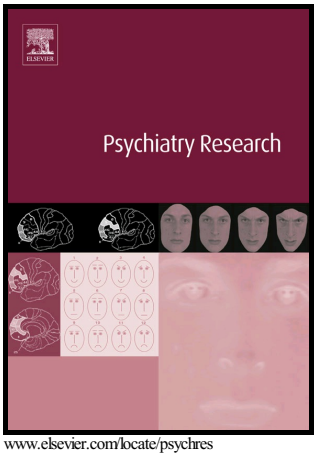
Author's Accepted Manuscript



www.elsevier.com/locate/psychres

Anxiety Sensitivity and Cannabis Use Problems, Perceived Barriers for Quitting, and Fear of Quitting

Michael J. Zvolensky, Andrew H. Rogers, Kara Manning, Julianna B.D. Hogan, Daniel J. Paulus, Julia D. Buckner, Nubia A. Mayorga, Gerald Hallford, Norman B. Schmidt

PII: S0165-1781(17)31987-X
DOI: https://doi.org/10.1016/j.psychres.2018.03.006
Reference: PSY11238

To appear in: *Psychiatry Research*

Received date: 25 October 2017
Revised date: 2 March 2018
Accepted date: 3 March 2018

Cite this article as: Michael J. Zvolensky, Andrew H. Rogers, Kara Manning, Julianna B.D. Hogan, Daniel J. Paulus, Julia D. Buckner, Nubia A. Mayorga, Gerald Hallford and Norman B. Schmidt, Anxiety Sensitivity and Cannabis Use Problems, Perceived Barriers for Quitting, and Fear of Quitting, *Psychiatry Research,* https://doi.org/10.1016/j.psychres.2018.03.006

Anxiety Sensitivity and Cannabis Use Problems, Perceived Barriers for Quitting, and Fear of Quitting

*Michael J. Zvolensky,[a,b] Andrew H. Rogers,[a]

Kara Manning,[a] Julianna B.D. Hogan,[c] Daniel J. Paulus,[a] Julia D. Buckner,[d]

Nubia A. Mayorga,[a] Gerald Hallford,[a] and Norman B. Schmidt[e]

[a] University of Houston, Department of Psychology, Houston, Texas, USA

[b] The University of Texas MD Anderson Cancer Center, Department of Behavioral Science, Houston, Texas, USA

[c] VA HSR&D Center for Innovations in Quality, Effectiveness and Safety, Michael E. DeBakey VA Medical Center, Houston, Texas, USA

[d] Louisiana State University, Department of Psychology, Baton Rouge, Louisiana, USA

[e] Florida State University, Department of Psychology, Tallahassee, Florida, USA

Abstract

Cannabis is among the most widely used psychoactive substances in the United States, and rates of cannabis use and cannabis-related problems are increasing. Anxiety sensitivity, or the fear of aversive interoceptive sensations, may be relevant to better understanding cannabis use problems and other significant cannabis use processes (e.g., beliefs about quitting). Previous research has primarily focused on the global anxiety sensitivity construct; however, anxiety sensitivity lower-order facets (Cognitive Concerns, Physical Concerns, and Social Concerns) tend to be differentially related to substance use processes in non-cannabis specific studies. The current study therefore explored anxiety sensitivity lower-order facets in relation to cannabis use problems, perceived barriers for cannabis cessation, and abstinence phobia (fear of not using cannabis) among a community sample of 203 cannabis-using adults. Results indicated that anxiety sensitivity Cognitive Concerns were significantly associated with each of the dependent measures and these effects were not explained by shared variance with the other lower-order factors or a range of other covariates (e.g., tobacco use). The present findings suggest future work may benefit from focusing on the role of anxiety sensitivity Cognitive Concerns in the maintenance of cannabis use.

Keywords: Cannabis; Barriers for Quitting; Cannabis Use; Substance Use

Anxiety Sensitivity and Cannabis Use Problems, Perceived Barriers for Quitting, and Fear of Quitting

1. Introduction

For decades, cannabis has been among the most widely used substances in the United States (U.S.) and worldwide (Johnston et al., 2013). Recent estimates suggest that past-year cannabis use in the U.S. may be greater than 13% of adults (Grucza et al., 2016) and rates of past-year cannabis use disorder are almost 3% of the general population (Hasin et al., 2016). Moreover, the prevalence of cannabis use (Compton and Baler, 2016) and the prevalence of cannabis use disorder in the U.S. has significantly increased over the past two decades (Hasin et al., 2015). Frequent cannabis use has been related to several adverse consequences, including physical health complaints and problems (e.g., respiratory symptoms and disease; Volkow et al., 2014), cognitive dysfunction (e.g., memory impairment; Solowij et al., 2002), and mental health problems (Lev-Ran et al., 2013).

Due partially to the observation that elevated psychiatric symptoms are frequently comorbid among persons with cannabis use disorder (e.g., Budney et al., 1998; Metrik et al., 2016; Stephens et al., 1993), studies have been conducted to ascertain whether psychological vulnerabilities may be relevant to better understanding cannabis use processes. Anxiety sensitivity, the fear of anxiety and related aversive internal sensations (Bernstein and Zvolensky, 2007; McNally, 2002), is one such vulnerability. Anxiety sensitivity is a relative stable cognitive predisposition that arises from genetic and social learning factors (Taylor, 1999). Theoretically and empirically, anxiety sensitivity is unique from, and demonstrates incremental validity relative to, trait anxiety (Rapee and Medoro, 1994) and neuroticism (Zvolensky et al., 2003). There is a global anxiety sensitivity construct with three lower-order factors (Zinbarg et al., 1997). The three lower-order factors index fears of adverse physical outcomes (Physical

Concerns; i.e., “I fear having a heart attack when my heart rate increases”), fears of cognitive dyscontrol (Cognitive Concerns; i.e., “I worry about losing control of my mind”), and fears of the public display of anxiety symptoms (Social Concerns; i.e., “I worry about what people think of me when my stomach growls in public”). Furthermore, these lower-order anxiety sensitivity factors differentially predict clinical outcomes, and therefore, may represent different psychological mechanisms for certain types of behavioral health problems (e.g., Eifert et al., 1999). These findings broadly suggest that the higher the level of correspondence between the particular anxiety sensitivity domain and events/experiences that closely match that fear, the more accurate the explanatory model (Schmidt, 1999).

Available studies suggest that greater global levels of anxiety sensitivity are associated with more severe cannabis withdrawal symptoms (Bonn-Miller et al., 2007), craving (Buckner et al., 2011), coping motives (Mitchell et al., 2007; Zvolensky et al., 2009), and more severe cannabis use problems (Johnson et al., 2010; Paulus et al., 2017). Although available work suggests anxiety sensitivity as a global construct is associated with several clinically significant aspects of cannabis use, there is limited information on how the lower-order facets of this construct relate to cannabis use processes. One study found that anxiety sensitivity Cognitive Concerns were related to retrospectively reported cannabis withdrawal severity among a sample of young White adult cannabis users (Bonn-Miller et al., 2007). In a separate study, only anxiety sensitivity Cognitive Concerns interacted with state craving to predict cannabis use among a small sample of cannabis users (Buckner et al., 2011). Such cannabis-specific work is in line with non-cannabis substance use research that has found anxiety sensitivity Cognitive Concerns are related to alcohol use problems and expectancies for tension reduction (Harwell et al., 2011; Koven et al., 2005).

This body of work, although limited in size, suggests anxiety sensitivity Cognitive Concerns may be especially relevant to cannabis use, perhaps because cannabis use among regular users of the drug offers a means to regulate cognitive-affective processes (Bonn-Miller et al., 2007). That is, anxiety sensitivity Cognitive Concerns, indicative of fears of mental incapacitation or losing control of mental processes, may be especially relevant to using cannabis to cope with adverse mental life stressors (e.g., managing occupational or educational demands, relationship problems or challenges, financial stress). Indeed, anxiety sensitivity Cognitive Concerns is related to perseverative thinking, such as worry (Rector et al., 2007). This lower-order facet of anxiety sensitivity, relative to the others, may therefore promote beliefs that stress-related thoughts are dangerous (e.g., "I have lost control of my thoughts) or threatening (e.g., "I am losing my mind"). Cognitive models of psychopathology posit such negative metacognitive beliefs promote problems regulating emotions, thereby exacerbating threat perceptions (Wells, 2009). For cannabis users with higher anxiety sensitivity Cognitive Concerns, such increased threat perceptions, and perhaps corresponding emotion regulatory problems (Paulus et al., in press), should contribute to more problematic patterns of cannabis use, worries about quitting because a major (cannabis) coping strategy is lost, and fears of not using (e.g., worries about tolerating withdrawal). For example, a cannabis user who thinks they are losing control of their mind may be more likely to engage in cannabis use to help modulate such aversive thinking (Buckner et al., 2017; Buckner et al., 2018).

Although promising, past work focused on anxiety sensitivity lower-order facets and cannabis use is presently limited in overall scope. There is a clear need to replicate and extend such work to larger cannabis using samples, including those that reflect a more racially/ethnically diverse population. Moreover, past work has not addressed if associations

between anxiety sensitivity Cognitive Concerns are explained by shared variance of the other lower-order facets and other variables related to more severe cannabis use problems (e.g., concurrent substance use, negative affectivity). Beyond cannabis use problems, there also is a need to explore whether anxiety sensitivity Cognitive Concerns maintains clinically significant relations with other affect-related cannabis use processes, such as perceived barriers for cannabis cessation (i.e., perceptions of quitting as more personally difficult; Zvolensky et al., 2018) and fears of quitting (i.e., typically labeled as 'abstinence phobia' in the literature; Milby et al., 1987). Both of these constructs are related to severity of substance use problems and other clinically significant substance-related problems (e.g., more problems when quitting, more severe substance use problems; Milby et al., 1987; Zvolensky et al., 2018).

The purpose of the present cross-sectional study was to test whether anxiety sensitivity Cognitive Concerns would be relatively more strongly (i.e., greater association) related to cannabis use problems, perceived barriers for quitting cannabis, and cannabis-specific fear of quitting among a community-recruited cannabis using adult sample. Specifically, we expected that the anxiety sensitivity Cognitive Concerns relation to the cannabis variables would not be explained by the shared variance with the other two anxiety sensitivity lower-order factors (Physical Concerns and Social Concerns) or the variance accounted for by gender, years of cannabis use, number of cigarettes per day, alcohol use problems, and negative affectivity.

2. Method

2.1 Participants

Participants were eligible if they were between the ages 18–65, reported daily cannabis use (defined as smoking at least 25 days a month for the past 6 months), and reported at least two previous self-defined cannabis quit attempts, with one of the attempts occurring in the past year.

Exclusion criteria included current suicidal or homicidal ideation, expressed limited mental competency (not oriented to person, place, or time), inability to give informed, voluntary, written consent to participate, current professional treatment for cannabis use disorder or other substance use problems, recent legal mandate limiting cannabis use, use of cannabis explicitly for a medical disorder, or pregnancy or current breastfeeding.

Two hundred and three current cannabis-using adults (29.2% female, *M*= 37.7 years, *SD*= 10.2) were recruited in Houston, Texas (where cannabis has not been legalized for medical or recreational use) through newspaper and community flyer advertisements targeting individuals interested in participating in research related to their current cannabis use and their past quit experiences. Participants were 63.0% Black or African American, 24.0% White, 2.0% Asian, 0.5% Native American/Alaskan Native, 10.5% other, and 16.3% reported being Hispanic or Latino. More than half (64.4%) of participants attended at least some college, with 26.6% having graduated from college. In terms of employment over the previous three years, 38.8% indicated they had been employed less than half the time or not at all; 14.9% indicated being employed half of the time; 46.3% indicated being employed most or all the time. Forty six percent indicated making $14,999 or less per year; 22.3% reported earning between $15,000 and $34,999; 13.4% indicated earning more than $35,000; and 18.3% of individuals did not report income.

In the current sample, the average age of first use was 15.42 years old (*SD* = 3.74 years). Participants indicated that they have been regular daily cannabis users for an average of 20.09 years (*SD* = 11.96). Participants indicated they most commonly consumed cannabis in the form of a joint (56.4%); others reported most common use via a bowl (10.9%), bong (6.4%), one-hitter (1.5%), or other (24.8%). Half of participants indicated they typically smoke cannabis alone

(50.5%); the other half stated a preference of smoking with two to three people (46.5%), and 3% reported smoking cannabis with a group of more than three people. In addition, 39.9% of participants were currently smoking cigarettes, and 37.2% were considered hazardous drinkers as measured by the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993).

2.2 Measures

Demographics Questionnaire. Participants completed a demographics form, which was used to measure sociodemographic factors such as gender, education, and yearly income.

Marijuana Smoking History Questionnaire (MSHQ; Bonn-Miller and Zvolensky, 2009). The MSHQ is a self-report questionnaire used to measure respondents' cannabis use history. In the current study, the MHSQ was used to measure age of cannabis use onset, years as a regular cannabis user, preferred method of consuming cannabis, and typical context of use.

Fagerstrom Test for Cigarette Dependence (FTCD; Fagerström, 2012; Heatherton et al., 1991). The FTCD is a 6-item self-report measure, formerly called the Fagerström Test for Nicotine Dependence, that different aspects of cigarette use and assess gradations in cigarette dependence (e.g., "How soon after you wake up do you smoke your first cigarette?"). In this study, number of cigarettes smoked per day was used as a covariate.

Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). The AUDIT is a 10-item self-report screening measure developed to identify individuals with hazardous alcohol use. The AUDIT total score was utilized as a continuous index of potential alcohol misuse and employed as a covariate; internal consistency was good (Saunders et al., 1993; Cronbach's $\alpha = 0.87$).

Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). The PANAS is a 20-item self-report scale measuring positive (PANAS-PA) and negative affectivity (PANAS-

NA), measured on a 5-point Likert scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Items ask how individuals generally feel according to a list of various feelings and emotions (*interested, nervous ashamed*). In the current study, the PANAS-NA was used as a covariate and internal consistency was good (Cronbach's α = 0.88).

Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007). The ASI-3 is an 18-item measure to assess the extent to which individuals are concerned about possible negative consequences of anxiety-related symptoms. Responses are rated on a 5-point Likert scale ranging from 0 (*very little*) to 4 (*very much*) and summed to create a total score. The ASI-3 has three subscales: Physical Concerns, Cognitive Concerns, and Social Concerns (Taylor et al., 2007) and has been used successfully in previous cannabis research (e.g., Pang et al., 2017; Paulus et al., 2017). In the current study, the internal consistency of the ASI-3 subscales were acceptable to good (Cronbach's α's = 0.78 - 0.86).

Marijuana Problems Scale (MPS; Stephens et al., 2000). The MPS is a well-established 19-item self-report measure of negative social, occupational, physical, and personal consequences associated with cannabis use in the past 90 days. Items are rated on a 3-point Likert scale from 0 (*no problem*) to 2 (*serious problem*). As in past work (Buckner and Schmidt, 2008), internal consistency was excellent in the current sample (Cronbach's α = 0.90).

Barriers of Cannabis Cessation Scale (BCCS; Zvolensky et al., 2018). The BCCS is a 19-item measure that captures a respondent's perceived barriers to cannabis cessation (Zvolensky et al., 2018). Items on the BCCS were adapted from the Barriers to Cessation Scale (BCS; Macnee and Talsma, 1995) to fit perceived barriers specific to cannabis cessation (example items: "Not knowing for how long it will be very hard not to use marijuana," "Miss the

companionship of using marijuana," "being addicted to cannabis"). The BCCS yields a total score and internal consistency was excellent in the current sample (Cronbach's α = 0.91).

Detoxification Fear Survey Schedule (DFSS; Milby et al., 1987). The DFSS is a 14-item clinician administered interview used to assess fears of discontinuation from a substance. The instrument has sound psychometric properties and measures fears of quitting cannabis, which has been described in past work using this scale as 'abstinence phobia' (Milby et al., 1987). Fear of quitting cannabis reflects fear about being drug free and not using cannabis, such as fears about experiencing withdrawal or relapsing when trying to quit (Gentile and Milby, 1992; Latowsky, 1996; Stotts et al., 2012). Items are scored on a five-point scale, ranging from 0 (*not disturbed at all*) to 4 (*very much disturbed*). The DFFS questions were specific to cannabis in the current study and the total score was used, which had excellent internal consistency (Cronbach's α = 0.94).

2.3 Procedure

Participants who responded to the study advertisements were telephone screened to determine eligibility. Eligible participants were then scheduled for an in-person assessment. Participants were asked not to use cannabis 24 hours prior to their appointment, which was verbally verified at the in-person appointment. During the in-person appointment, participants first provided written informed consent and then completed study measures. Participants were compensated with a $20.00 gift card. The study protocol was approved by the Institutional Review Board at the University of Houston.

2.4 Data Analysis

Analyses were conducted using SPSS version 24. First, bivariate correlations among the measures were examined (Table 1). Additionally, three-step hierarchical multiple regression

analyses were conducted for cannabis use problems, perceived barriers for cannabis cessation, and fears of quitting cannabis (Table 2). In the first step, gender, years of cannabis use, number of cigarettes per day, and alcohol use problems were entered. In the second step, the PANAS-NA was entered. In the third step, anxiety sensitivity Physical Concerns, Cognitive Concerns, and Social Concerns were entered simultaneously. Squared semi-partial correlations (sr^2) were computed as indices of effect size. To correct for multiple comparisons, an alpha value of 0.01 was employed to determine significance of correlations.

3. Results

3.1 Descriptive Statistics

For the bivariate correlations between variables, see Table 1. The anxiety sensitivity lower-order factors were significantly related to each of the studied cannabis variables, with the exception of the BCCS total score not being significantly correlated with the anxiety sensitivity Physical Concerns ($r = 0.13$).

3.2 Hierarchical Regression Analyses

Cannabis Use Problems. In predicting MPS total score, step one of the model accounted for significant variance (F (4, 84) = 8.39, $p < 0.001$, $R^2 = 0.29$). Specifically, AUDIT total ($sr^2 = 0.04$, $p = 0.03$) and number of cigarettes smoked per day ($sr^2 = 0.13$, $p < 0.001$) were significant predictors of cannabis use problems. In step two, the model was significant (ΔF (5, 83) = 9.75, $p = 0.001$, $\Delta R^2 = 0.08$) and the PANAS-NA was a significant predictor ($sr^2 = 0.08$, $p = 0.001$). For step three, the model was significant (ΔF (8, 80) = 7.73, $p = 0.03$, $\Delta R^2 = 0.07$). Anxiety sensitivity Cognitive Concerns were the only facet significantly related to the MPS total score ($sr^2 = 0.03$, $p = 0.04$; see Table 2).

Perceived Barriers for Cannabis Cessation. In predicting BCCS total score, step one of the model accounted for significant variance (F (4, 84) = 4.97, $p = 0.001$, $R^2 = 0.19$); number of cigarettes smoked per day ($sr^2 = 0.13$, $p = 0.03$) and male gender ($sr^2 = 0.14$, $p < 0.001$) were significant predictors. In step two, the model was not significant (ΔF (1, 83) = 3.75, $p = 0.06$, $\Delta R^2 = 0.04$). For step three, the model was significant (ΔF (3, 80) = 3.75, $p = 0.01$, $\Delta R^2 = 0.10$) and anxiety sensitivity Cognitive Concerns was the only significant univariate predictor ($sr^2 = 0.07$, $p = 0.004$; see Table 2).

Fears of Quitting Cannabis. In predicting DFSS, step one (F (4, 84) = 2.44, $p = 0.05$, $R^2 = 0.10$) and two (ΔF (1, 83) = 0.03, $p = 0.87$, $\Delta R^2 < 0.001$) were not significant. For step three, the model was significant (ΔF (3, 80) = 8.86, $p < 0.001$, $\Delta R^2 = 0.22$) and anxiety sensitivity Cognitive Concerns ($sr^2 = 0.12$, $p < 0.001$) and Social Concerns ($sr^2 = 0.04$, $p = 0.03$) were significant predictors (see Table 2).

4. Discussion

The present investigation tested whether individual differences in anxiety sensitivity lower-order facets were related to cannabis use problems, perceived barriers for cannabis cessation, and fear of quitting cannabis among a racially/ethnically diverse cannabis using community-based sample. As hypothesized, there was empirical evidence that the anxiety sensitivity Cognitive Concerns lower-order construct was significantly and robustly related to each of the cannabis variables and explained 3% (cannabis use problems), 7% (perceived barriers for cannabis cessation), and 11% (fear of quitting cannabis) of unique variance in this construct *after* accounting for the variance attributable to gender, years of cannabis use, number of cigarettes per day, alcohol use problems, negative affectivity, and the shared variance with the other anxiety sensitivity lower-order factors. Thus, the current findings for anxiety sensitivity

Cognitive Concerns cannot be explained by a wide range of theoretically-relevant factors, highlighting its potential clinical significance. These data are broadly consistent with previous work that has found anxiety sensitivity Cognitive Concerns is related to alcohol use aimed at mood management and greater substance use problems (Harwell et al., 2011; Koven et al., 2005; Schmidt et al., 2007). It also is in line with cannabis-specific work that has reported Cognitive Concerns are related to withdrawal severity (Bonn-Miller et al., 2007) and cannabis use problems (Buckner et al., 2011), and interacts with craving to predict cannabis use (Buckner et al., 2011). Although past research has not focused on the relations between anxiety sensitivity and perceived barriers for cannabis cessation or fear of quitting cannabis, the current results are in line with the perspective that a heightened tendency to believe stressful mental sensations are personally detrimental may be a relevant factor for understanding the subgroups of cannabis users that are at greatest risk for an array of clinically significant cannabis use processes. Together, these data provide novel empirical evidence suggesting anxiety sensitivity Cognitive Concerns may be an important, yet heretofore underrecognized construct, to better understanding cannabis use problems, perceptions of quitting, and fears of cannabis-use abstinence and should be included in theoretical models focused on the maintenance of cannabis use.

There was no relation between anxiety sensitivity Physical and Social Concerns and the cannabis variables except for the negative relation between Social Concerns and fear of quitting cannabis. Inspection of the size of the observed effect for anxiety sensitivity Social Concerns in terms of fear of quitting cannabis was 4%, which is potentially clinically meaningful given the variance accounted for in the total model (Abelson, 1985). The reasons for anxiety sensitivity Social Concerns being relevant only to fears of cannabis-use abstinence are unclear, but may suggest a linkage between social expectancies (e.g., worry about being negatively evaluated by

others) and cannabis-related coping behavior. For example, in the tobacco literature anxiety sensitivity Social Concerns were incrementally related to a lower occurrence of early smoking relapse (Guillot et al., 2015; Zvolensky et al., 2007), possibly out of fear of being negatively evaluated by others who know they are trying to quit smoking cigarettes. Similarly, perhaps individuals high in anxiety sensitivity Social Concerns tend to be less fearful of relapsing when trying to quit cannabis (i.e., tend to have lower cannabis abstinence fear). That is, they may be more concerned with social fears than a cannabis-specific fear.

The lack of association between anxiety sensitivity Physical Concerns may be attributable to the fact that psychoactive elements of cannabis elicit a range of bodily sensations, and therefore, persons high in concerns about somatic events may be less likely to use cannabis. Although the current findings generally suggest anxiety sensitivity Cognitive Concerns, relative to the two other facets, is the most relevant to cannabis use problems and processes, it is also possible that specific lower-order anxiety sensitivity facets may interplay with domain-specific stress. Future research could therefore usefully build from the current research and use prospective modeling of the relations between anxiety sensitivity lower-order factors and cannabis use processes to help explicate the interplay of each of these facets with domain-specific life stressors (e.g., do Social Concerns amplify fears of abstinence specifically in response to social threat? Do Physical Concerns exacerbate perceived barriers for quitting in response to illness-related bodily symptoms?).

The present investigation suggests anxiety sensitivity Cognitive Concerns may be important to better understanding an array of clinically significant cannabis use processes. Clinically, reducing anxiety sensitivity Cognitive Concerns may therefore be useful in reducing cannabis use problems, perceived barriers for quitting, and fears of not using or being ‘drug

free.' For instance, the present findings suggest that there may be merit in terms of using anxiety sensitivity reduction tactics among treatment-seeking cannabis using samples to decrease Cognitive Concerns. This approach could build upon past work that has utilized behavioral and cognitive-behavioral tactics for improving mental health via anxiety sensitivity reduction (e.g., Schmidt et al., 2014; Schmidt et al., 2016), and perhaps, further refine them to include a greater psychoeducational and cannabis-specific emphasis on the importance of this construct in terms cannabis use beliefs and behavior.

Despite the clinical implications of this work, it remains unclear exactly *why* anxiety sensitivity Cognitive Concerns is related to cannabis use problems and stress-related beliefs such as perceived barriers for quitting and fears of abstinence. Several non-mutually exclusive possibilities exist. First, individual differences in the tendency to be sensitive to cognitive-based stress may fuel greater negative mood (e.g., anxiety, depression), contributing to greater cannabis use problems and stress-related beliefs. For example, anxiety sensitivity Cognitive Concerns may dynamically interact with daily stressors (e.g., mental stress at work) to potentiate effects and contribute to greater cannabis use problems. Second, it is possible that anxiety sensitivity Cognitive Concerns may be related to greater emotional dysregulation among cannabis using persons, which in turn, is associated with heightened levels of cannabis problems and fears of not using. For instance, anxiety sensitivity Cognitive Concerns may be related to an impaired ability to regulate mood states in an adaptive manner, and thereby promote more severe cannabis use. Thus, emotion dysregulation may represent an important construct to better understand in anxiety sensitivity-cannabis relations. Third, anxiety sensitivity Cognitive Concerns may be associated with cognitive processes that affect cannabis use. Research has found that anxiety sensitivity Cognitive Concerns impairs the efficiency of working memory and executive

functions (e.g., directing cognitive resources to achieve one's goals ; Otto et al., 2016). Such cognitive deficits, in turn, may be related to greater cannabis use problems and beliefs about using.

Study limitations warrant mentioning. First, the current research design was cross-sectional in nature. Future longitudinal modeling of the studied variables is needed to determine directionality and causation. Second, the present sample was non-treatment seeking from an inner-city environment, racially/ethnically diverse, and low income. Future work should examine associations among other samples from distinct backgrounds to better gauge the generalizability of the findings. Third, almost 70% of the sample was male. There may be clinically important differences in cannabis use processes among males versus females (Buckner et al., 2006). Future research could usefully explore how sex differences relate to anxiety sensitivity relations to cannabis use processes among a more sex-balanced sample. Finally, although we used a multi-method assessment approach of structured interviews and self-report data, future research may benefit by employing other assessment approaches to further explicate cross-system effects in the anxiety sensitivity-cannabis relation.

Overall, the current study found empirical evidence that individual differences in anxiety sensitivity Cognitive Concerns were significantly and uniquely related to cannabis use problems, perceived barriers for quitting, and fear of quitting cannabis among adult community-recruited cannabis users. These novel findings help to better understand the potential etiologic elements of cannabis use processes among this high-risk group. The current findings are consistent with the perspective that decreasing anxiety sensitivity Cognitive Concerns may be one way to offset the risks associated with cannabis use problems among regular users.

References

Abelson, R. P., 1985. A variance explanation paradox. When a little is a lot. Psychol bull. 97, 129–133.

Bernstein, A., Zvolensky, M. J., 2007. Anxiety sensitivity: selective review of promising research and future directions. Expert rev neurother. 7(2), 97–101.

Bonn-Miller, M. O., Zvolensky, M. J., 2009. An evaluation of the nature of marijuana use and its motives among young adult active users. Am j addiction. 18(5), 409–416.

Bonn-Miller, M. O., Zvolensky, M. J., Marshall, E. C., Bernstein, A., 2007. Incremental validity of anxiety sensitivity in relation to marijuana withdrawal symptoms. Addict behav. 32(9), 1843–1851.

Buckner, J. D., Mallott, M. A., Schmidt, N. B., Taylor, J., 2006. Peer influence and gender differences in problematic cannabis use among individuals with social anxiety. J anxiety disord. 20(8), 1087–1102.

Buckner, J. D., Schmidt, N. B., 2008. Marijuana effect expectancies: relations to social anxiety and marijuana use problems. Addict behav. 33(11), 1477–1483.

Buckner, J. D., Zvolensky, M. J., Smits, J. A. J., Norton, P. J., Crosby, R. D., Wonderlich, S. A., et al., 2011. Anxiety sensitivity and marijuana use: an analysis from ecological momentary assessment. Depress anxiety. 28 (5), 420–426.

Budney, A. J., Radonovich, K. J., Higgins, S. T., Wong, C. J., 1998. Adults seeking treatment for marijuana dependence: a comparison with cocaine-dependent treatment seekers. Exp clin psychopharm. 6(4), 419–426.

Compton, W. M., Baler, R., 2016. The epidemiology of dsm-5 cannabis use disorders among us adults: science to inform clinicians working in a shifting social landscape. Am j psychiat. 173(6), 551–553.

Eifert, G. H., Zvolensky, M. J., Sorrell, J. T., Hopko, D. R., Lejuez, C. W., 1999. Predictors of self-reported anxiety and panic symptoms: an evaluation of anxiety sensitivity, suffocation fear, heart-focused anxiety, and breath-holding duration. J psychopathol behav. 21(4), 293–305.

Fagerström, K., 2012. Determinants of tobacco use and renaming the FTND to the Fagerstrom Test for Cigarette Dependence. Nicotine tob res.14 (1), 75–78.

Gentile, M. A., Milby, J. B., 1992. Methadone maintenance detoxification fear: a study of its components. J clin psychol. 48(6), 797–807.

Grucza, R. A., Agrawal, A., Krauss, M. J., Cavazos-Rehg, P. A., Bierut, L. J., 2016. Recent trends in the prevalence of marijuana use and associated disorders in the United States. JAMA psychiat. 73(3), 300–301.

Guillot, C. R., Zvolensky, M. J., & Leventhal, A. M., (2015). Differential associations between components of anxiety sensitivity and smoking-related characteristics. Addict behav. 40, 39-44.

Harwell, B. D., Cellucci, T., Iwata, A. L., 2011. Rumination, anxiety sensitivity, and negative reinforcement drinking. J subst use. 16(1), 79–85.

Hasin, D. S., Kerridge, B. T., Saha, T. D., Huang, B., Pickering, R., Smith, S. M., et al., 2016. Prevalence and correlates of DSM-5 cannabis use disorder, 2012-2013: findings from the national epidemiologic survey on alcohol and related conditions–III. Am j psychiat.

Hasin, D. S., Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., et al., 2015. Prevalence of marijuana use disorders in the United States between 2001-2002 and 2012-2013. JAMA psychiat. 72(12), 1235–1242.

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., Fagerström, K. O., 1991. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. Brit j addict.86 (9), 1119–1127.

Johnson, K., Mullin, J. L., Marshall, E. C., Bonn-Miller, M. O., Zvolensky, M., 2010. Exploring the mediational role of coping motives for marijuana use in terms of the relation between anxiety sensitivity and marijuana dependence. The Am j addiction. 19(3), 277–282.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., 2013. Monitoring the future national results on drug use: 2012 overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, The University of Michigan, 168.

Koven, N. S., Heller, W., Miller, G. A., 2005. The unique relationship between fear of cognitive dyscontrol and self-reports of problematic drinking. Addict behav. 30(3), 489–499.

Latowsky, M., 1996. Improving detoxification outcomes from methadone maintenance treatment: the interrelationship of affective states and protracted withdrawal. J psychoactive drugs.28 (3), 251–257.

Lev-Ran, S., Le Foll, B., McKenzie, K., George, T. P., Rehm, J., 2013. Cannabis use and cannabis use disorders among individuals with mental illness. Compr psychiat. 54(6), 589–598.

Macnee, C. L., Talsma, A., 1995. Development and testing of the barriers to cessation scale. Nurs res. 44(4), 214.

McNally, R. J., 2002. Anxiety sensitivity and panic disorder. Biol psychiat. 52(10), 938–946.

Metrik, J., Jackson, K., Bassett, S. S., Zvolensky, M. J., Seal, K., Borsari, B., 2016. The mediating roles of coping, sleep, and anxiety motives in cannabis use and problems among returning veterans with PTSD and MDD. Psychol addict behav. 30(7), 743–754.

Milby, J. B., Gurwitch, R. H., Hohmann, A. A., Wiebe, D. J., Ling, W., McLellan, A. T., et al., 1987. Assessing pathological detoxification fear among methadone maintenance patients: The DFSS. J clin psychol. 43(5), 528–538.

Otto, M. W., Eastman, A., Lo, S., Hearon, B. A., Bickel, W. K., Zvolensky, M., et al., 2016. Anxiety sensitivity and working memory capacity: Risk factors and targets for health behavior promotion. Clin psychol rev. 49(Supplement C), 67–78.

Pang, R., Guillot, C., J. Zvolensky, M., Bonn-Miller, M., Leventhal, A., 2017. Associations of anxiety sensitivity and emotional symptoms with the subjective effects of alcohol, cigarettes, and cannabis in adolescents. Addict behav. 73, 192–198.

Paulus, D. J., Manning, K., Hogan, J. B. D., Zvolensky, M. J., 2017. The role of anxiety sensitivity in the relation between anxious arousal and cannabis and alcohol use problems among low-income inner city racial/ethnic minorities. J anxiety disord 48(Supplement C), 87–94.

Rapee, R. M., Medoro, L., 1994. Fear of physical sensations and trait anxiety as mediators of the response to hyperventilation in nonclinical subjects. J abnorm psychol. 103(4), 693–699.

Rector, N. A., Szacun-Shimizu, K., Leybman, M., 2007. Anxiety sensitivity within the anxiety disorders: Disorder-specific sensitivities and depression comorbidity. Behav res ther. 45(8), 1967-1975.

Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., Grant, M., 1993. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project

on Early Detection of Persons with Harmful Alcohol Consumption--II. Addiction (Abingdon, England), 88(6), 791–804.

Schmidt, N. B., 1999. Examination of differential anxiety sensitivities in panic disorder: a test of anxiety sensitivity subdomains predicting fearful responding to a 35% CO2 challenge. Cognitive ther res. 23(1), 3–20.

Schmidt, N. B., Buckner, J. D., Keough, M. E., 2007. Anxiety sensitivity as a prospective predictor of alcohol use disorders. Behav modif. 31(2), 202–219.

Schmidt, N. B., Raines, A. M., Allan, N. P., Zvolensky, M. J., 2016. Anxiety sensitivity risk reduction in smokers: A randomized control trial examining effects on panic. Behav res ther. 77, 138–146.

Solowij, N., Stephens, R. S., Roffman, R. A., Babor, T., Kadden, R., Miller, M., et al., 2002. Marijuana Treatment Project Research Group. Cognitive functioning of long-term heavy cannabis users seeking treatment. JAMA, 287(9), 1123–1131.

Stephens, R. S., Roffman, R. A., Curtin, L., 2000. Comparison of extended versus brief treatments for marijuana use. J consult clin psych. 68(5), 898–908.

Stephens, R. S., Roffman, R. A., Simpson, E. E., 1993. Adult marijuana users seeking treatment. J consult clin psych. 61(6), 1100–1104.

Stotts, A. L., Green, C., Masuda, A., Grabowski, J., Wilson, K., Northrup, T. F., et al., 2012. A stage I pilot study of acceptance and commitment therapy for methadone detoxification. Drug alcohol depen. 125(3), 215–222.

Taylor, S., 1999. Anxiety Sensitivity: Theory, Research, and Treatment of Fear, 1st ed. Routledge.

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., et al., 2007. Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index-3. Psychol assessment. 19(2), 176–188.

Volkow, N. D., Baler, R. D., Compton, W. M., Weiss, S. R., 2014. Adverse health effects of marijuana use. New engl j med. 370(23), 2219–2227.

Watson, D., Clark, L. A., Tellegen, A., 1988. Development and validation of brief measures of positive and negative affect: the PANAS scales. J pers soc psychol. 54(6), 1063–1070.

Wells, A., Fisher, P., Myers, S., Wheatley, J., Patel, T., Brewin, C. R., (2009). Metacognitive therapy in recurrent and persistent depression: A multiple-baseline study of a new treatment. Cog ther res. 33(3), 291-300.

Zinbarg, R., David, B., A. Brown, T., 1997. The hierarchical structure and general factor saturation of the Anxiety Sensitivity Index. Psychol assessment. 9, 277–284.

Zvolensky, M. J., Kotov, R., Antipova, A. V., Schmidt, N. B., 2003. Cross cultural evaluation of smokers risk for panic anxiety pathology: a test in a Russian epidemiological sample. Behav res ther. 41(10), 1199–1215.

Zvolensky, M. J., Vujanovic, A. A., Bernstein, A., Bonn-Miller, M. O., Marshall, E. C., & Leyro, T. M. (2007). Marijuana use motives: A confirmatory test and evaluation among young adult marijuana users. Addict behav. 32(12), 3122-3130.

Zvolensky, M. J., Marshall, E. C., Johnson, K., Hogan, J., Bernstein, A., Bonn-Miller, M. O., 2009. Relations between anxiety sensitivity, distress tolerance, and fear reactivity to bodily sensations to coping and conformity marijuana use motives among young adult marijuana users. Exp clin psych pharm. 17(1), 31.

Zvolensky, M. J., Paulus, D. J., Garey, L., Manning, K., Hogan, J. B. D., Buckner, J. D., et al., 2018. Perceived barriers for cannabis cessation: relations to cannabis use problems, withdrawal symptoms, and self-efficacy for quitting. Addict behav. 76, 45–51.

Table 1. Bivariate Correlations and Descriptive Statistics

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean (SD) or %
1. Gender (female)	1										29.2 %
2. AUDIT	0.07	1									6.97 (6.72)
3. Years of Cannabis	0.13	-0.09	1								20.09 (11.96)
4. Cigarettes per day	0.08	.031**	-0.07	1							8.02 (7.72)
5. PANAS-NA	-0.13	0.23**	-.29**	0.31**	1						19.90 (7.18)
6. ASI-3 Physical	-0.10	0.28**	-0.15	0.16	0.22**	1					5.17 (5.45)
7. ASI-3 Cognitive	-0.14	0.25**	-.19	-0.04	0.31**	0.64**	1				4.48 (5.18)
8. ASI-3 Social	-0.15	0.20**	-0.07	0.07	0.21**	0.57**	0.63**	1			5.73 (5.46)
9. MPS Total	0.05	0.26**	-0.13	0.46**	0.36**	0.20**	0.28**	0.20**	1		6.71 (6.62)
10. BCCS Total	-0.27**	0.18	-0.08	0.21	0.29**	0.14	0.26**	0.19**	0.42**	1	21.98 (12.88)
11. DFSS Total	-0.16	0.15	-0.01	0.22	0.15	0.32**	0.38**	0.23**	0.33**	0.53**	26.39 (19.72)

**To correct for multiple comparisons, $p < 0.01$ was used as a conservative measure. AUDIT – Alcohol Use Disorders Identification Test (Saunders et al., 1993); PANAS-NA – Positive and Negative Affect Schedule, Negative Affect Subscale (Watson et al., 1988); ASI-3 – Anxiety Sensitivity Index 3 (Taylor et al., 2007); MPS – Marijuana Problems Scale (Bonn-Miller and Zvolensky, 2009); BCCS – Barriers to Cannabis Cessation Scale (Zvolensky et al., 2018); DFSS – Detoxification Fear Schedule Survey (Milby et al., 1987)

		MPS Total Score					BCCS Total Score					DFSS Total Score				
Model		*B*	*SE*	*t*	*p*	sr^2	*B*	*SE*	*t*	*p*	sr^2	*B*	*SE*	*t*	*p*	sr^2
1	Years of Cannabis Use	-0.08	0.06	-1.31	0.19	0.01	-0.06	0.12	-0.54	0.59	<0.01	0.29	0.19	1.49	0.14	0.02
	AUDIT Total	**0.24**	**0.11**	**2.26**	**0.03**	**0.04**	0.09	0.22	0.44	0.67	<0.01	0.36	0.35	1.02	0.31	0.01
	Cigarettes per Day	**0.34**	**0.09**	**3.88**	**<0.001**	**0.13**	**0.39**	**0.18**	**2.19**	**0.03**	**0.05**	0.55	0.29	1.92	0.06	0.04
	Gender	1.09	1.53	0.72	0.48	<0.01	**-11.76**	**3.11**	**-3.79**	**<0.001**	**0.14**	-8.40	5.05	-1.67	0.10	0.03
2	Years of Cannabis Use	-0.03	0.06	-0.54	0.59	<0.01	-0.01	0.12	-0.06	0.95	<0.01	0.28	0.20	1.40	0.17	0.02
	AUDIT Total	0.17	0.10	1.61	0.11	0.02	0.002	0.22	0.01	0.99	<0.01	0.37	0.36	1.03	0.31	0.01
	Cigarettes per Day	**0.27**	**0.09**	**3.20**	**0.002**	**0.08**	0.31	0.18	1.70	0.09	0.03	0.56	0.30	1.89	0.06	0.04
	Gender	0.91	1.44	0.63	0.53	<0.01	**-11.99**	**3.06**	**-3.92**	**<0.001**	**0.14**	-8.37	5.08	-1.65	0.10	0.03
	PANAS-NA	**0.28**	**0.09**	**3.34**	**0.001**	**0.08**	**0.35**	**0.18**	**1.94**	**0.06**	**0.04**	-0.05	0.30	-0.16	0.87	<0.01
3	Years of Cannabis Use	-0.01	0.06	-0.29	0.77	0.001	0.04	0.12	0.32	0.75	<0.01	0.39	0.18	2.20	0.03	0.04
	AUDIT Total	0.16	0.10	1.56	0.12	0.02	0.001	0.21	0.01	1.00	<0.01	0.27	0.32	0.85	0.40	0.01
	Cigarettes per Day	**0.31**	**0.09**	**3.66**	**<0.001**	**0.10**	0.44	**0.18**	**2.45**	**0.02**	**0.05**	0.77	0.27	2.81	0.01	0.07
	Gender	1.14	1.42	0.80	0.43	0.005	-12.07	**2.97**	**-4.07**	**<0.001**	**0.14**	-7.91	4.56	-1.74	0.09	0.03
	PANAS-NA	**0.20**	**0.09**	**2.31**	**0.02**	**0.04**	0.18	0.18	1.01	0.32	0.01	-0.46	0.28	-1.67	0.10	0.02
	ASI-3 Physical	0.01	0.17	0.05	0.96	<0.01	-0.35	0.36	-0.97	0.33	0.01	0.70	0.56	1.26	0.21	0.01
	ASI-3 Cognitive	**0.39**	**0.19**	**2.08**	**0.04**	**0.03**	1.15	**0.39**	**2.95**	**0.004**	**0.07**	**2.22**	**0.60**	**3.70**	**<0.001**	**0.12**
	ASI-3 Social	-0.002	0.16	-0.02	0.99	<0.01	-0.11	0.34	-0.33	0.75	<0.01	**-1.11**	**0.52**	**-2.15**	**0.03**	**0.04**

Table 2. Hierarchical Multiple Regression

Bolded values indicate a statistically significant result ($p < 0.05$). AUDIT – Alcohol Use Disorders Identification Test (Saunders et al., 1993); PANAS-NA – Positive and Negative Affect Schedule,

Negative Affect Subscale (Watson et al., 1988); ASI-3 – Anxiety Sensitivity Index 3 (Taylor et al., 2007); MPS – Marijuana Problems Scale (Bonn-Miller and Zvolensky, 2009); BCCS – Barriers to Cannabis Cessation Scale (Zvolensky et al., 2018); DFSS – Detoxification Fear Schedule Survey (Milby et al., 1987)

Highlights:

- AS Cognitive Concerns were significantly associated with cannabis use variables.
- AS Cognitive Concerns significantly relate to stress related beliefs for cannabis use.
- Lowering AS Cognitive Concerns may help reduce fear of quitting cannabis use.