Expectancies and Marijuana Use Frequency and Severity among Young Females

Jumi Hayaki[a,b], **Claire E. Hagerty**[b], **Debra S. Herman**[b,c], **Marcel A. de Dios**[b,c], **Bradley J. Anderson**[b], and **Michael D. Stein**[b,d]

[a] Department of Psychology, College of the Holy Cross, 1 College Street, Worcester, MA 01610

[b] Butler Hospital, 345 Blackstone Boulevard, Providence, RI 02906

[c] Department of Psychiatry & Human Behavior, Warren Alpert School of Medicine, Brown University, Providence, RI 02912

[d] Department of Medicine and Community Health, Warren Alpert School of Medicine, Brown University, Providence, RI 02912

Abstract

This study examined associations between the endorsement of drug use expectancies and the frequency and severity of marijuana use in a community sample of 332 women aged 18–24 years who were not explicitly seeking treatment for their marijuana use. Participants were enrolled in a larger intervention study of motivational interviewing for various health behaviors and provided self-reports of their current and past marijuana use, marijuana abuse/dependence symptoms, and marijuana use expectancies. Marijuana use expectancies were measured using the six subscales of the Marijuana Effects Expectancy Questionnaire (MEEQ). Use frequency was defined as the number of use days in the past month, severity as the total number of DSM-IV marijuana abuse or dependence symptom criteria met. Replicating and extending prior research, expectations regarding Relaxation and Tension Reduction emerged as a robust belief in this cohort, predicting not only frequency (p<.01) but also severity (p<.01) of marijuana use in multivariate analyses. Severity of marijuana use was further predicted by expectations regarding loss of control, affective changes following marijuana use, and other aspects of emotion dysregulation (Global Negative Effects, p<.01). These findings document meaningful associations between substance related cognitions and use behavior and suggest that marijuana users who hold certain beliefs regarding marijuana use may be particularly susceptible to clinically significant problems associated with their substance use. As such, marijuana use expectancies may represent a clinical target that could be incorporated into future interventions.

Keywords

marijuana; drug use expectancies

Correspondence may be sent to: Jumi Hayaki, PhD, Department of Psychology, College of the Holy Cross, 1 College Street, Worcester, MA 01610, USA, Phone: 1 (508) 793-2612, Fax: 1 (508) 793-2709, jhayaki@holycross.edu.

1. Introduction

Marijuana is the most commonly used illicit drug among Americans aged 12 and above, with 14.4 million past month users (Substance Abuse and Mental Health Services Administration [SAMHSA], 2008). Marijuana use is associated with a number of physical and mental health consequences and adverse events including accidents and injury (Hall & Babor, 2000), executive dysfunction (Lundqvist, Jönsson, & Warkentin, 2001), respiratory disease (Taylor et al., 2002), substance abuse and dependence, psychosis (Hall & Babor, 2000), and depression and anxiety (Patton et al., 2002). Earlier age of onset is particularly associated with adverse effects; adults who first used marijuana at age 14 or younger are more likely to meet criteria for illicit substance abuse or dependence than those who first used marijuana at age 18 or older (SAMHSA, 2008). Thus, marijuana use, particularly among youth, remains a serious public health burden.

Young women constitute a previously understudied and perhaps especially vulnerable population of marijuana users. Because substance abuse has historically been considered a male problem, much of the literature has focused exclusively on men (Fattore, Altea, & Fratta, 2008). However, recent epidemiological research has revealed that the gender gap in use trends and age of initiation have begun to close for many substances (Greenfield, Manwani, & Nargiso, 2003). For marijuana specifically, rates of past month use have generally increased in the past two decades among females, especially adolescents (Wallace et al., 2002). Several researchers have argued that females carry heightened risk for the adverse physical, mental, and social consequences of substance use (e.g., Brady & Randall, 1999; Greenfield et al., 2003). As such, young females constitute a particularly high-risk marijuana group who require research attention.

1.1. Substance use expectancies

According to social learning theory, substance use expectancies are defined as beliefs regarding the anticipated effects from using substances that affect when and how much an individual engages in drug use (Jones, Corbin, & Fromme, 2001). Substance use expectancies include beliefs and attitudes toward drug use that result from a variety of sources, including social norms and influence, perceived drug effects in others, actual drug use experience, and expectations that are reciprocally reinforced and/or modified after drug exposure. Expectancies are thought to impact behavior through their effect on behavioral intentions, specifically, substance use decisions (Schafer & Brown, 1991). Although the precise association between expectancies and behavioral intentions is not fully known, preliminary research indicates that expectancies strongly predict intentions to use at least some drug classes (Skenderian, Siegel, Crano, Alvaro, & Lac, 2008; in Tidey & Rohsenow, 2009) and can, as such, pose powerful influence on substance use behavior.

Expectancies can vary in both direction and magnitude in terms of their influence on behavior. Positive expectancies involve beliefs about the desirable effects of substances that tend to increase their use, whereas negative expectancies entail beliefs about unwanted effects that, in theory, should discourage use (George et al., 1995). Firmly endorsed expectancies may be particularly salient to an individual and thus impact behavior to a larger degree than would expectancies that are less strongly endorsed. Expectancies can even influence behavior so as to override the actual physiological effect of substance use (Schafer & Brown, 1991).

Although some expectancy domains appear to span different drug classes (Simons, Correia, & Carey, 2000), others may be unique to a particular substance. To the extent that expectancies develop in part from actual drug use experience (George et al., 1995), it is important to examine expectancies that reflect beliefs about specific drugs. Preliminary

evidence from a small but growing literature indicates that expectancies demonstrate apparent utility in explaining marijuana use.

1.2. Marijuana use expectancies

Early work in the marijuana field identified several common expectancies regarding marijuana, including cognitive/behavioral impairment, relaxation/tension reduction, and social/sexual facilitation (Shafer & Brown, 1991). Much of this early work compared marijuana users and nonusers. Several studies found that beliefs about the desirable effects of marijuana use (i.e., positive expectancies) are generally associated with heavier levels of marijuana use, whereas beliefs about their undesirable effects (i.e., negative expectancies) are associated with non-use or less frequent use (Linkovich-Kyle & Dunn, 2001; Shafer & Brown, 1991). Some researchers theorize that negative expectancies may be more salient to nonusers due to their lack of experience (Galen & Henderson, 1999); never having used the drug, such individuals are unfamiliar with its positive effects and are perhaps more deterred by its purported negative effects. In contrast, marijuana users downplay the negative consequences of their substance use, believing use-related problems to be less serious and less likely to occur than do their non-using counterparts (Gaher & Simons, 2007). Further, among nonusers, changes in expectancies that reflect perceived advantages of marijuana use have been shown to predict future increased intentions to use (Skenderian et al., 2008).

Comparing marijuana users and nonusers on their beliefs regarding the anticipated effects of using marijuana is relevant in highlighting factors that promote (or protect against) *initial* use. However, because drug use expectancies can change as a function of drug exposure (George et al., 1995), expectancy research with actual users may be most useful in understanding beliefs that maintain *ongoing* drug use. In studies that have examined expectancies among experienced marijuana users, the perceived advantages of use tend to outweigh the perceived disadvantages, with greater reporting of positive than negative expectancies (Aarons, Brown, Stice, & Coe, 2001). One explanation is that positive expectancies may be more accessible in memory, thus more commonly endorsed, among current users (Linkovich-Kyle & Dunn, 2001). In some studies, marijuana users report plans to continue their use despite awareness of its negative outcomes (Hathaway, 2003), which could support the notion that they tend not to regard such outcomes as serious (Gaher & Simons, 2007). In particular, marijuana users who endorse relaxation/tension reduction or affective coping motives tend to use more frequently and experience greater psychosocial distress, more severe psychopathology, more adverse life events, and more use-related problems than those who use for social reasons (Brodbeck, Matter, Page, & Moggi, 2007; Simons et al., 2000). Further, differences between users who endorse these versus more recreational motives remain stable over a 2-year period (Brodbeck et al., 2007).

With rare exceptions, much of the literature on marijuana expectancies has focused on associations with use frequency and/or intensity (e.g., Gaher & Simons, 2007). To the extent that use frequency and intensity could be considered proxies for use severity, predictors of use days/occasions are certainly helpful in understanding the nature of substance use. However, many researchers (e.g., Bonn-Miller et al., 2007) have argued that the next line of expectancy research should instead turn to severity indicators such as the substance abuse and dependence criteria from the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV; American Psychiatric Association [APA], 1994). If endorsement of certain expectancies predicts greater use, then perhaps that heightened use frequency may, in turn, render individuals more susceptible to the clinical symptoms of problematic use. It would thus be useful to know whether endorsement of certain expectancies is indeed clinically "riskier," as has been suggested by some researchers (e.g., Zvolensky et al., 2005). If this is indeed the case, then it is possible that such beliefs could be targets for prevention efforts. This remains an empirical question.

1.3. The present study

The purpose of this study was to examine associations between endorsement of marijuana use expectancies and marijuana use frequency and severity. Unlike some prior work on marijuana use expectancies that has investigated beliefs among non-users, this study recruited a community sample of experienced, current users who did not explicitly state a desire to discontinue their use. The study also sought further to extend prior work on marijuana use expectancies (a) by identifying *specific* expectancy domains that are especially associated with a validated index of marijuana use severity, and (b) by examining these associations in young females, a historically understudied yet growing population of at-risk marijuana users.

2. Method

2.1. Participants

Participants in this study were women aged 18–24 years recruited from the community for a larger health behavioral study examining the relationship of marijuana use and sexual risk. Recruitment sites included local primary care clinics, college campuses, community health centers, and community businesses. Between 1/2005 and 5/2009, 1728 women completed a brief screening questionnaire in person or by telephone. Eligibility criteria included at least monthly marijuana use in the past 3 months, sexual activity in the past 3 months, absence of pregnancy, ability to speak English, and willingness to provide information. Although the consent form indicated that participants could be randomized to an intervention condition in which they would receive two sessions with a clinician to discuss their health behaviors, an explicitly stated commitment to reduce or quit marijuana use was not an enrollment criterion. Of those screened, 545 women were eligible for the study and invited to enroll. Of the 545 eligible women, 178 women either refused to enroll or agreed to enroll but did not keep their interview appointment and could not be reached afterwards. A comparison of enrollees and non-enrollees indicated that they did not differ statistically on age ($t_{536} = 1.91$, $p = .057$), racial background ($\chi^2 = 3.64$, df = 3, $p = .303$), or frequency of marijuana use in the past 3 months ($t_{542} = 0.35$, $p = .723$). Of the 367 women who provided informed consent, 35 were deemed ineligible for the study during the baseline assessment. A total of 332 women were fully enrolled. The current analysis uses data collected at the baseline interview.

Study approval was obtained from the Butler Hospital Institutional Review Board. In addition, a Certificate of Confidentiality was obtained from the federal government for further participant privacy.

2.2. Measures

2.2.1. Marijuana use frequency—Participants reported their marijuana use in the 90 days prior to the interview using the Timeline Followback (TLFB; Sobell & Sobell, 1995).

2.2.2. Marijuana use severity—Participants reported their marijuana use severity and associated negative consequences on the Substance Use Disorders section of the Structured Clinical Interview (SCID-I; First et al., 2002) for the DSM-IV (APA, 1994). For the purpose of this study, a single count variable was used to represent the number of combined current abuse symptoms (maximum = 4) and dependence symptoms (maximum = 7) on a continuous severity scale (e.g., Compton, Saha, Conway, & Grant, 2009; Langenbucher et al., 2004; Martin, Chung, Kirisci, & Langenbucher, 2006; Teesson, Lynskey, Manor, & Baillie, 2002).

2.2.3. Marijuana use expectancies—Marijuana use expectancies were measured using the 48-item Marijuana Effect Expectancies Questionnaire (MEEQ; Schafer & Brown, 1991). The MEEQ assesses six expectancy domains on the following subscales: Relaxation/ Tension Reduction (e.g., "Using marijuana makes me less tense or relieves anxiety; it helps me to unwind"); Social/Sexual Facilitation (e.g., "I have a better time at parties if I am using marijuana"); Perceptual/Cognitive Enhancement (e.g., "I become more creative or imaginative on marijuana"); Cognitive/Behavioral Impairment (e.g., "If I have been using marijuana, it is harder for me to concentrate and understand the meaning of what is being said"); Craving/Physical Effects (e.g., "I get the 'munchies' [craving for snacks] when I smoke"); and Global Negative Effects (e.g., "Marijuana causes me to lose control and become careless;" "After the 'high' of using marijuana, I feel down"). Each item is scored on a 5-point Likert scale (from 1 = disagree strongly to 5 = agree strongly), with subscales containing 6–10 items. The scale has good psychometric properties, including good reliability and good convergent and discriminant validity (Aarons et al., 2001).

2.3. Analytical methods

Simple descriptive statistics were computed to summarize the background characteristics of this cohort. Zero-order correlations were calculated to assess associations between marijuana use variables and the six expectancy subscales. Our choice of multivariate analytical methods was guided by careful examination of response distributions (Figure 1). Neither outcome is symmetrical or unbounded, and both exhibit a concentration of observations at the boundary. Proportion of days using marijuana is bounded at both 0 and 1; the distribution is approximately uniform distribution throughout much of the observed range with a concentration of observations with near daily use. The modal response was at the upper limit of 1.0; 33 (9.9%) participants reported daily use and 75 (22.6%) reported using marijuana on at least 95% of the TLFB days. Kieschnick and McCullough (2003) noted that such data fail to approximate the assumptions underlying the use of ordinary least squares regression and recommend the use of the fractional logit model developed by Papke and Wooldridge (1996).

Marijuana use severity (number of abuse/dependence criteria met) is a count variable with the modal category at the lower limit of 0. After evaluating these data we used negative-binomial regression to estimate the effects of selected predictors on marijuana use severity. Negative-binomial regression is often used to model count variables when distributions are overdispersed Poisson (variance > mean), as is the case here. Tests of significance and confidence interval estimates were based on robust variance estimators as implemented in Stata (StataCorp, 2007) 10.1. All continuous predictor variables were standardized to zero-mean and unit variance prior to estimation.

3. Results

Participants averaged 20.5 (± 1.8) years of age, 225 were Caucasian, 35 (10.5%) were African-American, 38 (11.4%) were Hispanic, and 34 (10.2%) were of other ethnic or racial origins (Table 1). A majority (69.9%) had at least some college education, and 96.4% had never been married. On average participants had used marijuana "regularly" for 3.9 (± 2.6) years. The mean proportion of days on which participants used marijuana was .57 (± .34). Participants met an average of 2.9 (± 2.6) current marijuana abuse/dependence criteria; 70 (21.1%) participants met no criteria. With respect to current DSM-IV (APA, 1994) clinical diagnoses, 175 (52.7%) met criteria for marijuana abuse and 131 (39.6%) for marijuana dependence; 125 (37.8%) participants did not meet diagnostic criteria for either abuse or dependence.

Zero-order correlations are reported in Table 2. Marijuana use frequency was moderately correlated with marijuana use severity (r = .50, p < .05). Marijuana use frequency was also positively associated with expectations regarding Relaxation/Tension Reduction (r = −.32, p < .05) and inversely associated with expectations regarding both Cognitive/Behavioral Impairment (r = −.26, p < .05) and Global Negative Effects (r = −.16, p < .05). Marijuana use severity was positively associated with all six expectancy subscales; the strongest correlations were with Relaxation/Tension Reduction (r = .28) and Global Negative Effects (r = .29). Although several MEEQ subscales were intercorrelated, an examination of diagnostic statistics indicated that collinearity was not problematic. Variance inflation factors ranged from 1.08 to 1.86 with a mean of 1.44, and the condition number was only 4.78.

Results of the multivariate models predicting marijuana use frequency and severity are presented in Table 3. Adjusting for other covariates included in the fractional logit model, Caucasians used marijuana less frequently than non-Caucasians (b = .53, p < .01). Frequency of marijuana use was positively associated with years of regular marijuana use (b = .19, p < .05) and the Relaxation/Tension Reduction expectancy (b = .51, p < .01) and inversely associated with the Cognitive/Behavioral Impairment expectancy (b = −.038, p < .01). In the negative-binomial regression analysis, severity of marijuana use was associated with both the Relaxation/Tension Reduction expectancy (IRR = 1.27, p < .01) and the Global Negative Effects subscale (IRR = 1.24, p < .01). Marijuana use frequency and severity were not associated significantly with any of the other predictors included in the full models (Table 3).

4. Discussion

This study examined associations between the endorsement of marijuana use expectancies and marijuana use frequency and severity in a sample of young adult females who were currently using marijuana with no explicitly stated intention to cease use. Beyond the minimum level of marijuana use required for study enrollment, this sample demonstrated a wide range of current marijuana use frequency and severity. In contrast to some prior work on marijuana use expectancies that has examined non-users, this sample consisted only of current users, thereby allowing examination of beliefs associated with varied levels of *actual*, as opposed to hypothetical, use. Also notable is the fact that this was a young female sample with an average age of regular use onset dating back almost 4 years. As such, the sample comprises a historically understudied yet growing population of marijuana users who may thus carry unique risk associated with their use (Fattore et al., 2008; Greenfield et al., 2003; Wallace et al., 2002). In addition, at least a subset of this sample represents a marijuana use group that has been identified by SAMHSA (2008) as especially likely to meet criteria for substance abuse or dependence, and much of the sample could also be deemed vulnerable to the detrimental effects of their likely continued use (Patton et al., 2007). Indeed, a majority of participants reported using marijuana on more than 50% of the past 90 days, and over 60% of the sample met criteria for a DSM-IV (APA, 1994) diagnosis of marijuana abuse, dependence, or both.

In this cohort, marijuana use frequency and severity were both correlated with many of the expectancy subscales. The observed associations between use frequency and expectations regarding Relaxation/Tension Reduction, Cognitive/Behavioral Impairment, and Global Negative Effects, corroborate previous research (e.g., Schafer & Brown, 1991), and, in particular, underscore the apparent utility of the Relaxation/Tension Reduction expectancy in explaining this feature of marijuana use. What is perhaps even more noteworthy, however, is the fact that marijuana use severity was associated with all six expectancy domains. This may indicate that, as marijuana users increasingly experience the symptoms

of problematic use, they become more aware of both its positive and negative effects. That they increasingly endorse the positive effects despite recognizing the negative effects can perhaps be attributed to the fact that they nonetheless enjoy the drug and, as was the case in this cohort, have not necessarily reached the point at which cessation is an explicitly stated desire. Indeed, acknowledgement of its undesirable effects does not mean that a marijuana user intends to stop using (Hathaway, 2003). However, strong endorsement of negative expectancies has been reported among those seeking treatment for other substance use (Rohsenow, Sirota, Martin, & Monti, 2004).

Only certain predictor variables remained significant in the multivariate analysis. The Relaxation/Tension Reduction expectancy emerged as a robust predictor of both marijuana use frequency and severity. This association supports previous reports linking this expectancy to levels of use, as well as to use-related problems and psychopathology (Brodbeck et al., 2007; Simons et al., 2000). Similar findings have been shown in studies of alcohol use expectancies in which tension reduction or affective coping motives have been commonly reported among problem drinkers (Nolen-Hoeksema, 2004), suggesting that this motive for substance use may span a number of drug classes. In fact, research indicates that coping motives are equally endorsed for alcohol and marijuana use in some samples (Simons et al., 2000). Perhaps more important than the association between coping motives and use frequency, however, is the observed association between coping motives and marijuana use severity, which had previously been speculated upon but not empirically supported. To the degree that use severity was defined by a valid and reliable index, namely, a symptom count from the DSM-IV marijuana use disorder criteria, our study is, to our knowledge, the first to demonstrate how endorsement of the Relaxation/Tension Reduction expectancy can, indeed, carry concurrent clinical validity (Zvolensky et al., 2005). Future research should investigate whether such beliefs could be addressed in treatment, as promising work in the alcohol field has preliminarily shown (Darkes & Goldman, 1998).

Despite a moderate correlation between marijuana use frequency and severity, a somewhat different pattern of findings was observed for these two predictors. Because the DSM-IV (APA, 1994) marijuana use disorder criteria do not specify frequency of use, severity will not entirely overlap here in terms of associations with expectancy domains. In this study, expectations of Cognitive/Behavioral Impairment significantly predicted lesser marijuana use frequency, as has been demonstrated in past research on marijuana (Aarons et al., 2001; Schafer & Brown, 1991) and on other substances (e.g., Fromme & D'Amico, 2000; Hayaki, Anderson, & Stein, 2008). In contrast, expectations of Global Negative Effects, rather than of Cognitive/Behavioral Impairment, predicted greater marijuana use severity in this cohort.

One explanation for this apparent discrepancy is that the MEEQ Cognitive/Behavioral Impairment subscale measures cognitive deficits that are easily recognizable by any individual who uses a critical mass of marijuana (e.g., "If I have been using marijuana, it is harder for me to concentrate and understand the meaning of what is being said"). In contrast, the MEEQ Global Negative Effects subscale (e.g., "Marijuana causes me to lose control and become careless;" "After the 'high' of using marijuana, I feel down") arguably assesses expectations regarding loss of control, affective changes following marijuana use, and other aspects of *emotion* dysregulation that perhaps represent a higher order level of clinical severity that only appears in more serious cases. As a result, it is possible that this expectancy drives use severity but not use frequency. If it is indeed the case that different expectancy domains predict different characteristics of marijuana use, as the findings from this study suggest, then such an interpretation would justify the continued inclusion of both frequency and clinical severity indicators in future research on marijuana use expectancies. Indeed, one might argue that the association between marijuana-related beliefs and use behavior is most meaningful in the detection of clinically problematic use that could require

intervention. However, as no empirical precedent exists for this finding, continued research is necessary.

This study has some limitations. First, the present cohort consisted exclusively of young adult women, thereby limiting external validity. Although young persons, and perhaps young women in particular, do appear to constitute an especially high-risk marijuana group (SAMHSA, 2008), future work should also extend findings regarding expectancies and their behavioral correlates to other populations. Second, all data are based on self-report. However, exclusive use of self-report is common in other studies of substance use expectancies including those for marijuana (e.g., Aarons et al., 2001), and research indicates that cannabis abuse and dependence symptoms (including physiological dependence) are reliably self-reported by both treatment and general population samples (Mennes, Abdallah, & Cottler, 2009). A final limitation is the cross-sectional study design, which precludes conclusions regarding causality. Due to the reciprocal association between substance use and expectancies (George et al., 1995), the expectancies endorsed by this sample are likely part antecedent, part product, of their substance use.

This study has documented associations between expectations regarding the effects of marijuana use and two distinct and meaningful substance use outcomes, namely, marijuana use frequency and severity. In contrast to some prior work on marijuana use expectancies, this study has examined beliefs regarding the consequences of marijuana use among experienced, current users who did not explicitly report a plan to quit use. The results confirm the role of expectations regarding relaxation/tension reduction in marijuana use and extend prior work by documenting these associations with a meaningful measure of clinical severity. In addition, this study indicates that endorsing expectations regarding the global negative emotional effects of marijuana use may be particularly associated with problematic marijuana use, thereby suggesting potential targets for future interventions. Continued future work on marijuana use expectancies, particularly involving longitudinal designs, is necessary further to elucidate the impact of substance-related beliefs on use behavior.

Acknowledgments

References

Aarons GA, Brown SA, Stice E, Coe MT. Psychometric evaluation of the marijuana and stimulant effect expectancy questionnaires for adolescents. Addictive Behaviors 2001;26:219–236. [PubMed: 11316378]

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: Author; 1994.

Bonn-Miller MO, Zvolensky MJ, Bernstein A. Marijuana use motives: Concurrent relations to frequency of past 30-day use and anxiety sensitivity among young adult marijuana smokers. Addictive Behaviors 2007;32:49–62. [PubMed: 16647822]

Brady KT, Randall CL. Gender differences in substance use disorders. Psychiatric Clinics of North America 1999;22:241–252. [PubMed: 10385931]

Brodbeck J, Matter M, Page J, Moggi F. Motives for cannabis use as a moderator variable of distress among young adults. Addictive Behaviors 2007;32:1537–1545. [PubMed: 17178197]

Compton WM, Saha TS, Conway KP, Grant BF. The role of cannabis use within a dimensional approach to cannabis use disorders. Drug and Alcohol Dependence 2009;100:221–227. [PubMed: 19062204]

Darkes J, Goldman MS. Expectancy challenge and drinking reduction: Process and structure in the alcohol expectancy network. Experimental and Clinical Psychopharmacology 1998;6:64–76. [PubMed: 9526147]

Fattore L, Altea S, Fratta W. Sex differences in drug addiction: A review of animal and human studies. Women's Health (London England) 2008;4:51–65.

First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JB. Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition. (SCID-I/P). New York, NY: Biometrics Research, New York State Psychiatric Institute; 2002.

Fromme K, D'Amico EJ. Measuring adolescent alcohol outcome expectancies. Psychology of Addictive Behaviors 2000;14:206–212. [PubMed: 10860120]

Gaher RM, Simons JS. Evaluations and expectancies of alcohol and marijuana problems among college students. Psychology of Addictive Behaviors 2007;21:545–554. [PubMed: 18072837]

Galen LW, Henderson MJ. Validation of cocaine and marijuana effect expectancies n a treatment setting. Addictive Behaviors 1999;24:719–724. [PubMed: 10574312]

George WH, Frone MR, Cooper ML, Russell M, Skinner JB, Windle M. A revised Alcohol Expectancy Questionnaire: Factor structure confirmation and invariance in a general population sample. Journal of Studies on Alcohol 1995;56:177–185. [PubMed: 7760564]

Greenfield SF, Manwani SG, Nargiso JE. Epidemiology of substance use disorders in women. Obstetrics & Gynecology Clinics of North America 2003;30:413–446. [PubMed: 14664320]

Hall W, Babor TF. Cannabis use and public health: Assessing the burden. Addiction 2000;95:485–490. [PubMed: 10829325]

Hathaway AD. Cannabis effects and dependency concerns in long-term frequent users: A missing piece of the public health puzzle. Addiction Research & Theory 2003;11:441–458.

Hayaki J, Anderson BJ, Stein MD. Drug use expectancies among nonabstinent community cocaine users. Drug and Alcohol Dependence 2008;94:109–115. [PubMed: 18078722]

Kieschnick R, McCullough BD. Regression analysis of variates observed on (0, 1): Percentages, proportions, and fractions. Statistical Modelling 2003;3:193–213.

Langenbucher JW, Labouvie E, Martin CS, Sanjuan PM, Bavly L, Kirisci L, Chung T. An application of item response theory analysis to alcohol, cannabis, and cocaine criteria in DSM-IV. Journal of Abnormal Psychology 2004;113:72–80. [PubMed: 14992659]

Linkovich-Kyle TL, Dunn ME. Consumption-related differences in the organization and activation of marijuana expectancies in memory. Experimental and Clinical Psychopharmacology 2001;9:334–342. [PubMed: 11534544]

Lundqvist T, Jönsson S, Warkentin S. Frontal lobe dysfunction in long-term cannabis users. Neurotoxicology and Teratology 2001;23:437–443. [PubMed: 11711246]

Martin CS, Chung T, Kirisci L, Langenbucher JW. Item response theory analysis of diagnostic criteria for alcohol and cannabis use disorders in adolescents: Implications for DSM-V. Journal of Abnormal Psychology 2006;115:807–814. [PubMed: 17100538]

Mennes CE, Abdallah AB, Cottler LB. The reliability of self-reported cannabis abuse, dependence and withdrawal symptoms: Multisite study of differences between general population and treatment groups. Addictive Behaviors 2009;34:223–226. [PubMed: 19004561]

Nolen-Hoeksema S. Gender differences in risk factors and consequences for alcohol use and problems. Clinical Psychology Review 2004;24:981–1010. [PubMed: 15533281]

Papke LE, Wooldridge JM. Econometric methods for fractional response variables with an application to 401(k) plan participation rates. Journal of Applied Econometrics 1996;11:619–632.

Patton GC, Coffey C, Carlin JB, Degenhardt L, Lynskey M, Hall W. Cannabis use and mental health in young people: Cohort study. British Medical Journal 2002;325:1195–1198. [PubMed: 12446533]

Patton GC, Coffey C, Lynskey MT, Reid S, Hemphill S, Carlin JB, Hall W. Trajectories of adolescent alcohol and cannabis use into young adulthood. Addiction 2007;102:607–615. [PubMed: 17286642]

Rohsenow DJ, Sirota AD, Martin RA, Monti PM. The cocaine effects questionnaire for patient populations: Development and psychometric properties. Addictive Behaviors 2004;29:537–553. [PubMed: 15050672]

Schafer J, Brown SA. Marijuana and cocaine effect expectancies and drug use patterns. Journal of Consulting & Clinical Psychology 1991;59:558–565. [PubMed: 1918560]

Simons J, Correia CJ, Carey KB. A comparison of motives for marijuana and alcohol use among experienced users. Addictive Behaviors 2000;25:153–160. [PubMed: 10708331]

Skenderian JJ, Siegel JT, Crano WD, Alvaro EE, Lac A. Expectancy change and adolescents' intentions to use marijuana. Psychology of Addictive Behaviors 2008;22:563–569. [PubMed: 19071982]

Sobell, LC.; Sobell, MB. Alcohol Timeline Followback Users' Manual. Toronto, Canada: Addiction Research Foundation; 1995.

StataCorp. Stata Statistical Software: Release 10. College Station, TX: StataCorp LP; 2007.

Substance Abuse and Mental Health Services Administration. DHHS Publication No. SMA 08–4343. Rockville, MD: U.S. Government Printing Office; 2008. Results from the 2007 National Survey on Drug Use and Health: National findings.

Taylor DR, Fergusson DM, Milne BJ, Horwood LJ, Moffitt TE, Sears MR, Poulton R. A longitudinal study of the effects of tobacco and cannabis exposure on lung function in young adults. Addiction 2002;97:1055–1061. [PubMed: 12144608]

Teesson M, Lynskey M, Manor &, Baillie A. The structure of cannabis dependence in the community. Drug and Alcohol Dependence 2002;68:255–262. [PubMed: 12393220]

Tidey JW, Rohsenow DJ. Smoking expectancies and intention to quit in smokers with schizophrenia, schizoaffective disorder and non-psychiatric controls. Schizophrenia Research 2009;115:310–316. [PubMed: 19836210]

Wallace JM Jr, Bachman JG, O'Malley PM, Schulenberg JE, Cooper SM, Johnston LD. Gender and ethnic differences in smoking, drinking and illicit drug use among American 8th, 10th, and 12th grade students, 1976–2000. Addiction 2003;98:225–234. [PubMed: 12534428]

Zvolensky MJ, Schmidt NB, Antony MM, McCabe RE, Forsyth JP, Feldner MT, Leen-Feldner E, Karekla E, Kahler CW. Evaluating the role of panic disorder in emotional sensitivity processes involved with smoking. Journal of Anxiety Disorders 2005;19:673–686. [PubMed: 15927780]
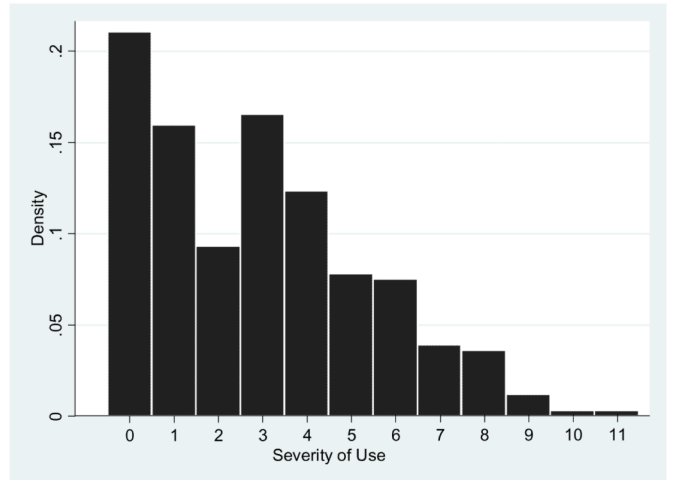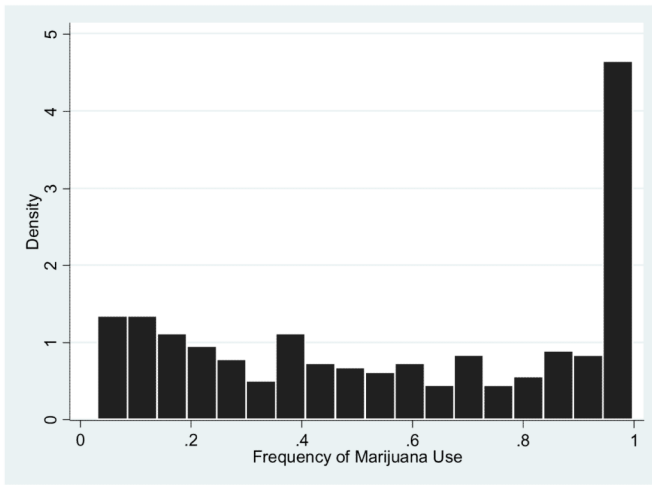
Figure 1.
Observed Distributions of Response Variables.

Table 1

Background Characteristics and Descriptive Statistics (n = 332).

	Mean (± SD)	Median	Range
Age (Years)	20.47 (1.78)	20.0	18 – 24
Years Regular Marijuana User	3.92 (2.58)	4.0	0 – 15
Frequency of Marijuana Use (proportion MJ use days)	0.57 (0.34)	0.57	0.03 – 1.00
Severity of Marijuana Use (abuse/dependence symptoms)	2.92 (2.46)	3.0	0 – 11
MEEQ Relaxation/Tension Reduction (6 items)	22.54 (4.04)	23.0	9 – 30
MEEQ Social/Sexual Facilitation (9 items)	26.64 (5.43)	26.0	10 – 43
MEEQ Perceptual/Cognitive Enhancement (8 items)	23.91 (5.89)	24.0	8 – 39
MEEQ Cognitive/Behavioral Impairment (10 items)	30.44 (7.37)	31.0	10 – 48
MEEQ Craving and Physical Effects (6 items)	24.61 (3.92)	26.0	12 – 30
MEEQ Global Negative Effects (9 items)	16.51 (5.63)	16.0	9 – 38
	n (%)		
Race/Ethnicity			
Caucasian (non-Hispanic)	225 (67.7%)		
African – American	35 (10.5%)		
Hispanic	38 (11.4%)		
Other race/ethnicity	34 (10.2%)		
Some College or Degree (Yes)	232 (69.9%)		
Marital Status			
Single/Never Married	320 (96.4%)		
Married	8 (2.4%)		
Separated/Divorced	3 (0.9%)		
Living w Partner	1 (0.3%)		
Marijuana Abuse/Dependence Diagnosis			
Neither	125 (37.8%)		
Abuse Only	75 (22.7%)		
Dependence Only	31 (9.4%)		
Both Abuse and Dependence	100 (30.2%)		

Table 2

Zero-Order Product-Moment Correlations (n = 332).

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Frequency of MJ use	1.00										
2. Severity of MJ use	.50*	1.00									
3. Caucasian	.08	−.07	1.00								
4. Some College or Degree	−.14*	−.13*	.23*	1.00							
5. Years Regular MJ Use	.16*	.09	−.00	−.18*	1.00						
6. Relaxation/Tension Reduction	.32*	.28*	−.18*	−.19*	.02	1.00					
7. Social/Sexual Facilitation	.10	.20*	−.10	−.11*	−.13*	.45*	1.00				
8. Perceptual/Cognitive Enhancement	.03	.26*	.01	.01	−.13*	.40*	.54*	1.00			
9. Cognitive/Behavioral Impairment	−.26*	.16*	.05	.19*	−.13*	−.00	.12*	.36*	1.00		
10. Craving/Physical Effects	−.06	.18*	−.03	.01	−.12*	.13*	.21*	.26*	.42*	1.00	
11. Global Negative Effects.	−.16*	.29*	−.13*	.02	.03	−.01	.14*	.34*	.55*	.22*	1.00

*
p < .05

Table 3

Generalized Linear Models Predicting Frequency and Severity of Marijuana Use (n = 332).

Predictor	Frequency of Use b (95% CI)[a]	Severity of Use IRR (95% CI)[b]
Caucasian (1 = yes)	0.53** (0.18–0.88)	1.07 (0.88–1.30)
Some College or BA (1 = Yes)	−0.18 (−0.53—0.17)	0.88 (0.73–1.06)
Years Marijuana Use	0.19* (0.27–0.35)	1.08 (0.98–1.19)
Relaxation/Tension Reduction	0.51** (0.33–0.68)	1.27** (1.14–1.41)
Social and Sexual Facilitation	0.00 (−0.18–0.19)	0.98 (0.88–1.09)
Perceptual and Cognitive Enhancement	−0.01 (−0.21—0.18)	1.05 (0.95–1.18)
Cognitive and Behavioral Impairment	−0.38** (−0.60—0.16)	0.98 (0.87–1.10)
Craving and Physical Effects	0.04 (−0.13–0.21)	1.08 (0.97–1.21)
Global Negative Effects	−0.01 (−0.20—0.18)	1.24** (1.11–1.38)

*
 $p < .05$,

**
 $p < .01$

[a]Fractional logistic regression model with robust standard errors.

[b]Negative-binomial regression model with robust standard errors.