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SOCIAL ANXIETY DISORDER AND MARIJUANA USE PROBLEMS: THE MEDIATING ROLE OF MARIJUANA EFFECT EXPECTANCIES

Julia D. Buckner, Ph.D.[1,*] and **Norman B. Schmidt, Ph.D.**[2]

[1]Department of Psychology, Louisiana State University, Baton Rouge, Los Angeles

[2]Department of Psychology, Florida State University, Tallahassee, Florida

Abstract

Background: Individuals with social anxiety disorder (SAD) appear particularly vulnerable to marijuana-related problems. Yet, mechanisms underlying this association are unclear.

Methods: This study examined the role of marijuana effect expectancies in the relation between SAD and marijuana problems among 107 marijuana users (43.0% female), 26.2% of whom met Diagnostic and Statistical Manual for Mental Disorders—Fourth Edition criteria for SAD. Anxiety and mood disorders were determined during clinical interviews using the Anxiety Disorders Interview Schedule—IV-L (ADIS-IV).

Results: Analyses (including sex, marijuana use frequency, major depressive disorder, and other anxiety disorders) suggest that SAD was the only disorder significantly associated with past 3-month marijuana problems. Compared to those without SAD, individuals with SAD were more likely to endorse the following marijuana expectancies: cognitive/behavioral impairment and global negative expectancies. Importantly, these expectancies mediated the relations between SAD status and marijuana problems.

Conclusions: These data support the contention that SAD is uniquely related to marijuana problems and provide insight into mechanisms underlying this vulnerability.

Keywords

social anxiety disorder; social phobia; marijuana; cannabis; expectancies

INTRODUCTION

Individuals with social anxiety disorder (SAD) suffer not only from the distress and impairment related to their disorder, but from a wide range of associated problems.[1-4] Recently, researchers have identified that individuals with SAD appear particularly vulnerable to marijuana-related problems. To illustrate, data from the National Comorbidity Study suggest that individuals with SAD are *7 times* more likely to experience marijuana dependence relative to the general population[5] and undergraduates with higher social anxiety appear to be particularly vulnerable to marijuana problems and symptoms of marijuana use disorder (MUD).[6-9] In a longitudinal investigation, adolescents with SAD were nearly 5 times more likely to develop marijuana dependence as young adults compared to adolescents without SAD.[10] This relation remained even after controlling for a wide array of relevant Axis I psychopathology (other anxiety disorders, depression, and externalizing disorders). No other

*Correspondence to: Julia D. Buckner, Department of Psychology, Louisiana State University, 236 Audubon Hall, Baton Rouge, LA 70803, USA. jbuckner@lsu.edu.

mood or anxiety disorder remained significantly related to subsequent marijuana dependence, suggesting that SAD may serve as an important risk factor for marijuana problems.

The high rate of marijuana-related problems among those with SAD is not trivial given that many marijuana-related problems are quite serious. To illustrate, smoking marijuana has been found to have a larger effect on respiratory function than tobacco,[11,12] including cellular changes that may serve as a risk factor for cancer.[13,14] Driving under the influence of marijuana is linked to greater accident risk[15] and marijuana use is prospectively related to academic underachievement.[16] In fact, approximately 28% current marijuana users in the US exhibit marijuana-related problems significant enough to warrant a diagnosis of MUD. [17]

Despite the emerging evidence of a SAD–marijuana problems link, we know of no studies that have examined the mechanisms underlying the high rates of marijuana problems among those with SAD. One promising area is that of marijuana effect expectancies, or expectations regarding the effects of marijuana. Expectations about the effects of substances are thought to be important predictors of substance use.[18] In fact, alcohol outcome expectancies serve as a consistently strong predictor of problematic alcohol use.[19] Although much less empirical work has examined marijuana effect expectancies, accumulating data suggest that different marijuana expectancies are related to different patterns of marijuana use. To illustrate, among undergraduates, expecting positive marijuana effects has been linked to greater frequency of marijuana use, whereas expecting negative marijuana effects was negatively correlated with marijuana use frequency.[20] In a sample composed of male patients in an in-patient substance abuse treatment facility, marijuana users were more likely to endorse tension-reduction/ relaxation expectancies than past or nonusers.[21]

We know of only one study examining the role of marijuana expectancies in the relations between social anxiety and marijuana problems.[7] In this nonclinical sample, higher levels of social anxiety were unexpectedly *negatively* related to tension-reduction and social facilitation expectancies. In other words, those with higher social anxiety did not expect marijuana use to result in reduction of negative affect more so than those with low social anxiety. Among marijuana users, higher levels of social anxiety were positively related to cognitive and behavioral impairment and global negative expectancies and these expectancies mediated the social anxiety-marijuana problems link. This finding suggests that socially anxious marijuana users are more likely to expect negative consequences (e.g., behavioral impairment) from using marijuana. In the discussion, it was posited that perhaps individuals with higher social anxiety use marijuana because they *want* marijuana to impair cognitive processes (e.g., slow down rapid, anxious thoughts). Alternatively, socially anxious individuals may use marijuana to self-handicap in social situations. Consistent with the self-handicapping theory of substance use, [22] socially anxious individuals may use marijuana because they believe that others will attribute any deficits in social functioning to the effects of marijuana and not to the individual.

Although certainly feasible interpretations of these data, it may also be the case that these unexpected findings were due to methodological issues. First, the prior study used a continuous measure of social anxiety rather than examination of individuals meeting Diagnostic and Statistical Manual for Mental Disorders—Fourth Edition (DSM-IV) criteria for SAD. Second, the prior study did not control for variables related to both social anxiety and marijuana effect expectancies, which could at least partially account for observed relations. For instance, sex, frequency of marijuana use, and the cooccurrence of depression or other anxiety disorders could have an impact given their relations to social anxiety and/or marijuana effect expectancies.[1,20,23] Thus, replication would strengthen the confidence in these findings, particularly if this replication occurred among individuals with SAD and if analyses controlled for these relevant variables.

The present investigation was composed of three interrelated research aims focused on elucidating the relations between SAD, marijuana-related problems, and marijuana effect expectancies. First, we sought to replicate the finding that SAD is related to marijuana problems even after controlling for sex, major depressive disorder (MDD), and other anxiety disorders.[10] Second, given that only one known study has investigated the relations between social anxiety and marijuana effect expectancies,[7] this study sought to replicate the finding that social anxiety is related to cognitive/behavioral impairment and global negative expectancies and to extend prior work (which used a nonclinical sample) by examining these relations among individuals meeting DSM-IV criteria for SAD. We further extended prior work by examining these relations after controlling for sex, marijuana use frequency, MDD, and other anxiety disorders. Given that these variables tend to be related to SAD and/or marijuana problems,[1, 20,23] it is important to rule out the possibility that observed relationships between SAD and marijuana problems are not simply due to these relevant variables. Third, we tested whether SAD-related expectancies mediated the relation between SAD and marijuana problems. We extended the original study by conducting a very stringent test of mediation that included variables relevant to SAD and marijuana problems (sex, marijuana use frequency, MDD, and other anxiety disorders). These relations were examined in an undergraduate sample, given research suggesting that this group is particularly vulnerable to marijuana problems. For instance, nearly one-fourth of the current marijuana-using undergraduates met criteria for an MUD, with the majority of frequent users reporting significant marijuana-related problems.[24]

METHODS

PARTICIPANTS

The present sample consisted of 107 (43.0% female) undergraduates recruited through introductory psychology courses. Participants were invited to participate based on their responses on a mass screening during which they completed the *Social Interaction Anxiety Scale (SIAS)*[25] and a question assessing past 3-month marijuana use. All participants who endorsed past 3-month marijuana use were invited to participate. To promote the recruitment of participants with SAD, we oversampled for those participants scoring at or above the clinical cut-score on the SIAS.[26]

Although 110 students were interviewed, three denied lifetime marijuana use and were excluded from the study. Participants were at least 18 years of age (range = 18–22, M = 19.13, SD = 1.07). The racial and ethnic composition of the sample was as follows: 1.9% African American or Black, 0.9% American Indian, 1.9% Asian, 84.1% Caucasian or White, 4.7% Hispanic/Latino, 5.6% mixed race/ethnicity, and 0.9% “other.” See Table 1 for additional demographic information.

MEASURES

***Anxiety Disorders Interview Schedule—IV-L* (ADIS-IV)[27]—**The ADIS, a structured diagnostic interview, was used to provide the detailed coverage of the current DSM-IV anxiety and mood disorders. The ADIS-IV-L has been shown to be a reliable and valid measure of DSM-IV mood and anxiety disorders.[28] Interviews were conducted by trained clinical graduate students under the supervision of a licensed clinical psychologist (N. B. S.). In the case of comorbidity, primary diagnoses were determined by therapists ascertaining the most functionally disabling and/or distressing disorder at baseline. ADISs were reviewed during weekly team meetings with the licensed clinical psychologist. Teams used all available data, including videotapes of the clinical interviews. A consensus of team members was required to confirm the diagnoses. Percent agreement on diagnoses between clinical interviewers in our laboratory using the ADIS has been found to be over 80%.[29]

Marijuana Use Form (MUF)—The MUF is a self-report instrument that assesses marijuana use.[6] Participants reported whether they have ever used marijuana, the date of last marijuana use, and the usual frequency of marijuana use (lifetime and past month). Lifetime frequency was assessed using a 0–6 rating scale (0 = never, 3 = once or twice per month, and 6 = once or more every day). Past-month frequency was assessed using a 0–9 rating scale (0 = once per month or less, 5 = 5–6 times per month, and 9 = at least 21 times per week). This questionnaire has been used to successfully assess marijuana use behaviors.[6,7]

Marijuana Problems Scale (MPS)—The MPS is a 19-item list of negative social, occupational, physical, and personal consequences associated with marijuana use in the past 90 days.[30] Examples of problems assessed include: (1) problems between you and your partner, (2) miss days at work or miss classes, (3) financial difficulties, (4) lower productivity, and (5) feel bad about your use. Participants rate marijuana use problems on a 0–2 scale (0 = *no problem*, 1 = *minor problem*, and 2 = *serious problem*). This measure has demonstrated good reliability.[7,31,32] In the present sample, scores ranged from 0.00 to 28.00 (M = 4.63, SD = 4.74).

Marijuana Expectancies Questionnaire (MEEQ)—The MEEQ is a 48-item list of expectations regarding marijuana use.[33] The questionnaire was developed to be used by those with and without experience using marijuana. The scale is composed of six subscales: cognitive and behavioral impairment, relaxation and tension reduction, social and sexual facilitation, perceptual and cognitive enhancement, global negative effects, and craving and negative effects. Participants rate each item from 1–5 (1 = *strongly disagree*, 3 = *uncertain*, and 5 = *strongly agree*). These subscales have demonstrated adequate reliability.[7,33,34]

PROCEDURES

The study was approved by the university's institutional review board prior to data collection. On the day of their appointment, participants met a clinical interviewer individually, who obtained informed consent and administered the ADIS. ADIS interviews were videotaped to allow for review of diagnoses with a licensed clinical psychologist (N. B. S.). Eligible participants then completed the self-report measures in our laboratory using surveymonkey.com, a secure on-line data collection web site. Upon completion of the study, participants were debriefed and awarded research credit for their participation.

RESULTS

In the present sample, 26.2% met criteria for SAD, 96.2% reported past-month marijuana use, 78.3% reported at least weekly use, and 32.1% indicated daily use. Age of first marijuana use ranged from 12 to 20 (M = 15.4, SD = 1.77). Participants reported an average lifetime MUF score of 4.00 (SD = 1.22), indicating an average lifetime usage in the 1–4 times per week range. In regard to past-month use, participants reported an average MUF score of 5.24 (SD = 2.80), suggesting an average past-month usage in the 3–4 times per week range.

A hierarchical linear regression analysis was conducted to examine the unique relation between SAD and marijuana problems after accounting for sex, marijuana use frequency, and other disorders. The dependent variable was marijuana problems and predictor variables were divided into three steps in the hierarchy: (1) sex and marijuana use frequency were entered into the first step, (2) MDD, generalized anxiety disorder, obsessive–compulsive disorder, panic disorder, specific phobia, and SAD were entered in the second step, and (3) SAD status was entered in the third step. This strategy ensures that observed effects for SAD at step 3 cannot be attributed to shared variance with the variables in step 1 or 2.[35] It is important to note that in hierarchical linear regression models, the final step is composed not only of the variable or

variables entered at that step, but all variables included in lower steps in the hierarchy. As evidenced in Table 2, analyses suggest that SAD was the only disorder to remain related to marijuana problems.

To examine the relations between SAD status and marijuana effect expectancies, a multivariate analysis of covariance was conducted in which SAD status was the independent variable and MEEQ scales were dependent variables. Sex, marijuana use frequency,[1] and other disorders were entered as covariates. As evidenced in Table 3, SAD was significantly, positively related to cognitive and behavioral impairment expectancies and global negative expectancies. There was a trend for SAD to also be positively related to craving and physical effect expectancies.

The mediational roles of relevant MEEQ scores in regard to the relation between SAD status and marijuana use problems were examined using the strategy outlined by Kenny et al.[36] To provide a stringent test, all covariates (sex, marijuana frequency, and other disorders) were retained in each step of these analyses. The first requirement for mediation is a significant association between the predictor variable (SAD) and the criterion (marijuana problems) (see Table 2). The second requirement for testing mediation requires establishing a relation between the predictor and the proposed mediator (i.e., marijuana expectancy). Given that cognitive/behavioral impairment and negative expectancies were the only expectancies significantly correlated with SAD (Table 3), these were the only MEEQ scales tested. To satisfy requirement three, the proposed mediator must be associated with the criterion after controlling for the effects of the predictor. Cognitive/behavioral impairment ($\beta = .55$, $P<.001$) and negative expectancies ($\beta = .53$, $P<.001$) were both related to marijuana problems after controlling for sex, marijuana frequency, MDD, and the anxiety disorders (including SAD).

The final requirement involves evaluating the relation between the predictor and the criterion when the variance accounted for by the proposed mediator has been removed. Traditionally, when this equation yields a nonsignificant effect for the predictor, mediation is thought to have occurred. In this sample, SAD was no longer significantly related to marijuana problems after controlling for cognitive/behavioral impairment ($\beta = .08$, $P = .41$) and global negative ($\beta = .11$, $P = .23$). Sobel tests confirmed that cognitive/behavioral impairment ($z = 2.11$, $P = .03$) and global negative ($z = 2.13$, $P = .03$) expectancies mediated the relation between SAD and marijuana problems.

DISCUSSION

This study adds to the growing body of literature indicating that social anxiety and SAD are related to marijuana use problems[6-10] and contributes to our understanding of these relationships in several ways. Specifically, this study replicated prior findings suggesting that SAD is related to marijuana problems above and beyond sex differences in SAD and variance accounted for by co-occurring depression or other anxiety disorders.[10] This study also replicated in a clinical sample of participants with SAD the finding that social anxiety appears related to cognitive/behavioral impairment and global negative expectancies[7] and further extended prior work by delineating that these relations do not appear attributable to other factors related to social anxiety and/or marijuana use problems (frequency of marijuana use, depression, sex, and other anxiety disorders). Importantly, endorsement of these expectancies may at least partially explain marijuana problems among those with SAD.

The results of our hierarchical linear analyses in which SAD emerged as the only depressive or anxiety disorder related to marijuana problems support prior work in this area.[10] This finding is not trivial, as it may have important implications for the current theoretical models

[1]Analyses were repeated without marijuana frequency in the models and a similar pattern of findings was obtained.

of problematic marijuana use. For instance, a variety of substance use models including the tension-reduction model,[37] motivational models,[38] and stress-dampening models[39] posit that the use of substances to manage negative affect increases the risk of substance-related problems. In other words, these models propose that negative affect is a risk for problematic substance use. However, our data, in conjunction with prior work,[10] suggest that it may not be negative affect generally that increases the risk of problematic marijuana use, given the weak association between marijuana problems and depression and other anxiety disorders in this and one other sample.[10] Rather, it may be that *specific types* of negative affect are associated with marijuana problems, among which SAD appears to be one. Further work is necessary to determine whether substance use prevention interventions that target individuals with these specific types of high-risk negative affect may be useful in preventing the development of subsequent marijuana problems.

Interestingly, SAD was associated with cognitive/behavioral impairment and global negative expectancies and these expectancies mediated the SAD–marijuana problems relation. It is noteworthy that this finding replicated these specific meditation effects found in a nonclinical sample.[7] However, this study built upon the initial study by examining these relations in a sample of those with SAD diagnoses as well as controlling for relevant variables that could have accounted for effects found in the initial study (e.g., sex, marijuana use frequency, depression, and other anxiety disorders). As discussed in the initial study,[7] there are several possible interpretations of this finding. First, it may be that cognitive and/or behavioral impairment is actually desirable by at least some with social anxiety given that this subscale is composed of items such as Marijuana slows thinking and actions; Marijuana alters my personality; Marijuana makes reaction times slower. It may be that some individuals with SAD use marijuana because they want marijuana to slow their anxiety-induced racing thoughts, to change their personality into one less likely to receive negative evaluation, and/or so things around them seem less real (which may make them less anxiety-provoking). Unfortunately, the MEEQ does not assess the desirability of particular marijuana expectancies and future work is necessary to test this hypothesis.

An alternate interpretation lies in the self-handicapping theory of substance use.[22] It may be that because socially anxious individuals expect marijuana to produce cognitive and/or behavioral impairment, they assume that others expect marijuana to produce these effects as well. They may therefore use marijuana because they believe others will attribute inappropriate or embarrassing behaviors to the effects of marijuana, not to a flaw in their personality. There is good reason to believe that marijuana users with SAD may be particularly vulnerable to self-handicapping. For instance, social anxiety has been linked to self-handicapping behaviors and it is thought that such self-handicapping may serve as an impression management strategy.[40,41] Marijuana use may be another way socially anxious individuals self-handicap in an effort to manage how others view/judge them. However, given that the MEEQ assesses “what you think about marijuana, regardless of what other people might think,” future work is also necessary to determine whether socially anxious individuals believe that others will judge them less negatively when under the influence of marijuana.

Consistent with prior work,[7] SAD was not related to tension-reduction/relaxation marijuana expectancies among marijuana users. This seemingly unexpected finding is less unexpected when considered in light of the social anxiety–alcohol literature. Although some prior studies have found social anxiety to be linked to general tension-reduction alcohol expectancies,[42,43] these expectancies have not been found to moderate or mediate the relation between social anxiety and alcohol use.[44] Rather, the expectation that alcohol use will reduce anxiety *in social situations* is related to greater alcohol consumption among those with higher social anxiety.[45] Future work examining situational specificity of marijuana expectancies could similarly elucidate the role of tension-reduction marijuana expectancies in social anxiety.

That marijuana users do not endorse tension-reduction marijuana expectancies seems contrary to prior work in which higher social anxiety was related to greater coping motives for marijuana use (i.e., using marijuana to cope with negative affect).[6] Yet, although coping motives may be related to tension-reduction expectancies, there are meaningful differences. First, expectancies are anticipated effects of marijuana, whereas motives are reasons for using. Thus, it is conceivable that individuals with social anxiety report that they use marijuana to manage negative affect (i.e., endorse coping motives) although they do not really expect it to help them relax or feel calm (i.e., do not endorse tension-reduction expectancies). Second, examination of the items on the marijuana motives measures (MMM)[46] and the tension-reduction subscale of the MEEQ suggests that these measures may actually tap slightly different constructs. The MMM coping motives scale is composed of the following items: I use marijuana to forget my worries, because it helps me when I feel depressed or nervous, to cheer me up when I am in a bad mood, because I feel more self-confident and sure of myself, and to forget about my problems. The MEEQ tension-reduction subscale is composed of the following items: I get a sense of relaxation from smoking marijuana, Smoking marijuana makes me less tense or relieves anxiety, it helps me to unwind, Marijuana makes me carefree and I do not care about my problems as much, When I smoke marijuana I do not feel insecure, I am not concerned about how others evaluate me when I am on marijuana, Marijuana makes it easier to escape from problems and responsibilities, Marijuana makes me calm, and I am more relaxed in social situations if I've been smoking marijuana. The MMM does not ask specifically about using marijuana to manage negative affect while in social situations, whereas the MEEQ scale is composed of several items concerning evaluations from others, social situations, etc. Thus, it may be that individuals with social anxiety use marijuana to manage negative affect alone (i.e., before or after a social situation or even to avoid a social situation), but do not expect marijuana to help manage anxiety in the presence of others. Future work is clearly necessary to test this hypothesis.

This study has a number of limitations that suggest the need for further work in this area. First, given the cross-sectional nature of these analyses, we cannot delineate whether cognitive/behavioral impairment expectancies occur prior to marijuana problems. Prospective work examining the temporal relations between SAD onset, marijuana expectancy development, and marijuana problems will serve as an important next step in this area. Second, self-report measures are vulnerable to biases (e.g., social desirability, memory bias) and replication using a multi-method, multi-informant approach is warranted. Third, this study examined undergraduate students. Although our data are thereby generalized to groups particularly vulnerable to marijuana-related impairment (i.e., young adults, college students),[17,24] future study is needed to examine whether the observed relations generalize to other marijuana-using populations (e.g., adolescents, older adults, young adults who do not attend university).

This study serves as an important step toward the delineation of mechanisms that may contribute to the high rates of co-occurrence between SAD and marijuana-related impairment. Our data suggest that the expectation that marijuana use will result in cognitive and behavioral impairment plays an important role in the co-occurrence of SAD and marijuana problems. Future prospective work is necessary, however, to delineate the temporal relations between SAD, marijuana problems, and marijuana expectancies to fully understand the nature of these relations. Further, additional research is necessary to continue to demarcate why some individuals with SAD abuse marijuana whereas others do not. Such work will have important implications for the prevention and treatment of this high-risk population.

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REFERENCES

1. Grant BF, Hasin DS, Blanco C, et al. The epidemiology of social anxiety disorder in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. J Clin Psychiatry 2005;66:1351–1361. [PubMed: 16420070]
2. Schneier FR, Heckelman LR, Garfinkel R, et al. Functional impairment in social phobia. J Clin Psychiatry 1994;55:322–331. [PubMed: 8071299]
3. Davidson JR, Hughes DL, George LK, et al. The epidemiology of social phobia: findings from the Duke Epidemiological Catchment Area Study. Psychol Med 1993;23:709–718. [PubMed: 8234577]
4. Stein MB, Kean YM. Disability and quality of life in social phobia: epidemiologic findings. Am J Psychiatry 2000;157:1606–1613. [PubMed: 11007714]
5. Agosti V, Nunes E, Levin F. Rates of psychiatric comorbidity among U.S. residents with lifetime cannabis dependence. Am J Drug Alcohol Abuse 2002;28:643–652. [PubMed: 12492261]
6. Buckner JD, Bonn-Miller MO, Zvolensky MJ, et al. Marijuana use motives and social anxiety among marijuana-using young adults. Addict Behav 2007;32:2238–2252. [PubMed: 17478056]
7. Buckner JD, Schmidt NB. Marijuana effect expectancies: relations to social anxiety and marijuana use problems. Addict Behav 2008;33:1477–1483. [PubMed: 18694625]
8. Buckner JD, Mallott MA, Schmidt NB, et al. Peer influence and gender differences in problematic cannabis use among individuals with social anxiety. J Anxiety Disord 2006;20:1087–1102. [PubMed: 16621436]
9. Buckner JD, Schmidt NB, Bobadilla L, et al. Social anxiety and problematic cannabis use: evaluating the moderating role of stress reactivity and perceived coping. Behav Res Ther 2006;44:1007–1015. [PubMed: 16168950]
10. Buckner JD, Schmidt NB, Lang AR, et al. Specificity of social anxiety disorder as a risk factor for alcohol and cannabis dependence. J Psychiatr Res 2008;42:230–239. [PubMed: 17320907]
11. Bloom JW, Kaltenborn WT, Paoletti P, et al. Respiratory effects of non-tobacco cigarettes. Br Med J 1987;295:1516–1518. [PubMed: 3122882]
12. Sherrill DL, Krzyzanowski M, Bloom JW, et al. Respiratory effects of non-tobacco cigarettes: a longitudinal study in general population. Int J Epidemiol 1991;20:132–137. [PubMed: 2066211]
13. Fligiel SE, Roth MD, Kleerup EC, et al. Tracheobronchial histopathology in habitual smokers of cocaine, marijuana, and/or tobacco. Chest 1997;112:319–326. [PubMed: 9266864]
14. Sarafian TA, Magallanes JA, Shau H, et al. Oxidative stress produced by marijuana smoke. An adverse effect enhanced by cannabinoids. Am J Respir Cell Mol Biol 1999;20:1286–1293. [PubMed: 10340948]
15. Ramaekers JG, Berghaus G, van Laar M, et al. Dose related risk of motor vehicle crashes after cannabis use. Drug Alcohol Depend 2004;73:109–119. [PubMed: 14725950]
16. Fergusson DM, Horwood LJ, Beautrais AL. Cannabis and educational achievement. Addiction 2003;98:1681–1692. [PubMed: 14651500]
17. Substance Abuse and Mental Health Services Administration. Results from the 2005 National Survey on Drug Use and Health: National Findings. Rockville, MD: 2006. Office of Applied Studies, NSDUH Series H-30, DHHS Publication No. SMA 06-4194
18. Stacy AW, Newcomb MD, Bentler PM. Cognitive motivation and drug use: a 9-year longitudinal study. J Abnorm Psychol 1991;100:502–515. [PubMed: 1757664]
19. Goldman, MS.; Del Boca, FK.; Darkes, J. Alcohol expectancy theory: the application of cognitive neuroscience. In: Blane, HT.; Leonard, KE., editors. Psychological Theories of Drinking and Alcoholism. Guilford; New York: 1999. p. 203-246.

20. Simons JS, Arens AM. Moderating effects of sensitivity to punishment and sensitivity to reward on associations between marijuana effect expectancies and use. Psychol Addict Behav 2007;21:409–414. [PubMed: 17874892]
21. Galen LW, Henderson MJ. Validation of cocaine and marijuana effect expectancies in a treatment setting. Addict Behav 1999;24:719–724. [PubMed: 10574312]
22. Jones EE, Berglas S. Control of attributions about the self through self-handicapping strategies: the appeal of alcohol and the role of underachievement. Pers Soc Psychol Bull 1978;4:200–206.
23. Buckner JD, Mallott MA, Schmidt NB, et al. Peer influence and gender differences in problematic cannabis use among individuals with social anxiety. J Anxiety Disord 2006;20:1087–1102. [PubMed: 16621436]
24. Caldeira KM, Arria AM, O'Grady KE, et al. The occurrence of cannabis use disorders and other cannabis-related problems among first-year college students. Addict Behav 2008;33:397–411. [PubMed: 18031940]
25. Mattick RP, Clarke JC. Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. Behav Res Ther 1998;36:455–470. [PubMed: 9670605]
26. Heimberg RG, Mueller GP, Holt CS, et al. Assessment of anxiety in social interaction and being observed by others: The Social Interaction Anxiety Scale and the Social Phobia Scale. Behav Ther 1992;23:53–73.
27. DiNardo, PA.; Brown, TA.; Barlow, DH. Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version (ADIS-IV-L). Oxford University Press; New York: 1994.
28. Brown TA, DiNardo PA, Lehman CL, et al. Reliability of DSMIV anxiety and mood disorders: implications for the classification of emotional disorders. J Abnorm Psychol 2001;110:49–58. [PubMed: 11261399]
29. Buckner, JD.; Schmidt, NB. Association for Behavioral and Cognitive Therapies Convention. Orlando, FL: 2008. Motivational enhancement therapy increases cognitive-behavior therapy utilization among non-treatment-seekers with social anxiety disorder.
30. Stephens RS, Roffman RA, Curtin L. Comparison of extended versus brief treatments for marijuana use. J Consult Clin Psychol 2000;68:898–908. [PubMed: 11068976]
31. Stephens RS, Roffman RA, Fearer SA, et al. The marijuana check-up: reaching users who are ambivalent about change. Addiction 2004;99:1323–1332. [PubMed: 15369571]
32. Buckner JD, Keough ME, Schmidt NB. Problematic alcohol and cannabis use among young adults: the roles of depression and discomfort and distress tolerance. Addict Behav 2007;32:1957–1963. [PubMed: 17258398]
33. Aarons GA, Brown SA, Stice E, et al. Psychometric evaluation of the marijuana and stimulant effect expectancy questionnaires for adolescents. Addict Behav 2001;26:219–236. [PubMed: 11316378]
34. Schafer J, Brown SA. Marijuana and cocaine effect expectancies and drug use patterns. J Consult Clin Psychol 1991;59:558–565. [PubMed: 1918560]
35. Cohen, J.; Cohen, P. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences. Lawrence Erlbaum Associates; Hillsdale, NJ: 1983.
36. Kenny, DA.; Kashy, DA.; Bolger, N. Data analysis in social psychology. In: Gilbert, DT.; Fiske, ST.; Lindzey, G., editors. The Handbook of Social Psychology. McGraw-Hill; New York: 1998. p. 233-265.
37. Conger JJ. Alcoholism: theory, problem and challenge. II. Reinforcement theory and the dynamics of alcoholism. Q J Stud Alcohol 1956;17:296–305. [PubMed: 13336262]
38. Cooper ML, Frone MR, Russell M, et al. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. J Pers Soc Psychol 1995;69:990–1005. [PubMed: 7473043]
39. Levenson RW, Sher KJ, Grossman J. Alcohol and stress response dampening: pharmacological effects, expectancy, and tension reduction. J Abnorm Psychol 1980;89:528–538. [PubMed: 7400453]
40. Ferrari JR. Procrastinators and perfect behavior: an exploratory factor analysis of self-presentation, self-awareness, and self-handicapping components. J Res Pers 1992;26:75–84.
41. Snyder CR, Smith TW, Augelli RW, et al. On the self-serving function of social anxiety: shyness as a self-handicapping strategy. J Pers Soc Psychol 1985;48:970–980. [PubMed: 3989676]

42. Tran GQ, Haaga DAF. Coping responses and alcohol outcome expectancies in alcohol abusing and nonabusing social phobics. Cogn Ther Res 2002;26:1–17.

43. Ham LS, Hope DA, White CS, et al. Alcohol expectancies and drinking behavior in adults with social anxiety disorder and dysthymia. Cogn Ther Res 2002;26:275–288.

44. Eggleston AM, Woolaway-Bickel K, Schmidt NB. Social anxiety and alcohol use: evaluation of the moderating and mediating effects of alcohol expectancies. J Anxiety Disord 2004;18:33–49. [PubMed: 14725867]

45. Tran GQ, Haaga DAF, Chambless DL. Expecting that alcohol use will reduce social anxiety moderates the relation between social anxiety and alcohol consumption. Cogn Ther Res 1997;21:535–553.

46. Simons J, Correia CJ, Carey KB, et al. Validating a five-factor marijuana motives measure: relations with use, problems, and alcohol motives. J Couns Psychol 1998;45:265–273.

TABLE 1

Demographic information for participants with (SAD+) and without (SAD−) social anxiety disorder

	SAD− (*n* = 79)		SAD+ (*n* = 28)			
	%	*M* (*SD*)	%	*M* (*SD*)	*F* or χ^2	*P*
Age		19.23 (1.03)		18.86 (1.15)	2.54	.11
Sex (female)	36.7		60.7		4.86	.03
Race (Caucasian)	83.5		85.7		0.07	.79
Frequent marijuana use	79.7		75.0		0.28	.60
Major depressive disorder	1.3		0.0		0.36	.55
Generalized anxiety disorder	0.0		3.6		2.85	.09
Obsessive–compulsive disorder	3.8		10.7		1.87	.17
Panic disorder	1.3		3.6		0.60	.44
Specific phobia	15.2		14.3		0.01	.91

Note: Frequent marijuana use was defined as once per week or greater.[7,30] Characteristics were analyzed using analysis of variance (ANOVA) models for continuous variables and χ^2 tests for nominal/categorical variables.

TABLE 2

Hierarchical linear regression analyses for marijuana problems

	ΔR^2	*t*	*B*	*SE B*	β	*P*
Step 1	.046					
Sex		−1.53	−0.72	0.47	−.15	.13
Marijuana use frequency		1.56	0.26	0.17	.15	.12
Step 2	.031					
Major depressive disorder		0.77	3.68	4.81	.08	.45
Generalized anxiety disorder		0.71	3.44	4.81	.07	.48
Obsessive–compulsive disorder		1.35	2.94	2.17	.14	.18
Panic disorder		−0.86	−3.04	3.54	−.09	.39
Specific phobia		0.06	0.09	1.40	.01	.95
Step 3	.048					
Social anxiety disorder		2.29	2.52	1.10	.23	.03

Note: Marijuana problems were measured using the *Marijuana Problems Scale*.[37] Sex was dummy coded (0 = male, 1 = female).

TABLE 3

Multivariate ANOVA for marijuana effect expectancies (MEEQ) among current users for participants with (SAD+) and without (SAD−) social anxiety disorder

MEEQ subscale	SAD− (*n* = 79)		SAD+ (*n* = 28)		*F*	*P*
	Mean[a]	*SE*	Mean[a]	*SE*		
Cognitive and behavioral impairment	29.25	0.78	35.05	1.32	9.09	.00
Relaxation and tension reduction	28.00	0.60	28.03	1.02	0.40	.53
Social and sexual facilitation	27.03	0.53	26.83	0.89	0.12	.73
Perceptual and cognitive enhancement	25.04	0.58	26.52	0.98	0.24	.63
Global negative effects	15.48	0.61	18.60	1.03	6.59	.01
Craving and physical effects	23.18	0.43	25.54	0.72	2.96	.09

[a]Means reported are estimated marginal means controlling for the effects of sex, marijuana use frequency, depression, and other anxiety disorders. ANOVA, analysis of variance; MEEQ, Marijuana Expectancies Questionnaire.