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Rates and Patterns of Comorbidity among First-Year College Students with ADHD

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Abstract

Objective—The purpose of this study was to examine rates and patterns of non-ADHD psychiatric diagnoses among a large group of first-year college students with and without ADHD.

Method—A total of 443 participants, including 214 males and 229 females ranging in age from 18 to 22-years of age (*M*= 18.2), were recruited from nine colleges involved in a large scale, multi-site longitudinal investigation. Non-Hispanic Caucasian students represented 67.5% of the total sample. A comprehensive multi-method assessment approach was used in conjunction with expert panel review to determine both ADHD and comorbidity status.

Results—Significantly higher rates of overall comorbidity were found among college students with well-defined ADHD, with 55.0% exhibiting at least one comorbid diagnosis, and 31.8% displaying two or more, relative to the corresponding rates of non-ADHD diagnoses among Comparison students, which were 11.2% and 4.0%, respectively. These differences in overall

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comorbidity rates were, in large part, attributable to the increased presence of Depressive and Anxiety Disorders, especially Major Depressive Disorder (active or in partial remission) and Generalized Anxiety Disorder, among the students with ADHD. Within the ADHD group, differential comorbidity rates were observed as a function of ADHD presentation type and gender but not ethnic/racial diversity status.

Conclusions—The current findings fill a gap in the literature and shed new light on the rates and patterns of comorbidity among emerging adults with ADHD in their first year of college. Implications for providing clinical and support services to college students with ADHD are discussed.

Keywords

ADHD; College Students; Comorbidity; Diagnostic Assessment

Similar to many other neurodevelopmental and psychiatric disorders, Attention-Deficit/Hyperactivity Disorder (ADHD) is often accompanied by co-occurring or comorbid conditions. Among children with ADHD, comorbidity rates are typically quite high but can vary substantially depending on the nature of the sample, sampling techniques, the diagnostic criteria used, and other factors. In a recent investigation using a large community sample, Willcutt and colleagues (Willcutt et al., 2012) found that up to 44% of children and adolescents with ADHD exhibited at least one comorbid condition and that as many as 43% displayed two or more disorders. Even higher comorbidity rates have been identified in clinic-referred samples, with 60-80% of children and adolescents with ADHD having one additional diagnosis and as many as 50% displaying two or more comorbid conditions (Pliszka, 2014). Disruptive behavior disorders, such as Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD), are especially common comorbid conditions in youth with ADHD. Although occurring less frequently, mood and anxiety disorders, learning disabilities, and other psychiatric and developmental conditions have been found to co-occur with ADHD at rates higher than that in the general population (Angold, Costello, & Erkanli, 1999; DuPaul, Gormley, & Laracy, 2013; Nigg & Barkley, 2014).

Adults with ADHD also display high comorbidity rates. Based upon their examination of data obtained from both cross-sectional and longitudinal samples, Barkley and colleagues (Barkley, Murphy, & Fischer, 2008) found that 80.0 to 84.3% of adults with ADHD experienced at least one comorbid condition, and 53.0 to 60.8% exhibited two or more. More so than for children, mood and anxiety disorders occur at higher rates among adults with ADHD. As reported by Kessler and colleagues (Kessler et al., 2006), 12-month rates of mood disorders were 38.3% for adults with ADHD versus 11.1% for non-ADHD adults; similarly, anxiety disorders were evident in 47.1% of adults with ADHD versus 19.5% for the non-ADHD group. Along with mood and anxiety disorders, adults with ADHD are at risk for other comorbid conditions, albeit at lower rates (Biederman, Petty, Evans, Small, & Faraone, 2010; Garcia et al., 2012).

Although it is well established that ADHD is often accompanied by other conditions, the manner in which comorbidity unfolds across development is not well understood. Further limiting our understanding is that while there has been an abundance of research examining

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comorbidity among child and adult ADHD populations, much less attention has been focused on the rates and patterns of comorbidity among individuals with ADHD, 18 to 25 years of age, who are transitioning through the developmental period known as emerging adulthood (Arnett, 2007).

Longitudinal investigations that began following hyperactive children in the 1970's have provided initial insights into the outcomes of emerging adults with ADHD (Barkley et al., 2008; Mannuzza, Gittelman-Klein, Bessler, Malloy, & LaPadula, 1993; Weiss & Hechtman, 1993). More recently, most of what is known about this age group has been gleaned from cross-sectional investigations using college populations. One reason for focusing on college students is that increasing numbers of individuals with ADHD have been entering college (DuPaul & Weyandt, 2009), with estimates of the prevalence of ADHD among college students ranging from 2 to 8% (DuPaul et al., 2001; McKee, 2008; Eagan et al., 2014). Conceptual justification for studying college students with ADHD stems from a consideration of their increased risk for negative outcomes, due to a "perfect storm" of circumstances that converge upon them (Anastopoulos & King, 2015). For any individual attending college for the first time, adjustments must be made with respect to the increased demands for self-regulation inherent in the college experience. For first-year students with ADHD whose capacity for self-regulation is limited (Barkley et al., 2008), mastering this developmental challenge can be substantially more difficult (Fleming & McMahon, 2012), especially when accompanied by withdrawal of parental monitoring, medication regimens, school accommodations, and other supports that may have been in place prior to attending college (Meaux, Green, & Broussard, 2009). Moreover, upon entering college many students with ADHD may not seek out campus resources that could provide them with the types of support services they need. Consistent with this "perfect storm" conceptualization, college students with ADHD have been shown to be at increased risk for experiencing significant educational and social impairment. For example, relative to peers without ADHD, college students with ADHD have significantly lower grade point averages, take longer to receive their degrees, and are more likely to drop out (Advokat, Lane, & Luo, 2011; Barkley et al., 2008; Faraone & Biederman, 2005; Weyandt & DuPaul, 2013). College students with ADHD are also at increased risk for having lower levels of social adjustment and social skills, engaging in risky sexual behavior, and experiencing driving-related difficulties (Barkley et al., 2008; Janusis & Weyandt, 2010; Rooney, Chronis-Tuscano, & Yoon, 2011).

The extent to which comorbid conditions may exist and contribute to impairment in the educational and social functioning of college students with ADHD is unclear. Such uncertainty is in large part due to the fact that mixed results have emerged from the relatively small number of studies that have addressed these issues. Based on their chart review of 42 students with ADHD presenting at a university health center, Heiligenstein and Keeling (1995) reported a 55% overall rate of comorbidity, primarily involving mood disorders (26%) and to a much lesser extent, anxiety disorders (5%). In a subsequent chart review study, Heiligenstein and colleagues (Heiligenstein, Guenther, Levy, Savino, & Fulwiler, 1999) compared college students with and without ADHD but found no differences between these groups on dimensional self-report ratings of psychological functioning. Nelson and Gregg (2012) also failed to find differences between college students with and without ADHD on dimensional measures of depression and anxiety. Others, however, have found

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differences for dimensional depression (Rabiner, Anastopoulos, Costello, Hoyle, & Swartzwelder, 2008) and anxiety (Richards, Rosen, & Ramirez, 1999).

Complicating matters are numerous methodological limitations. Of particular concern is that most studies defined ADHD status in less than rigorous ways, including retrospective record reviews and self-report of previously diagnosed ADHD status (Heiligenstein & Keeling, 1995; Heiligenstein et al., 1999; Rabiner et al., 2008). A notable exception to this was evident in the Nelson and Gregg study (2012), which used a multi-method procedure to identify participants with ADHD. This same assessment approach, however, was not used to evaluate comorbidity. The manner in which comorbidity has been evaluated in other studies has also been limited in both rigor and scope. With only one exception (Heiligenstein & Keeling, 1995), comorbidity was determined on the basis of dimensional self-report ratings of psychopathology in the absence of clinical interviewing (Heiligenstein et al., 1999; Rabiner et al., 2008; Richards et al., 1999). Thus, it is not possible to ascertain whether observed comorbid features reached a level of clinical significance warranting a formal diagnosis as defined in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) or in any of its predecessors (e.g., DSM-IV-TR; American Psychiatric Association, 2000). In addition, the extant literature has not yet systematically examined the potential influence of ADHD presentation type and demographic factors (e.g., gender, ethnic/racial diversity) on comorbidity status among college students. ADHD presentation type is of particular importance, given that the Combined type, a more severe form of ADHD, is more often associated with comorbidity in child and adult ADHD populations (Nigg & Barkley, 2014).

As a context for understanding comorbidity among college students with ADHD, it is important to consider recent findings pointing to a rise in mental health problems in the general college student population within the United States (Clay, 2013). As many as 12-18% have been shown to have a diagnosable mental health condition (Mowbray et al., 2006), with mood and anxiety disorders being especially common, occurring in 10.6% and 11.9% of the general college population, respectively (Blanco et el., 2008). Similar findings have been reported for college students in other countries (Verger, Guagliardo, Gilbert, Rouilln, & Koves-Masfety, 2010). Such mental health problems place college students at risk for significant educational, social, and personal difficulties (Eisenberg, Gollust, Golberstein, & Hefner, 2007). Given that children and adults with ADHD are at substantially higher risk for comorbid psychiatric conditions, it is reasonable to speculate that college students with ADHD would also display higher rates of comorbid psychiatric disorders relative to their non-ADHD college peers. Such increased risk may in turn contribute to the educational and social impairments that have been identified in this population (Advokat et al., 2011; Barkley et al., 2008; Faraone & Biederman, 2005).

To gain greater understanding of comorbidity issues within the ADHD college population, the purpose of this study was to examine rates and patterns of non-ADHD psychiatric diagnoses among a large group of college students with and without ADHD. In contrast with prior research, the current investigation used a comprehensive, multi-method assessment approach and expert panel review to ascertain both ADHD and comorbidity status. Based upon what is known about comorbidity among children and adults with ADHD, it was

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hypothesized that there would be continuity across development, such that college students with ADHD would show higher rates of other psychiatric conditions relative to a non-ADHD comparison group. At the same time, however, it was expected that the magnitude of the comorbidity rates among first year college students with ADHD, who represent an educationally more successful segment of the ADHD population and who have not been in college long enough to be impacted by the "perfect storm," would be less than that typically reported for the general population of children and adults with ADHD. A secondary goal of this study was to examine the potential influence of ADHD presentation type, gender, and ethnic/racial diversity status. Consistent with findings from child and adult ADHD populations (Barkley et al., 2008; Nigg & Barkley, 2014), higher rates of comorbidity were expected for students with a Combined presentation versus a Predominantly Inattentive presentation. Given that adult females with ADHD may be at increased risk for depression and anxiety, whereas adult males with ADHD are more inclined to display conduct-related problems (Cumyn, French, & Hechtman, 2009), differential gender patterns of comorbidity were also expected. In the absence of systematic research addressing ethnic and racial characteristics within ADHD populations, the association between ethnic/racial diversity status and comorbidity was examined on an exploratory basis.

Method

Participants

A total of 527 first-year college students were initially screened to determine their eligibility for the *Trajectories Related to ADHD in College* (TRAC) project, a 5-year multi-site longitudinal investigation. Of that number, 456 met the study's eligibility requirements; 13, however, withdrew from the project before completing the second of a four-stage assessment process. Thus, the sample for the current study comprised 443 participants, including 214 males and 229 females ranging in age from 18 to 22-years (M = 18.2). Approximately 10.6% of the participants reported having Hispanic backgrounds. The racial composition of the sample was 71.1% Caucasian, 12.6% African-American, 5.6% Asian, 3.8% multi-racial, and 6.8% from other racial backgrounds. Non-Hispanic Caucasian students represented 67.5% of the total sample.

To be eligible for the ADHD group, participants were required to meet DSM-5 criteria (American Psychiatric Association, 2013). ADHD status, as well as non-ADHD Comparison group status, was determined on the basis of a multi-gating, multi-method assessment procedure that included expert panel review. At the first stage of this assessment process, all participants initially completed a self-report ADHD Rating Scale (DuPaul, Power, Anastopoulos, & Reid, 1998), which was modified to address current and past ADHD symptoms, as well as medication status. If a participant's self-report or parent-report indicated that he/she frequently displayed 4 or more symptoms of either inattention or hyperactivity-impulsivity during both childhood and the past 6 months, a semi-structured interview for adult ADHD was then administered to address full DSM-5 criteria for ADHD, including the requirement of 5 or more symptoms of either inattention or hyperactivity-impulsivity being present. This same interview was administered to potential Comparison participants whose self- and parent-reported responses to the ADHD Rating Scale indicated

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the presence of 3 or fewer symptoms for both inattention and hyperactivity-impulsivity during childhood and during the past 6 months. Participants whose interview responses continued to suggest the presence of 3 or fewer symptoms from both symptom lists were deemed eligible for the Comparison group. All potentially eligible cases were then reviewed by a panel of four ADHD experts (i.e., the three principal investigators and a nationally recognized adult ADHD consultant). Unanimous panel agreement was required for final determination of ADHD and Comparison group status, as well as for comorbidity status.

As can be seen in Table 1, the ADHD (n = 220) and Comparison (n = 223) groups were statistically equivalent with respect to age, gender, and ethnic/racial diversity status, all of which were consistent with the demographics of the universities from which they were drawn. As expected, the two groups differed in terms of their self-reported ADHD symptoms. Within the ADHD group, there were 48.2% with a Combined presentation, 46.8% with a Predominantly Inattentive presentation, and 5.0% with a Predominantly Hyperactive-Impulsive presentation.

Measures

Background information—All participants completed a one-page information form to provide demographic and contact information. Participants also underwent a background interview to provide information about their K-12 school history, family of origin demographics, and personal and family histories of mental health difficulties.

ADHD Rating Scale, Self-Report Version (ADHD RS-SRV)—The ADHD RS-SRV, developed specifically for the purposes of this study, is a modified version of the ADHD RS-IV (DuPaul, Power, Anastopoulos, & Reid, 1998). Like its predecessor, the ADHD RS-SRV lists the inattention (IN) and hyperactive-impulsive (HI) symptoms in alternating fashion, and the frequency of occurrence for each symptom can be rated as: 0 (never or rarely present), 1 (sometimes present), 2 (often present), or 3 (very often present). Summing the number of items scored 2 or 3 yields symptom frequency counts for both IN and HI, which were used for eligibility screening purposes. Unlike the ADHD RS-IV, the ADHD RS-SRV addresses ADHD symptoms both during childhood and during the past 6 months, while also taking into account medication status. In the current study coefficient alphas were very good (.74) to excellent (.94) for the childhood and past 6 months reports of both IN and HI symptoms, regardless of medication status. There was also evidence of concurrent validity, with correlations between the IN and HI scores and their respective Conners Adult ADHD Rating Scale, Self-Report, Long Form (CAARS-S:L) dimensions ranging from .27 to .92 (all p values < .01).

ADHD Rating Scale, Parent-Report Version—The ADHD RS-PRV is a modified version of the ADHD RS-IV (DuPaul et al., 1998), requiring parents to rate their child's ADHD symptoms during both childhood and the past 6 months. For participants with histories of taking ADHD medication, parents were instructed to provide ratings based on their child's status when not taking medication. The format and scoring of the ADHD RS-PRV are similar to that of the ADHD RS-SRV. In the current study the ADHD RS-PRV demonstrated excellent psychometric properties, with high internal consistency (.89 to .94),

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and correlations between the IN and HI scores and corresponding CAARS-S:L dimensions ranging from .49 to .61 (all *p* values < .001).

Semi-Structured Interview for Adult ADHD—The Semi-Structured Interview for Adult ADHD was developed specifically for this study. We opted to use a study-specific interview rather than one previously developed because it allowed us to assess (a) functional impairment for each of the 18 symptoms, and (b) symptom frequency counts for times when on and off medication. The nine IN symptoms are presented first, followed by the nine HI symptoms. For each symptom endorsed as being present "most of the time," additional questioning examines that symptom's impact on daily functioning. After reviewing all IN and HI symptoms, further questioning addresses the duration, age of onset, and other DSM-5 criteria for ADHD. For participants whose initial responses were based on functioning while taking medication, follow-up questioning was conducted to assess symptom frequency when not taking medication. In the current study coefficient alphas for both the IN and HI portions of the interview were excellent (.90 and .85, respectively), and both symptom dimensions were highly correlated with their respective CAARS-S:L dimensions (.78 and .84, respectively).

Structured Clinical Interview for DSM Disorders (SCID-I)—The SCID-I (First, Gibbon, Spitzer, & Williams, 1996) is a psychometrically sound interview used widely in clinical research. The SCID-I Mood and Anxiety Disorders modules were administered to all participants. Although many researchers routinely administer all SCID-I modules, this was not possible within the time parameters and resources of the current study. Instead, other SCID-I modules were given only to participants reporting a personal or family history of psychiatric disorders during the background interview. Because DSM-5 criteria had not yet been finalized at the time these data were collected, DSM-IV guidelines were used to assess these non-ADHD conditions. Diagnoses generated from the SCID-I served to identify mental health conditions that might rule out ADHD, be comorbid with ADHD, or be present among Comparison participants.

Conners Adult ADHD Rating Scale, Self-Report, Long Form (CAARS-S:L)—The CAARS-S:L (Conners, Erhardt, & Sparrow, 2006) is a frequently used self-report measure of adult ADHD symptoms that has been used extensively in research and clinical practice. The CAARS-S:L is psychometrically sound and well-standardized, allowing for normative data comparisons. In this study the DSM-IV Inattentive Symptoms and Hyperactive-Impulsive Symptoms T-scores were used to assess the severity of ADHD symptoms across groups.

Beck Depression Inventory-II (BDI-II)—The BDI-II (Beck, Steer, & Brown, 1996) is self-report measure of depression that is psychometrically sound (coefficient alpha = .92 in this study) and has been widely used in research and clinical practice. The total score from the BDI-II was used as a dimensional measure of depression.

Beck Anxiety Inventory (BAI)—The BAI (Beck & Steer, 1993) is often used in research and clinical practice and possesses adequate psychometric properties (study-specific

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coefficient alpha = .92). In this study the BAI total score served as a dimensional measure of anxiety.

Externalizing Behavior Rating Scale (EBRS)—The EBRS is a study-specific measure to assess self-reported symptoms of ODD and CD. Modeled after the ADHD RS, the EBRS first lists the 8 ODD symptoms, followed by the 12 (out of 15) CD items deemed developmentally appropriate for a college population. Each EBRS item is rated on a 0 (not at all) to 3 (very much) scale reflecting the degree to which items characterize a participant's behavior over the past six months. Items are then summed to yield separate ODD and CD total scores, which were used as dimensional outcome measures. Internal consistency for all 20 items was .83, with coefficient alphas of .85 and .66 noted for the ODD and CD portions of the scale, respectively. Preliminary validity information comes from the finding that the ODD and CD portions of the scale correlate significantly with the CAARS ADHD Index (.68 and .33, respectively).

Procedure

The TRAC project is a 5-year longitudinal investigation of first-year college students with and without ADHD. The goal of TRAC is to examine multiple functional trajectories (e.g., educational, behavioral, social, vocational) across this early period of emerging adulthood and to identify risk and protective factors that inform clinical assessment and treatment. Three primary sites are involved, including one university in the Southeast and two universities in the Northeast United States. In addition, six colleges and universities near the primary sites served exclusively as recruitment sites. To achieve recruitment goals, two cohorts of first-year students were recruited successively across the first two years of the project. A total of 219 participants were recruited in Cohort 1, another 237 participants were recruited in Cohort 2. All participants underwent an annual four-stage assessment process, for which they earned up to $100 as an incentive for completing all required procedures. Recruitment and data collection occurred continuously throughout the fall and spring semesters at times convenient to each participant. Data collected from the first of four planned annual assessments were used in this study.

Participants were recruited from multiple sources, including summer orientation sessions, disability services, student counseling centers, fliers, and presentations to large first-year classes. Students who were between 18 and 25 years of age and entering college for the first time were recruited and, subsequent to providing informed consent, asked to complete the current and childhood self-report versions of the ADHD RS. Students' parents were also asked to complete the ADHD RS, addressing both current and childhood symptoms. Data collected from these self- and parent-report versions of the ADHD RS served as the basis for determining which participants moved on to the next assessment phase, involving the Semi-Structured Interview for Adult ADHD. Information from this interview and the SCID-I was then used to determine which cases would be forwarded to the expert panel for final determination of ADHD or Comparison group classification, as well as non-ADHD psychiatric status. Background history, service utilization data (e.g., prior special education services), and IQ-achievement discrepancies were similarly forwarded to the panel for determination of learning disability (LD) status. For cases lacking unanimous panel

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agreement, weekly conference calls were conducted for the purpose of resolving these differences of opinion and ultimately reaching a unanimous decision.

All data were collected by pre-doctoral and doctoral level staff from clinical psychology and school psychology backgrounds. All staff received extensive training prior to the start of the project, and their adherence to the various assessment protocols was monitored on an ongoing basis to maintain consistency across sites. All study procedures are reviewed on an annual basis and were approved by the Institutional Review Boards at each site.

Planned Statistical Analyses

Chi square analyses were conducted to address the primary hypothesis comparing the two groups categorically on overall and disorder-specific rates of non-ADHD conditions. Independent sample *t*- tests were used to assess dimensional differences in symptoms of depression, anxiety, oppositional-defiant behavior, and conduct problems. Using ADHD group data only, similar categorical and dimensional analyses were performed to examine the association of ADHD presentation, gender, and ethnic/racial diversity status with comorbidity. Although DSM-IV criteria were used to determine non-ADHD diagnostic status, all categorical results are presented in a manner consistent with DSM-5 groupings of these disorders. For all categorical analyses, alpha was set at .01 based upon a Bonferroni family-wise correction for the number of psychiatric domains that were evaluated (e.g., Mood, Anxiety, OCD, Trauma & Stressor, and Eating). For all dimensional analyses, each of which involved four comparisons, a Bonferroni-corrected alpha of .0125 was used.

Results

Comorbidity by Group

The overall rate of having one current non-ADHD diagnosis was significantly higher for the ADHD group (55%) versus the Comparison group (11.2%), χ^2 (1) = 96.1, $p < .001$, with a corresponding $OR = 9.7$, 95% CI [5.9, 15.8]. The ADHD group also displayed a substantially higher rate of having two or more current non-ADHD disorders (31.8% versus 4.0%, χ^2 [1] = 58.3, $p < .001$), $OR = 11.1$, 95% CI [5.4, 22.9].

As shown in Table 2, observed differences in overall comorbidity rates are largely due to group differences in current Depressive and Anxiety disorders. The rate of having any Depressive Disorder, which included consideration of Major Depressive Disorder (MDD) , Dysthymic (Persistent Depressive) Disorder, and Depression Not Otherwise Specified (Other Specified Depressive Disorder), was 32.3% for the ADHD group and 5.4% for the Comparison group, χ^2 (1) = 52.6, $p < .001$, $OR = 8.4$, 95% CI [4.4, 16.0]. MDD in particular, which included both single and recurrent episodes that were either active or in partial remission, accounted for much of this difference (28.2% versus 3.6%), χ^2 (1) = 50.4, $p < .001$, such that the ADHD group was at a 10.5 increased risk for having MDD, 95% CI [4.9, 22.7]. The ADHD group also displayed a significantly higher rate (28.6% versus 3.6%, χ^2 [1] = 51.6, $p < .001$) and risk (OR =10.8, 95% CI [5.0, 23.1] for having a current Anxiety Disorder, which took into account Generalized Anxiety Disorder (GAD), Panic Disorder, Social Phobia (Social Anxiety Disorder), Specific Phobia, and Anxiety Disorder Not

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Otherwise Specified (Other Specified Anxiety Disorder). Among these, GAD occurred the most often, accounting for most of this difference.

Additional group differences were evident with respect to Trauma- and Stressor-Related Disorders, with rates of 7.3% and 0.9% occurring in the ADHD and Comparison groups, respectively (χ^2 [1] = 11.6, p = .001), OR = 8.7, 95% 95% CI [2.0, 38.2]. Much of this difference stemmed from the ADHD group exhibiting higher rates (5.0% versus 0.4%, χ^2 [1] = 8.7, p = .003) and risk (OR = 11.7, 95% CI [1.5, 91.3] for Adjustment Disorders relative to the Comparison group. No further group differences emerged with respect to the other psychiatric disorders that were assessed, including Bipolar Disorder (BD), Obsessive Compulsive Disorder (OCD), and Eating Disorders (ED). The two groups differed, however, with respect to Learning Disorders (LD), with the ADHD group displaying a significantly higher rate (10.0% versus 0.4%, χ^2 [1] = 20.5, p < .001) and risk (OR = 24.7, 95% CI [3.3, 184.7] than the Comparisons.

The results of the dimensional analyses (Table 3) were consistent with the categorical depression findings, showing higher BDI-II severity levels for the ADHD group relative to the Comparison group, t (441) = 13.1, p < .001. The same was true for anxiety, with significantly higher BAI scores noted among the ADHD group versus the Comparison group, t (441) = 11.8, p < .001. The ADHD group also reported significantly higher severity scores for both ODD and CD symptoms, p < .001. With the exception of CD (d = .66), effect sizes were large for these group differences in depression (d = 1.25), anxiety (d = 1.12), and ODD (d = 1.31).

Comorbidity by ADHD Presentation Type

Due to the small number of participants displaying a Predominantly Hyperactive-Impulsive presentation (5%), only cases with either a Combined (n = 106) or Predominantly Inattentive (n = 103) presentation were included in the analyses of ADHD clinical presentation. The Combined group displayed a significantly higher overall rate of having one current comorbid diagnosis relative to those with an Inattentive presentation, 67.0% versus 46.6%, χ^2 (1) = 8.8, p = .003. This difference represented an increased risk of 2.3, 95% CI [1.3, 4.1], for the Combined group. The Combined and Inattentive groups did not differ, however, with respect to having two or more comorbid disorders, 37.7% versus 28.2%.

Rates of current Depressive Disorders (Table 4) were significantly higher for those with a Combined presentation (42.5% versus 24.3%), χ^2 (1) = 7.8, p = .005, primarily due to higher rates of MDD within the Combined group, χ^2 (1) = 8.4, p = .004. A similar pattern emerged with respect to risk for any Depressive Disorder, OR = 2.3, 95% CI [1.3, 4.2], as well as for MDD in particular, OR = 2.5, 95% CI [1.3, 4.6]. No other findings were statistically significant, but trends were noted in terms of OCD (p = .03) and Eating Disorders (p = .06), with the Combined group displaying higher rates of both disorders (6.6% vs. 1% and 3.8% vs. 0%, respectively).

The results of the dimensional analyses (Table 5) were consistent with the categorical depression findings, but differed with respect to anxiety. Specifically, the Combined group reported significantly higher severity scores for both depression, t (207) = 2.6, p = .01, and

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anxiety, t (207) = 3.2, p = .002, than did the Inattentive group. The Combined group also reported significantly higher severity scores for ODD, t (198) = 5.5, p < .001, but not for CD. The magnitude of these ODD symptom differences was medium to large (d = .79), whereas those for both depression (d = .35) and anxiety (d = .44) represented small to medium effects.

Comorbidity by Gender

Within the ADHD group, females (n = 114) displayed significantly higher rates of having one comorbid disorder than did males (n = 106), 68.4% versus 40.6%, χ^2 [1] = 17.2, p < .001, with a corresponding OR = 3.2, 95% CI [1.8, 5.5]. Females also displayed higher rates of (43.9% versus 18.9%, χ^2 [1] = 15.8, p < .001) and risk for (OR = 3.4, 95% CI [1.8, 6.2]) having two or comorbid disorders than did males.

As shown in Table 6, much of this overall comorbidity difference was related to higher rates of and risk for current Depressive Disorders, especially MDD, among females (43.0%) versus males (20.8%), χ^2 [1] = 12.4, p < .001), OR = 2.9, 95% CI [1.6, 5.2]). Females with ADHD also exhibited significantly higher rates of Anxiety Disorders (39.5% versus 17.0%, χ^2 [1] = 13.6, p < .001), reflecting an increased risk of 3.2 [95% CI [1.7, 6.0]. None of the remaining gender analyses was statistically significant but two trends did emerge, suggesting higher rates of Trauma- & Stressor-Related Disorders (p = .05) and Eating Disorders (p = .04) among females (10.5% vs. 3.8% and 4.4% vs. 0%, respectively).

A summary of the independent t-test analyses of the dimensional data appears in Table 7. Consistent with the categorical findings, females reported higher levels of depression, t (218) = 3.2, p = .002, and anxiety, t (218) = 3.1, p = .002, than did males. No differences emerged with respect to ODD symptoms, but as expected, males reported higher levels of CD symptoms, t (209) = 3.5, p = .001. Such differences in comorbid internalizing and externalizing symptoms were small to medium in magnitude, ranging from d = .43 to d = .46.

Comorbidity by Ethnic/Racial Diversity Status

Within the ADHD group, categorical and dimensional comparisons were conducted between participants self-identifying as being non-Hispanic Caucasian (n = 157) or as having Hispanic ethnicity and/or African American, Asian, multi-racial, or other racial backgrounds (n = 63). No group differences were found for any of the categorical analyses, addressing rates of and risk for Depressive Disorders, Anxiety Disorders, BD, OCD, Trauma- and Stressor-Related Disorders, ED, and LD. The dimensional analyses of depression, anxiety, and CD did not reveal significant differences. There was, however, one dimensional analysis that yielded a statistically significant finding, showing slightly higher levels of ODD symptoms among participants from ethnically/racially diverse backgrounds (M = 9.6, SD = 4.5) relative to those from non-Hispanic Caucasian backgrounds (M = 8.2, SD = 4.4), t (209) = 2.0, p = .04, d = .31.

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Discussion

The current study used a comprehensive multi-method assessment approach in conjunction with expert panel review to determine both ADHD and comorbidity status. Results revealed a high rate of comorbidity among college students with well-defined ADHD, with 55.0% exhibiting at least one current comorbid diagnosis, and 31.8% displaying two or more. Consistent with study expectations, these overall comorbidity rates within the ADHD group were significantly higher than the corresponding rates of non-ADHD diagnoses among Comparison students, which were 11.2% and 4.0%, respectively. Generally speaking, these elevated ADHD comorbidity rates among emerging adults in college are higher than the overall comorbidity rates reported for a community sample of children and adolescents with ADHD (Willcutt et al., 2012), but lower than those reported for adults with ADHD (Barkley et al., 2008). Such findings, while cross-sectional in nature, raise the possibility that there may indeed be continuity in the developmental unfolding of comorbid conditions among individuals with ADHD.

The magnitude of these overall comorbidity rates is somewhat surprising, given that they occurred among first-year college students with ADHD, who represent an educationally more successful segment of the ADHD population. This raises the possibility that factors other than educational attainment (e.g., social relations) may play a larger role than previously thought in the development of comorbid features. An additional concern stems from a consideration of when these comorbid conditions began. For many of the participants with ADHD, it is likely that their comorbid conditions were present prior to college, rather than arising for the first time while in college. In either scenario, it is important to keep in mind that having comorbid conditions places college students with ADHD at increased risk for experiencing psychosocial difficulties (Eisenberg et al., 2007), which may help to explain some of the educational and social impairments identified in this population (Barkley et al., 2008; Weiss & Hechtman, 1993).

The group differences in overall comorbidity rates are, in large part, attributable to the increased presence of Depressive and Anxiety Disorders, especially MDD and GAD, among college students with ADHD. Although slightly lower in absolute terms, the 32.3% rate of Depressive Disorders and the 28.6% rate of Anxiety Disorders are consistent with those reported for adults with ADHD (Kessler et al., 2006). Another factor contributing to the group differences in overall comorbidity rates is the increased presence of LD and Trauma- and Stress-Related Disorders within the ADHD group. In addition to these categorical differences, the dimensional analyses revealed significantly higher levels of self-reported ODD and CD symptoms among the students with ADHD. That differences in externalizing symptoms would emerge is not entirely surprising, given what is known about ODD and CD in child and adolescent ADHD populations (Nigg & Barkley, 2014). What makes this finding unique, however, is that it was obtained via self-report rather than from parent or teacher reporting.

Further examination of the ADHD group revealed that college students with a Combined presentation displayed a higher overall rate of comorbidity than those with a Predominantly Inattentive presentation, largely due to more frequent reports of current Depressive

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Disorders. Dimensional analyses also revealed significantly higher levels of anxiety and ODD symptoms in the Combined group. Together, such findings are consistent with the view that the Combined type represents a more severe ADHD presentation. Gender differences within the ADHD group were evident as well, with females reporting higher overall comorbidity rates. Much of this gender difference stems from significantly higher rates of current Depressive and Anxiety Disorders, and to a lesser extent, from higher rates of Eating Disorders and Trauma- & Stressor-Related Disorders. In contrast with these categorical outcomes, the dimensional analyses revealed higher levels of self-reported CD symptoms among males than females. Such gender-related differences in observed rates and patterns of internalizing and externalizing symptoms are consistent with previously reported findings among adults with ADHD, as well as in the general population (Cumyn et al., 2009). Exploratory examination of the impact of ethnic/racial diversity within the ADHD group revealed slightly higher dimensional levels of ODD symptoms among participants from ethnically/racially diverse backgrounds. Apart from this finding, no other significant dimensional or categorical differences emerged from the comparisons of participants self-identifying as non-Hispanic Caucasian and those self-identifying as having Hispanic ethnicity and/or African American, Asian, multi-racial, or other racial backgrounds.

The above findings must, of course, be considered in light of limitations inherent in this investigation. This study did not, for example, address the conceptual matter of why so many different conditions co-occur with ADHD. Although it is commonly assumed that having ADHD increases the risk of developing another disorder, additional research is needed to disentangle whether the comorbidity associated with ADHD is due to increased risk versus other possible explanations, such as shared etiological mechanisms or overlapping symptoms (Lilienfeld, Waldman, & Israel, 1994). Methodological limitations need to be taken into consideration as well. One such limitation is the scope of the comorbid conditions that were examined. Several diagnoses, including ODD, CD, Substance Use Disorders, and Personality Disorders were not evaluated categorically. Had these diagnostic categories been included, overall comorbidity rates may have been different. The absence of ODD, CD, and Substance Use Disorders in particular may have had a meaningful impact, especially on observed gender differences. Such gender differences in turn may have been influenced by the relatively equal distribution of females and males within our sample. Although this distribution runs counter to the disproportionally higher rates of ADHD reported for males versus females in child populations (Nigg & Barkley, 2014), it may be the case that females enter college at disproportionally higher rates than males, due to the fact that females display higher rates of the Inattentive ADHD presentation, which is less impairing. Another potential limitation is that our sample was drawn from college campuses in the United States, and therefore results cannot be generalized to college students with ADHD in other parts of the world. Similarly, our findings may not be applicable to emerging adults with ADHD who do not attend college, given that demands for self-regulation and access to treatment services may be very different for this population. The manner in which ethnic/racial diversity status was examined does not allow for a more refined analysis of how these demographic factors may impact comorbidity status. Yet another potential limitation is that our findings are based on self-report ratings, which may have been subject to feigning or other response biases. The current study also did not directly examine the impact of

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comorbidity on participants' educational and social functioning, nor did it address the degree to which: (a) identified comorbid conditions remain stable over time, and (b) new comorbid conditions develop during the college years. Comprehensive examination of these impairment and longitudinal issues is beyond the scope of the present paper. These issues are, however, in the process of being examined as part of our ongoing TRAC study.

Bearing such limitations in mind, the current findings have important implications for clinical practice. For example, to the extent that students with ADHD are entering college with pre-existing comorbid problems, it is critically important for parents and high school educators to be keenly aware of these circumstances and to work together with students to ensure continuity of care during the transition to college. Likewise, in college and university settings, campus units that provide clinical and support services must be keenly aware of the strong possibility that students presenting with ADHD may have impairing comorbid conditions that should not be overlooked during evaluations and provision of treatment services (Shaw & Dukes, 2013). Knowledge of the possible influence of ADHD presentation and gender should also be taken into account when screening for comorbid conditions.

In conclusion, the current findings address a gap in the literature and shed new light on the rates and patterns of comorbidity among emerging adults with ADHD in their first year of college. In so doing, this study provides a baseline for tracking the trajectories of ADHD and its comorbid features across this period of development. Tracking these trajectories, along with identification of associated risk and protective factors, ultimately can inform clinical assessment and treatment of this population.

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Table 1

Participant Demographic and ADHD Features by Group

	ADHD	Comparison
	%	%
Gender (% Female)	51.8	51.6
Ethnicity		
Hispanic	10.9	10.3
Race		
Caucasian	76.4	65.9
African American	11.4	13.9
Asian	2.7	8.5
Multiracial	4.1	3.6
Other	5.5	8.1
Ethnic/Racial Diversity	28.1	35.5
	M (SD)	*M (SD)*
Age	18.2 (5.2)	18.2 (4.6)
CAARS DSM-IV IN *	78.6 (12.4)	47.2 (9.7)
CAARS DSM-IV HI *	63.5 (13.5)	40.7 (6.8)
CAARS Total ADHD *	74.4 (13.5)	42.8 (8.5)

Note. ADHD group n=220, Comparison group n=223; CAARS = Conners Adult ADHD Rating Scale; IN=Inattention T-Score, HI=Hyperactivity-Impulsivity T-score.

* $p < .001$.

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Table 2

Comorbid and Non-ADHD Disorders by Group

Disorder %	ADHD	% Comparison	χ^2	*p*	*OR*	*95% CI*
Depressive	32.3	5.4	52.6	< .001	8.4	[4.4, 16.0]
MDD	28.2	3.6	50.4	< .001	10.5	[4.9, 22.7]
Dysthymia[a]	4.1	0.0	-	.002	-	-
Depression NOS	1.8	1.8	0.0	*ns*	1.0	[0.3, 4.1]
Bipolar	0.0	0.0	-	-	-	-
Anxiety	28.6	3.6	51.6	< .001	10.8	[5.0, 23.1]
GAD	15.5	1.8	26.4	< .001	10.0	[3.5, 28.7]
Panic Disorder	3.2	0.4	4.7	.03	7.3	[0.9, 59.8]
Social Phobia	3.2	0.4	4.7	.03	7.3	[0.9. 59.8]
Specific Phobia	2.3	0.9	1.4	*ns*	2.6	[0.5, 13.4]
Anxiety NOS	7.7	0.9	12.6	< .001	9.3	[2.1, 40.6]
OCD	3.6	1.8	1.4	*ns*	2.1	[0.6, 7.0]
Trauma & Stressor	7.3	0.9	11.5	.001	8.7	[2.0, 38.2]
PTSD	2.3	0.4	2.8	*ns*	5.2	[0.6, 44.6]
Adjustment	5.0	0.4	8.7	.003	11.7	[1.5, 91.3]
Eating	2.3	1.3	0.5	*ns*	1.7	[0.4, 7.2]
LD	10.0	0.4	20.5	< .001	24.7	[3.3, 184.7]

Note. MDD = Major Depressive Disorder; NOS = Not Otherwise Specified; GAD = Generalized Anxiety Disorder; OCD = Obsessive-Compulsive Disorder; PTSD = Post-Traumatic Stress Disorder; LD = Learning Disorder; OR = Odds ratio; CI = Confidence Interval.

[a] Fisher's Exact Test used in place of χ^2 due to zero value in one cell. Total percentages may exceed 100% due to participants having two or more diagnoses.

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Table 3

Means and Standard Deviations of Dimensional Measures by Group

	ADHD	Comparison			
	M (SD)	*M (SD)*	*t*	*p*	Cohen's *d*
BDI-II	15.5 (9.6)	5.9 (5.1)	13.1	< .001	1.25
BAI	14.3 (11.0)	4.8 (4.9)	11.8	< .001	1.12
EBRS					
ODD Severity	8.6 (4.4)	3.8 (2.7)	13.5	< .001	1.31
CD Severity	1.4 (2.0)	0.4 (0.8)	6.2	< .001	0.66

Note. BDI-II = Beck Depression Inventory-Second Edition; BAI = Beck Anxiety Inventory; EBRS = Externalizing Behavior Rating Scale; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder. Clinical cutoff scores for the BDI-II and BAI are 14 and 8, respectively.

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Table 4

Comorbid Diagnoses by ADHD Presentation

Disorder %	Combined	% Inattentive	χ^2	*p*	*OR*	*95% CI*
Depressive	42.5	24.3	7.8	.005	2.3	[1.3, 4.2]
MDD	38.7	20.4	8.4	.004	2.5	[1.3, 4.6]
Dysthymia	4.7	2.9	0.5	*ns*	1.6	[0.4, 7.1]
Depression NOS	0.9	2.9	1.1	*ns*	0.3	[0.0, 3.1]
Bipolar	0.0	0.0	-	-	-	-
Anxiety	34.0	26.2	1.5	*ns*	1.4	[0.8, 2.6]
GAD	17.9	14.6	0.4	*ns*	1.3	[0.6, 2.7]
Panic Disorder	4.7	1.9	1.2	*ns*	2.5	[0.5, 13.2]
Social Phobia	3.8	2.9	0.1	*ns*	1.3	[0.3, 6.0]
Specific Phobia	2.8	1.9	0.2	*ns*	1.5	[0.2, 9.0]
Anxiety NOS	8.5	7.8	0.0	*ns*	1.1	[0.4, 3.0]
OCD	6.6	1.0	4.5	.034	7.2	[0.9, 59.7]
Trauma & Stressor	9.4	4.9	1.6	*ns*	2.0	[0.7, 6.2]
PTSD	3.8	1.0	1.8	*ns*	4.0	[0.4, 36.4]
Adjustment	5.7	3.9	0.4	*ns*	1.5	[0.4, 5.4]
Eating [a]	3.8	0.0	-	.064	-	-
LD	7.5	13.6	2.0	*ns*	0.5	[0.2, 1.3]

Note. MDD = Major Depressive Disorder; NOS = Not Otherwise Specified; GAD = Generalized Anxiety Disorder; OCD = Obsessive-Compulsive Disorder; PTSD = Post-Traumatic Stress Disorder; LD = Learning Disorder; OR = Odds ratio; CI = Confidence Interval.

[a] Fisher's Exact Test used in place of χ^2 due to zero value in one cell. Total percentages may exceed 100% due to participants having two or more diagnoses.

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Table 5

Means and Standard Deviations of Dimensional Measures by ADHD Presentation

	Combined	Inattentive			
	M (SD)	*M (SD)*	*t*	*p*	Cohen's *d*
BDI-II	17.3 (9.9)	13.9 (9.3)	2.6	.01	.35
BAI	16.8 (10.9)	12.0 (10.8)	3.2	.002	.44
EBRS					
ODD Severity	10.2 (4.3)	6.9 (4.1)	5.5	< .001	.79
CD Severity	1.6 (2.0)	1.1 (2.1)	1.5	.127	.24

Note. BDI-II = Beck Depression Inventory-Second Edition; BAI = Beck Anxiety Inventory; EBRS = Externalizing Behavior Rating Scale; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder. Clinical cutoff scores for the BDI-II and BAI are 14 and 8, respectively.

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Table 6

Comorbid Diagnoses within ADHD Group by Gender

Disorder	% Female	% Male	χ^2	*p*	*OR*	*95% CI*
Depressive	43.0	20.8	12.4	< .001	2.9	[1.6, 5.2]
MDD	38.6	17.0	12.7	< .001	3.1	[1.6, 5.8]
Dysthymia	5.3	2.8	0.8	*ns*	1.9	[0.5, 7.8]
Depression NOS	0.9	2.8	1.2	*ns*	0.3	[0.0, 3.0]
Bipolar	0.0	0.0	-	-	-	-
Anxiety	39.5	17.0	13.6	< .001	3.2	[1.7, 6.0]
GAD	19.3	11.3	2.7	.102	1.9	[0.9, 4.0]
Panic Disorder	4.4	1.9	1.1	*ns*	2.4	[0.4, 12.6]
Social Phobia	5.3	0.9	3.4	.068	5.8	[0.7, 49.3]
Specific Phobia	2.6	1.9	0.1	*ns*	1.4	[0.2, 8.6]
Anxiety NOS	12.3	2.8	6.9	.009	4.8	[1.3, 17.2]
OCD	3.5	3.8	0.1	*ns*	0.9	[0.2, 3.8]
Trauma & Stressor	10.5	3.8	3.7	.054	3.0	[0.9, 9.6]
PTSD	3.5	0.9	1.6	*ns*	3.8	[0.4, 34.7]
Adjustment	7.0	2.8	2.0	*ns*	2.6	[0.7, 10.0]
Eating [a]	4.4	0.0	-	.036	-	-
LD	12.3	7.5	1.4	*ns*	1.7	[0.7, 4.3]

Note. MDD = Major Depressive Disorder; NOS = Not Otherwise Specified; GAD = Generalized Anxiety Disorder; OCD = Obsessive-Compulsive Disorder; PTSD = Post-Traumatic Stress Disorder; LD = Learning Disorder; OR = Odds ratio; CI = Confidence Interval.

[a] Fisher's Exact Test used in place of χ^2 due to zero value in one cell. Total percentages may exceed 100% due to participants having two or more diagnoses.

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Table 7

Means & Standard Deviations of Dimensional Measures within ADHD Group by Gender

	Females	Males			
	M (SD)	*M (SD)*	*t*	*p*	Cohen's *d*
BDI-II	17.5 (9.7)	13.4 (9.1)	3.2	.002	.44
BAI	16.5 (11.6)	11.9 (9.8)	3.1	.002	.43
EBRS					
ODD Severity	8.6 (4.5)	8.6 (4.4)	0.1	*ns*	.00
CD Severity	0.9 (1.4)	1.8 (2.4)	−3.5	.001	.46

Note. BDI-II = Beck Depression Inventory-Second Edition; BAI = Beck Anxiety Inventory; EBRS = Externalizing Behavior Rating Scale; ODD = Oppositional Defiant Disorder; CD = Conduct Disorder. Clinical cutoff scores for the BDI-II and BAI are 14 and 8, respectively.