Review Article

Comorbidity in Disconnected Emerging Adults with ADHD

Andrea Bergman[1]*, Meredith Owens[2], Jill D. Kelter[3] and Grace Kong[4]

[1]Department of Psychology, St. John's University, Jamaica, New York, USA

[2]Psychologist for Child and Adolescent Psychiatry at Zucker Hillside Hospital and North Shore LIJ Health System, New York, USA

[3]Psychologist at Valley Coordinated Children's Services, Los Angeles County Department of Mental Health, Reseda, California, USA

[4]Department of Psychiatry, Yale University School of Medicine, New Haven Connecticut, USA

*Corresponding author: Andrea Bergman, Department of Psychology, St. John's University, 8000 Utopia Parkway, Jamaica, New York, USA 11439, Tel: +91 7189901550; E-mail: bergmana@stjohns.edu

Abstract

Research on ADHD has typically neglected the transition period of emerging adulthood. This study examined comorbidity in 105 disconnected, emerging adults with ADHD recruited from a General Education Diploma (GED) program. Participants were administered questionnaires and an interview to evaluate ADHD, psychoactive substance use disorders, antisocial personality disorder (APD), and depressive disorders. Compared to participants without ADHD (n=82), those with ADHD (n-29) reported higher rates of substance use disorders (alcohol use disorders=56%; cocaine use disorders=23%), APD (59%), and depressive disorders (39%). Further, APD mediated the relationship between ADHD and alcohol and cocaine use disorders. The results indicated high rates of comorbidity among emerging adults with ADHD. Findings are discussed with regard to treatment and highlight the need for research in underserved populations.

Keywords

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is defined in the DSM-IV-TR as a disorder that manifests before the age of 7 years [1]. It is widely accepted, however, that 10 to 60 percent of childhood-onset cases persist into adulthood [2,3]. In adulthood, the negative effects of ADHD may include increased substance use, academic and vocational difficulties, emotional difficulties, poor interpersonal relationships, and trouble with the law [4-7]. The majority of the research on ADHD has focused on school-age children utilizing clinical samples [8,9] or community samples recruited in school settings [10,11]. There appears to be a dearth of ADHD literature focusing on the transition period between adolescence and adulthood, referred to as emerging adulthood [12,13]. The goal of this study was to assess comorbidity in a sample of disconnected, emerging adults with ADHD recruited from a General Education Diploma (GED) program.

Emerging adulthood is a distinct period demographically, subjectively, and in terms of identity explorations that differs from adolescence and young adulthood [14]. The lack of attention to transitional periods of development may be due, in part, to a tendency for a somewhat artificial distinction to

be made at the age of 18. For instance, in both research and clinical work, individuals age 18 and below are often considered to be in the domain of child psychology and those above age 18 are often included with adult populations. This practice obscures the importance of the transition from dependent adolescent to independently functioning adult, which may be an especially critical period for emerging adults who do not participate in structured, culturally sanctioned institutions such as college. Few studies have focused on neither emerging adults with ADHD [15], especially samples of emerging adults who are neither in college nor seeking clinical treatment. As it is becoming increasingly evident, there are millions of "disconnected" (dropped out of school and not employed) youth between the ages of 16 and 24, who are more likely to suffer from mental health problems among other things [16,17], with ADHD being a likely problem for this population.

The rich literature on ADHD in children has established the prevalence of comorbid disorders, which is one of the most troubling outcomes for these children. Likewise, there is evidence that ADHD in adolescents and adults is also commonly associated with comorbid disorders, including conduct disorder/antisocial personality disorder (CD/APD), psychoactive substance use disorders, depression, and anxiety. Clearly, comorbidity has a negative impact on functioning [18] and treatment outcome and is deserving of further study in the emerging adult population, where much is to be learned regarding the expression of ADHD.

The diagnosis of ADHD and symptoms of ADHD have been found to be associated with conduct problems, criminal behavior, and CD/APD in adolescents and adults [19-21]. Barkley and colleagues [4] found that young adults with hyperactivity committed more antisocial acts and as a result were arrested more often than controls. Further, adolescent boys with ADHD and CD had more CD symptoms and earlier onset of CD compared to boys with CD alone [22]. Because research indicates that children and adolescents with comorbid ADHD symptoms and conduct problems are at an increased risk for subsequent antisocial behavior, professionals have encouraged early intervention with this population [23]. Further, adults with ADHD have significantly higher rates of CD/APD than adults without ADHD [24,25,7] as well as earlier onset of CD [7]. Researchers have suggested that comorbid ADHD and CD is not simply an additive relationship, but a distinct genetic subtype [26,27].

Psychoactive Substance Use Disorders (PSUD) are also frequently comorbid with ADHD in adolescents and adults. In a clinical sample of older adolescents and emerging adults, Murphy, Barkley, and Bush [28] found that the subjects with ADHD reported a higher prevalence of alcohol and cannabis dependence/abuse disorders than subjects without ADHD. Adults with ADHD have also been found to have higher prevalence of substance use and abuse than adults without ADHD [24,5,25,7]. Notably, higher rates of substance abuse

among adults with ADHD have often been found for drugs but not for alcohol [5,25]. In clinical samples of adolescents and adults receiving treatment for substance abuse, rates of ADHD are higher than are found in the general population, with earlier onset of alcohol use for individuals with ADHD [29,30]. Earlier onset of PSUD was also found in a clinical sample of adults with ADHD compared to adults without ADHD [31]. While the comorbidity of ADHD and substance use in adolescents and adults has been repeatedly demonstrated [32], a meta-analysis of this research by Lee, Mulsow, and Reifman [20] has found that average correlations are small. Additionally, despite continued concerns that stimulant medication used to treat ADHD in childhood may heighten the risk for later substance use, a meta-analysis by Wilens, Faraone, Biederman, and Gunawardene [33] found that medication is actually more likely to reduce the risk for substance use in individuals with ADHD.

Recently, attempts have been made to explain the relationship between ADHD and PSUD and one of the factors explored has been CD/APD. Researchers have debated whether CD/APD mediates the relationship between ADHD and PSUD. Some researchers have found that ADHD alone does not increase the risk for substance use, and instead point to comorbid CD/APD to explain the higher rates of substance use [34]. In samples of early adolescents and emerging adults, individuals with ADHD only did not differ from controls in rates of substance use [4,35]. McGough and colleagues [7] found that ADHD in adults was not a significant risk factor for substance use when sex, socioeconomic status, and oppositional defiant disorder/conduct disorder were controlled. Modestin, Matutat, and Wurmle [36] found that ADHD alone did not predispose male inpatients to opioid dependence; however, they stated that increased rates of ADHD might be found among these addicts due to comorbid CD. Other researchers found that ADHD diagnosis or ADHD symptoms were related only to nicotine dependence after CD was controlled [34,37]. A review by Lynskey and Hall [38] concluded that the connection between ADHD and substance abuse has been overemphasized and that in the absence of CD, ADHD is not associated with an increased risk of substance abuse problems.

Conversely, other research has found that ADHD alone does, in fact, increase the risk for substance use [5]. Horner and Scheibe [30] found that among adolescents in treatment for substance abuse, those with ADHD had more severe substance use than those without ADHD, however these groups did not differ significantly on conduct problems, effectively ruling out conduct problems as a mediator of ADHD and substance use. Wilens and colleagues [33] found that adults with ADHD alone had an earlier age of onset of PSUD compared to adults without ADHD, concluding that ADHD is a risk factor for late adolescent to young adulthood onset of PSUD. While they noted that CD might put individuals at risk for PSUD sooner during early adolescence, ADHD was concluded to be an independent risk factor for the onset of PSUD [33].

A review by Tucker [39] concluded that although comorbidity between ADHD and PSUD may often be mediated by CD/APD, this does not fully account for the association between ADHD and PSUD, which is similar to that of PSUD and other psychiatric diagnoses. Flory and Lynam [37] also acknowledge that when researchers have statistically controlled for CD, the relationship between ADHD and substance abuse typically ceases to exist which may lead to the conclusion that ADHD is unrelated to substance abuse. Flory and Lynam [37] point out, however, that research supports an interaction between ADHD and CD that yields a higher risk for substance abuse than either disorder alone. Molina and colleagues [35] found that preadolescents with comorbid ADHD and CD reported the use of tobacco, alcohol, and other drugs more often than those with ADHD alone or CD alone. Flory and colleagues [19] also found that young adults with both ADHD symptoms and conduct problems had higher rates of substance use and dependence when compared to those with ADHD symptoms or conduct problems alone. Additionally, adolescents with ADHD and CD had more substance abuse diagnoses than those with CD alone [22]. Thus, it might be that ADHD increases the risk for substance use by setting the stage for early onset CD [35].

While affective disorders have been found to be less commonly comorbid with ADHD as compared to CD or PSUD [27], the comorbidity of affective disorders with ADHD remains an important topic. One study reported between 9 and 32 percent of children diagnosed with ADHD also met the criteria for major depression and/or dysthymia [40]. There is evidence that this rate may be even greater in adolescents and adults. An examination of a community sample of older adolescents revealed that 46 percent of subjects with ADHD (6 of 13) received a comorbid diagnosis of major depression [12]. Barkley [41] indicated that 76 percent of adolescents with ADHD had depressive symptoms and Angold and Costello [42] reported a varying rate of 0 to 57 percent comorbidity between ADHD and major depression. Further, adolescent boys with ADHD and CD had comorbid diagnoses of depression and anxiety more often than those with CD alone [22]. Consistent with these findings, a follow-up study of hyperactive children found them to have higher rates of major depression in young adulthood than a community control group and the presence of APD increased this risk [43].

Adults with ADHD often have higher rates of depression and anxiety compared to those without ADHD [24,7]. ADHD is also associated with earlier onset of depressive disorders in adults [7]. There is additional evidence that ADHD and affective disorders may share a common familial etiology [44]. Despite these findings, however, higher prevalence of affective disorders in adults with ADHD compared to those without ADHD has not always been supported [25]. Clearly, further investigation into the relationship between ADHD and depression is warranted.

Many previous studies of comorbidity of ADHD have been limited by the use of either clinical samples, which may include those most severe in terms of symptoms or comorbidity [45], and community samples, with relatively low prevalence rates [12]. Among adolescents, ADHD is associated with poorer educational achievement and attainment. In a prospective study, boys with ADHD failed a greater number of academic classes in junior high and high school compared to boys without ADHD [50]. Boys with ADHD also tend to complete fewer years of formal schooling than boys without ADHD [51,50]. Therefore, high school dropout is a concern for adolescents with ADHD. In a sample of over 150 adolescents, 25 percent of the ADHD group dropped out of high school whereas only 1 percent of the non-ADHD group dropped out of high school [51]. The use in this study of a sample of emerging adults who have dropped out of high school and are pursuing their GED will provide a unique opportunity to study comorbidity in a nonclinical, community sample.

Specifically, this study tested the hypothesis that within our GED sample, participants with ADHD would have higher rates of psychoactive substance use disorders, antisocial personality disorder, and depressive disorders than those without ADHD. Furthermore, based on the previous literature, we proposed that the relationship between ADHD and PSUD would be mediated by APD.

Method

Participants

The participants in this cross-sectional study were 105 emerging adults (64 males and 41 females) between 16 and 21 years old (M=18.02, SD=0.92) recruited from a General Education Diploma (GED) program in New York City. Since these students have previously dropped out of high school, they may be especially likely to manifest behavioral and substance use problems. The sample was ethnically diverse, with approximately 52 percent of the participants identifying themselves as Hispanic, 17.6 percent as African-American, 12.7 percent as Caucasian, and 3.9 percent as Asian. The remaining 10.8 percent identified their ethnicity as "other" or chose not to provide that information.

Measures

Modified ADHD Interview for Adolescents

The Modified ADHD Interview for Adolescents is a modified version of the Schedule for Affective Disorders and Schizophrenia for School-aged Children [K-SADS; 52], a semi-structured interview for diagnosing Axis I psychiatric disorders in children and adolescents. The original K-SADS interview was supplemented with additional age-appropriate questions [53] in order to best assess the presence of ADHD symptomatology in the present sample of emerging adults. For example, one of the K-SADS suggested questions for the "difficulty organizing tasks" symptom of inattention ("Is your desk or locker school at school a mess?") was replaced with the question worded, "Do you have difficulty organizing your activities or responsibilities?" from the Gittelman and

Mannuzza [53] interview. Because the K-SADS is a semi-structured instrument, the addition of questions to assess the symptoms outlined in the ADHD module should not have negatively impacted the validity of this measure. Further, whereas the K-SADS instructions allow for the interviewer to choose among the suggested probes in order to assess presence of symptoms, we chose to use the specific list of questions outlined in the Gittleman and Manuzza interview in order to increase the uniformity of study procedures.

The participants' responses to questions based on DSM-IV-TR symptoms were rated for severity by the interviewer on a scale taken from Gittelman and Mannuzza [53] that ranges from 1 to 5 with a score of 3 being significant to endorse the presence of that symptom. All interviewers for this measure were trained doctoral students in clinical psychology with practicum experience in clinical interviewing. Selected interviews were recorded, with the participants' knowledge and written consent, and checked for reliability purposes by additional raters (n=10). The mean (standard deviation) percent agreement on ADHD diagnosis across raters was 94.44 percent (16.67).

The Parents' Rating Scale [PRS; 54] is a questionnaire adapted from the Connors' Abbreviated Teacher Rating Scale which was administered to the parent or other informant for the participant with ADHD. This questionnaire was read to the informant over the telephone and ratings were obtained for two time periods: when the participant was 6-10 years old and at his or her current age. Ward et al. [54] reported concurrent validity between the Wender Utah Rating Scale and the Parents' Rating Scale with a correlation coefficient of .41 for ADHD subjects. For the current study, 15 questions from the Attention Deficit Hyperactivity subscale of the Schedule for Affective Disorders and Schizophrenia-Child Scale [K-SADS; 52] were added in an effort to increase the sensitivity of the measure. A total of 25 questions were administered and rated on a scale of 0 (not at all) to 3 (pretty much). The results of the parent/informant interview were used in conjunction with the participant's information to confirm the presence of at least 6 of the 25 symptoms at a clinically significant level, in order to confirm a diagnosis of ADHD.

Structured clinical interview for DSM-IV: Non-patient version

[SCID-NP; 55]. The Axis-I portion of the SCID was administered in order to assess whether participants met criteria for a (current or past) psychoactive substance use disorder. This interview is designed to deliver accurate DSM-IV-TR diagnoses and is commonly used in both research and clinical settings. All interviewers for this measure were trained doctoral students in clinical psychology with practicum experience in clinical interviewing. Selected interviews were recorded, with the participants' knowledge and written consent, and checked for reliability purposes by additional raters (n=10). The mean (standard deviation)

percent agreement for substance diagnosis across raters was 95.83 percent (14.43); for depression was 98.9 percent (5.98).

Structured clinical interview for the DSM-IV Axis II personality disorders

[SCID-II; 55]. The SCID II interview is designed to deliver an accurate DSM-IV-TR [1] diagnosis of APD which requires some consistency in symptom presentation over the life course (criterion D) and so covers recent (after the age of 15 years) as well as childhood (prior to age 15 years) symptoms along the antisocial/conduct disorder spectrum. For the present study, a dimensional scoring approach was utilized in which each symptom was scored as 0 (absent), 1 (subthreshold), or 2 (present) and then summed to create a total APD score [56], which was then used for a diagnosis of APD according to the DSM-IV-TR. The scoring of each APD symptom was reviewed and confirmed during consultation with a licensed clinical psychologist (AB). This dimensional scoring approach has been shown to be a far more reliable estimate than the traditional categorical method in the literature [57]. Internal consistency for this dimensional APD score in the present study was good, α=0.88 and mean (standard deviation) percent agreement for APD diagnosis was 96.67 (10.54) percent.

Procedure

Participants were initially recruited from their classrooms or at intake into the GED program. Students were under no obligation to participate and all willing participants were awarded a small stipend for their participation. Participation in the study consisted of completing self-report questionnaires and a clinical interview with a doctoral student in an office setting. Participants were classified as ADHD or non-ADHD based on DSM-IV-TR criteria [1], as assessed by responses recorded during a semi-structured clinical interview (Modified ADHD Interview for Adolescents). Twenty-three participants (18 males and 5 females) reported current symptoms consistent with an ADHD diagnosis (i.e., at least six symptoms in one of the specified categories, attention or hyperactivity/impulsivity). Only participants who reported fewer than three ADHD symptoms were included in the non-ADHD group, which consisted of eighty-two participants (46 males and 36 females). For the participants who endorsed six or more ADHD symptoms, several attempts were made to obtain parent confirmation of these symptoms prior to seven years of age. The majority of parents were not able to be interviewed because they either did not respond or did not speak English (68%). Of the 32 percent who did respond, all of them confirmed the presence of ADHD symptoms prior to seven years of age. Due to the lack of parental response, criterion B was dropped as a necessary condition for classification of ADHD for the purposes of the present study. Final group classification (i.e., ADHD or control) of each participant was later confirmed via group consensus meeting under the supervision of a licensed clinical psychologist. The study procedures described above were reviewed and

approved by the St. John's University Institutional Review Board prior to the collection of any data (Figure 1).
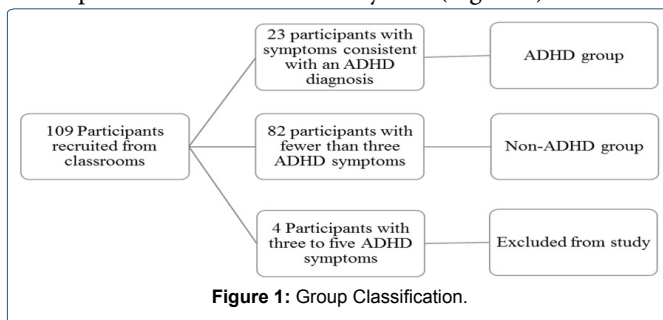

Figure 1: Group Classification.

Analyses

In order to investigate the hypothesis that participants with ADHD would have higher rates of psychoactive substance use disorders, antisocial personality disorder, and depressive disorders than those without ADHD, a series of chi-square analyses were conducted. Separate chi-square analyses were run with alcohol use disorders, marijuana use disorders, and cocaine use disorders as the dependent variables. An individual was coded as having an alcohol use, cocaine use or marijuana use disorder if he or she met all of the DSM-IV criteria for either abuse or dependence on the relevant substance, as specified in Disney, Elkins, McGue, and Iacono [34]. An individual was coded as having a depressive disorder if he or she met all of the DSM-IV criteria for either Major Depressive Disorder or Dysthymia. Subjects with missing data were excluded from that particular analysis; therefore, some of the analyses may contain slightly different subject numbers for the non-ADHD group only (e.g., 82 vs. 81).

In order to test the hypothesis that antisocial personality disorder would mediate the relationship between ADHD and substance use disorders, a hierarchical logistic regression analysis was conducted. A separate regression analysis was completed using each substance use disorder measure that was significant in the chi-square analysis (alcohol and cocaine) as the dependent variable and ADHD diagnosis (present or absent) and antisocial personality disorder (APD) diagnosis (present or absent) as the independent variables. According to Baron and Kenny [58], APD can be considered a mediator of the relationship between ADHD and substance use disorders if the effects of ADHD are no longer significant when APD is included as a significant independent variable in the model. In other words, it appears that APD is accounting for all of the variance between ADHD and substance use disorders.

Results

Group demographics

The characteristics of the ADHD and non-ADHD groups were similar to those of the entire sample with the exception of gender. As is typical of ADHD samples, the ADHD group was predominantly male (78.2%) in contrast to the non-ADHD group (56.1%), which was significantly different, $\chi^2(1)=3.70$, df=1, p≤0.5. The groups did not differ with respect to age or ethnicity.

Characteristic	ADHD group		Non-ADHD		All participants	
	N	%	N	%	N	%
Gender- male	18	78.2	46	56.1	64	60.9
Gender- female	5	21.7	36	43.9	41	39.1
African/African American	2	8.7	16	20.3	18	17.6
Asian/Asian American	2	8.7	2	2.5	4	3.9
Caribbean	0	0	2	2.5	2	2.0
Caucasian	5	21.7	8	10.1	13	12.7
Hispanic/Hispanic American	10	43.4	43	54.4	53	52.0
Other	4	17.4	7	8.8	11	10.8
multiple	0	0	1	1.3	1	1.0

Table 1: Demographic information of each group.

Comorbidity: Table 2 shows the distribution of comorbid disorders for the participants with and without ADHD. In terms of psychoactive substance use diagnoses, when compared to the non-ADHD group the ADHD group reported higher rates of alcohol use disorders (54.5% versus 22.8%, $\chi^2(1)=8.313$, p<.01, η=.298) and cocaine use disorders (22.7% versus 3.8%, $\chi^2(1)=8.455$, p <.01, η=.352). No significant difference between the two groups were found for marijuana use disorders (ADHD = 45.5% and non-ADHD = 34.2%; $\chi^2(1)=943$, p= .33, η=.120).

Disorder	ADHD group		Non-ADHD		All partici-pants		Chi-square value	P-value
	N	%	N	%	N	%		
Alcohol Use Disorder	12	54.5	18	22.8	30	29.7	8.313	P=.004
Cocaine Use Disorder	5	22.7	3	3.8	8	7.9	8.455	P=.004
Marijuana Use Disorder	10	45.5	27	34.2	37	36.6	.943	P=.332
Depressive Disorder	9	39.1	12	14.6	21	20.4	6.736	P=.009
Antisocial PD	13	59.1	8	9.9	21	20.4	25.816	P<.001

Table 2: Percentage (Number) of Each Group Having Comorbid Disorders.

In terms of depressive disorders (defined as a DSM-IV diagnoses of any lifetime diagnosis of Major Depressive Disorder or of Dysthymia), the ADHD group reported significantly higher rates (48%) than the non-ADHD group (18%); $\chi^2(1)=7.04$, p<.01, η=.302. A diagnosis of antisocial personality disorder was more prevalent in the ADHD group compared to the non-ADHD group (59% versus 7%), $\chi^2(1)=24.05$, p<.001, η=.563.

The results of the logistic regression analysis for alcohol use disorders (see Table 3) indicated that a diagnosis of ADHD was not a significant predictor once the effects of APD had been taken into account. In fact, the previously significant relationship between ADHD and alcohol use disorder (B=1.39, p<0.01) became non-significant (B=0.23, p=0.73) when APD was entered in the equation and was now a significant predictor

of alcohol use disorder (B=2.59, p<.01). These results suggest that APD mediates the relationship between ADHD and alcohol use disorder, according to Baron and Kenny [58]. Therefore, a follow-up analysis using a Sobel test calculator [59] were conducted on the relevant regression coefficients to test the finding of mediation for significance. Results of this analysis were statistically significant, z=2.53, p<.01.

Predictor	B (SE)	OR	Wald	95% CI
Step 1				
ADHD	1.39 (0.51)	4.0	7.52**	1..49-10.77
Step 2				
ADHD	0.23 (0.67)	1.26	0.12	0.34-4.7
APD	2.59 (0.67)	13.27	14.991***	3.59-49.13

Table 3: Logistic regression predicting Alcohol Use Disorders with ADHD and APD.

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

For cocaine use disorder (Table 4), ADHD was a significant predictor in the first step of the logistic regression analysis, B=2.00, p=0.01. When APD was entered into the equation on the second step, however, ADHD was no longer a significant predicator (B=0.88, p=0.34) and APD was significant (B=2.30, p=0.02) suggesting that APD mediates the relationship between ADHD and cocaine use disorder. Again, a follow-up analysis using a Sobel test calculator was conducted on the relevant regression coefficients to test the finding of mediation for significance and the results of the analysis was statistically significant (z=2.08, p<0.05).

Predictor	B (SE)	OR	Wald	95% CI
Step 1				
ADHD	2.00 (0.79)	7.35	6.57**	1..60-35.79
Step 2				
ADHD	0.89 (0.92)	0.24	0.91	0.40- 14.49
APD	2.30 (0.98)	9.94	5.52*	1.46-67.49

Table 4: Logistic regression predicting Cocaine Use Disorders with ADHD and APD

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

Discussion

One goal of the present study was to test the hypothesis that participants with ADHD would have higher rates of psychoactive substance use disorders, antisocial personality disorder, and depressive disorders than those without ADHD. As predicted, those with ADHD had higher rates of alcohol use disorders and cocaine use disorders but surprisingly did not have significantly higher rates of marijuana use disorders. As noted previously, earlier research on ADHD and substance use disorders has found an association between ADHD and increased substance use in older adolescents and adults [24,5,25,7,28], although the average correlations have been noted to be small [20]. Although we failed to find the predicted differences in marijuana use disorders, it should be noted that in another study with this sample we did find that the ADHD participants reported a younger age at first use

of marijuana [60] which is generally related to a more severe course of the disorder [61].

In addition to alcohol and cocaine use disorders, ADHD in this sample was associated with depressive disorders and antisocial personality disorder (APD). Our finding that 39% of the participants with ADHD reported a depressive disorder is quite consistent with a previous study finding a rate of 46% in a community sample of older adolescents with ADHD [12]. These findings have important implications for the treatment of emerging adults with ADHD. Since externalizing disorders such as substance abuse and antisocial personality disorder are more often reported as comorbid with ADHD [27], clinicians may be more sensitive to symptoms of these disorders in their ADHD patients. However, the current results support the need for clinician sensitivity to depressive symptoms in their ADHD patients as well.

As was expected, there was a strong association between ADHD and APD in our sample. The rate of APD was 59% in the ADHD group and only 10% in the non-ADHD group. In general, these findings are consistent with previous studies of both clinical samples of ADHD adults [24] and follow-up studies of ADHD children grown up [4,25]. The findings are also consistent with the nature of the sample in that they had already dropped out of high school and so might be considered relatively low functioning.

The hypothesis that the relationship between ADHD and alcohol and cocaine use disorders was mediated by APD was supported by the results of the logistic regression analysis. More specifically, when APD was entered into the equation, the previously significant relationship between ADHD and alcohol and cocaine use disorders became non-significant and APD became the only significant predictor. Based on these analyses, it appears that APD mediated the relationship between ADHD and alcohol and cocaine use disorders. This finding is consistent with previous research supporting relationships between CD/APD and substance use disorders in adolescents and adults [34]. Furthermore, the results suggest that ADHD is not a significant predictor of alcohol and cocaine use disorders beyond the effects of APD, which is consistent with many previous studies [34,37,38,7].

While the findings have indicated that ADHD is not an independent predictor of alcohol and cocaine use disorders, this conclusion may be a bit premature. First of all, it should be noted that the highly correlated nature of ADHD and APD may obscure the true nature of the relationship between these two variables. Molina et al. [35] point out the importance of exploring the interaction of these two variables but in our sample there were only eight participants meeting criteria for APD without ADHD, making this analysis unrealistic. This finding is somewhat consistent with the CD literature, in which other researchers have reported difficulty in identifying a pure CD group [62,63]. However, our low sample size is clearly a limitation of this study.

One of the unique contributions of this study is the nature of the sample, which is not a clinical sample but yet not a pure community sample in that the participants may be considered at risk for future difficulties since they have already dropped out of high school. Thus the participants had been pre-selected based on their status as members of a group who have already experienced a negative outcome. While these results may not be generalized to other clinical or community samples, one could argue that these are the individuals most in need of intervention and most underserved [64]. In addition, it is clear that there is a high prevalence of individuals with untreated disorders in this population and it is possible that earlier intervention with this population may prevent some of their later problems. For instance, most of the ADHD sample (90%) had never been on medication and there is evidence that treatment with medication is associated with decreased substance use [33].

Furthermore, the findings of this study may have clinical implications for the treatment of ADHD in emerging adulthood. The finding that almost half of the ADHD sample reported either a current or a prior depressive disorder suggests that perhaps clinicians should screen for depression when treating young adults for ADHD. It also raises questions regarding the use of drugs and alcohol to self-medicate in this sample of emerging adults who have received virtually no treatment despite self-reports of serious, chronic mental disorders.

As previously mentioned, ADHD may put adolescents at risk for high school dropout, which has been associated with negative outcomes. Adolescents who drop out of high school appear to be at greater risk for substance use. Compared to students in good academic standing and those with academic difficulties, students who drop out of high school were more likely to have used a variety of drugs (e.g., marijuana, cocaine, and heroin) and to engage in moderate to heavy drug use [65]. High school dropouts were also found to use cigarettes and illicit drugs more than high school graduates or college students [66-68].

Patterns of alcohol use among adolescents and emerging adults seem to be more complex. Although high school dropouts were more likely to use alcohol than their high school counterparts, in a college-age sample, college students who did not live with their parents had higher rates of alcohol use than high school dropouts [65,66]. However, high school dropouts have been found more likely to develop substance abuse and dependence when compared to college graduates [69-71]. In addition to elevated rates of substance use and abuse, high school dropouts were also more likely to perpetrate violence and to be victims of violence when compared to their high school counterparts [65]. Therefore, adolescents with ADHD may need academic and other school-based support services, in order to prevent dropout.

This study, therefore, highlights the need for research that goes beyond the traditional clinical and community samples in order to reach populations that are not currently being served by the mental health community. One of the limitations of this study relates to the low number of parent questionnaires completed to confirm the symptoms of ADHD before age 7 years as required in Criterion B of the DSM-IV [1]. Difficulty in obtaining parent confirmation may have been due to a variety of factors including the age and ethnic composition of the sample.

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