Published in final edited form as:

Drug Alcohol Depend. 2012 July 1; 124(1-2): 128–134. doi:10.1016/j.drugalcdep.2011.12.023.

The Relationship between Cannabis Use Disorders and Social Anxiety Disorder in the National Epidemiological Study of Alcohol and Related Conditions (NESARC)

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Abstract

Background—Cannabis use disorders (CUD) are highly comorbid with social anxiety disorder (SAD), and SAD may be a risk factor for cannabis dependence. This study explored these relationships in several ways. First, we examined whether SAD was more likely to be related to cannabis dependence than abuse. Second, we examined the temporal relations between CUD and SAD. Third, we examined whether SAD was related to faster transition from age of first cannabis use to CUD onset relative to other anxiety disorders. Fourth, we tested whether having both disorders was associated with greater impairment and psychiatric comorbidity.

Method—The sample consisted of adults from Wave 1 of the National Epidemiological Survey on Alcohol and Related Conditions, 2,957 of whom had CUD and no SAD, 1,643 had SAD and no CUD, and 340 had CUD-SAD.

Results—SAD was more likely to be related to cannabis dependence than abuse. This relation remained after controlling for race, sex, and some other psychiatric disorders (including some anxiety disorders). Age-of-onset data suggest SAD onset prior to CUD onset for most CUD-SAD respondents. CUD-SAD was related to greater impairment and psychiatric comorbidity than either disorder alone.

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Contributors

Authors Buckner and Heimberg designed the current study, managed the literature searches and summaries of previous related work, and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of Interest

Dr. Schneier has received funds from GlaxoSmithKline for speaking. The remaining authors declare that they have no conflicts of interest.

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Conclusions—Although SAD is related to CUD, it has a stronger association with cannabis dependence than abuse. This link is not better accounted for by other psychopathology measured in this study. SAD onset prior to CUD for the majority of CUD-SAD respondents. Importantly, the co-occurrence of these two disorders appears to result in greater impairment and distress than either disorder alone.

Keywords

Cannabis; Marijuana; Cannabis Dependence; Social Anxiety Disorder; Comorbidity

1. Introduction

Individuals with cannabis use disorders (CUD) often struggle with anxiety. People with cannabis dependence are over five times more likely to have an anxiety disorder (Stinson et al., 2006), and 73.1% of cannabis dependent adults meet criteria for a primary anxiety disorder (Agosti et al., 2002). Social anxiety disorder (SAD) appears particularly related to CUD. In the National Comorbidity Survey, 29% of individuals with lifetime cannabis dependence had lifetime SAD, whereas rates of other lifetime anxiety disorders ranged from 6.9% to 18.5% (Agosti et al., 2002). Also, adolescents with SAD are seven times more likely to develop cannabis dependence as young adults (Buckner et al., 2008a).

Despite the high comorbidity of CUD-SAD, the literature is limited in several ways. First, it is unclear whether people with SAD are vulnerable to cannabis abuse or dependence. Although elevated social anxiety has been consistently linked to cannabis-related problems (e.g., Buckner et al., 2007; Buckner et al., in press; Buckner et al., 2011; Buckner et al., 2006a; Buckner and Schmidt, 2008, 2009; Buckner et al., 2006b), only two studies have examined whether those with SAD are especially vulnerable to cannabis dependence. SAD in adolescence was related to greater risk of cannabis dependence, but not cannabis abuse, by age 30 (Buckner et al., 2008a). In the National Epidemiological Study of Alcohol and Related Conditions (NESARC), rates of lifetime SAD were 15.5% among those with cannabis dependence and 5.0% among those with cannabis abuse (Stinson et al., 2006). Whether SAD contributes to cannabis-related problems over and above other types of psychopathology common to cannabis use (e.g., internalizing and externalizing disorders) has not been sufficiently studied. It may be that the high rates of cannabis dependence among those with SAD are due to co-occurring Axis I disorders. For instance, SAD often co-occurs with other anxiety disorders and depression (Grant et al., 2005a), and these disorders are common among those with cannabis dependence (Agosti et al., 2002). Only two studies have examined the relations between SAD and cannabis-related problems after controlling for relevant demographic and clinical variables. Adolescent SAD predicted cannabis dependence at age 30 after controlling for gender and conduct disorder, alcohol use disorders (AUD), mood disorders, and other anxiety disorders (Buckner et al., 2008a). SAD remained significantly related to cannabis-related problems after controlling for gender, cannabis use frequency, major depressive disorder (MDD), and other anxiety disorders (Buckner and Schmidt, 2009). However, these studies were conducted with young samples with low prevalence of some disorders. Replication with more representative samples is warranted.

The temporal relations between CUD and SAD have also not been fully elucidated. Socially anxious individuals report using cannabis to cope in social situations (Buckner et al., in press) and for conformity and coping motives (Buckner et al., 2007). Coping mediates the relation between social anxiety and cannabis-related problems (Buckner et al., 2007; Buckner et al., in press), suggesting that SAD onset should occur prior to CUD. Anxiety disorders do tend to occur prior to CUD onset (Agosti et al., 2002). Yet, it is possible that

CUD occurs prior to SAD for some individuals who may develop a fear of scrutiny by others (a hallmark feature of SAD) as a result of experiencing humiliating consequences of CUD (e.g., behaving foolishly while intoxicated, legal troubles, problems with family or friends). Also, the practice of examining anxiety disorders as a group makes it impossible to determine whether some anxiety disorders occur prior to CUD whereas others occur after. In fact, some types of anxiety appear to be a consequence of cannabis use (e.g., panic; Zvolensky et al., 2008).

Another understudied area is whether those with CUD-SAD demonstrate faster transition from first cannabis use to CUD compared to people with CUD without SAD. Given that socially anxious individuals report using cannabis to manage negative affect (Buckner et al., 2007), it may be that these individuals quickly become reliant upon cannabis to help them cope and thus continue to use despite negative consequences. In partial support of this hypothesis, Marmorstein et al. (2010) found that SAD was related to faster transition from use to cannabis problems after controlling for history of delinquent behaviors. However, this study is limited in that these relations were only examined in boys, and it examined transition from use to problems, not use to CUD.

It is also unclear whether people with CUD-SAD experience greater impairment and more psychiatric disorders than people with CUD or SAD alone. It follows that the comorbid group would exhibit greater impairment (e.g., less occupational attainment) and other types of psychopathology (e.g., higher rates of co-occurring mood disorders, other anxiety disorders). Yet, it is also conceivable that SAD could protect people with CUD from greater impairment (e.g., if SAD prevents a person from venturing into social situations, thereby decreasing the likelihood of driving while intoxicated). Similarly, CUD could protect people with SAD from experiencing more SAD-related problems if self-medication decreases anxiety symptoms to a less interfering level. Examination of whether CUD-SAD is related to greater impairment and other types of psychiatric disorders could have important implications for prevention and treatment and inform theoretical models of this comorbidity pattern.

The present study sought to fill these gaps in the literature using data from the first wave of the National Institute on Alcohol Abuse and Alcoholism's (NIAAA) NESARC, allowing us to examine the relations between CUD and SAD in a large, representative U.S. sample. Prior work with the NESARC determined that SAD is related to greater odds of lifetime and 12-month CUD (Stinson et al., 2006) and that anxiety disorders (as a group) are related to greater odds of transitioning from cannabis use to dependence (Lopez-Quintero et al., 2011). We extend these findings in several ways. First, given that prior work found SAD to be related to cannabis dependence but not abuse (Buckner et al., 2008a), we directly examined whether those with SAD were more likely to have cannabis dependence than cannabis abuse and whether observed relations between SAD and cannabis dependence remained after controlling for a wide range of relevant variables (e.g., gender, other substance use disorders [SUD]). Second, we examined the temporal relations between CUD and SAD. Given that SAD prospectively predicted onset of cannabis dependence (Buckner et al., 2008a), it was hypothesized that SAD would occur prior to CUD for the majority of CUD-SAD respondents. Third, we strove to extend prior work finding greater social anxiety to be related to faster transition from age of first cannabis use to cannabis-related problems (Marmorstein et al., 2010) by testing whether SAD was related to a faster transition from age of first cannabis use to CUD onset relative to the other anxiety disorders assessed in the NESARC (generalized anxiety disorder [GAD], panic disorder, specific phobia). Fourth, we examined whether CUD-SAD respondents differed from those with either disorder alone on demographic variables, substance use behaviors, and psychiatric comorbidity.

2. Method

2.1 Sample

The 2001–2002 NESARC surveyed a representative sample of the U.S. adult population (Grant et al., 2005a; Grant et al., 2004a; Grant et al., 2003b). It targeted civilians (18 years and older) residing in households or group living quarters. Face-to-face interviews were conducted with 43,093 respondents, with a response rate of 81%. Blacks, Hispanics, and young adults (18–24 years old) were over-sampled, with data adjusted for over-sampling, household- and person-level non-response.

The weighted data were then adjusted to represent the U.S. civilian population based on the 2000 Census. All potential respondents were informed about the nature of the survey, the statistical uses of the survey data, the voluntary nature of their participation and federal laws regarding the confidentiality of identifiable survey information. Those respondents consenting to participate were interviewed. The research protocol was approved by the U.S. Census Bureau and the U.S. Office of Management and Budget.

We examined the 2,957 respondents with CUD and no SAD, 1,643 with SAD and no CUD, and 340 with both CUD and SAD. Of respondents with CUD, 2,767 met criteria for a lifetime diagnosis of cannabis abuse, whereas 530 met criteria for cannabis dependence (84 of whom also met criteria for abuse; per DSM-IV (American Psychiatric Association, 1994), respondents meeting criteria for both abuse and dependence were classified as dependence only). Most (84%) SAD diagnoses were generalized SAD.

2.2 Measures

2.2.1 DSM-IV diagnostic interview—The *NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV Version* (AUDADIS-IV; Grant et al., 2003a), a fully structured diagnostic interview designed for administration by lay professional interviewers, was used to assess lifetime DSM-IV disorders.

Substance use disorders: The AUDADIS-IV questions operationalize DSM-IV criteria for substance-specific abuse and dependence for alcohol, cannabis, and nine other drug classes. Age at first use, age of disorder onset, and use of non-cannabis substances were also assessed.

Social anxiety disorder: Diagnosis of SAD required a marked or persistent fear of one or more social or performance situations (at least 1 of 14 social interaction or performance situations, including an “other” category). The fear had to be recognized as excessive or unreasonable. Exposure to the situation must have almost invariably provoked anxiety, and the feared social situations must have been avoided or endured with intense anxiety. The DSM-IV clinical significance criterion must have been met (i.e., symptoms caused clinically significant distress or impairment in social, occupational, or other areas of functioning). Unlike the diagnoses provided by other instruments used in epidemiologic surveys (e.g., Alonso et al., 2004; Kessler et al., 1998; Wittchen et al., 1992), AUDADIS-IV diagnoses of SAD excluded persons whose SAD symptoms were substance-induced or due to general medical conditions (Grant et al., 2004a).

Other psychiatric disorders: The AUDADIS-IV assessed three other anxiety disorders (panic disorder, specific phobia, and GAD) and four mood disorders (MDD, bipolar I disorder, bipolar II disorder, and dysthymia; Grant et al., 2005b; Grant et al., 2004a). These diagnoses required that the clinical significance criterion be met and excluded substance-induced episodes or those due to general medical conditions. The AUDADIS-IV

assessments of personality disorders included avoidant, dependent, obsessive-compulsive, paranoid, schizoid, histrionic and antisocial personality disorders, and have been described in detail previously (Grant et al., 2008; Grant et al., 2004a). A diagnosis of psychotic disorder was assigned when respondents answered affirmatively when asked they had ever been told by a doctor or other health professional that they had schizophrenia or a psychotic disorder.

Test-retest reliability of the AUDADIS diagnosis of SAD was fair ($\kappa = 0.42\text{--}0.46$; Grant et al., 2005a; Grant et al., 2003b). Reliability ($\kappa > 0.74$) was good to excellent for SUDs (Grant et al., 1995; Grant et al., 2003b; Grant et al., 2004b; Vrásti et al., 1998). Reliability was fair to good for mood and other anxiety disorders ($\kappa = 0.40\text{--}0.60$) and personality disorders ($\kappa = 0.40\text{--}0.67$; Grant et al., 2003a; Grant et al., 2003b).

2.2.2 Other measures—In addition to demographic variables, perceived health status (rated on a 5-point scale from “poor” to “excellent”) was assessed.

2.3 Statistical Analyses

Weighted percentages and means were computed to derive prevalence, sociodemographic correlates, and clinical correlates of CUD and/or SAD. Logistic regression analyses yielded odds ratios (ORs) measuring associations between lifetime CUD and/or SAD and demographic characteristics and comorbid psychiatric disorders. In the hierarchical logistic regression analysis of the relationship of SAD to cannabis abuse versus dependence, ORs were adjusted for demographic characteristics (sex, race) and the occurrence of other psychiatric disorders. Standard errors and 95% confidence intervals for all analyses were estimated using SUDAAN (Research Triangle Institute, 2004) to account for design effects of the NESARC.

3. Results

3.1. Hypothesis 1: SAD would be more strongly related to cannabis dependence than abuse

Table 1 presents the relationships between cannabis abuse and dependence and anxiety disorders, as well as other psychiatric disorders. Consistent with prediction, SAD was significantly more likely to be related to cannabis dependence than abuse. In fact, all disorders except conduct disorder and pathological gambling were significantly related to cannabis dependence.

Also as predicted, SAD was related to cannabis dependence above and beyond shared variance explained by sex, race, and other psychiatric disorders (Table 2). Interestingly, the other anxiety disorders were no longer significantly related to dependence in these analyses.

3.2. Hypothesis 2: The majority of CUD-SAD respondents would report SAD onset prior to CUD onset

As expected, the majority of respondents (81.5%) with CUD-SAD reported that SAD onset prior to CUD. However, a substantial minority (15.0%) reported that CUD onset occurred prior to SAD onset. A small proportion (3.5%) reported that age of onset of SAD and CUD occurred in the same year.

3.3. Hypothesis 3: SAD would be related to faster transition from cannabis use to CUD onset

Although there was no difference between those with other anxiety disorders (excluding those with SAD) and those with SAD in the entire sample (Table 3), among men, those with

SAD transitioned from first use to CUD approximately eight months faster ($p = .093$). Among women, those with SAD did not significantly differ from those with other anxiety disorders on speed of transition from use to CUD.

3.4. Hypothesis 4: CUD-SAD respondents would differ from those without this comorbidity on demographic characteristics and substance use

Relationships between CUD-SAD status and demographic variables appear in Table 4. Among those with CUD, the odds of comorbid SAD were significantly less for men, and significantly greater for those with less than a high school education, individual incomes less than \$35,000, family incomes below \$20,000, and those receiving financial aid. Individuals with CUD-SAD were less likely to report their health as excellent, very good, or good than those with CUD and no SAD. Comorbid CUD-SAD was also related to greater use of illicit drugs other than cannabis (but was unrelated to alcohol or nicotine use).

Among those with SAD, the odds of comorbid CUD were significantly greater for men, those with less than a high school education, and those receiving financial aid. Interestingly, those with CUD-SAD were more likely to be employed. Comorbid CUD was less likely among those at least 45 years of age, of Asian race, who graduated from high school, and those who were married. Those with CUD-SAD (20.15%, $SE = 3.58$) were significantly more likely to use alcohol to reduce social fears or to avoid social situations compared to those with SAD and no CUD (3.45%, $SE = 0.80$), $OR = 7.07$ (95% $CI = 3.72-13.44$). Those with CUD-SAD (5.90%, $SE = 2.13$) were also significantly more likely to use cannabis to reduce social fears or to avoid social situations compared to those with SAD and no CUD (0.28%, $SE = 0.17$), $OR = 22.31$ (95% $CI = 5.36-92.94$).

3.5. Hypothesis 5: CUD-SAD respondents would differ from those without this comorbidity on other psychiatric disorders

Table 5 details the relationships between CUD-SAD group status and other psychiatric disorders. Almost all (99.21%) CUD-SAD respondents experienced at least one other psychiatric disorder, with 98.99% experiencing at least one other Axis I disorder and 73.71% experiencing at least one Axis II disorder. The most common Axis I disorders were other SUDs, followed by mood disorders (MDD, bipolar I, dysthymia, and bipolar II, respectively) and other anxiety disorders (specific phobia, panic disorder, and GAD, respectively). The most common Axis II disorder was obsessive-compulsive, followed by paranoid, avoidant, antisocial, and schizoid personality disorders.

A large proportion (94.5%) of CUD without SAD respondents also experienced at least one other psychiatric disorder, although they were more likely to experience at least one other Axis I disorder (93.9%) than an Axis II disorder (31.47%). The majority (87.4%) of respondents with SAD but no CUD also experienced at least one other psychiatric disorder. Again, they were more likely to experience at least one other Axis I disorder (82.5%) than Axis II disorder (51.5%).

Among those with CUD, comorbid SAD was related to having any psychiatric disorder, having any Axis I or II disorder, substance dependence (nicotine, alcohol, other [non-cannabis] drug), mood disorders (although not bipolar II), other anxiety disorders, and psychotic disorder. Among those with SAD, comorbid CUD was significantly related to having any psychiatric disorder, having any Axis I or II disorder, non-cannabis SUD, mood disorders, other anxiety disorders, and psychotic disorder. Interestingly, although CUD was related to any mood disorder, it did not appear to be related to MDD, bipolar II, or dysthymia. Thus, the mood disorder finding for the larger category appears driven by CUD's relationship with bipolar I.

4. Discussion

This study is the first systematic, epidemiological investigation of the relationships between CUD and SAD. Findings contribute to our understanding of these relationships in several ways. First, although SAD was related to both cannabis abuse and dependence (Lopez-Quintero et al., 2011), the association was greater for dependence than abuse. This finding is consistent with prior work finding SAD to be prospectively related to onset of cannabis dependence but not abuse (Buckner et al., 2008a) and that social anxiety tends to be related to more and/or more severe cannabis-related problems (Buckner et al., 2007; Buckner et al., in press; Buckner et al., 2011; Buckner et al., 2006a; Buckner and Schmidt, 2008, 2009; Buckner et al., 2006b). However, given that abuse may be a less reliable diagnosis than dependence (Hasin et al., 2006), future work is necessary to determine whether those with CUD-SAD experience more severe CUD than those without SAD. Importantly, SAD remained significantly related to dependence after controlling for a wide range of relevant variables. These data, in conjunction with past research (Buckner et al., 2008a), support the contention that SAD is robustly related to cannabis dependence and that this effect does not seem to be attributable to gender, race, or other co-occurring psychiatric disorders. In fact, no other anxiety disorder was significantly related to cannabis dependence after controlling for race and gender, suggesting that SAD may be uniquely related to cannabis dependence (Buckner et al., 2008a) among the anxiety disorders.

Second, the vast majority of respondents with CUD-SAD reported the onset of SAD prior to CUD onset. In light of the finding that SAD in adolescence prospectively predicts development of cannabis dependence in adulthood (Buckner et al., 2008a), our data, relying on retrospective account of age of onset, are consistent with the notion that persons with SAD use substances in an attempt to cope in social situations (Buckner et al., in press). In fact, respondents with CUD-SAD were more likely to report using cannabis to help them manage social fears. Thus, it could be some persons with SAD come to rely on cannabis to help them cope in social situations, continuing to use cannabis despite experiencing negative consequences related to its use, thereby developing CUD.

Interestingly, our data also indicate that for some individuals, SAD onset occurred after CUD onset, suggesting there may be at least two developmental pathways to CUD-SAD. This is consistent with work examining the temporal relations between anxiety disorders and AUD (Bernstein et al., 2007; Buckner et al., 2008b; Schneier et al., 2010). It may be that for some individuals, CUD results in the experience of problems in social domains (e.g., loss of control over social behavior) that lead them to fear negative social evaluation. They may also develop cannabis-induced paranoia that others are negatively evaluating them. Future prospective work will be necessary to determine whether CUD does, in fact, serve as a risk factor for the development of SAD and then to identify causal mechanisms underlying this pathway, as this group could respond differently to treatment than individuals who exhibit the more typical developmental trajectory.

Third, using age-of-onset data, we tested whether SAD was related to a faster transition from age of first cannabis use to CUD onset relative to the other anxiety disorders assessed in the NESARC. Consistent with prior work (Marmorstein et al., 2010), SAD tended to be related to faster transition among men; however, among women, SAD was unrelated to speed of transition. It may be that there are different mechanisms underlying the development of CUD among men versus women. For instance, social avoidance was found to be more related to cannabis-related problems among men than women (Buckner et al., 2011). Future work examining sex differences in the development and expression of cannabis problems among those with SAD will be an important next step.

Fourth, our data suggest that SAD is associated with a variety of negative features in those with CUD. The co-occurrence of SAD was related to lower educational attainment, lower income, greater financial aid, and lower perceived health. The relation to health status is especially important given the clear link between cannabis use and health problems such as lung cancer, sexually transmitted disease, and impaired reproduction capacity (Berthiller et al., 2008; Hall et al., 1994; Han et al., 2010). SAD was also related to higher rates of mood disorders, other anxiety disorders, psychotic disorders, and Axis II disorders. It is especially noteworthy that the co-occurrence of SAD was related to other substance dependence, but not other substance abuse, suggesting that people with SAD appear vulnerable to more severe substance-related problems when they use other (non-cannabis) substances as well. This is consistent with prior work finding SAD to be related to alcohol dependence but not alcohol abuse (Buckner et al., 2008a; Buckner et al., 2008b) and extends this finding to other types of substance dependence.

Among those with SAD, co-occurring CUD was associated with less educational attainment, less likelihood of being married, greater reliance on financial assistance, and greater use of other substances. Further, co-occurring CUD was related to greater likelihood of experiencing other SUDs, bipolar I disorder, other anxiety disorders, psychotic disorders, and Axis II disorders. This is not surprising given that CUD tends to be related to some of these disorders (Agosti et al., 2002). However, CUD was not related to unipolar depressive disorders, suggesting that the observed relationship between CUD and SAD does not appear to be due to co-occurring depression.

One surprising finding was that CUD-SAD individuals were more likely to be employed than those with SAD and no CUD. A possible explanation is that these individuals use cannabis to manage their anxiety enough to allow them to enter social situations (in this case, employment settings) they might have otherwise avoided. Such improved social functioning, however, is inconsistent with higher rates of financial assistance and lower rates of marriage in these respondents.

Our findings have several clinical implications. Clinicians should be encouraged to assess for and attend to co-occurring SAD during CUD treatment. Similarly, cannabis use and cannabis-related problems should be assessed during SAD treatment. Further, given that respondents with CUD-SAD reported using alcohol as well as cannabis to manage their social fears, these patients may benefit from monitoring of alcohol use and acquiring skills to help them more effectively manage their social anxiety. In fact, greater anxiety at termination of treatment for CUD predicts greater post-treatment cannabis use and cannabis-related problems (Buckner and Carroll, 2010), suggesting that these patients may especially benefit from skills to help them better manage negative affect to prevent relapse.

Results should be viewed in light of limitations. The cross-sectional nature limits our ability to delineate causal relations. Age-of-onset data were based on retrospective recall and additional prospective work is necessary. All data relied on self-report during a clinical interview, and future work could benefit from multi-method, multi-informant approach. Our reliance on retrospective recall may be particularly problematic given poorer recall among cannabis users (Battisti et al., 2010). Also, some constructs were assessed using single items, and additional work using reliable multi-item assessments is necessary. It is also noteworthy that obsessive-compulsive disorder and PTSD were not assessed in the NESARC. Patients seeking CUD treatment report comparable levels of obsessive-compulsive tendencies and interpersonal sensitivity (Copeland et al., 2001), suggesting the need to examine whether observed relations between SAD and CUD remain after controlling for these variables. Although other studies found respondents with cannabis dependence to endorse higher rates of SAD than PTSD (Agosti et al., 2002), replication with more recent data is warranted.

Similarly, the present data were collected in 2001–2002. Given observed increases in marijuana use (Substance Abuse and Mental Health Services Administration, 2010), replication with more recent data is necessary to confirm study findings.

Acknowledgments

Role of Funding Source

Funding for this study was provided by NIH Grants DA019606, DA020783, DA023200 and MH076051 (Dr. Blanco), and by the New York State Psychiatric Institute (Drs. Blanco and Schneier). NIMH had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication.

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Table 1

Associations between Lifetime Cannabis Abuse and Cannabis Dependence with Other Lifetime Psychiatric Disorders

Other psychiatric disorders	Cannabis Abuse n=2767; %=84.67		Cannabis Dependence n=530; %=15.33		OR	95% CI	Frequency (%total sample)
	%	SE	%	SE			
Social Anxiety Disorder	8.52	0.69	21.31	2.34	2.91	2.1 4.03	4.97
Other Anxiety Disorder *	23.90	1.03	43.27	2.67	2.43	1.88 3.14	14.87
GAD	6.95	0.57	20.76	2.59	3.51	2.46 5.00	4.14
Panic Disorder	9.68	0.75	22.44	2.31	2.7	1.97 3.7	5.07
Specific Phobia	14.58	0.90	27.18	2.86	2.19	1.58 3.04	9.39
Nicotine Dependence	48.25	1.23	69.64	2.58	2.46	1.92 3.15	17.72
Alcohol Use Disorder	80.34	0.97	87.99	1.78	1.79	1.26 2.55	30.28
Other Drug Use Disorder **	37.17	1.19	56.80	2.55	2.22	1.77 2.78	5.27
Any Mood Disorder	33.22	1.16	56.95	2.85	2.66	2.06 3.43	18.33
Psychotic Disorder	2.23	0.38	4.98	1.41	2.3	1.13 4.68	0.78
Any Personality Disorder	31.26	1.14	61.52	2.63	3.52	2.77 4.47	14.80
Conduct Disorder	2.00	0.33	2.74	0.90	1.39	0.65 2.95	1.05
Pathological Gambling	1.38	0.28	1.99	0.62	1.45	0.66 3.19	0.42

Note. Cannabis abuse was the reference group. Predictors were entered simultaneously to identify unique predictors of CUD. Bolded ORs and CIs illustrate significant relationships.

* Other Anxiety Disorder includes GAD, Panic Disorder, and Specific Phobia.

** Other drug use disorders include sedative, tranquilizer, opioid, amphetamine, cocaine, hallucinogen, inhalant/solvent, heroin, and other drugs (excluding cannabis, alcohol, and nicotine).

Table 2

Hierarchical Logistic Regression Model of the Relationship Between Social Anxiety Disorder and Lifetime Cannabis Abuse And Cannabis Dependence after Controlling for Demographic and Psychiatric Variables.

	Cannabis Abuse		Cannabis Dependence			
	n=2767		n=530			
	%	SE	%	SE	AOR	95% CI
Step 1						
Sex (% male)	67.16	1.08	64.55	2.52	1.03	0.80 1.32
Race (% White)	78.29	1.23	73.78	2.12	0.77	0.59 1.00
Step 2						
Nicotine Dependence	48.25	1.23	69.64	2.58	1.81	1.39 2.35
Alcohol Use Disorder	80.34	0.97	87.99	1.78	1.33	0.90 1.97
Other Drug Use Disorder	37.17	1.19	56.80	2.55	1.65	1.29 2.10
Any Mood Disorder	33.22	1.16	56.95	2.85	1.54	1.14 2.09
Psychotic Disorder	2.23	0.38	4.98	1.41	0.90	0.41 1.96
Any Personality Disorder	31.26	1.14	61.52	2.63	2.19	1.67 2.86
Other Anxiety Disorder*	23.90	1.03	43.27	2.67	1.37	1.00 1.86
Conduct Disorder	2.00	0.33	2.74	0.90	1.82	0.73 4.49
Pathological Gambling	1.38	0.28	1.99	0.62	0.85	0.38 1.87
Step 3						
Social Anxiety Disorder	8.52	0.69	21.31	2.34	1.58	1.06 2.34

Note. Cannabis abuse served as the reference group in these analyses. Bolded AORs and CIs illustrate significant relationships.

* Other Anxiety Disorder includes GAD, Panic Disorder, and Specific Phobia.

Table 3

Years from first marijuana use to CUD onset (age of CUD onset - age of first marijuana use)

Social Anxiety Disorder vs. Other Anxiety Disorder*						
Social Anxiety Disorder(ref)			Other Anxiety Disorder*			
	M	SE	M	SE	F	p
Entire Sample	2.22	0.23	2.66	0.20	2.39	0.1268
Women Only	2.00	0.33	2.18	0.27	0.20	0.6599
Men Only	2.38	0.30	3.06	0.27	2.90	0.0934

* Includes GAD, Panic Disorder, and Specific Phobia (without co-occurring SAD).

Table 4

Characteristics of Individuals with Lifetime Cannabis Use Disorder (CUD) and Social Anxiety Disorder (SAD), with and without Comorbid CUD-SAD

	CUD-SAD n = 340 (7.1%)			SAD no CUD n = 1643 (32.6%)			CUD no SAD n = 2957 (60.4%)				
	%	SE		%	SE		%	95% CI	SE	OR	95% CI
Gender (Male)	58.8	3.4	36.5	1.4	2.5	1.8	3.4	67.7	1.1	0.7	0.5 0.9
Age group											
18–29 years old	30.0	3.2	20.3	1.2	1.0	1.0	1.0	31.6	1.1	1.0	1.0 1.0
30–44 years old	40.6	3.4	31.7	1.5	0.9	0.6	1.3	42.7	1.1	1.0	0.7 1.4
45–64 years old	29.3	3.1	36.3	1.4	0.6	0.4	0.8	25.3	1.0	1.2	0.8 1.8
65+ years old	0.1	0.1	11.8	0.8	0.0	0.0	0.1	0.4	0.1	0.3	0.0 2.7
Race/ethnicity											
White	77.9	2.7	78.4	1.6	1.0	1.0	1.0	77.6	1.2	1.0	1.0 1.0
Black	8.9	1.6	7.4	0.8	1.2	0.8	1.9	9.7	0.7	0.9	0.6 1.4
Native American	4.8	1.6	3.4	0.6	1.4	0.7	3.0	3.8	0.5	1.3	0.6 2.6
Asian	0.7	0.4	3.4	0.9	0.2	0.1	0.8	1.5	0.3	0.5	0.1 1.8
Hispanic	7.8	1.7	7.4	0.8	1.1	0.6	1.8	7.4	0.8	1.0	0.7 1.7
Urban Residence	75.7	3.8	74.3	2.2	1.1	0.8	1.5	80.9	1.8	0.7	0.5 1.1
Education											
< High school	21.2	2.6	13.6	1.1	1.5	1.1	2.2	12.3	0.8	1.9	1.3 2.6
High school	24.4	2.6	33.2	1.6	0.7	0.5	1.0	28.9	1.1	0.9	0.7 1.3
College	54.4	3.0	53.1	1.7	1.0	1.0	1.0	58.9	1.2	1.0	1.0 1.0
Individual income											
\$0–\$19,999	52.4	3.2	52.6	1.7	1.1	0.6	2.1	42.3	1.3	2.5	1.3 4.7
\$20,000–\$34,999	26.9	2.8	22.7	1.3	1.3	0.7	2.6	23.7	1.0	2.3	1.1 4.4
\$35,000–\$69,999	15.8	2.3	19.3	1.4	0.9	0.5	1.8	24.4	1.0	1.3	0.6 2.6
\$70,000	4.8	1.4	5.3	0.7	1.0	1.0	1.0	9.6	0.8	1.0	1.0 1.0
Family income											
\$0–\$19,999	31.4	3.5	25.6	1.3	1.2	0.8	1.8	21.4	0.9	1.8	1.2 2.7
\$20,000–\$34,999	20.4	2.6	19.2	1.2	1.0	0.7	1.6	19.4	0.9	1.3	0.8 2.0
\$35,000–\$69,999	26.6	3.1	34.3	1.5	0.8	0.5	1.2	33.1	1.0	1.0	0.6 1.5
\$70,000	21.6	2.9	20.8	1.3	1.0	1.0	1.0	26.2	1.3	1.0	1.0 1.0

	CUD-SAD n =340 (7.1%)			SAD no CUD n =1643 (32.6%)			CUD no SAD n =2957 (60.4%)					
	%	SE		%	SE		%	SE				
Marital status												
Married	51.3	3.4	61.9	1.4	0.6	0.4	0.9	54.5	1.1	1.0	0.7	1.4
Divorced/separated/widowed	20.6	2.5	17.3	1.0	0.9	0.6	1.3	15.3	0.8	1.5	1.0	2.1
Never married	28.1	3.2	20.7	1.3	1.0	1.0	1.0	30.2	0.9	1.0	1.0	1.0
Employed	71.6	3.2	61.7	1.5	1.6	1.1	2.2	77.9	0.9	0.7	0.5	1.0
Financial aid	21.2	2.6	12.5	0.9	1.9	1.3	2.7	10.5	0.7	2.3	1.7	3.2
Perceived health status												
Excellent	21.2	3.0	20.3	1.3	0.8	0.4	1.4	25.6	1.0	0.3	0.2	0.6
Very good	31.4	3.3	30.0	1.4	0.8	0.4	1.4	34.9	1.1	0.4	0.2	0.7
Good	25.6	2.6	27.3	1.4	0.7	0.4	1.2	26.5	1.0	0.4	0.2	0.7
Fair	12.6	2.1	15.5	1.1	0.6	0.3	1.2	9.3	0.7	0.5	0.3	1.1
Poor	9.2	2.0	6.9	0.7	1.0	1.0	1.0	3.7	0.4	1.0	1.0	1.0
Non-cannabis substance use*												
Alcohol	337	98.8 (0.7)	1424	86.6 (1.1)	12.8	3.9	41.6	2905	98.5 (0.3)	1.3	0.4	4.3
Nicotine	272	82.4 (2.6)	787	47.9 (1.5)	5.1	3.4	7.6	2293	79.8 (1.0)	1.2	0.8	1.7
Non-cannabis drug*	256	74.3 (2.9)	257	16.2 (1.2)	15.0	10.4	21.6	1936	66.8 (1.2)	1.4	1.1	2.0

Note. SAD without CUD and CUD without SAD were reference groups (compared to CUD-SAD). Bolded ORs and CIs illustrate significant relationships.

* Non-cannabis drug includes sedative, tranquilizer, opioid, amphetamine, cocaine, hallucinogen, inhalant/solvent, heroin, and other drugs (excluding cannabis).

Comorbid disorders	CUD-SAD			SAD no CUD (ref)			CUD no SAD (ref)										
	n=340 (7.07%)			n=1643(32.6%)			n =2957 (60.37%)										
	%	SE		%	SE		%	SE		%	SE		%	SE		%	SE
Obsessive-Compulsive	44.29	3.39		29.79	1.32	1.87	1.39	2.52	11.94	0.70	5.86	4.36	7.88				
Paranoid	37.03	3.38		20.32	1.32	2.31	1.67	3.18	7.92	0.58	6.84	4.92	9.50				
Schizoid	23.81	2.84		16.17	1.02	1.62	1.14	2.30	5.47	0.53	5.40	3.73	7.82				
Histrionic	16.13	2.54		6.28	0.72	2.87	1.84	4.48	4.70	0.44	3.90	2.60	5.86				
Antisocial	30.68	3.26		7.04	0.71	5.84	3.94	8.68	17.48	0.91	2.09	1.51	2.90				

Note. Bolded ORs and CIs illustrate significant relationships.

* Compared to SAD-CUD group

** Other drug includes sedative, tranquilizer, opioid, amphetamine, cocaine, hallucinogen, inhalant/solvent, heroin, and other drugs (excluding cannabis).