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Medicinal Versus Recreational Cannabis Use Among Returning Veterans

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Although increasing rates of cannabis use and cannabis use disorder (CUD) are well documented among veterans, little is known about their use of cannabis specifically for medicinal purposes. The present study characterizes such use and compares veterans reporting cannabis use for medicinal ($n = 66$) versus recreational ($n = 77$) purposes on (a) sociodemographic factors, (b) psychiatric disorders (posttraumatic stress disorder [PTSD], major depressive disorder [MDD], and CUD), (c) other substance use, (d) reasons for cannabis use and cannabis-related problems, and (e) physical and mental health. Participants were veterans deployed post 9/11/2001 recruited from a Veterans Health Administration (VHA) facility ($N = 143$; mean [*SD*] age = 30.0 [6.6]; mean [*SD*] deployments = 1.7 [1.1]) who reported past-year cannabis use. The most frequently endorsed conditions for medicinal cannabis (MC) use were anxiety/stress, PTSD, pain, depression, and insomnia. In logistic regression analyses adjusted for frequency of cannabis use, MC users were significantly more likely (odds ratio [*OR*] = 3.16) to meet criteria for PTSD than were recreational cannabis (RC) users. Relative to RC users, MC users reported significantly greater motivation for using cannabis to cope with sleep disturbance, as well as significantly poorer sleep quality and worse physical health. Veterans who use cannabis for medicinal purposes differ significantly in sleep, physical, and mental health functioning than do veterans who use cannabis for recreational purposes. PTSD and sleep problems may be especially relevant issues to address in screening and providing clinical care to returning veterans who are using cannabis for medicinal purposes.

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What is the significance of this article for the general public?
The most common conditions for medicinal cannabis (MC) use among returning veterans were anxiety/stress, posttraumatic stress disorder (PTSD), pain, depression, and insomnia, with sleep being a more important reason for cannabis use among MC users than recreational cannabis (RC) users. MC users were more likely to have PTSD diagnosis yet used alcohol less frequently than RC users.

Keywords: medical marijuana, cannabis, sleep, PTSD, veteran

With the majority of U.S. states having adopted legislation to medically and/or recreationally legalize cannabis, the already high prevalence of cannabis use (Hasin et al., 2015) is expected to further increase nationwide, especially among existing users (Hall & Lynskey, 2016; Pacula & Lundberg, 2014). States that allow the legal use of cannabis for medicinal purposes have higher rates of cannabis use and cannabis use disorder (CUD) in national survey data (Cerdá, Wall, Keyes, Galea, & Hasin, 2012) and specifically within the Veterans Health Administration (VHA; Bonn-Miller, Harris, & Trafton, 2012). Veteran advocacy groups have been created to further veterans' rights to access cannabis for medical (MC) purposes and discuss its use with their VHA providers (for e.g., http://www.vetscp.org/#). There are also published reports that veterans perceive cannabis to be a low-risk or safe substance unlike other drugs of abuse (Wilkinson, van Schalkwyk, Davidson, & D'Souza, 2016) and expect cannabis to provide relief from symptoms of combat-related trauma (Earleywine & Bolles, 2014). However, there has been little research on the patterns and correlates of MC use specifically among veterans.

Growing research indicates that rates of cannabis use and CUD are particularly elevated among veterans with posttraumatic stress disorder (PTSD) and major depressive disorder (MDD; Bonn-Miller et al., 2012; Goldman et al., 2010). These individuals are particularly likely to use cannabis as a means of coping with negative affect and with sleep disturbances (Boden, Babson, Vujanovic, Short, & Bonn-Miller, 2013; Bremner, Southwick, Darnell, & Charney, 1996; Earleywine & Bolles, 2014; Farris, Zvolensky, Boden, & Bonn-Miller, 2014; Gentes et al., 2016; Metrik et al., 2016). Nonveteran research also identifies cannabis use as an emotion-regulatory strategy to reduce or manage perceived aversive psychological and mood states (Bonn-Miller, Vujanovic, Boden, & Gross, 2011; Bonn-Miller, Vujanovic, Feldner, Bernstein, & Zvolensky, 2007; Buckner & Zvolensky, 2014; Bujarski, Norberg, & Copeland, 2012; Farris, Metrik, Bonn-Miller, Kahler, & Zvolensky, 2016; Metrik, Kahler, McGeary, Monti, & Rohsenow, 2011; Simons, Gaher, Correia, Hansen, & Christopher, 2005). However, although such sleep and emotion regulation motives are commonly endorsed reasons for non-MC use among veterans in general, little is known about potential differences in motives among veterans using MC relative to those using cannabis recreationally (RC) for nonmedical reasons.

Motivation for MC use has been examined in nonveteran populations (Lin, Ilgen, Jannausch, & Bohnert, 2016), with the most commonly endorsed reasons for use being pain, anxiety, and sleep problems (Babson, Boden, & Bonn-Miller, 2013; Belendiuk, Baldini, & Bonn-Miller, 2015; Bonn-Miller, Boden, Bucossi, & Babson, 2014; Ilgen et al., 2013; Nunberg, Kilmer, Pacula, & Burgdorf, 2011; Walsh et al., 2013). Besides pain management, relief of anxiety, especially PTSD, appears to be a prevalent motive for MC use in community samples (Bohnert et al., 2014; Bonn-Miller, Babson, & Vandrey, 2014; Bonn-Miller, Boden, et al., 2014; Greer, Grob, & Halberstadt, 2014; Walsh et al., 2017) and among veterans (Davis et al., 2016; Loflin, Earleywine, & Bonn-Miller, 2017). Indeed, PTSD is now recognized as a qualifying condition by the majority of states permitting legal access to medicinal cannabis. Sleep disturbance, particularly in conjunction with PTSD, is associated with more frequent and more problematic use of cannabis in nonveteran samples (Babson et al., 2013; Bonn-Miller, Babson, et al., 2014; Bonn-Miller, Boden, et al., 2014) and with frequent cannabis use and CUD among veterans (Metrik et al., 2016). Thus, MC use may be driven by specific motives for use that are inter-

related with certain comorbid conditions (PTSD, sleep disorders) that are particularly prevalent in veteran populations.

Medical dispensary patients also report using cannabis as a substitute for prescription medication and for alcohol (Nunberg et al., 2011; Reiman, 2007), with the most common motives for using cannabis instead of alcohol or illicit or prescription drugs being fewer perceived side effects, better symptom management (Perron, Bohnert, Perone, Bonn-Miller, & Ilgen, 2015; Reiman, 2007; Troutt & DiDonato, 2015), and decreased severity of withdrawal with cannabis (Reiman, 2009). Indeed, the vast majority of MC patients self-report at least moderate symptom relief across all conditions (Bonn-Miller, Boden, et al., 2014; Walsh et al., 2013; Zaller, Topletz, Frater, Yates, & Lally, 2015). Preliminary prospective research found a 42% reduction in use of prescribed opiates over 3 months following the initiation of MC treatment (Gruber et al., 2016). Yet, cannabis used specifically for pain management among MC users is significantly associated with past history of more severe substance use patterns including use of alcohol, illicit drugs, and nonprescribed pain relievers (Perron et al., 2015; Reiman, 2007; Zaller et al., 2015).

In contrast to the growing literature on MC use, only a few nonveteran studies explicitly compared MC and RC users on cannabis-related behaviors and motives. MC users were found to have poorer health but lower levels of alcohol and drug use disorders relative to RC users (excluding CUD; Lin et al., 2016). Compared with RC users, MC users have reported lower frequency of alcohol and drug problems during a visit to the emergency department (Woodruff & Shillington, 2016) and primary care clinic (Roy-Byrne et al., 2015). Among MC users, patients with state legal access to cannabis had lower rates of other substance use relative to cannabis users without access to MC who might have used cannabis recreationally (Richmond et al., 2015).

To date, there has been little research on MC use in veteran populations, with only one study differentiating between MC and RC use in veterans (Loflin et al., 2017). Findings from this online survey of veterans recruited from a pro-marijuana legalization listserv showed that MC users had more PTSD symptoms and greater combat exposure than RC veterans as well as lower levels of alcohol use. Veteran research can greatly inform federal and state cannabis-related policies, which are in constant flux yet shifting toward more tolerant practices regarding MC use within the VHA. These policies are especially relevant to returning veterans from the Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn (OEF/OIF/OND) conflicts, because they have endured high stress levels due to their military experiences (combat exposure) and postdeployment reintegration problems (e.g., financial, family, unemployment; Brenner et al., 2015; Wilcox et al., 2015). Like nonveteran MC users, OEF/OIF/OND soldiers, particularly those with PTSD, also report poor general health and increased somatic symptoms such as chronic pain (Gironda, Clark, Massengale, & Walker, 2006; Spiro, Hankin, Mansell, & Kazis, 2006), greater medical services utilization (Cohen et al., 2010; Kim, Thomas, Wilk, Castro, & Hoge, 2010), and worse sleep (Capaldi, Guerrero, & Killgore, 2011; Lavie, Katz, Pillar, & Zinger, 1998; Lew et al., 2009; Mysliwiec et al., 2013). Anecdotal reports indicate returning veterans also use cannabis as a substitute for other prescribed and nonprescribed substances and may perceive cannabis to be less harmful than opioids (Krawitz, 2015). Cannabis use also increases the perception of poor health above and beyond cigarette smoking and other relevant factors (Bonn-Miller, Zvolensky, Leen-Feldner, Feldner, & Yartz, 2005). Therefore, both actual and perceived poor health combined with increasingly favorable attitudes toward cannabis among veterans (Wilkinson et al., 2016) may further increase the likelihood of OIF/OEF/OND veterans seeking MC.

In summary, use of MC within the VHA is a growing clinical issue. However, there is a dearth of studies differentiating MC versus RC use patterns and correlates in veterans, despite their disproportionately higher rates of PTSD, anxiety, sleep, and chronic pain diagnoses relative to the general population (Alexander et al., 2016; Lew et al., 2009; Magruder et al., 2005; Van Den Kerkhof, Carley, Hopman, Ross-White, & Harrison, 2014). The present study has two aims. First, we describe the characteristics and motives for past-year MC use in a sample of returning veterans. Second, we compare past-year MC versus RC users on sociodemographic factors and diagnostic characteristics, substance use, motives for cannabis use, and physical and mental health variables. MC use was determined by veteran self-report of using cannabis for medicinal purposes, regardless

of whether a veteran possessed a medical marijuana registration card. Frequency of marijuana use was covaried in these analyses because MC users typically endorse daily or almost daily patterns of use (Lin et al., 2016; Walsh et al., 2013). We hypothesized that MC veteran users would endorse more salient coping and sleep cannabis use motives relative to RC users as a means of coping with psychiatric and medical conditions. These comparisons between MC and RC users can inform the development of future VHA policy as well as current screening, assessment and clinical practices with OIF/OEF/OND veterans.

Method

Sample and Procedure

Data were drawn from a larger ongoing prospective study examining cannabis use and affective disorders in returning OEF/OIF/OND veterans who were deployed post-9/11/2001 and who used cannabis at least once in his or her lifetime. Participants were recruited from a VHA facility in the Northeast United States (see Metrik et al., 2016, for details of recruitment procedures), with all participants residing in a state with medical marijuana laws. Veterans were screened for eligibility by telephone and were invited for a baseline visit, at which time they signed informed consent and completed a battery of interview and self-report assessments. The study was approved by the university and local VHA Institutional Review Boards. Participants were compensated $50 upon completion of the study session. Analyses were completed on the subsample of participants who reported any use of cannabis in the past year (n = 143). The sample was predominantly male (93%), with a mean age of 30.0 (SD = 6.6) years. Most participants identified as White (78.7%), followed by Black/African American (4.3%), American Indian/Alaskan Native (0.7%), and Multiracial/other (14.2%), with 14.7% also identifying as Hispanic/Latino. The majority of participants was employed (67.8%) and single/separated/divorced (66.5%), with 33.6% married or living with a partner. On average, participants had been deployed 1.7 times (SD = 1.1), with their most recent deployment occurring on average 4.3 years ago (SD = 2.6).

Measures

Characteristics of medicinal cannabis users. Participants were classified as a MC user (n = 66) if they endorsed ever using cannabis for medicinal purposes (i.e., less than monthly, monthly, weekly, daily or almost daily) on The Medical Marijuana Patient Questionnaire (MMPQ; N. L. Cohen, Heinz, Ilgen, & Bonn-Miller, 2016). Participants responded to a modified MMPQ, which retained three original items determining the duration of MC use, the condition(s) for which participants used MC, and perceived effectiveness of MC, as well as seven new items developed for this study on legal access to medical marijuana (i.e., registration card), experience and/or plans in discussing using medical marijuana with a doctor, and conventional and alternative treatments tried (e.g., prescription medication, physical therapy, counseling). Next, MC users completed the Reasons for Medical Marijuana Questionnaire (RFUMM; Reinarman, Nunberg, Lanthier, & Heddleston, 2011), rating on a 1 = "*almost never/never*" to 5 = "*almost always/always*" scale how often they used medical marijuana for each of 25 reasons (e.g., to relieve pain; to improve sleep). Items on anger and PTSD and cannabis as a substitute for another drug were added (25-item scale: α = .88).

Participants were classified as a RC user (n = 77) if they responded never using marijuana for medicinal purposes and not needing medical marijuana for any conditions. Participants who stated they did not need medical marijuana for any conditions (first item on the MMPQ) were prompted to skip the rest of the MMPQ and did not complete the RFUMM.

Demographic information. Demographic and background information, such as sex, ethnicity, marital status, employment, branch of service, location, and number of deployments (OEF/OIF/OND) was collected on all participants at baseline and verified through the VHA Computerized Patient Record System (CPRS).

Psychiatric diagnoses. The Clinician Administered PTSD Scale for *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., *DSM–IV*; CAPS; Blake et al., 1995) is a semi-structured interview for assessing lifetime and past-month *DSM–IV* PTSD diagnosis. Participants were scored for frequency (score $\geq$1) and intensity (score $\geq$2) of symptoms using estab-

lished diagnostic guidelines (Weathers, Keane, & Davidson, 2001). Participants were assigned a lifetime and past-month dichotomous diagnosis score.

Structured Clinical Interview for DSM nonpatient edition (SCID-NP) was used to determine diagnosis of lifetime and past-month *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., *DSM–5*) MDD (First, Spitzer, Gibbon, & Williams, 2002). *DSM–5* diagnosis of lifetime and past-year CUD was also determined with the SCID-NP based on endorsement of 2+ of 11 symptoms). With the release of *DSM–5* (American Psychiatric Association, 2013), legal problems diagnostic criterion was excluded and items assessing cannabis withdrawal and craving were included.

Cannabis use and other substance use-related variables. The Time-Line Follow-Back (TLFB; Dennis, Funk, Godley, Godley, & Waldron, 2004; Sobell & Sobell, 1992) covered the 6 months prior to the visit and was used to determine percentage of cannabis use days and percentage of cannabis, other drug use, alcohol, heavy drinking days (gender-adjusted for 5/4 drinks) and number of drinks per week in the past month. The TLFB is a calendar-assisted structured interview, which provides a way to cue memory to enhance recall accuracy. The TLFB interview is established as a psychometrically sound retrospective method for assessing alcohol use (Sobell & Sobell, 1992) and cannabis use (Dennis et al., 2004).

Cannabis-related problems were assessed with the Marijuana Problems Scale (MPS; Stephens, Roffman, & Curtin, 2000), a self-report 22-item questionnaire that evaluates cannabis-related problems experienced in the past 90 days ($\alpha = .89$).

The Comprehensive Marijuana Motives Questionnaire (CMMQ; Lee, Neighbors, Hendershot, & Grossbard, 2009). All participants rated on a 1 = "*almost never/never*" to 5 = "*almost always/always*" scale how often they used cannabis for each of 36 reasons; three items per subscale were used to derive a mean composite score for 12 different motives (αs: .77 to 90).

Physical and mental health characteristics. The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a psychometrically sound self-report questionnaire for assessing sleep quality and disturbances over a 1-month period (Carpenter & Andrykowski, 1998). The PSQI scale score (summed across seven component scores) ranges from 0 = "*indicating no difficulty*" to 21 = "*indicating severe difficulty in all sleep areas.*" A global PSQI score >5 indicates poor sleep quality.

The RAND 36-Item Short Form Health Survey (SF-36; Hays & Morales, 2001) is a health-related quality of life measure of physical and mental health. Items were scored from 0 to 100 and were averaged across subscales to form physical ($\alpha = .92$) and mental health ($\alpha = .91$) summary scores.

The Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) is a summed scale score across four items measuring perception of life stress, with items ranging from 0 = "*never*" to 4 = "*very often*" ($\alpha = .85$).

The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) is a summed scale score across five items measuring participants' judgments regarding their life satisfaction, with items ranging from 1 = "*strongly disagree*" to 7 = "*strongly agree*" ($\alpha = .86$).

Results

Characteristics of Medicinal Cannabis Users

As shown in Table 1, only about a quarter of MC veterans reported obtaining a state-issued medical marijuana card. The most frequently endorsed conditions for which the majority of the participants sought medicinal cannabis were anxiety, PTSD, chronic pain, depression, stress, and insomnia (Table 1).

On the RFUMM, MC users reported using cannabis most frequently to improve sleep ($M = 4.0$; $SD = 1.3$) and relaxation ($M = 4.0$; $SD = 1.2$), to relieve PTSD ($M = 3.9$; $SD = 1.5$), anxiety ($M = 3.6$; $SD = 1.4$), pain ($M = 3.44$; $SD = 1.5$), and depression ($M = 3.35$; $SD = 1.5$), to prevent PTSD ($M = 3.6$; $SD = 1.6$) and anger ($M = 3.1$; $SD = 1.6$), and as a substitute for prescription medication ($M = 3.4$; $SD = 1.6$), for alcohol ($M = 2.6$; $SD = 1.7$), and for another drug ($M = 1.9$; $SD = 1.6$).

Comparisons Between MC and RC Users

The two groups did not significantly differ by age ($p = .33$), sex ($p = .12$), race ($p = .42$), ethnicity ($p = .88$), marital status ($p = .25$),

Table 1
Characteristics of Medicinal Cannabis Users (n = 66)

Characteristics	*N*	*%*
Do you have a qualifying medical condition that would make you eligible to receive medical marijuana in your state?		
• Yes	41	62.1
• I do not know whether my medical condition would make me eligible	16	24.2
• I do not have a medical condition that would make me eligible but think medical marijuana would help me with a problem	9	13.6
	M	*SD*
How long have you been using marijuana for medicinal purposes?		
• Years	3.39	5.47
• Months	1.27	2.30
	N	*%*
How often have you used marijuana for medicinal purposes?		
• Less than monthly	2	3.0
• Monthly	6	9.1
• Weekly	16	24.2
• Daily or almost daily	42	63.6
Have you ever obtained a medical marijuana registration card?		
• Yes	16	24.2
• No	50	75.8
If no, have you before or are you now considering obtaining a medical marijuana card?		
• Definitely will not obtain	1	2.0
• Probably will not obtain	2	4.0
• Not sure	10	20.0
• Probably will obtain	19	38.0
• Definitely will obtain	18	36.0
Have you ever discussed the possibility of using medical marijuana (using marijuana for medicinal purpose) with your doctor (check all that apply)?		
• Yes and my doctor agreed that I would benefit from medical marijuana	24	36.4
• Yes and my doctor said that I would not benefit from medical marijuana	2	3.0
• No because I know s/he will not be willing to consider medical marijuana in my treatment	10	15.2
• No because I do not think I would be eligible for the medical marijuana program in my state	5	7.6
• No but plan to do so in the near future	21	31.8
• No but plan to seek another doctor who would discuss the medical marijuana option with me	9	13.6
• No because I do not want to get in trouble and/or have this discussion negatively affect my benefits and services at the VA	17	25.8
What condition(s) have led you to seek out medicinal marijuana (i.e., what is it prescribed for; check all that apply)?[a]		
• Anxiety	49	74.2
• PTSD	43	65.2
• Chronic pain	41	62.1
• Depression	41	62.1
• Stress	39	59.1
• Insomnia	37	56.1
• Headaches	29	43.9
• Nightmares	23	34.8
• Appetite	20	30.3
• Muscle spasms	21	31.8
• Nausea	14	21.2
How well has the use of marijuana helped your condition?		
• Not at all	1	1.5
• A little bit	1	1.5
• Moderately	7	10.6
• Quite a bit	23	34.8
• Extremely	34	51.5
Have you tried any of the following treatments for your medical condition (choose all that apply)?		

(*table continues*)

Table 1 (*continued*)

Characteristics	*N*	%
• Prescription medications	53	80.3
• Counseling	45	68.2
• Physical therapy	39	59.1
• Chiropractic	19	28.8
• Acupuncture	13	19.7
• Therapeutic injection	10	15.2
• Surgery	7	10.6
• Other	5	7.6
• Homeopathy	3	4.5
• None, do not need any treatment	2	3.0
Have you ever used marijuana obtained by someone else with their medical card?		
• No, no need, I have my own medical marijuana card	12	18.2
• No, I use marijuana from other sources	25	37.9
• Not sure	16	24.2
• Yes, I have used it but only a few times	8	12.1
• Yes, I use it regularly	5	7.6

Note. VA = U.S. Department of Veterans Affairs; PTSD = posttraumatic stress disorder. Questions in *italics* were from The Medical Marijuana Patient Questionnaire.

[a] Includes conditions for which at least 10% of the sample endorsed using cannabis. Less than 10% reported using for the following conditions: HIV/AIDS, glaucoma, cancer, seizures, gastrointestinal problems (e.g., Crohn's disease, gastroparesis, ulcerative colitis), epilepsy, hepatitis C, multiple sclerosis, Lyme disease, degenerative disc disease, and pain pills.

employment ($p = .08$), number of deployments ($p = .63$), or last deployment ($p = .07$). Table 2 presents comparisons between MC and RC users in analyses that were conducted in two ways. First, to facilitate comparison with other similar studies comparing MC and RC use, we did not statistically adjust for frequency of cannabis use. As shown in Table 2, MC users were five times more likely to have a current diagnosis of PTSD and almost four times more likely to have current diagnosis of MDD than RC users (unadjusted for frequency of cannabis use). MC users were also more than three times more likely to meet criteria for current CUD and endorse significantly more cannabis-related problems than RC users. With respect to cannabis-use motives, MC users reported using cannabis more frequently than RC users for enjoyment, coping, social anxiety, relative low risk, and sleep. Relative to MC users, RC users reported alcohol was more often a motive for cannabis use and reported greater number of alcohol use days on the TLFB. MC users reported worse sleep quality than RC users on the PSQI and scored significantly lower than RC users on the Satisfaction with Life scale and the physical health and mental health summary scales of the SF-36.

As expected, MC users reported using cannabis more frequently than RC users, with 64% endorsing daily or nearly daily use (compared with 21% for RC users). Therefore, we conducted comparisons that controlled for frequency of cannabis use in the past 6 months. As can be seen in Table 2, logistic regressions revealed that MC users remained significantly more likely to have a current ($OR = 3.16$) and lifetime diagnosis of PTSD ($OR = 2.33$). Analyses of covariance (ANCOVAs) controlling for cannabis use frequency revealed that MC users reported significantly lower on percentage of alcohol use days but not on percentage of heavy drinking days or drinks consumed per week on the TLFB, compared with RC users. Regarding cannabis use motives, significant group differences were evident for sleep (greater use of cannabis to manage sleep by MC users) and alcohol use (greater use of cannabis when under the influence of alcohol by RC users). ANCOVAs comparing groups on physical and mental health indicated that MC users reported significantly worse physical health on the SF-36 relative to RC users.

Discussion

To our knowledge, this is the first study to compare MC and RC users in a sample of veterans enrolled in a VHA facility. Results indicated that the most frequently endorsed conditions for MC use were anxiety, stress, PTSD,

Table 2
Group Differences Between Medicinal and Recreational Cannabis Users in Diagnoses, Cannabis-Related Problems, Reasons for Using Marijuana, and Other Health-Related and Substance Use Outcomes

Variable	*n* (%)		Unadjusted for frequency of use		Adjusted for frequency of use	
	Medicinal users ($n = 66$)	Recreational users ($n = 77$)	χ^2	OR	*B*	*OR*
Diagnoses						
PTSD, current	22 (33.3)	7 (09.1)	12.92***	5.00	1.15*	3.16
PTSD, lifetime	33 (50.0)	19 (24.7)	9.85**	3.05	.85*	2.33
MDD, current	22 (33.3)	9 (11.7)	9.81**	3.78	.89	2.42
MDD, lifetime	47 (71.2)	44 (57.1)	3.04	1.85	.24	1.28
CUD, current	34 (51.5)	19 (24.7)	10.98**	3.24	.16	1.17
CUD, lifetime	46 (69.7)	37 (48.1)	6.84**	2.49	.23	1.26
	M (*SD*)	*M* (*SD*)	*t*-test	*d*	*F*	η^2
% of cannabis use days past 6 months	64.49 (37.17)	20.82 (33.65)	7.37***	1.23	—	—
% of cannabis use days in past month	70.10 (39.22)	19.83 (35.38)	8.06***	1.35	—	—
% of alcohol use days in past month	14.49 (23.32)	31.86 (30.90)	3.74***	.63	5.48*	.04
% heavy drinking days in past month	7.73 (20.53)	16.41 (23.78)	2.32*	.39	2.51	.02
No. of alcohol drinks/week, past month	5.62 (12.42)	11.86 (14.11)	2.79**	.47	2.78	.02
% of drug use days in past month[a]	3.23 (13.13)	4.76 (16.38)	.61	.10	1.60	.01
Cannabis-related problems	2.85 (4.07)	1.61 (2.65)	2.18*	.36	.48	.00
Reasons for using cannabis						
Enjoyment	3.55 (1.11)	3.15 (1.26)	1.10*	.34	.05	.00
Conformity	1.24 (.51)	1.40 (.77)	1.44	.24	.18	.00
Coping	2.28 (1.11)	1.73 (1.12)	2.94**	.49	.64	.00
Experimentation	1.66 (.91)	1.89 (1.00)	1.40	.24	.00	.00
Boredom	2.23 (1.23)	2.23 (1.18)	.00	.00	1.45	.01
Alcohol	1.33 (.52)	1.97 (1.11)	4.33***	.74	7.62**	.05
Celebration	2.32 (1.17)	2.28 (1.23)	.21	.03	.65	.00
Altered perception	2.45 (1.29)	2.20 (1.23)	1.21	.20	.42	.00
Social anxiety	2.26 (1.17)	1.67 (1.04)	3.22**	.53	1.40	.01
Relative low risk	2.82 (1.42)	2.07 (1.12)	3.51**	.58	3.71	.02
Sleep	3.51 (1.16)	2.16 (1.32)	6.47***	1.09	17.05***	.09
Availability	2.36 (1.26)	2.72 (1.20)	1.75	.29	3.89	.03
SF-36 physical health score	63.28 (21.74)	73.73 (18.67)	3.09**	.52	4.09*	.03
SF-36 mental health score	49.80 (23.60)	61.62 (22.06)	3.09**	.52	2.87	.02
Global PSQI score	10.97 (4.00)	9.08 (4.12)	2.77**	.47	2.95	.02
Perceived Stress Scale	7.24 (1.87)	7.05 (1.71)	.64	.11	.01	.00
Satisfaction with Life Scale	15.68 (6.8)	18.42 (7.46)	2.27*	.38	1.25	.01

Note. PTSD = posttraumatic stress disorder; MDD = major depressive disorder; CUD = cannabis use disorder; SF-36 = 36-Item Short Form Health Survey; PSQI = Pittsburgh Sleep Quality Index. All individuals who met criteria for a current diagnosis have also met criteria for a lifetime diagnosis for a given disorder. Heavy drinking days = four or more drinks per day for females and five or more drinks per day for males.
[a] Past month drug use was endorsed by 14 medicinal cannabis users and 14 recreational cannabis users.
* $p < .05$. ** $p < .01$. *** $p < .001$.

pain, depression, and insomnia. Consistent with findings from nonveteran studies, this veteran study demonstrated that MC users endorsed worse physical and mental health functioning relative to RC users. MC users were three times more likely to meet criteria for PTSD than RC users, adjusting for frequency of cannabis use, which varied across the two groups. As hypothesized, the greatest difference between MC and RC users was found for sleep as the reason for cannabis use. Furthermore, this difference remained and was one of the two significantly different motives (in addition to alcohol motives) when adjusting for frequency of use.

Mental health concerns were highly prevalent in this veteran sample, in contrast to previous findings identifying pain as the most prevalent qualifying condition among nonveteran MC users (see Walsh et al., 2017 for review). Specifically, more MC users endorsed anxiety and PTSD (74% and 65%) than chronic pain (62%) and other psychological conditions (depression 62%, stress 59%, and insomnia 56%). As mentioned previously, sleep emerged as one of the most important motives for MC use, along with using for relaxation reasons and to relieve PTSD. This is consistent with other studies (Babson et al., 2013; Davis et al., 2016), indicating that sleep motives are the most robust significant mediating factor underlying the relations between both PTSD with cannabis use and increased risk of CUD (Metrik et al., 2016).

Furthermore, MC users were more likely to meet criteria for current and lifetime diagnosis of PTSD than were RC users. One prior online survey of veterans similarly demonstrated that, relative to RC users, MC users endorsed more PTSD symptoms on a PTSD screening checklist and reported greater combat exposure and greater subjective arousal to items on the PTSD screen (Loflin et al., 2017). These findings are not surprising given the high prevalence of PTSD among veterans using cannabis and with increasing number of MC users endorsing PTSD symptoms and/or history of trauma (Bohnert et al., 2014; Bonn-Miller, Babson, et al., 2014; Bonn-Miller, Boden, et al., 2014; Davis et al., 2016; Greer et al., 2014; Walsh et al., 2017). Although controlled evidence on effectiveness of MC as PTSD treatment is currently lacking, preliminary research indicates cannabinoid receptor agonists to have beneficial effects in terms of relief from PTSD symptoms (Fraser, 2009; Jetly, Heber, Fraser, & Boisvert, 2015; Roitman, Mechoulam, Cooper-Kazaz, & Shalev, 2014). Clearly, data from clinical trials is needed to help clarify whether cannabis helps relieve PTSD symptoms or whether it iatrogenically maintains some aspects of PTSD (e.g., avoidance, sleep disruptions). Evidence in support of the endocannabinoid system's therapeutic potential in the modulation of stress response (Volkow, Hampson, & Baler, 2017) may help stimulate the sorely lacking empirical research on the use of cannabis for psychological distress and sleep problems.

Additional findings regarding MC users are worth noting, especially in the context of acquiring and using cannabis. For example, although 62% of MC users reported having a medical condition that would qualify them for a medical marijuana registration card in their state, only 24% reported having obtained one. One possible explanation for this discrepancy that we can posit from our data is that nearly 26% of MC users reported that they refrained from discussing medical cannabis with their doctor out of concern that doing so may get them into trouble and/or negatively affect their benefits and services at the U.S. Department of Veterans Affairs (VA). Veterans also indicated they can more easily access cannabis from a source that does not require a state-issued medical card (38%) or that they obtained cannabis from someone else who had a medical marijuana card (19.7%). Factors contributing to this may include prohibitive costs of maintaining a medical marijuana registration or higher prices of cannabis sold legally in dispensaries than on the black market. Future qualitative research might help explicate the nature of this incongruity.

As increasing numbers of mental health care providers encounter veterans who use cannabis, many may be concerned about the risk of misuse of cannabis and other substances. Consistent with national sample data (Lin et al., 2016), our findings suggest that while cannabis-related problems and CUD were more prevalent among MC users relative to RC users, none of these differences remained significant in analyses controlling for cannabis use frequency. With respect to other substance use, MC users reported lower frequency of alcohol use, as compared with RC users. This finding is consistent with other studies reporting lower alcohol problem severity and lower frequency of drug use in MC users relative to nonmedical cannabis users (Lin et al., 2016; Loflin et al., 2017; Roy-Byrne et al., 2015; Woodruff & Shillington, 2016). Groups differed specifically in terms of the frequency of alcohol consumption but were similar in terms of quantity of alcohol used once frequency of cannabis use was controlled in the analyses. Furthermore, alcohol was the only significant cannabis-use motive more frequently endorsed by RC relative to MC users in the analyses adjusted for frequency of cannabis use. Consistent with the finding on higher frequency

of alcohol use, alcohol-intoxication motives (e.g., using cannabis "because you were under the influence of alcohol") reflect greater prevalence of problem alcohol use among RC as compared with MC users. Of note, while MC users reported using cannabis at least half of the time or more as a substitute for prescription medication, they did not use it as a substitute for alcohol or other drugs as often (only "some of the time" or less). These findings are consistent with other studies indicating significant history of *past* alcohol, drug and prescription substance use and misuse among MC users (Ashrafioun, Bohnert, Jannausch, & Ilgen, 2015; Nunberg et al., 2011; O'Connell & Bou-Matar, 2007; Perron et al., 2015; Reiman, 2007; Walsh et al., 2013; Zaller et al., 2015), with evidence from other studies (reviewed in Walsh et al., 2017) suggesting cannabis is often effectively used as a harm-reduction strategy to substitute for alcohol, opiates, and other drugs (Lucas et al., 2013, 2016). For example, among Canadian medical cannabis dispensary patients, over 36% were found to report using cannabis as a substitute for illicit drugs, 41% reported using cannabis as a substitute for alcohol, and nearly 68% reported using cannabis as a substitute for prescription drugs (Lucas et al., 2013). The most commonly endorsed reasons for substituting cannabis for the previous substances included the belief that cannabis led to less withdrawal, produced fewer side effects, and provided better symptom management.

Recommendations for substance use disorder (SUD) treatment providers of veterans using MC in VHA and seeking SUD treatment are limited because of the dearth of clinical trials on the impact of MC use on the effectiveness of addiction treatment combined with equivocal findings on the effect of cannabis on alcohol and drug treatment. Specifically, some studies do not find negative impact of cannabis on treatment retention or compliance with opiate maintenance therapy (Epstein & Preston, 2003; Hill et al., 2013) or smoking cessation (Metrik, Spillane, Leventhal, & Kahler, 2011), yet cannabis has been implicated in worse outcomes in opiate (Wasserman, Weinstein, Havassy, & Hall, 1998) and alcohol (Mojarrad, Samet, Cheng, Winter, & Saitz, 2014; Subbaraman, Metrik, Patterson, & Swift, 2017) treatments. Future longitudinal studies and controlled research specifically examining the role of MC use on treatment of other SUDs is needed to help elucidate its impact on addiction treatment. Another implication of these findings is the need for more innovative treatment solutions for veterans with PTSD and sleep disturbance who may be turning to cannabis in search of relief of their symptoms. Many of the individuals with PTSD and CUD comorbidity do not have access to evidence-based integrated trauma-focused and CUD treatment (Roberts, Roberts, Jones, & Bisson, 2015; Vujanovic, Bonn-Miller, & Petry, 2016). Furthermore, although MC users cited improving sleep as a central reason to use cannabis, both MC and RC users had endorsed clinically significant poor sleep quality, as measured by the PSQI, despite their use of cannabis in efforts to address insomnia and sleep disturbances. The current study did not examine variability in sleep patterns and sleep problems (e.g., difficulty falling asleep, difficulty staying asleep, nightmares,) that may be particularly salient to MC users. Additional research in this area is needed to better inform treatment interventions. Meanwhile, treatments such as cognitive–behavioral therapy (CBT) for insomnia (CBT-I) should be routinely available to veterans who may derive greater benefit from this behavioral strategy than resorting to using cannabis with its known adverse effects on health, cognitive, and psychological functioning (Hall & Degenhardt, 2014). Finally, VHA providers should expect an increase in the number of veterans seeking voluntary treatment for CUD, because more cannabis users now seek treatment since the legalization of MC use (Hall & Lynskey, 2016). Therefore, routine screening or assessment for cannabis use and CUD in the VHA is recommended, particularly in the context of assessing for sleep problems and trauma-related symptoms. At a minimum, researchers and clinicians should not be combining cannabis use with other illicit drugs of abuse in terms of screening and treatment recommendations.

Several study limitations warrant mention. As with many veteran samples, a small number of female veterans limited the generalizability of our findings to female veterans who are using the VHA for health care services. The caveat to our and other similar cross-sectional findings (see Walsh et al., 2017 for review) is that these data cannot establish precedence of cannabis versus other substances or whether MC use leads to subsequent reductions in alcohol or other illicit or prescribed substances, or whether

sleep problems amount to increased MC use or vice versa. Planned longitudinal analyses of the larger parent study will indeed help clarify the putative relationship between these variables and MC use in this veteran sample. Next, characterizing MC and RC groups as mutually exclusive categories does not take into account the nuance and complexity of using cannabis for reasons that can be viewed as both medicinal and recreational. Future studies might need to utilize a continuous index of the proportion of use for medicinal and recreational purposes and account for differences across states and jurisdictions in their definitions of medical use of cannabis. Next, it is possible that responding to the questionnaires specific to medicinal cannabis use could have influenced responses on the subsequent MPS assessing cannabis-related problems for the MC users. Finally, the study was explicitly focused on examining differences between MC and RC users in terms of the presence of PTSD and MDD diagnoses, the two psychiatric disorders that are most prevalent among the returning veterans. However, comorbidity with other anxiety disorders (e.g., generalized anxiety disorder) may be important to investigate in future comparisons between MC and RC users. In conclusion, our findings suggest research on MC use in veterans needs to continue. In addition, although the line between cannabis use for medicinal and recreational reasons may often be blurred (Reinarman et al., 2011), current findings help identify motivations underlying medicinal cannabis use among veterans. Future research can further resolve and address specific needs of veterans seeking medicinal cannabis, which could inform mental health treatment within the VHA.

References

Alexander, M., Ray, M. A., Hébert, J. R., Youngstedt, S. D., Zhang, H., Steck, S. E., . . . Burch, J. B. (2016). The National Veteran Sleep Disorder Study: Descriptive Epidemiology and Secular Trends, 2000–2010. *Sleep, 39,* 1399–1410. http://dx.doi.org/10.5665/sleep.5972

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC: Author.

Ashrafioun, L., Bohnert, K. M., Jannausch, M., & Ilgen, M. A. (2015). Characteristics of substance use disorder treatment patients using medical cannabis for pain. *Addictive Behaviors, 42,* 185–188. http://dx.doi.org/10.1016/j.addbeh.2014.11.024

Babson, K. A., Boden, M. T., & Bonn-Miller, M. O. (2013). Sleep quality moderates the relation between depression symptoms and problematic cannabis use among medical cannabis users. *The American Journal of Drug and Alcohol Abuse, 39,* 211–216. http://dx.doi.org/10.3109/00952990.2013.788183

Belendiuk, K. A., Baldini, L. L., & Bonn-Miller, M. O. (2015). Narrative review of the safety and efficacy of marijuana for the treatment of commonly state-approved medical and psychiatric disorders. *Addiction Science & Clinical Practice, 10,* 10. http://dx.doi.org/10.1186/s13722-015-0032-7

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a Clinician-Administered PTSD Scale. *Journal of Traumatic Stress, 8,* 75–90. http://dx.doi.org/10.1002/jts.2490080106

Boden, M. T., Babson, K. A., Vujanovic, A. A., Short, N. A., & Bonn-Miller, M. O. (2013). Posttraumatic stress disorder and cannabis use characteristics among military veterans with cannabis dependence. *The American Journal on Addictions, 22,* 277–284. http://dx.doi.org/10.1111/j.1521-0391.2012.12018.x

Bohnert, K. M., Perron, B. E., Ashrafioun, L., Kleinberg, F., Jannausch, M., & Ilgen, M. A. (2014). Positive posttraumatic stress disorder screens among first-time medical cannabis patients: Prevalence and association with other substance use. *Addictive Behaviors, 39,* 1414–1417. http://dx.doi.org/10.1016/j.addbeh.2014.05.022

Bonn-Miller, M. O., Babson, K. A., & Vandrey, R. (2014). Using cannabis to help you sleep: Heightened frequency of medical cannabis use among those with PTSD. *Drug and Alcohol Dependence, 136,* 162–165. http://dx.doi.org/10.1016/j.drugalcdep.2013.12.008

Bonn-Miller, M. O., Boden, M. T., Bucossi, M. M., & Babson, K. A. (2014). Self-reported cannabis use characteristics, patterns and helpfulness among medical cannabis users. *The American Journal of Drug and Alcohol Abuse, 40,* 23–30. http://dx.doi.org/10.3109/00952990.2013.821477

Bonn-Miller, M. O., Harris, A. H. S., & Trafton, J. A. (2012). Prevalence of cannabis use disorder diagnoses among veterans in 2002, 2008, and 2009. *Psychological Services, 9,* 404–416. http://dx.doi.org/10.1037/a0027622

Bonn-Miller, M. O., Vujanovic, A. A., Boden, M. T., & Gross, J. J. (2011). Posttraumatic stress, difficulties in emotion regulation, and coping-oriented marijuana use. *Cognitive Behaviour Therapy, 40,* 34–44. http://dx.doi.org/10.1080/16506073.2010.525253

Bonn-Miller, M. O., Vujanovic, A. A., Feldner, M. T., Bernstein, A., & Zvolensky, M. J. (2007). Posttraumatic stress symptom severity predicts marijuana use coping motives among traumatic event-exposed marijuana users. *Journal of Traumatic Stress, 20,* 577–586. http://dx.doi.org/10.1002/jts.20243

Bonn-Miller, M. O., Zvolensky, M. J., Leen-Feldner, E. W., Feldner, M. T., & Yartz, A. R. (2005). Marijuana use among daily tobacco smokers: Relationship to anxiety-related factors. *Journal of Psychopathology and Behavioral Assessment, 27,* 279–289. http://dx.doi.org/10.1007/s10862-005-2408-6

Bremner, J. D., Southwick, S. M., Darnell, A., & Charney, D. S. (1996). Chronic PTSD in Vietnam combat veterans: Course of illness and substance abuse. *The American Journal of Psychiatry, 153,* 369–375. http://dx.doi.org/10.1176/ajp.153.3.369

Brenner, L. A., Betthauser, L. M., Bahraini, N., Lusk, J. L., Terrio, H., Scher, A. I., & Schwab, K. A. (2015). Soldiers returning from deployment: A qualitative study regarding exposure, coping, and reintegration. *Rehabilitation Psychology, 60,* 277–285. http://dx.doi.org/10.1037/rep0000048

Buckner, J. D., & Zvolensky, M. J. (2014). Cannabis and related impairment: The unique roles of cannabis use to cope with social anxiety and social avoidance. *The American Journal on Addictions, 23,* 598–603. http://dx.doi.org/10.1111/j.1521-0391.2014.12150.x

Bujarski, S. J., Norberg, M. M., & Copeland, J. (2012). The association between distress tolerance and cannabis use-related problems: The mediating and moderating roles of coping motives and gender. *Addictive Behaviors, 37,* 1181–1184. http://dx.doi.org/10.1016/j.addbeh.2012.05.014

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193–213. http://dx.doi.org/10.1016/0165-1781(89)90047-4

Capaldi, V. F., II, Guerrero, M. L., & Killgore, W. D. S. (2011). Sleep disruptions among returning combat veterans from Iraq and Afghanistan. *Military Medicine, 176,* 879–888. http://dx.doi.org/10.7205/MILMED-D-10-00440

Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research, 45,* 5–13. http://dx.doi.org/10.1016/S0022-3999(97)00298-5

Cerdá, M., Wall, M., Keyes, K. M., Galea, S., & Hasin, D. (2012). Medical marijuana laws in 50 states: Investigating the relationship between state legalization of medical marijuana and marijuana use, abuse and dependence. *Drug and Alcohol Dependence, 12,* 22–27. http://dx.doi.org/10.1016/j.drugalcdep.2011.06.011

Cohen, B. E., Gima, K., Bertenthal, D., Kim, S., Marmar, C. R., & Seal, K. H. (2010). Mental health diagnoses and utilization of VA non-mental health medical services among returning Iraq and Afghanistan veterans. *Journal of General Internal Medicine, 25,* 18–24. http://dx.doi.org/10.1007/s11606-009-1117-3

Cohen, N. L., Heinz, A. J., Ilgen, M., & Bonn-Miller, M. O. (2016). Pain, cannabis species, and cannabis use disorders. *Journal of Studies on Alcohol and Drugs, 77,* 515–520. http://dx.doi.org/10.15288/jsad.2016.77.515

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385–396. http://dx.doi.org/10.2307/2136404

Davis, A. K., Bonar, E. E., Ilgen, M. A., Walton, M. A., Perron, B. E., & Chermack, S. T. (2016). Factors associated with having a medical marijuana card among Veterans with recent substance use in VA outpatient treatment. *Addictive Behaviors, 63,* 132–136. http://dx.doi.org/10.1016/j.addbeh.2016.07.006

Dennis, M. L., Funk, R., Godley, S. H., Godley, M. D., & Waldron, H. (2004). Cross-validation of the alcohol and cannabis use measures in the Global Appraisal of Individual Needs (GAIN) and Timeline Followback (TLFB; Form 90) among adolescents in substance abuse treatment. *Addiction, 99*(Suppl. 2), 120–128. http://dx.doi.org/10.1111/j.1360-0443.2004.00859.x

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment, 49,* 71–75. http://dx.doi.org/10.1207/s15327752jpa4901_13

Earleywine, M., & Bolles, J. R. (2014). Marijuana, expectancies, and post-traumatic stress symptoms: A preliminary investigation. *Journal of Psychoactive Drugs, 46,* 171–177. http://dx.doi.org/10.1080/02791072.2014.920118

Epstein, D. H., & Preston, K. L. (2003). Does cannabis use predict poor outcome for heroin-dependent patients on maintenance treatment? Past findings and more evidence against. *Addiction, 98,* 269–279. http://dx.doi.org/10.1046/j.1360-0443.2003.00310.x

Farris, S. G., Metrik, J., Bonn-Miller, M. O., Kahler, C. W., & Zvolensky, M. J. (2016). Anxiety sensitivity and distress intolerance as predictors of cannabis dependence symptoms, problems, and craving: The mediating role of coping motives. *Journal of Studies on Alcohol and Drugs, 77,* 889–897. http://dx.doi.org/10.15288/jsad.2016.77.889

Farris, S. G., Zvolensky, M. J., Boden, M. T., & Bonn-Miller, M. O. (2014). Cannabis use expectancies mediate the relation between depressive

symptoms and cannabis use among cannabis-dependent veterans. *Journal of Addiction Medicine, 8,* 130–136. http://dx.doi.org/10.1097/ADM.0000000000000010

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (2002). *Structured Clinical Interview for DSM–IV–TR Axis I Disorders, research version, non-patient edition* (SCID-I/NP). New York, NY: Biometrics Research, New York State Psychiatric Institute.

Fraser, G. A. (2009). The use of a synthetic cannabinoid in the management of treatment-resistant nightmares in posttraumatic stress disorder (PTSD). *CNS Neuroscience & Therapeutics, 15,* 84–88. http://dx.doi.org/10.1111/j.1755-5949.2008.00071.x

Gentes, E. L., Schry, A. R., Hicks, T. A., Clancy, C. P., Collie, C. F., Kirby, A. C., . . . Calhoun, P. S. (2016). Prevalence and correlates of cannabis use in an outpatient VA posttraumatic stress disorder clinic. *Psychology of Addictive Behaviors, 30,* 415–421. http://dx.doi.org/10.1037/adb0000154

Gironda, R. J., Clark, M. E., Massengale, J. P., & Walker, R. L. (2006). Pain among veterans of Operations Enduring Freedom and Iraqi Freedom. *Pain Medicine, 7,* 339–343. http://dx.doi.org/10.1111/j.1526-4637.2006.00146.x

Goldman, M., Suh, J. J., Lynch, K. G., Szucs, R., Ross, J., Xie, H., . . . Oslin, D. W. (2010). Identifying risk factors for marijuana use among Veterans' Affairs patients. *Journal of Addiction Medicine, 4,* 45–51. http://dx.doi.org/10.1097/ADM.0b013e3181b18782

Greer, G. R., Grob, C. S., & Halberstadt, A. L. (2014). PTSD symptom reports of patients evaluated for the New Mexico Medical Cannabis Program. *Journal of Psychoactive Drugs, 46,* 73–77. http://dx.doi.org/10.1080/02791072.2013.873843

Gruber, S. A., Sagar, K. A., Dahlgren, M. K., Racine, M. T., Smith, R. T., & Lukas, S. E. (2016). Splendor in the grass? A pilot study assessing the impact of medical marijuana on executive function. *Frontiers in Pharmacology, 7,* 355. http://dx.doi.org/10.3389/fphar.2016.00355

Hall, W., & Degenhardt, L. (2014). The adverse health effects of chronic cannabis use. *Drug Testing and Analysis, 6,* 39–45. http://dx.doi.org/10.1002/dta.1506

Hall, W., & Lynskey, M. (2016). Evaluating the public health impacts of legalizing recreational cannabis use in the United States. *Addiction, 111,* 1764–1773. http://dx.doi.org/10.1111/add.13428

Hasin, D. S., Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., . . . Grant, B. F. (2015). Prevalence of marijuana use disorders in the United States between 2001–2002 and 2012–2013. *Journal of the American Medical Association Psychiatry, 72,* 1235–1242. http://dx.doi.org/10.1001/jamapsychiatry.2015.1858

Hays, R. D., & Morales, L. S. (2001). The RAND-36 measure of health-related quality of life. *Annals of Medicine, 33,* 350–357. http://dx.doi.org/10.3109/07853890109002089

Hill, K. P., Bennett, H. E., Griffin, M. L., Connery, H. S., Fitzmaurice, G. M., Subramaniam, G., . . . Weiss, R. D. (2013). Association of cannabis use with opioid outcomes among opioid-dependent youth. *Drug and Alcohol Dependence, 132,* 342–345. http://dx.doi.org/10.1016/j.drugalcdep.2013.02.030

Ilgen, M. A., Bohnert, K., Kleinberg, F., Jannausch, M., Bohnert, A. S. B., Walton, M., & Blow, F. C. (2013). Characteristics of adults seeking medical marijuana certification. *Drug and Alcohol Dependence, 132,* 654–659. http://dx.doi.org/10.1016/j.drugalcdep.2013.04.019

Jetly, R., Heber, A., Fraser, G., & Boisvert, D. (2015). The efficacy of nabilone, a synthetic cannabinoid, in the treatment of PTSD-associated nightmares: A preliminary randomized, double-blind, placebo-controlled cross-over design study. *Psychoneuroendocrinology, 51,* 585–588. http://dx.doi.org/10.1016/j.psyneuen.2014.11.002

Kim, P. Y., Thomas, J. L., Wilk, J. E., Castro, C. A., & Hoge, C. W. (2010). Stigma, barriers to care, and use of mental health services among active duty and National Guard soldiers after combat. *Psychiatric Services, 61,* 582–588. http://dx.doi.org/10.1176/ps.2010.61.6.582

Krawitz, M. (2015). Veterans' Health Administration policy on cannabis as an adjunct to pain treatment with opiates. *American Medical Association Journal of Ethics, 17,* 558–561. http://dx.doi.org/10.1001/journalofethics.2015.17.6.pfor2-1506

Lavie, P., Katz, N., Pillar, G., & Zinger, Y. (1998). Elevated awaking thresholds during sleep: Characteristics of chronic war-related posttraumatic stress disorder patients. *Biological Psychiatry, 44,* 1060–1065. http://dx.doi.org/10.1016/S0006-3223(98)00037-7

Lee, C. M., Neighbors, C., Hendershot, C. S., & Grossbard, J. R. (2009). Development and preliminary validation of a comprehensive marijuana motives questionnaire. *Journal of Studies on Alcohol and Drugs, 70,* 279–287. http://dx.doi.org/10.15288/jsad.2009.70.279

Lew, H. L., Otis, J. D., Tun, C., Kerns, R. D., Clark, M. E., & Cifu, D. X. (2009). Prevalence of chronic pain, posttraumatic stress disorder, and persistent postconcussive symptoms in OIF/OEF veterans: Polytrauma clinical triad. *Journal of Rehabilitation Research and Development, 46,* 697–702. http://dx.doi.org/10.1682/JRRD.2009.01.0006

Lin, L. A., Ilgen, M. A., Jannausch, M., & Bohnert, K. M. (2016). Comparing adults who use cannabis

medically with those who use recreationally: Results from a national sample. *Addictive Behaviors, 61,* 99–103. http://dx.doi.org/10.1016/j.addbeh.2016.05.015

Loflin, M., Earleywine, M., & Bonn-Miller, M. (2017). Medicinal versus recreational cannabis use: Patterns of cannabis use, alcohol use, and cued-arousal among veterans who screen positive for PTSD. *Addictive Behaviors, 68,* 18–23. http://dx.doi.org/10.1016/j.addbeh.2017.01.008

Lucas, P., Reiman, A., Earleywine, M., McGowan, S. K., Oleson, M., Coward, M. P., & Thomas, B. (2013). Cannabis as a substitute for alcohol and other drugs: A dispensary-based survey of substitution effect in Canadian medical cannabis patients. *Addiction Research & Theory, 21,* 435–442. http://dx.doi.org/10.3109/16066359.2012.733465

Lucas, P., Walsh, Z., Crosby, K., Callaway, R., Belle-Isle, L., Kay, R., . . . Holtzman, S. (2016). Substituting cannabis for prescription drugs, alcohol and other substances among medical cannabis patients: The impact of contextual factors. *Drug and Alcohol Review, 35,* 326–333. http://dx.doi.org/10.1111/dar.12323

Magruder, K. M., Frueh, B. C., Knapp, R. G., Davis, L., Hamner, M. B., Martin, R. H., . . . Arana, G. W. (2005). Prevalence of posttraumatic stress disorder in Veterans Affairs primary care clinics. *General Hospital Psychiatry, 27,* 169–179. http://dx.doi.org/10.1016/j.genhosppsych.2004.11.001

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. *Psychology of Addictive Behaviors, 30,* 743–754. http://dx.doi.org/10.1037/adb0000210

Metrik, J., Kahler, C. W., McGeary, J. E., Monti, P. M., & Rohsenow, D. J. (2011). Acute effects of marijuana smoking on negative and positive affect. *Journal of Cognitive Psychotherapy, 25,* 31–46. http://dx.doi.org/10.1891/0889-8391.25.1.31

Metrik, J., Spillane, N. S., Leventhal, A. M., & Kahler, C. W. (2011). Marijuana use and tobacco smoking cessation among heavy alcohol drinkers. *Drug and Alcohol Dependence, 119,* 194–200. http://dx.doi.org/10.1016/j.drugalcdep.2011.06.004

Mojarrad, M., Samet, J. H., Cheng, D. M., Winter, M. R., & Saitz, R. (2014). Marijuana use and achievement of abstinence from alcohol and other drugs among people with substance dependence: A prospective cohort study. *Drug and Alcohol Dependence, 142,* 91–97. http://dx.doi.org/10.1016/j.drugalcdep.2014.06.006

Mysliwiec, V., Gill, J., Lee, H., Baxter, T., Pierce, R., Barr, T. L., . . . Roth, B. J. (2013). Sleep disorders in US military personnel: A high rate of comorbid insomnia and obstructive sleep apnea. *Chest, 144,* 549–557. http://dx.doi.org/10.1378/chest.13-0088

Nunberg, H., Kilmer, B., Pacula, R. L., & Burgdorf, J. (2011). An analysis of applicants presenting to a medical marijuana specialty practice in California. *Journal of Drug Policy Analysis, 4,* 1. http://dx.doi.org/10.2202/1941-2851.1017

O'Connell, T. J., & Bou-Matar, C. B. (2007). Long term marijuana users seeking medical cannabis in California (2001–2007): Demographics, social characteristics, patterns of cannabis and other drug use of 4117 applicants. *Harm Reduction Journal, 4,* 16. http://dx.doi.org/10.1186/1477-7517-4-16

Pacula, R. L., & Lundberg, R. (2014). Why changes in price matter when thinking about marijuana policy: A review of the literature on the elasticity of demand. *Public Health Reviews, 35,* 1–18.

Perron, B. E., Bohnert, K., Perone, A. K., Bonn-Miller, M. O., & Ilgen, M. (2015). Use of prescription pain medications among medical cannabis patients: Comparisons of pain levels, functioning, and patterns of alcohol and other drug use. *Journal of Studies on Alcohol and Drugs, 76,* 406–413. http://dx.doi.org/10.15288/jsad.2015.76.406

Reiman, A. (2007). Medical cannabis patients: Patient profiles and health care utilization patterns. *Complementary Health Practice Review, 12,* 31–50. http://dx.doi.org/10.1177/1533210107301834

Reiman, A. (2009). Cannabis as a substitute for alcohol and other drugs. *Harm Reduction Journal, 6,* 35. http://dx.doi.org/10.1186/1477-7517-6-35

Reinarman, C., Nunberg, H., Lanthier, F., & Heddleston, T. (2011). Who are medical marijuana patients? Population characteristics from nine California assessment clinics. *Journal of Psychoactive Drugs, 43,* 128–135. http://dx.doi.org/10.1080/02791072.2011.587700

Richmond, M. K., Pampel, F. C., Rivera, L. S., Broderick, K. B., Reimann, B., & Fischer, L. (2015). Frequency and risk of marijuana use among substance-using health care patients in Colorado with and without access to state legalized medical marijuana. *Journal of Psychoactive Drugs, 47,* 1–9. http://dx.doi.org/10.1080/02791072.2014.991008

Roberts, N. P., Roberts, P. A., Jones, N., & Bisson, J. I. (2015). Psychological interventions for posttraumatic stress disorder and comorbid substance use disorder: A systematic review and meta-analysis. *Clinical Psychology Review, 38,* 25–38. http://dx.doi.org/10.1016/j.cpr.2015.02.007

Roitman, P., Mechoulam, R., Cooper-Kazaz, R., & Shalev, A. (2014). Preliminary, open-label, pilot study of add-on oral Δ9-tetrahydrocannabinol in chronic post-traumatic stress disorder. *Clinical Drug Investigation, 34,* 587–591. http://dx.doi.org/10.1007/s40261-014-0212-3

Roy-Byrne, P., Maynard, C., Bumgardner, K., Krupski, A., Dunn, C., West, I. I., . . . Ries, R. (2015). Are medical marijuana users different from recreational users? The view from primary care. *The American Journal on Addictions, 24,* 599–606. http://dx.doi.org/10.1111/ajad.12270

Simons, J. S., Gaher, R. M., Correia, C. J., Hansen, C. L., & Christopher, M. S. (2005). An affective-motivational model of marijuana and alcohol problems among college students. *Psychology of Addictive Behaviors, 19,* 326–334. http://dx.doi.org/10.1037/0893-164X.19.3.326

Sobell, L., & Sobell, M. (1992). Timeline Follow-Back: A technique for assessing self-reported alcohol consumption. In *Measuring alcohol consumption: Psychosocial and biological methods* (pp. 41–72). Totowa, NJ: Humana Press. http://dx.doi.org/10.1007/978-1-4612-0357-5_3

Spiro, A., III, Hankin, C. S., Mansell, D., & Kazis, L. E. (2006). Posttraumatic stress disorder and health status: The Veterans Health Study. *The Journal of Ambulatory Care Management, 29,* 71–86. http://dx.doi.org/10.1097/00004479-200601000-00008

Stephens, R. S., Roffman, R. A., & Curtin, L. (2000). Comparison of extended versus brief treatments for marijuana use. *Journal of Consulting and Clinical Psychology, 68,* 898–908. http://dx.doi.org/10.1037/0022-006X.68.5.898

Subbaraman, M. S., Metrik, J., Patterson, D., & Swift, R. (2017). Cannabis use during treatment for alcohol use disorders predicts alcohol treatment outcomes. *Addiction, 112,* 685–694. http://dx.doi.org/10.1111/add.13693

Troutt, W. D., & DiDonato, M. D. (2015). Medical cannabis in Arizona: Patient characteristics, perceptions, and impressions of medical cannabis legalization. *Journal of Psychoactive Drugs, 47,* 259–266. http://dx.doi.org/10.1080/02791072.2015.1074766

Van Den Kerkhof, E. G., Carley, M. E., Hopman, W. M., Ross-White, A., & Harrison, M. B. (2014). Prevalence of chronic pain and related risk factors in military veterans: A systematic review. *JBI Database of Systematic Reviews and Implementation Reports, 12,* 152–186. http://dx.doi.org/10.11124/jbisrir-2014-1720

Volkow, N. D., Hampson, A. J., & Baler, R. D. (2017). Don't worry, be happy: Endocannabinoids and cannabis at the intersection of stress and reward. *Annual Review of Pharmacology and Toxicology, 57,* 285–308. http://dx.doi.org/10.1146/annurev-pharmtox-010716-104615

Vujanovic, A. A., Bonn-Miller, M. O., & Petry, N. M. (2016). Co-occurring posttraumatic stress and substance use: Emerging research on correlates, mechanisms, and treatments-Introduction to the special issue. *Psychology of Addictive Behaviors, 30,* 713–719. http://dx.doi.org/10.1037/adb0000222

Walsh, Z., Callaway, R., Belle-Isle, L., Capler, R., Kay, R., Lucas, P., & Holtzman, S. (2013). Cannabis for therapeutic purposes: Patient characteristics, access, and reasons for use. *International Journal on Drug Policy, 24,* 511–516. http://dx.doi.org/10.1016/j.drugpo.2013.08.010

Walsh, Z., Gonzalez, R., Crosby, K. S., Thiessen, M., Carroll, C., & Bonn-Miller, M. O. (2017). Medical cannabis and mental health: A guided systematic review. *Clinical Psychology Review, 51,* 15–29. http://dx.doi.org/10.1016/j.cpr.2016.10.002

Wasserman, D. A., Weinstein, M. G., Havassy, B. E., & Hall, S. M. (1998). Factors associated with lapses to heroin use during methadone maintenance. *Drug and Alcohol Dependence, 52,* 183–192. http://dx.doi.org/10.1016/S0376-8716(98)00092-1

Weathers, F. W., Keane, T. M., & Davidson, J. R. (2001). Clinician-administered PTSD scale: A review of the first ten years of research. *Depression and Anxiety, 13,* 132–156. http://dx.doi.org/10.1002/da.1029

Wilcox, S. L., OH, H., Redmond, S. A., Chicas, J., Hassan, A. M., Lee, P.-J., & Ell, K. (2015). A scope of the problem: Post-deployment reintegration challenges in a National Guard Unit. *Work: Journal of Prevention, Assessment & Rehabilitation, 50,* 73–83.

Wilkinson, S. T., van Schalkwyk, G. I., Davidson, L., & D'Souza, D. C. (2016). The formation of marijuana risk perception in a population of substance abusing patients. *Psychiatric Quarterly, 87,* 177–187. http://dx.doi.org/10.1007/s11126-015-9369-z

Woodruff, S. I., & Shillington, A. M. (2016). Sociodemographic and drug use severity differences between medical marijuana users and non-medical users visiting the emergency department. *The American Journal on Addictions, 25,* 385–391. http://dx.doi.org/10.1111/ajad.12401

Zaller, N., Topletz, A., Frater, S., Yates, G., & Lally, M. (2015). Profiles of medicinal cannabis patients attending compassion centers in Rhode Island. *Journal of Psychoactive Drugs, 47,* 18–23. http://dx.doi.org/10.1080/02791072.2014.999901

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