 3 shows results for students with ADHD on and off medication. Reports of inattentive and hyperactive-impulsive symptoms were comparable in the two groups and differences did not approach significance.

Academic functioning. Students with a current diagnosis of ADHD had significantly lower GPAs than students with a past diagnosis and students who had never been diagnosed. On average, their GPA was roughly 0.4 to 0.5 standard deviations below students in these other groups, consistent with a moderate sized effect.

Although the overall GPAs of ADHD students on and off medication were highly similar, significant interactions were found between group and site, $F(3, 3243) = 3.93, p < .01$; and between group and class standing, $F(3, 3243) = 2.08, p < .05$. Inspecting the individual cell means for the group \times site interaction indicated that at the public university, students with ADHD taking medication had lower GPAs than students not on medication (-0.56 vs. -0.32); at the private university this was reversed (-0.12 vs. -0.80). The interaction with class standing reflected the fact that GPAs of treated and nontreated students were reasonably similar among sophomores (-0.43 vs. -0.25), juniors (-0.48 vs. -0.61), and seniors (-0.13 vs. 0.07). For freshmen, however, they were highly discrepant (-0.33 for treated students vs. -1.45 for nontreated students).

Students with a current or past diagnosis of ADHD also reported greater concerns about their academic performance than other students; group differences were greater than 0.5 standard deviations in each case. Within the ADHD group, scores for students on and off medication were nearly identical.

Social and emotional functioning. Students with a current or past diagnosis of ADHD both reported higher depressive symptoms than other students; the magnitude of these differences was in the moderate range, that is, about 0.5 standard deviations. Students in these groups also reported more depressive symptoms, lower emotional stability, and greater social concerns than other students; effect sizes for these differences were in the small to moderate range, that is, all were less than 0.5 standard deviations. Responses between students indicating a current or past ADHD diagnosis did not differ in any of these domains. Among students with ADHD, scores were not significantly related to medication treatment in any domain, as even the apparently moderate difference found for emotional stability was not significant, $F(1, 3248) = 2.51, p = .11$].

Alcohol use. Standard scores for frequency of drinking and number of drinks typically consumed are presented at the bottom of Table 2. Students with ADHD tended to drink more frequently than students never diagnosed, $F(1, 3242) = 3.41, p < .10$; and to consume more alcohol on occasions when they drank, $F(1, 3242) = 3.25, p < .10$. They did not differ from students reporting a past ADHD diagnosis who, in turn, did not significantly differ from students who had never been diagnosed.

Although comparisons between students with and without ADHD, and between ADHD students on and off medication, were not significant, the interaction between group and class

standing was significant for both drinking frequency, $F(3, 3242) = 2.02, p < .05$; and drinking quantity, $F(3, 3242) = 2.00, p < .05$. Examination of the cell means for drinking frequency indicated that whereas average scores increased from freshman to sophomore years for treated students—from -0.57 to 0.35 —and for nontreated students—from -0.02 to 0.34 —they remained relatively constant for students in the remaining groups (from 0.11 to 0.00 for students with past ADHD and from -0.23 to -0.24 for comparison students). The significant interaction between group and drinking quantity reflected higher scores for sophomores than freshmen among treated students, -0.43 versus 0.42 , and the opposite pattern for untreated students, 0.86 versus 0.29 . Scores for students in the remaining groups were more consistent in these classes, 0.18 versus 0.25 for students with past ADHD and -0.05 versus -0.06 for comparison students.

Tobacco and drug use. Because smoking, marijuana use, and cocaine use were reported by a minority of participants, that is, 20.2% for marijuana, 15.5% for smoking, and 2.6% for cocaine, we treated these behaviors categorically and classified participants as users or nonusers of each substance. Results are presented in Table 4. Smoking and marijuana use was between 2 and 2.5 times more common among students in all three ADHD groups than in comparison students. In contrast, use of these substances was not related to medication treatment or to whether students reported a current or past diagnosis of ADHD. For cocaine use, the corresponding percentages were 7.5%, 2.5%, 8.3%, and 2% ($\chi^2 = 20.23, p < .01$).³ Cocaine use was far less common overall, but somewhat higher in ADHD students on medication and students reporting past ADHD than among nontreated ADHD students and comparison students.

Table 4 Percentage of Students in Each Group Using cigarettes, Marijuana, mor Cocaine in Prior 6 Months

Outcome	Current ADHD, Medication ($n = 113$)	Current ADHD, No Medication ($n = 40$)	Past ADHD ($n = 73$)	Never ADHD ($n = 3,153$)
Cigarettes ^a	35.5	37.5	30.1	14.2
Marijuana ^a	36.5	37.5	40.0	19.0
Cocaine ^a	7.5	2.5	8.3	2.3

a. Chi-square test indicates that groups differ at $p < .05$.

Domains of Impairments in Students With and Without ADHD

As a second method for understanding how students with ADHD were faring in each adjustment domain, we identified the percentage of students in each group who scored at least one standard deviation from the mean in the deviant direction; this was considered to reflect impairment in that domain.

The percentage of students from each group who were impaired in the different adjustment domains—defined as at least one standard deviation from the mean in the deviant direction—is shown in Table 5. The results are consistent with those reported above in that students with ADHD, including those who reported a past diagnosis, were consistently overrepresented in the deviant range. Furthermore, with the exception of GPA, students indicating a past diagnosis of ADHD looked very similar to students with a current diagnosis. What is important to note about these results, however, is that only a minority of students with ADHD scored in the deviant range within each domain. In fact, between 70% and 80% of

students with ADHD were functioning within the normal range in each of the adjustment domains.

To examine students' adjustment more globally, we examined the total number of domains in which students were impaired, with impairment in at least three of the five domains deemed to reflect overall poor adjustment to college. Table 6 shows the number of domains in which students within each group were impaired. More than one-third of students in each ADHD group were not impaired in any domain and nearly two thirds were impaired in no more than one domain. In contrast, more than 80% of comparison students were impaired in no more than one domain. Overall poor adjustment—defined as impairment in at least three domains—was present in 8.9% of students without ADHD, 15% of students in the past ADHD group, 17.5% of ADHD students not on medication, and 23% of ADHD students on medication ($\chi^2 = 29.85, p < .001$).

Study 2: A Longitudinal Study of College Students With ADHD

Methods

Participants

Participants were 846 students from the same universities who completed the Web-based survey described above during their first and fourth semesters of college.

Procedure

Approximately 5 weeks into the fall semester of 2006, all freshman 18 years and older were invited via e-mail to complete a Web-based survey on the nonmedical use of ADHD medications by college students; recruitment procedures and incentives were identical to those described for Study 1. During spring 2007, when students should have been second semester sophomores, they were invited to complete the survey a second time. A total of 1,648 students—46% of those invited—completed the survey as first semester freshmen. Of these, 846 (51%) completed the survey a second time, including 347 students from the public university (41% of the original participants) and 494 students from the private university (62% of the original sample). Lower reenrollment rates in the public university—75% versus 94%—contributed to reduced participation in the follow-up survey by public university students.

Results

Sample Characteristics

In all, 27 of the 68 students who reported a diagnosis of ADHD as freshmen (39.7%) completed the survey a second time compared with 51.8% of students without ADHD ($\chi^2 = 3.84, p = .05$); this represents 3.2% of students in the longitudinal sample. Among students in the longitudinal sample, ADHD status was not related to gender (70.4% of ADHD sample vs. 66.3% of others; $\chi^2 = .19, p > .05$). However, students with ADHD were more likely to be White (92.6% of ADHD sample vs. 68.7% of others; $\chi^2 = 7.03, p < .05$) and to attend the public university (74.1% of ADHD sample vs. 40.1% of others; $\chi^2 = 12.35, p < .05$). The greater

prevalence of ADHD at the public university, where the majority of students are female, explains the atypical gender ratio among students with ADHD in our sample.

ADHD as a Predictor of College Adjustment

To examine whether ADHD was associated with students' adjustment over time, scores on each adjustment measure were standardized and analyzed in a series of ANCOVAs where ADHD status was the between subjects variable of interest and covariates included gender, site, race (coded as White vs. non-White), the Time 1 score for the outcome, and students' Time 1 depression score. Including the Time 1 score (available for all outcomes except GPA) allowed us to test whether self-reported ADHD contributed to sophomore year adjustment in each domain controlling for adjustment at the start of college. Freshman year depression scores were included to determine whether ADHD contributed to students' adjustment over time independent of another important class of psychiatric symptoms. Because the size of our ADHD sample was greatly reduced relative to Study 1 (27 vs. 153), medicated and nonmedicated students were combined into a single group. Because the number of students with ADHD who were male or who attended the private university were few, that is, only 8 and 7, respectively, we did not test for interactions of ADHD with site and gender as was done with the cross-sectional sample.

Mean ratings for GPA, academic concerns, depressive symptoms, and social satisfaction are shown in Table 7; entries reflect the average standard score within each group adjusted for covariates. ADHD predicted poorer academic performance and greater academic concerns during students' second year in college; differences between students with and without ADHD were moderate to large—about 0.6 standard deviations for GPA and about 0.4 standard deviations for academic concerns. In contrast, freshman year ADHD did not predict students' social concerns, depressive symptoms, or emotional stability at Time 2 after controlling for Time 1 covariates.

Table 7 Predicting Functioning in Students With and Without ADHD

Outcome	ADHD (<i>n</i> = 27)	No ADHD (<i>n</i> = 813)
Measures of college adjustment		
GPA ^a	-0.69	-0.11
Academic concerns ^a	0.45	0.02
Depression	0.13	-0.02
Emotional stability	0.03	0.04
Social concerns	-0.26	0.01
Alcohol use		
Alcohol quantity	0.12	-0.04
Alcohol frequency ^a	0.32	-0.07

a. Groups differ at $p < .001$.

Note: Entries represent average standard score adjusted for covariates.

ADHD as a Predictor of Alcohol, Tobacco, and Drug Use

As seen at the bottom of Table 7, ADHD did not predict a significant increase in the number of drinks students consumed on a typical drinking occasion; it did, however, predict an increase in the frequency of students' self-reported drinking.

For tobacco and drug use, we were particularly interested in whether students with ADHD were at increased risk of initiating these behaviors during college. To examine this, students who reported smoking, using marijuana, or using cocaine at Time 1 were excluded, and the remaining students were grouped according to whether they reported any of these behaviors at Time 2; these students represent new users of each substance. Students with ADHD were more likely than their peers to initiate smoking (21% vs. 5%; $\chi^2 = 9.43$, $p < .01$). Initiation rates for marijuana (7.1% vs. 9.6%) and cocaine (0.0% vs. 3.0%) did not differ. Identical results were obtained when these outcomes were examined via logistic regression, where site, gender, and race were included as covariates.

Discussion

The purpose of this study was to build on current knowledge of adjustment to college in students with ADHD and to begin addressing several gaps in the literature that were recently identified recently by Weyandt and DuPaul (2006). Using a larger and perhaps more representative sample of college students with ADHD than has previously been studied, we examined students' adjustment in multiple domains and paid particular attention to whether medication treatment was associated with better adjustment. We also examined longitudinal data on a portion of our sample to test how ADHD may influence the course of students' adjustment during their first 2 years in college.

Data from our cross-sectional sample indicate that, on average, students reporting a current diagnosis of ADHD are faring less well than peers in multiple domains. They have lower GPAs, are more concerned about their academic performance, report higher levels of emotional distress and social concerns, and rate themselves as less emotionally stable. Alcohol use tends to be higher and they are more likely to smoke and use marijuana. Thus, even among individuals with ADHD who have done well enough academically to complete high school and enroll in college, including a highly selective institution, there is clear evidence of ongoing struggles associated with the disorder. Interestingly, the same is true for students who reported a past diagnosis of ADHD, as these students did not differ from currently diagnosed students in any domain other than having a higher GPA. We found no evidence that the association between ADHD and different indices of adjustment was moderated by either gender or ethnicity. However, our ability to detect such interactions may have been mitigated by the underrepresentation of males and non-Whites in our sample, and the small number of non-White students reporting an ADHD diagnosis. It should be noted, however, that the absence of significant interaction between ADHD and gender on adjustment outcomes is consistent with findings reported on younger samples (Bauermeister et al., 2007; Biederman et al., 2005; DuPaul et al., 2006), where such interactions have been infrequently found.

When impairment was defined as being more than a standard deviation from the sample mean in the deviant direction, students who reported having ADHD were about twice as likely as peers to be impaired within each domain. However, no more than 30% of students with ADHD were impaired in any individual domain, more than one third were functioning in the normal range within every domain, and more than 50% were impaired in only a single domain. Thus, even though students who reported having ADHD were more likely to be struggling than other

students, the majority appear to be relatively free of significant adjustment difficulties. This is an important and encouraging finding.

Consistent with what was reported in a recent study of students with ADHD during their initial semester in college (Rabiner et al., 2008), we found little evidence that medication treatment was associated with better functioning. In fact, there were no main effects consistent with a medication benefit in any domain. However, a significant interaction between treatment status and site suggested that treatment may be associated with better academic performance at more selective institutions. The interaction between treatment status and class standing for alcohol use suggests that medication is associated with reduced alcohol consumption in students with ADHD during their freshman year, but there was no evidence that this persisted.

Given that many previous studies have explored and supported the advantages of taking ADHD medication treatment for both adolescents and adults (Greydanus, Sloane, & Rappley, 2002; Wilens, 2003), it is interesting to consider why our data did not provide any direct evidence of medication benefits. This could be due to a number of factors, including poor maintenance of treatment regimen during the less-structured atmosphere of college life or limited follow-up by a medical practitioner as a result of the student's move to a new location. Failure to follow a prescription schedule would also diminish the benefits, yet this could not be evaluated in our data as compliance was not assessed. It is also possible that compared with students not on medication, students treated with medication were more impaired to begin with and were in fact benefiting from its use even though this was not evident in the group comparisons.

Another explanation for the absence of discernible medication benefits to consider, however, is that medication treatment for ADHD is less effective in college populations because of the unique demands of college life. Relative to what most students would have experienced in high school, the typical college student has substantially increased academic demands and greater amounts of unstructured time, for which self-directed organizational skills are necessary for success. As these executive abilities are often compromised in people with ADHD, college life may present a particular difficulty for these students because they are no longer receiving structure and support which parents and high school instructors may have previously provided. It is also the case that because attentional demands for undergraduates with ADHD frequently extend from morning classes to late night/ early morning study sessions, the need for symptom coverage each day may be substantially longer for college students than for any other group. If the treatment regimen for students receiving ADHD medication is not adjusted to accommodate for these new demands and lifestyle changes, medication benefits may be less pronounced. Although our data did not indicate any obvious benefit of pharmaceutical treatment for college students with ADHD, it is important to emphasize that the design of our study does not enable firm conclusions about the impact of such treatment to be drawn. However, our results do highlight the need for a controlled study of medication treatment for college students with ADHD. Although this would be a difficult study to conduct, it remains necessary to develop a better understanding of the potential benefits and limitations of medication treatment for this population.

Results from the longitudinal study add to these findings in several interesting ways. Although ADHD status predicted greater academic concerns among sophomores, controlling for prior academic concerns, this is likely to reflect the fact that students now had tangible evidence of struggling academically in the form of a lower GPA. ADHD also predicted a modest increase in the frequency of alcohol use and the initiation of smoking among students who were not already smokers. This suggests that ADHD is a particular risk factor during college for increases

in alcohol use and the initiation of tobacco use. However, it did not predict students' emotional or social functioning as sophomores, nor did it predict the initiation of marijuana or cocaine use.

When these findings are considered in conjunction with findings from the cross-sectional analyses, where interactions between ADHD and class standing were found only for alcohol use, there is relatively little evidence that suggests ADHD is associated with declining adjustment over the college years. Instead, our data suggest that the struggles experienced by many students with ADHD are present early on in their college careers, and are likely to remain relatively stable over time, at least among those who remain in college. However, it is important to note that our longitudinal sample of students with ADHD is restricted to those who completed the survey on two occasions, and students with ADHD were less likely to participate in the second administration than other students. These students are likely to be somewhat more stable and better adjusted than the general population of students with ADHD and this would work against finding that ADHD is associated with the emergence of adjustment difficulties over time. Within our cross-sectional sample, participation is limited to students who remained enrolled as upper classman. These are likely to be among the best adjusted in an entering cohort of students with ADHD as it excludes those who dropped out because of struggles related to the disorder. Thus, both our longitudinal and cross-sectional data may underestimate the adverse impact of ADHD on college students' adjustment over time (see below for additional discussion of this issue).

Although these two studies contribute to the existing literature on college adjustment in students with ADHD, there are several important limitations to note. In particular, given the anonymous Web-based survey methodology that we employed, ADHD status was determined solely by students' self-report and we had no way to verify the accuracy of this information. Although students identifying themselves as having ADHD reported elevated rates of inattentive and hyperactive-impulsive symptoms that were consistent with their self-reported diagnosis, it is highly likely that some of these students were incorrectly diagnosed and would not have met diagnostic criteria for the disorder. It is also likely that a number of students did not self-identify as having ADHD, not because they did not have the disorder but because they were never evaluated and diagnosed. Both of these occurrences would be likely to mitigate the differences between students with and without a self-reported diagnosis of ADHD; our results may thus underestimate the magnitude of adjustment difficulties in college students with ADHD. In subsequent work on this issue, it would thus be extremely important to confirm students' self-reported diagnostic status via a more comprehensive evaluation so that a more accurate understanding of adjustment in college students with ADHD could be obtained. It should also be noted that our measurement of several adjustment outcomes, that is, emotional stability and substance use, was based on a small number of items and was not as psychometrically strong as desirable.

There are a number of issues with our sample that raise cautions about the generalizability of our results. First, although students from a private and public university were surveyed, our sample is hardly representative of the general population of college/university students, and even within our sample, males and non-White students were underrepresented. In addition, our response rate in both studies was lower than desirable, and there is no way to know how students with ADHD who elected to participate differed from those who did not. We would note, however, that by surveying students from the general university population at each school, rather than from college counseling centers, our sample is likely to better represent undergraduates with ADHD than has been the case in several prior studies. In addition, the response rate we obtained is consistent with what has been reported in several other Web-based

studies that have examined related issues (Babcock & Byrne, 2000; Johnston et al., 2003; Low & Gendaszek, 2002; McCabe et al., 2005; Teter et al., 2005).

Another important issue raised by our findings pertains to the benefit of medication treatment for ADHD in a college population. As discussed above, we found essentially no indication that students treated with medication were doing any better than those who were not. Although the design of our study precludes firm conclusions about the impact of ADHD medication treatment in college students from being drawn, the findings highlight the need for a better controlled study of medication treatment in this population.

In summary, results from this study suggest that although undergraduates with ADHD tend to struggle in multiple domains relative to other students, the majority appear to be experiencing a satisfactory adjustment. Future studies of this issue would benefit from verifying students' self-reported diagnostic status via clinical evaluation and from carefully examining predictors of adjustment among students who enter college with ADHD. The latter would be especially important for developing programs to promote a more successful transition to college in entering undergraduates with ADHD. Following a cohort of students with ADHD beyond their sophomore years, and being able to document which students successfully graduated and which dropped out, would also provide a better understanding of the true impact of ADHD on college students and help to identify students whose needs for academic and other supports may be especially profound.

Notes

1. The survey was submitted by 3,409 students. However, 70 did not respond to items required to determine whether they were diagnosed with ADHD or taking medication for ADHD. These students were dropped leaving a final sample of 3,379. Because a number of students skipped other items in the survey, the number of participants included in the different analyses reported range from 3,243 to 3,274.
2. An alternative to using self-reported diagnostic status for classification would have been to group participants based on the level of ADHD symptoms that they reported. In this scheme, students with total ADHD symptoms scores above a certain cut-off, for example, 1.5 or 2.0 standard deviations above the mean, would constitute our ADHD group. We decided against this because it would have eliminated students who could be below this cut-off because their symptoms were being managed well by medication. This would have made it impossible to examine the association between medication treatment and adjustment. As a check on the results reported, however, we repeated the analyses using a standard score of >1.5 on the sum of the inattentive and impulsive scales to identify our ADHD group. In general, results were strongly consistent with those reported, although students in the ADHD group tended to look somewhat more impaired when defined in this way. Details are available on request.
3. We also tested for group differences in cigarette, marijuana, and cocaine use via logistic regression where site, gender, race, and class standing were included as control variables. The results obtained parallel those reported in the text as students with current and past ADHD were more likely than comparison students to have smoked, used marijuana, and used cocaine in the past 6 months.

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