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Incremental Validity of Anxiety Sensitivity in relation to Marijuana Withdrawal Symptoms

Marcel O. Bonn-Miller, **Michael J. Zvolensky**, and **Erin C. Marshall**
University of Vermont

Amit Bernstein
Veterans Affairs Palo Alto Health Care System

Abstract

The present investigation examined the relation between anxiety sensitivity (AS) and marijuana withdrawal severity among 84 (47 female) young adult marijuana smokers. As expected, after covarying for the theoretically-relevant variables of frequency of past 30-day marijuana use, number of cigarettes smoked per day, volume of alcohol consumed, and anxious arousal as well as anhedonic depressive symptoms, both the global AS factor and the AS-mental incapacitation concerns factor were significantly related to the severity of retrospectively reported marijuana withdrawal symptoms. Results are discussed in relation to better understanding cognitive-emotional variables related to the marijuana withdrawal.

Keywords

Anxiety Sensitivity; Marijuana; Withdrawal; and Anxiety

Marijuana is the most commonly used recreational drug in the world (Patton, Coffey, Carlin, Degenhardt, Lynskey, & Hall, 2002) and increased rates of problematic use (i.e., abuse and dependence) have been observed among young adults (Compton, Grant, Colliver, Glantz, & Stinson, 2004). Recent studies have indicated that marijuana discontinuation among regular users produces a withdrawal pattern (Budney, Hughes, Moore, & Vandrey, 2004). Indeed, studies ranging from case reports to controlled field evaluations to laboratory tests suggest that (current) regular marijuana users who abstain from marijuana use (ranging from 12 hours to 30 or more days) report increases in anxiety, irritability, physical tension, and other related types of symptoms (Budney Hughes, Moore, & Novy, 2001;Budney, Moore, Vandrey, & Hughes, 2003;Duffy & Milin, 1996;Haney, Ward, Comer, Foltin, & Fischman, 1999;Kouri & Pope, 2000); the peak effects of marijuana withdrawal appear to be within 2–4 days post discontinuation (Budney et al., 2004). The clinical significance of such withdrawal symptoms is evident from a number of different perspectives. For example, the majority of regular marijuana users experience such symptoms (Budney et al., 2004), often report that withdrawal symptoms motivate them to relapse (Kouri & Pope, 2000), and experience such symptoms as problematic to life functioning (Budney et al, 2001). These data may suggest, like that of many

Correspondence concerning this article should be addressed to Michael J. Zvolensky, Ph.D. Dr. Zvolensky can be contacted at The University of Vermont, Department of Psychology, 2 Colchester Avenue, John Dewey Hall, Burlington, VT 05405-0134, 802-656-8994 (phone), 802-656-8783 (facsimile). Electronic mail may be sent to Michael.Zvolensky@uvm.edu.

other drugs (Robinson & Berridge, 1993), marijuana withdrawal symptoms should be a focus of clinical intervention.

There has been little empirical investigation of what factors relate to the severity of marijuana withdrawal symptoms. Understanding correlates and predictors of withdrawal severity may have important theoretical and clinical implications relevant for better understanding individual differences in the marijuana withdrawal syndrome, marijuana use maintenance, and relapse. Of available work, some studies suggest that both psychiatric symptoms as well as heavier marijuana use are related to greater severity of reported withdrawal symptoms (Budney, Novy, & Hughes, 1999;Crowley, MacDonald, Whitmore, & Mikulich, 1998). Although this work indicates individuals with psychological disturbances or vulnerabilities and more frequent patterns of use may be more likely to experience marijuana withdrawal symptoms during a period of abstinence (e.g., not using marijuana due to testing for use at the workplace) or a designated quit attempt, other individual difference characteristics may serve a similar type of role. One theoretically promising variable to explore in this regard is anxiety sensitivity (AS; McNally, 2002). Anxiety sensitivity is the fear of anxiety-related bodily sensations, which arise from beliefs that the sensations have harmful personal consequences (Reiss & McNally, 1985;McNally, 2002). The AS construct is hierarchical in structure, with three first-order factors titled AS-physical concerns, AS-mental incapacitation concerns, and AS-social concerns and a single, higher order general factor (Zinbarg, Barlow, & Brown, 1997). To illustrate, people high in AS may be frightened of harmless heart palpitations because they believe the sensations will lead to cardiac arrest, whereas people low in AS do not fear these sensations because they believe them to be harmless. To the extent a marijuana user is high in AS, this person should theoretically be more emotionally sensitive to withdrawal symptoms that occur during discontinuation. For example, a high compared to low AS person may be more apt to catastrophically interpret withdrawal sensations as personally threatening or dangerous (e.g., “I am losing control” or “I am going crazy”), promoting a more severe withdrawal symptom experience. Though no studies have addressed an AS-marijuana withdrawal symptom linkage, indirect support for this type of model has been found for tobacco, whereby high AS cigarette smokers report nicotine-based withdrawal symptoms as more severe (Zvolensky, Baker et al., 2004).

The purpose of the present investigation was to provide an initial empirical evaluation of an AS-marijuana withdrawal severity association among community-recruited (current) marijuana-using adults. Young adults were studied, as opposed to other age groups, as marijuana use and its disorders represent a common and growing problem among this population (Compton et al., 2004). It was hypothesized that AS would predict the severity of marijuana withdrawal symptoms over and above the variance accounted for by the theoretically-relevant factors of level of marijuana use, cigarettes smoked per day, alcohol consumption, and anxiety as well as depressive symptoms; these factors are conceptually expected to be related to the criterion variable. An incremental test was critical to test whether AS is associated with marijuana withdrawal symptom severity not merely as a function of shared variability with other substance or affective problems. It also was hypothesized that, of the AS lower-order components, the mental incapacitation concerns would be the most robust predictor of withdrawal symptoms relative to the other AS factors. This hypothesis was based on work suggesting that AS-mental incapacitation may be the most relevant to negative affect states (Schmidt, Lerew, & Jackson, 1999) and cognitive dyscontrol (Zvolensky, Feldner, Eifert, & Stewart, 2001), dominant aspects of marijuana withdrawal (Budney et al., 2004)

Method

Participants

The sample consisted of 84 (47 female) young adult (current, as defined by use in the past 30 days) non-treatment seeking marijuana users from the greater Burlington, Vermont university community. This sample was part of a larger study (N = 160) that was not directly related to marijuana use, though it did contain questions regarding such use. As such, of the total sample, approximately 47.5% were *not* marijuana users. Individuals were recruited through newspaper and other local advertisements posted in university and non-university settings (see Procedure section for details). Participants were excluded from the study if they evidenced limited mental competency or the inability to give informed, written consent or were not a current marijuana smoker who had discontinued use at some point in their lives. Participants were administered the Structured Clinical Interview for DSM-IV Axis I Disorders- Non-Patient Edition (SCID-NP; First, Spitzer, Gibbon, & Williams, 1995) and those with current AXIS-I psychopathology (with the exception of substance use disorders) were excluded from the study. Among the current marijuana using sample, 32.1% of participants met criteria for marijuana abuse and 27.4% met criteria for marijuana dependence according to the Diagnostic and Statistical Manual for Mental Disorders - 4th Edition (DSM-IV; American Psychiatric Association, 1994). Inter-rater reliability in our laboratory has been high for Axis I diagnoses, including substance use disorders (Zvolensky, Leen-Feldner, et al., 2004).

Measures

Marijuana smoking history and pattern were assessed with the *Marijuana Smoking History Questionnaire (MSHQ;* Bonn-Miller & Zvolensky, 2005). The MSHQ is a self-report instrument that includes items pertaining to marijuana smoking rate (lifetime and past 30 days), age of onset at initiation, years of being a regular marijuana smoker, and other descriptive information (e.g., number of attempts to discontinue using marijuana). The MSHQ has performed well in pasts studies (Bonn-Miller et al., 2005;Zvolensky, Bonn-Miller et al., 2006).

Alcohol consumption was measured with the *Alcohol Assessment (AA*; Zvolensky, Bonn-Miller et al., 2006). The AA is a three-item measure that includes items examining the (1) presence/absence of current alcohol use, (2) frequency (weekly, monthly, and yearly), and (3) quantity of such use. Frequency and quantity of alcohol consumption were assessed in a manner used in previous research (Stewart, Peterson, & Pihl, 1995;Stewart, Zvolensky, & Eifert, 2001). An average alcohol volume index was computed via the product of the weekly frequency by quantity items (Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994).

Cigarette smoking history and pattern were assessed with the *Smoking History Questionnaire (SHQ*; Brown, Lejuez, Kahler, & Strong, 2002*)*. The SHQ includes items pertaining to smoking rate, age of onset at initiation, and years of being a regular smoker.

The *Mood and Anxiety Symptom Questionnaire* (MASQ; Watson et al., 1995) was used to assess anxious arousal and anhedonic depression. The MASQ is a comprehensive measure of affective symptoms (Watson et al., 1995). Participants indicate how much they have experienced each symptom from 1 (“*not at all*”) to 5 (“*extremely*”). In the present study, the MASQ-AA and MASQ-AD subscales were used to index anxiety and depressive symptoms, respectively.

The *Anxiety Sensitivity Index* (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is a 16-item measure in which respondents indicate on a 5-point Likert-type scale (0 = *"very little"* to 4 = *"very much"*) the degree to which they are concerned about possible negative consequences of anxiety symptoms (e.g. *“It scares me when I feel shaky”*). Factor analysis of the scale indicates

that it has a hierarchical structure, with three first-order factors titled AS-physical concerns, AS-mental incapacitation concerns, and AS-social concerns and a single, higher order general factor (Zinbarg et al., 1997). The ASI is distinguishable from, and has incremental validity over, measures of negative affectivity (Zvolensky, Kotov, Antipova, & Schmidt, 2005) and trait anxiety (Rapee & Medero, 1994).

Marijuana withdrawal symptoms and severity were assessed with the *Marijuana Withdrawal Checklist – Short Form (*MWC; Budney et al., 1999;Vandrey, Budney, Kamon, & Stanger, 2005).

The MWC is a 16-item measure in which participants indicate on a 4-point Likert-type scale (0 = "*none"* to 3 = "*very severe"*) the severity of commonly identified marijuana withdrawal symptoms (e.g., "*Sleep difficulty*") experienced during their most recent time of marijuana discontinuation. As recommended by the authors, a sum score was computed to index total marijuana withdrawal symptom severity (Vandrey et al., 2005). The MWC is a well established measure that has been used successfully in prior work examining marijuana withdrawal (Budney et al., 1999;Vandrey et al., 2005).

Procedure

Potential participants were recruited through newspaper and other local advertisements (e.g. community-based flyers and newspaper advertisements). Advertisements communicated that individuals could earn a modest monetary reward for their participation in a research study focused on emotion at the University of Vermont. The recruitment phase was conducted throughout the duration of the study: approximately 8 months. Interested participants who contacted the research team about the study were given a detailed description of the investigation and scheduled for a laboratory visit. Upon arrival, participants provided written informed consent. Thereafter, participants completed a battery of self-report measures. After the study, participants were debriefed and compensated $30 for their time and effort.

Results

The mean age of the sample was 18.9 (*SD* = 1.2) years. The racial distribution of the study sample generally reflected that of the local population (State of Vermont Department of Health, 2000): 99% of the total sample was Caucasian, and 1% Hispanic. Over half (60.7%) of the sample smoked marijuana on a weekly basis and about 20% used marijuana more than once per day. Participants reported first using the drug at a mean age of 15.3 (*SD* = 2.5) years old, using regularly for a mean of 1.8 (*SD* = 1.7) years, with slightly less than half of the sample having made at least one serious quit attempt in their lifetime (41.7%); reporting a mean of 2.5 (*SD* = 2.4) serious marijuana quit attempts in their lifetime. Approximately twenty-seven percent of participants smoked tobacco daily, and this group reported smoking a mean of 6.7 (*SD* = 6.2) cigarettes per day. Sixty-five percent of the participants reported currently using alcohol at least 2–3 times per week.

See Table 1 for the zero-order associations between variables. As expected, the AS global factor was significantly correlated with marijuana withdrawal symptoms during the most recent discontinuation ($r = .30$, $p < .01$). It is important to note here that AS global factor and marijuana withdrawal symptoms, although positively associated with one another, shared only 9% of variance with one another. Thus, from an empirical perspective, there is little reason to suspect that these are overlapping constructs per se or subject-reaction effects. Similar effects were apparent for the AS subscales wherein the AS mental incapacitation factor, but no other lower-order AS factors, was significantly related to marijuana withdrawal symptoms ($r = .31$, $p < .01$, shared variance = 9%). Regarding the relation between other predictor variables and the criterion variable, daily tobacco use ($r = .30$, $p < .01$) and frequency of past 30 day marijuana

use (r = .43, p < .01) were significantly positively associated with marijuana withdrawal symptom severity.

AS was evaluated in relation to marijuana withdrawal symptoms using a hierarchical multiple regression procedure (Cohen & Cohen, 1983). Two separate models were constructed, one for the global AS factor and one for the lower order AS factors (entered simultaneously). Past 30 day marijuana use, as well as number of cigarettes smoked per day, volume of alcohol consumed, anxious arousal, and anhedonic depressive symptoms were simultaneously entered as covariates at step one in the model. At the second step, either the global AS factor, or all three first order AS factors (depending on the regression run) were simultaneously entered into the model in order to estimate the amount of variance accounted for by these main effects individually after accounting for the variance at step one.

In terms of the global AS factor, step one of the model accounted for 28.3% of the variance. Daily cigarettes (t = 2.00, β = .22, p = .05) and past 30 day marijuana use (t = 3.30, β = .41, p < .01) were the only significant predictors. As predicted, after controlling for variance accounted for by step one of the model, the global AS factor was a significant incremental predictor at step two of the model (t = 2.48, β = .26, p < .05, 6.3% of unique variance). In terms of the first order AS factors, as hypothesized, the only significant lower order AS factor to predict withdrawal was mental incapacitation concerns (t = 2.06, β = .23, p < .05).

Discussion

There is little empirical study of the factors that may relate to the nature of marijuana withdrawal symptoms. Drawing from anxiety-substance use comorbidity work (Stewart & Kushner, 2001;Zvolensky & Schmidt, 2004), AS has emerged as a cognitive factor related to affect-relevant addictive behavior processes. The present study sought to extend past work on AS to the study of marijuana withdrawal symptoms by evaluating whether this cognitive factor was incrementally related to marijuana withdrawal symptoms among a young adult sample of current marijuana users.

Consistent with expectation, the AS global construct was significantly and uniquely related to marijuana withdrawal symptom severity. The observed effect was above and beyond the variance accounted for by frequency of marijuana use, alcohol consumption, frequency of tobacco use, anxious arousal as well as anhedonic depressive symptoms. Such work uniquely extends past work on marijuana withdrawal by suggesting that AS is relevant to better understanding the severity of marijuana withdrawal. Subsequent analysis found that, as expected, the AS-mental incapacitation, but not other lower-order factors, was incrementally related to severity of reported withdrawal symptoms. This finding is broadly consistent with work indicating that, relative to other lower order facets of AS, the AS-mental incapacitation concerns tend to be the most predictive of negative emotional symptoms (Bernstein, Zvolensky, Weems, Stickle, & Leen-Feldner, 2005;Schmidt, Lerew, & Jackson, 1999;Zvolensky, Forsyth, Bernstein, & Leen-Feldner, in press). Such findings suggest that high AS marijuana users may be more apt to interpret and react negatively to the expected (aversive) cognitive consequences of the marijuana withdrawal syndrome. It is possible that because these high AS users tend to use marijuana more to cope with distressing withdrawal symptoms and perhaps stressors in general than their low AS counterparts (Bonn-Miller, Zvolensky, & Bernstein, in press), that they may worry about the aversive personal consequences of withdrawal symptoms (e.g., losing control) because they do not have a preferred coping strategy for regulating negative affect states (Zvolensky, Bernstein, Marshall, & Feldner, 2006). Based upon the present findings, future work is needed to address the interconnection among AS, motives for use, and the nature of withdrawal among marijuana users.

Three secondary findings are noteworthy in light of the relatively limited extant literature on correlates and predictors of individual differences in marijuana withdrawal. First, the present investigation replicated earlier findings (Budney et al., 1999) suggesting that greater levels of marijuana use are associated with greater levels of marijuana withdrawal. This finding extends past work by finding heavier levels of use are related to withdrawal symptoms among non-treatment seeking marijuana users. Second, it is important to note that although AS, and mental concerns in particular, were associated with marijuana withdrawal severity, anxiety and depressive symptoms were not. Although preliminary, these discriminant effects are theoretically provocative. Indeed, these discriminant findings provide further confidence in the theoretical conjecture that marijuana withdrawal symptomatology is not simply anxious or other psychopathological symptoms related to marijuana use or discontinuation. Moreover, these findings are theoretically provocative in that they may suggest that individual differences in marijuana withdrawal severity are related to emotional sensitivity processes specifically as opposed to emotional functioning more generally. Third, although cigarette smoking frequency was related to marijuana withdrawal severity, alcohol consumption was not. On the one hand, these findings suggest that certain substance use behaviors, other than marijuana, may be related to marijuana withdrawal; on the other hand, these findings suggest that this may be the case only for certain substances. These findings make clear the importance of future study focused on studying withdrawal syndromes of specific substances in a more ecologically valid context of other co-occurring substances and withdrawal syndromes.

Although work on marijuana withdrawal and even anxiety-marijuana relations more generally is only emerging, there is a need to continue to study AS and other anxiety factors in relation to marijuana and its disorders. As one illustrative example, to the extent marijuana withdrawal symptoms relate to negative quit experiences (e.g. less success quitting), as posited by models of withdrawal (Budney et al., 1999), identifying factors related to such an experience is potentially highly clinically important. That is, such knowledge prompts those working with marijuana users to assess for anxiety factors and perhaps intervene with them in a targeted fashion using established treatment strategies to decrease the severity of withdrawal symptoms during a quit attempt. Similar approaches have been successfully used in the case of AS in regard to benzodiazepine discontinuation (Otto et al., 1993) as well as smoking cessation (Zvolensky, Lejuez, Kahler, & Brown, 2003).

Though promising, the present findings represent only an initial effort to examine associations between AS and marijuana withdrawal symptoms. First, although consistent with the approach used in past work (Budney et al., 1999), withdrawal ratings were made retrospectively rather than prospectively. Based upon the present findings, future work is needed to replicate and extend such observations using prospective methodologies during an actual quit attempt. Second, while participants were asked to report on the nature of their marijuana withdrawal symptoms, it is possible that they could be confusing or misinterpreting symptoms related to other substance use behavior (e.g., tobacco use). Future studies could further evaluate this issue by exploring the nature of AS-marijuana withdrawal symptoms among users who do and do not use other substances. Third, a persistent challenge to marijuana research is attaining reliable and valid assessments of the parameters of drug behavior (see Stephens, 1999). In the present investigation, we followed previous work and examined marijuana use and frequency of such use. However, this is just one approach similar to past work and other studies may benefit from employing alternative methods (e.g., frequency by quantity of use in a specified epoch of time). Finally, while the sample was comprised of young adult marijuana users, participants, as a whole, were of a similar ethnic background and were not seeking treatment for their drug use. To aid in the generalizability of the present results, studies could employ alternative sampling strategies and test whether a similar AS effect for withdrawal is apparent among marijuana users seeking treatment for their drug use problem. This type of alternative sampling strategy would theoretically likely incorporate longer term users who experience more severe

withdrawal symptoms than the current population, and would help inform the relevance of these findings for clinical settings.

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Table 1

Descriptive Data and Zero-order Relations among Theoretically-Relevant Variables

	MASQ-AA	MASQ-AD	VAC	Cig/Day	MJ Use	ASI	ASI-P	ASI-M	ASI-S	MJ Withdrawal	Mean (SD)
MASQ-AA	1	.00	.02	.24*	.40**	.16	.12	.07	.23*	.21	21.6 (4.6)
MASQ-AD		1	−.24*	.02	−.11	.05	.08	.03	−.16	.06	50.7 (12.1)
VAC			1	−.04	.21	.05	−.01	.22*	−.01	.17	8.7 (4.0)
Cig/Day				1	.22*	.01	.06	−.06	−.09	.30**	1.8 (4.4)
MJ Use					1	.12	.09	.07	.16	.43**	4.5 (2.5)
ASI						1	.90**	.62**	.52**	.30**	15.3 (7.2)
ASI-P							1	.37**	.25*	.21	7.3 (4.9)
ASI-M								1	.20	.31**	1.9 (2.1)
ASI-S									1	.09	5.4 (2.0)
MJ Withdrawal										1	4.3 (5.5)

* = $p < .05$;

** = $p < .01$;

MASQ-AA: Mood and Anxiety Symptom Questionnaire – Anxious Arousal (Watson et al., 1995); MASQ-AD: Mood and Anxiety Symptom Questionnaire – Anhedonic Depression (Watson et al., 1995); VAC: Volume of Alcohol Consumed; Cig/Day: Daily Cigarettes; MJ Use: Past 30 day Marijuana Use; ASI: Anxiety Sensitivity Index – Total Score (Reiss et al., 1986); ASI-P, ASI-M and ASI-S: AS-physical concerns, AS-mental incapacitation concerns, and AS-social concerns, respectively (Zinbarg et al., 1997); MJ Withdrawal: Withdrawal Discomfort Score (Budney et al., 1999;Vandrey et al., 2005).