ORIGINAL ARTICLE

Cannabis Use and Anxiety Sensitivity in Relation to Physical Health and Functioning in Post-9/11 Veterans

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Abstract

Frequency of cannabis use and cognitive vulnerabilities such as anxiety sensitivity (i.e., the fear of bodily sensations), have been independently linked with poor physical health, however the interplay between these health-mental health processes may compound poor physical health and functioning in cannabis users. Thus, the current study evaluated the direct and interactive effects of cannabis use frequency and anxiety sensitivity on physical health and functioning among cannabis-using veterans. Participants ($N = 138$) were post-9/11 United States veterans recruited from a Veterans Affairs hospital who reported cannabis use in the past 6 months. Cannabis use frequency in the past month and anxiety sensitivity were significantly negatively correlated with perceived overall physical health. There was a significant interaction between cannabis use frequency and anxiety sensitivity, such that more frequent cannabis use was associated with poorer overall health and role functioning due to health problems among veterans with higher anxiety sensitivity (but not lower). Findings suggest that anxiety sensitivity is a cognitive vulnerability linked to poor perceived physical health and impairment among frequent cannabis users and could be targeted, along with cannabis use, for health-promotion in cannabis users.

Keywords Veterans · Marijuana · Physical health · Anxiety · Mechanisms

Introduction

Cannabis is the most commonly used illicit drug in the United States, with 22.2 million people aged 12 or older reporting use in the past month (SAMHSA 2015). Among United States military veterans, prevalence rates of cannabis use and disorder have more than doubled in the past decade (Bonn-Miller et al. 2012). The prevalence and healthcare burden of cannabis use disorder (CUD) are expected to continue to increase, especially in light of the changing landscape in cannabis legalization for medicinal and recreational use and low perceived risk from cannabis use (Compton et al. 2016; Hasin 2018; Hasin et al. 2015; Perron et al. 2015; Wilkinson et al. 2016). Rates of cannabis use are especially elevated among veterans with anxiety and related disorders, such as posttraumatic stress disorder (PTSD; Bonn-Miller et al. 2012; Bujarski et al. 2016; Goldman et al. 2010; Metrik et al. 2016), perhaps due to reliance on cannabis to cope with heightened negative affect and distress (Baker et al. 2004). Indeed, among cannabis-using veterans, coping-oriented reasons for use mediated the relation between PTSD and CUD (Metrik et al. 2016) and the most frequently endorsed conditions for self-identified medical use of cannabis were anxiety, stress, and PTSD (Metrik et al. 2018).

There is growing evidence that smoked cannabis may have negative acute and chronic effects on physical health outcomes (e.g., Hall 2009; Hill 2015; Mehra et al. 2006; Thomas et al. 2014; Volkow et al. 2014). These effects are particularly important to understand as veterans have greater

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impairments in physical health functioning when compared to the general population (Buckley et al. 2004), especially veterans with anxiety-related symptoms and disorders like PTSD (Boscarino 2008; Hall et al. 2014; Heppner et al. 2009; Jakupcak et al. 2008; Schnurr et al. 2000). Indeed, veterans who use cannabis for therapeutic reasons frequently report doing so to cope with chronic pain and to aid in sleep (Metrik et al. 2018), which is consistent with nonveteran literature (Walsh et al. 2013). Though less documented, poor physical health may also increase risk for heavy cannabis use (Jones and Lollar 2008). However, longitudinal research suggests that frequent and heavy cannabis use precedes the onset of poor health outcomes. For example, more frequent and heavier cannabis use early in life is associated with poorest physical health outcomes several years later, including poorer health-related quality of life, greater service utilization for physical health treatment, and greater functional impairment due to physical illness (Arria et al. 2016; Caldeira et al. 2012; Ellickson et al. 2004). This line of research can be meaningfully informed by examining psychological factors that may confer or compound risk for poor physical health functioning in the context of frequent cannabis use.

Cognitive processes play an important role in understanding the link between psychological and physical health (e.g., Eifert et al. 2000; Salkovskis 1992). In the past decade, anxiety sensitivity has been implicated in the etiology of anxiety-related disorders (e.g., PTSD; Olatunji and Wolitzky-Taylor 2009), linked directly and indirectly to problematic cannabis use and dependence symptoms (Bonn-Miller et al. 2007; Buckner et al. 2011; Bujarski et al. 2012; Farris et al. 2016; Johnson et al. 2010) and identified as a mechanism underlying the comorbidity of PTSD and substance use disorders (Vujanovic et al. 2018). Anxiety sensitivity is a cognitive vulnerability defined as the fear of bodily sensations and is characterized by the tendency to catastrophically interpret the meaning of such sensations (Reiss et al. 1986). For example, a high anxiety sensitive cannabis user may fear increased heart rate prompted by cannabis use and interpret it as evidence of a heart attack. Among the general population, anxiety sensitivity predicts heightened emotional and physical distress in response to acute somatic provocation (e.g., Keogh et al. 2006; McLeish et al. 2016; Nillni et al. 2012; Pane-Farre et al. 2015) and is associated with more severe somatic symptoms (e.g., Asmundson and Taylor 1996; Dixon et al. 2018; Fergus et al. 2018; Smitherman et al. 2015; Sugaya et al. 2013). Anxiety sensitivity has also been linked with somatic complaints among veterans (Jakupcak et al. 2006). Research non-specific to veterans also indicates that individuals with elevated anxiety sensitivity tend to hold poorer perceptions of their physical health (e.g., McLeish et al. 2007; Yartz et al. 2005) and often rely on health-risk behaviors to avoid or cope with distress (Otto

et al. 2016), including cannabis use (Farris et al. 2016; Zvolensky et al. 2009).

Based on the above evidence, anxiety sensitivity may be a novel cognitive mechanism for poor health in cannabis users. This line of research may be particularly useful to extend to veterans considering the high prevalence of psychological and physical morbidity in this subgroup of the population. Although not yet examined, veterans who use cannabis and have elevated anxiety sensitivity may hold more negative perceptions of their physical health and functioning due to heightened awareness and fear of bodily sensations. This may be particularly true among frequent cannabis users given that higher frequency of cannabis use is associated with poorer physical health and functioning. Thus, anxiety sensitivity and frequency of cannabis use can have direct and synergistic associations with physical health status in veterans.

The present study sought to evaluate the concurrent associations between cannabis use frequency, anxiety sensitivity, and physical health indices, including physical functioning, role functioning, bodily pain, general perceived health and overall physical health among post-9/11 returning veterans. It was hypothesized that cannabis use frequency and anxiety sensitivity would (a) be directly associated with poorer health across all domains and (b) synergistically relate to poor physical health, such that the combination of higher frequency of cannabis use and elevated anxiety sensitivity would be associated with the poorest physical health across health domains.

Method

Participants and Procedure

Data were obtained from OEF/OIF/OND veterans deployed post-9/11/2001 who completed baseline assessments as part of a longitudinal study of the trajectories of cannabis use and disorders, related problems, and concurrent affective disorders (Metrik et al. 2016). Participants met the following study inclusion criteria: (a) at least 18 years old; (b) an OEF/OIF/OND veteran as confirmed by the Providence VHA Computerized Patient Record Systems (CPRS); and (c) self-reported use of cannabis at least once in his or her lifetime. Exclusion criteria were: (a) suicidal risk in the past 2 weeks; (b) psychotic symptoms in the past month; (c) score ≤ 23 on the Mini-Mental Status Exam; or (d) active duty at the time of the baseline assessment (due to increased likelihood of study dropout due to deployment). Participants were recruited from a VA in the Northeastern US and by using a database of OEF/OIF/OND combat veterans who recently returned from military service in Iraq and Afghanistan and enrolled in VHA (see Metrik et al. 2016 for details

of recruitment procedures). Veterans were screened for eligibility by telephone and subsequently signed informed consent and completed a battery of interview and self-report assessments at a baseline visit. The present analysis included current cannabis users ($N = 138$), defined as any reported cannabis use in the past 6 months.

Measures

Demographic Information

Demographic and background variables including age, sex, and number of years since the end of last deployment were verified through the electronic medical record system at the VHA.

Cannabis Use Frequency

The Time-Line Follow-Back Interview (TLFB; Dennis et al. 2004; Sobell and Sobell 1992) was conducted to assess the presence and frequency of cannabis use in the past 6 months, including the percentage of cannabis use days in the past month. Past-month tobacco use (yes/no) and alcohol use (percent drinking days) were also assessed.

Anxiety Sensitivity

The Anxiety Sensitivity Index-3 (ASI-3; Taylor et al. 2007) is an 18-item self-report measure of the tendency to fear anxiety-related bodily sensations (e.g., "It scares me when my heart beats rapidly"). Items are rated on a scale of 0 (*very little*) to 4 (*very much*) and summed to create a total score with a possible range of 0–72. This measure has strong psychometric properties (Taylor et al. 2007), including among substance using individuals (Farris et al. 2015) and has been commonly used in veteran (e.g., Babson et al. 2013) and non-veteran (e.g., Buckner et al. 2011; Johnson et al. 2010) cannabis users. Internal consistency of ASI-3 items in this sample was $\alpha = 0.91$.

Physical Health

The Short-Form Health Survey of the Medical Outcomes (SF-36; Brazier et al. 1992) is a 36-item measure with eight health scales summarized as mental and physical components, with normative scores of 50 (mean) and 10 (standard deviation), where higher scores reflect more favorable health status. The SF-36 yields a Physical Health Summary Scale (21 items), and four subscales that tap specific aspects of health, including: Physical functioning (10 items; e.g., limited mobility; sample item: "Does your health now limit you in vigorous activities, such as running, lifting heavy objects,

participating in strenuous sports?"), Role Functioning (4 items; i.e., role limitations due to physical health problems; sample item: "During the past 4 weeks, have you cut down the amount of time you spent on work or other activities as a result of your physical health?"), Bodily Pain (2 items; i.e., perceptions of physical pain; sample item: "How much bodily pain have you had during the past 4 weeks?"), and General Health (5 items; i.e., perceived health; sample item: "My health is excellent.").

Statistical Analyses

Regression analyses were used to test the cross-sectional main and interactive effects of cannabis use frequency and anxiety sensitivity on overall physical health and the four health domains (physical functioning, role functioning, bodily pain, and general health). Continuous predictors were mean centered prior to model entry. Analyses were conducted using the PROCESS macro for SPSS, an ordinary least squares regression path analysis modeling program (Hayes 2013). Cannabis use frequency was entered as the predictor (X) and anxiety sensitivity was entered as the moderator (M) to examine the interaction of these predictors. Participant age was associated with four of the five physical health outcomes, and the number of years since the end of last deployment was associated with anxiety sensitivity and three of the five health outcomes. Therefore, all regression analyses controlled for these variables. In addition, tobacco use status and alcohol consumption were entered as covarying factors. To probe the interactions, we applied the Johnson–Neyman technique (Hayes and Matthes 2009). Using this technique we were able to identify values across anxiety sensitivity at which the conditional association between cannabis use frequency and physical health was significant.

Results

Sample Characteristics

The sample was predominantly male (93.5%) with a mean age of 30.1 ($SD = 7.10$) years and averaged 4.3 ($SD = 2.60$) years since the end of their last deployment. Participants reported using cannabis an average of 44.6% ($SD = 44.8$%) of days in the past month (range of 0–100%). Alcohol consumption was reported on an average of 24.6% of days in the past month, and 54.3% of the sample reported tobacco use in the past month. Baseline average score on the ASI-3 was 19.1 ($SD = 13.7$; range of 0–62), reflecting moderate levels of anxiety sensitivity (Taylor et al. 2007).

Descriptive information and bivariate correlations among main study variables are presented in Table 1. Frequency of cannabis use was significantly associated (small to medium

sized correlations) with poorer overall physical health, and specific domains including poorer role functioning due to physical health, more bodily pain, and lower perceived health, but was not significantly associated with physical functioning. Frequency of cannabis use was not associated with anxiety sensitivity. However, anxiety sensitivity was significantly associated with poorer overall physical health, including all four health domains (medium to large sized correlations).

Next, to evaluate the main and interactive effects of cannabis use frequency and anxiety sensitivity on physical health, multiple regression analyses were conducted (see Table 2).

Overall Physical Health

There were significant negative main effects of cannabis use frequency and anxiety sensitivity on overall physical health. The interactive effect of anxiety sensitivity and cannabis use on overall health was significant. Simple slopes analysis indicated that more frequent cannabis use was associated with significantly poorer physical health among veterans with higher levels of anxiety sensitivity ($+1SD$; $b = -0.19$, $t = -3.85$, $p < .001$) and with average levels of anxiety sensitivity (Mean; $b = 0.12$, $t = -3.30$, $p = .001$), but not with lower levels of anxiety sensitivity ($-1SD$; $b = -0.42$, $t = -0.86$, $p = .389$). See Fig. 1 (left panel). The Johnson–Neyman technique revealed that higher frequency of cannabis use was associated with poorer overall physical health at moderately elevated scores on the ASI-3 (≥ 12.0), which included 60.9% of the sample.

Role Functioning Due to Physical Health

There was a significant main effect of cannabis use frequency and anxiety sensitivity on poorer role functioning due to physical health. The interaction between cannabis use frequency and anxiety sensitivity was significant. Simple slopes analysis revealed that higher frequency of cannabis use was significantly related to poorer role functioning for those with higher levels of anxiety sensitivity ($+1SD$; $b = -0.34$, $p < .001$) and average levels of anxiety sensitivity (Mean; $b = -0.19$, $p = .006$), but not for those with lower levels of anxiety sensitivity (-1 SD; $b = -0.02$, $p = .853$). See Fig. 1 (right panel). The Johnson–Neyman technique revealed that higher frequency of cannabis use was associated with poorer role functioning at moderately elevated scores on the ASI-3 (≥ 15.2), which included 51.4% of the sample.

Bodily Pain

Cannabis use frequency was significantly associated with greater bodily pain, however there was a non-significant association between anxiety sensitivity and bodily pain. Additionally, the interaction between cannabis use frequency and anxiety sensitivity on bodily pain was non-significant.

Physical Functioning

There was a non-significant association between cannabis use frequency on physical functioning, however anxiety sensitivity was significantly negatively associated with

Table 1 Bivariate (zero-order) correlations

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Cannabis use	–	0.09	0.11	−0.25**	−0.27**	−0.15	−0.23**	−0.27**	−0.18*	−0.08	0.04
2. Anxiety sensitivity		–	0.08	−0.15	−0.38**	−0.25**	−0.32**	−0.22*	−0.41**	0.16	0.24**
3. Tobacco use status			–	−0.07	−0.20*	−0.03	−0.21*	−0.15	−0.18*	−0.04	−0.06
4. Alcohol use				–	0.06	0.08	0.03	0.08	−0.01	0.16	−0.06
5. Overall physical health					–	0.76**	0.85**	0.84**	0.64**	−0.25**	−0.18*
6. Physical functioning						–	0.49**	0.63**	0.36**	−0.29**	−0.18*
7. Role functioning							–	0.60**	0.37**	−0.20*	−0.11
8. Bodily pain								–	0.39**	−0.18*	−0.14
9. Perceived general health									–	−0.11	−0.17*
10. Age										–	0.42**
11. Years since last deployment											–
Mean	44.6	19.1	75	24.6	69.7	83.5	73.6	62.2	59.7	30.1	4.3
SD	44.83	13.71	54.3	39.86	20.37	19.59	36.34	26.24	21.25	7.10	2.60

Higher scores on the SF-36 indicate better health (e.g., higher scores on the pain subscale indicate *less* pain)

**$p < .01$; *$p < .05$; Cannabis Use (Time-Line Follow-Back Interview Past Month % days used); Tobacco Use (Y/N), and Alcohol Use (Time-Line Follow-Back Interview Past Month % days used); Anxiety Sensitivity (Anxiety Sensitivity Index-3 Total score); Overall Physical Health (SF-36 Physical health summary score); Physical Functioning (SF-36 Physical functioning subscale); Role Functioning (SF-36 Role limitations due to physical health problems); Bodily Pain (SF-36 Bodily pain); Perceived General Health (SF-36 General health)

Table 2 Multivariate association of cannabis use and anxiety sensitivity with physical health outcomes

	R^2	b	se	t	p	sr^2
Overall physical health						
Age	0.294**	−0.65	0.24	−2.72	0.007	0.040
Years since last deployment		−0.17	0.65	−0.26	0.794	0.000
Drinking frequency		−0.02	0.05	−0.34	0.738	0.001
Tobacco use status		−6.81	3.05	−2.23	0.027	0.027
Cannabis use frequency		−0.12	0.03	−3.30	0.001	0.059
Anxiety sensitivity		−0.44	0.12	−3.85	0.000	0.081
Cannabis x anxiety sensitivity		−0.01	0.00	−2.15	0.033	0.025
Physical functioning						
Age	0.162**	−0.79	0.25	−3.15	0.002	0.064
Years since last deployment		−0.12	0.69	−0.17	0.862	0.000
Drinking frequency		0.04	0.06	0.78	0.436	0.004
Tobacco use status		−0.59	3.20	−0.18	0.855	0.000
Cannabis use frequency		−0.06	0.04	−1.61	0.110	0.017
Anxiety sensitivity		−0.24	0.12	−2.02	0.045	0.026
Cannabis x anxiety sensitivity		0.00	0.00	−1.28	0.203	0.011
Role functioning						
Age	0.242**	−1.07	0.45	−2.41	0.017	0.034
Years since last deployment		0.38	1.21	0.32	0.751	0.001
Drinking frequency		−0.05	0.10	−0.51	0.613	0.001
Tobacco use status		−13.50	5.64	−2.39	0.018	0.033
Cannabis use frequency		−0.18	0.06	−2.77	0.006	0.045
Anxiety sensitivity		−0.68	0.21	−3.17	0.002	0.059
Cannabis x anxiety sensitivity		−0.01	0.00	−2.58	0.011	0.039
Bodily pain						
Age	0.161**	−0.69	0.34	−2.04	0.043	0.027
Years since last deployment		−0.24	0.92	−0.26	0.792	0.000
Drinking frequency		0.02	0.08	0.21	0.835	0.000
Tobacco use status		−6.44	4.28	−1.50	0.135	0.015
Cannabis use frequency		−0.15	0.05	−3.08	0.003	0.061
Anxiety sensitivity		−0.27	0.16	−1.68	0.095	0.018
Cannabis x anxiety sensitivity		0.00	0.00	−0.83	0.408	0.004
General health						
Age	0.237**	−0.06	0.26	−0.24	0.809	0.000
Years since last deployment		−0.71	0.71	−1.00	0.320	0.006
Drinking frequency		−0.08	0.06	−1.40	0.164	0.011
Tobacco use status		−6.69	3.31	−2.02	0.045	0.024
Cannabis use frequency		−0.07	0.04	−1.90	0.059	0.021
Anxiety sensitivity		−0.58	0.13	−4.67	0.000	0.128
Cannabis x anxiety sensitivity		0.00	0.00	−1.23	0.222	0.009

*$p < .05$; **$p < .01$

physical functioning. The interaction between cannabis use frequency and anxiety sensitivity on physical functioning was non-significant.

General Health

There was a non-significant association between cannabis use frequency on general health, however anxiety sensitivity was significantly negatively associated with general health. The interaction between cannabis use frequency and anxiety sensitivity on general health was non-significant.
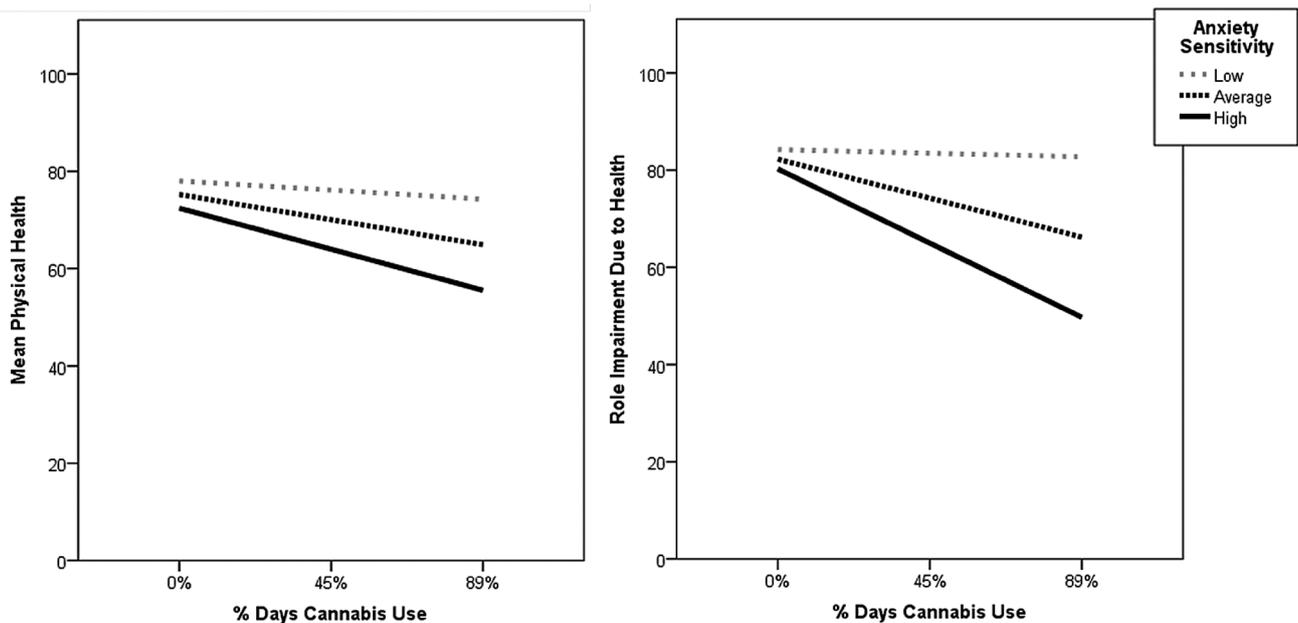
Fig. 1 Frequency of cannabis use is significantly associated with poorer physical health and poorer role functioning due to physical health for participants with high (+ 1 SD) and average, but not low (− 1 SD), levels of anxiety sensitivity

Discussion

The current study evaluated the main and interactive effects of cannabis use frequency and anxiety sensitivity on physical health and functioning. As hypothesized, higher frequency of cannabis use was associated with poorer overall physical health, greater role functioning impairment due to physical condition, greater bodily pain, and perceived general health. A similar patterning of associations was observed after adjusting for age, time since last deployment, and past-month tobacco and alcohol use. This set of findings replicates prior studies that document the inverse association between cannabis use frequency and physical health, health-related quality of life, health service utilization, and functional impairment (e.g., Arria et al. 2016; Ellickson et al. 2004; Walsh et al. 2013), and uniquely extends it to cannabis-using veterans.

Findings also provide novel evidence of the association between anxiety sensitivity and physical health and functioning in this sample of veterans. Consistent with prior work in non-veteran (Fergus et al. 2018; Hensley and Varela 2008; McLeish et al. 2007; Yartz et al. 2005) and veteran (Jakupcak et al. 2006) samples, greater anxiety sensitivity was associated with poorer physical health and functioning across all domains at the bivariate level. Thus, the tendency to fearfully appraise bodily sensations is linked with perceptions of poorer physical health and functional impairment in veterans. Of note, anxiety sensitivity accounted for 2.6–12.8% unique variance in physical health and functioning over and

above the effects of covariates, except in the case of bodily pain. This finding is somewhat surprising considering the well-documented association between anxiety sensitivity and pain, particularly fear of pain and to a lesser extent pain severity and pain-related disability, in clinical and nonclinical samples (Ocanez et al. 2010). Thus, at the bivariate level, anxiety sensitivity is associated with greater bodily pain in cannabis-using veterans, although this small association is no longer evident after accounting for additional factors, like age and frequency of cannabis use. Theoretically, older cannabis-using veterans may attribute bodily pains to age-related decline and may therefore respond with less anxiety and fear to bodily pain (Chopik 2017; Mahoney et al. 2015). It is also possible that veterans that use cannabis more frequently do so for management of their bodily pain, and motivation to alleviate bodily pain may become more salient than concerns about other bodily sensations.

Anxiety sensitivity and cannabis use frequency demonstrated a synergistic role in overall physical health and role functioning due to health problems. Specifically, the combination of elevated anxiety sensitivity and high frequency of cannabis use (89% days; i.e., daily users) was associated with the poorest physical health and greatest functional impairment due to health problems. These interactive effects were only significant at moderate to high, but not low levels of anxiety sensitivity. Because frequent cannabis users are exposed more often to cannabis' acute effects on cognition, motor functioning, and physiological arousal (Metrik et al. 2012; Ramaekers et al. 2006), frequent users with elevated

anxiety sensitivity may more often encounter and negatively react to altered physical and mental states (Farris and Metrik 2016), which can contribute to subjective experiences of poorer physical health and more role impairment. Alternatively, heavy cannabis use can produce tolerance to cannabis' acute neurocognitive effects (e.g., Desrosiers et al. 2015) and the development of tension-reduction expectancies surrounding the acute effects of cannabis (Metrik et al. 2011). In this case, individuals with elevated anxiety sensitivity may be hypervigilant and reactive to breakthrough tension, pain, or other uncomfortable bodily states (Portenoy et al. 1999), and subsequently interpret these interoceptive symptoms as evidence of poor health that negatively impact role functioning. More research is recommended to distill the mechanism underlying these observed associations, especially in light of the non-significant interaction effects for other physical health domains, including physical functioning, bodily pain and general health.

The significant interactions are particularly interesting to consider in light of the non-significant bivariate association between anxiety sensitivity and cannabis use frequency. Anxiety sensitivity is generally not associated with frequency of substance use, across different substance use types (e.g., tobacco, alcohol; Vujanovic et al. 2018). In fact, existing evidence suggests that anxiety sensitivity is not directly related to substance use behavior, but instead, indirectly via moderating or mediating influences (Vujanovic et al. 2018). For instance, anxiety sensitivity is associated with coping-focused reasons for cannabis use (e.g., Bonn-Miller et al. 2007; Farris et al. 2016; Mitchell et al. 2007; Zvolensky et al. 2009), which contributes to more problematic cannabis use (e.g., Bujarski et al. 2012; Johnson et al. 2010). Elevated anxiety sensitivity may also motivate use of additional avoidance behaviors to cope with distress, which further hinder physical health. Future research is warranted to further understand the dynamic associations between anxiety sensitivity and physical health in the context of cannabis use.

There are several limitations to the current study. First, this study used cross-sectional data, which limits inferences about directionality. For example, in the current data, it is unknown how physical health contributed to frequency of cannabis use. Prospective modeling of the relationships among anxiety sensitivity and cannabis use on the development of subsequent physical health problems and impairment is needed. Second, the current sample was primarily men (93.5%). Although men have a higher prevalence of cannabis use relative to women (Azofeifa et al. 2016; Carliner et al. 2017), more research is needed in women to increase external validity of this work. Finally, the current study relied exclusively on self-reported assessment of physical health and functioning. Thus, research is needed to understand the nature

of anxiety sensitivity and cannabis use in the context of perceived (subjective) health relative to objectively measured physical health and impairment.

In conclusion, anxiety sensitivity is a cognitive vulnerability that independently and interactively contributes to perceptions of poorer health and role impairment among cannabis-using veterans. As a transdiagnostic risk factor implicated in maintenance of PTSD, cannabis use, and their comorbidity (Vujanovic et al. 2018), anxety sensitivity is a promising therapeutic target for the veteran population involved with cannabis use. Cannabis users with elevated anxiety sensitivity, especially those who are frequent users, might benefit from intervention addressing hypervigilance to, and misperceptions of, bodily sensations (Smits et al. 2008). Another indicated clinical strategy could be enhancing emotion regulation techniques and stress reduction skills (Buckner et al. 2016). By promoting cognitive flexibility response to psychological and physical distress, perceptions of well-being and physical health may improve along with reductions in substance use behaviors (e.g., reductions in cannabis use). Indeed, acceptance- and mindfulness-based interventions for chronic pain produce large improvements in pain-interference, and to a lesser extent pain intensity (Veehof et al. 2016), which is consistent with the proximal goal of improving adaptive functioning even in the presence of physical distress (Hayes et al. 1999). Finally, mindfulness-based interventions that incorporate aspects of relapse prevention show particular promise in reducing substance use behaviors via targeted changes in pain and anxiety-related symptoms (Grant et al. 2017). For individuals high in anxiety sensitivity, this approach may help weaken reliance on cannabis use to cope with negative affectivity and may yield significant benefit in terms of improved physical health functioning.

Compliance with Ethical Standards

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