JOURNAL OF VETERANS STUDIES

Cannabis Use Characteristics and PTSD-Related Outcomes Among Canadian Veterans With Chronic Pain

RESEARCH

MITCHELL R. SHEEHY
GREG K. TIPPIN
DAVID P. STOREY
VIKAS PARIHAR
JOSHUA A. RASH
NICK HARRIS

*Author affiliations can be found in the back matter of this article

VIRGINIA TECH PUBLISHING

ABSTRACT

Previous research on the relationship between cannabis and posttraumatic stress disorder (PTSD) has produced equivocal results. One explanation is that differences in cannabis use characteristics (e.g., medicinal vs. recreational use, route of administration, THC to CBD ratio, and grams per day) are associated with differences in PTSD severity. Using data from a previous cross-sectional study, we performed a series of MANOVAs to examine how cannabis use, cannabis use characteristics, sex, and talk therapy attendance are associated with PTSD severity, psychological distress (i.e., depression and anxiety), and insomnia in a sample of Canadian veterans with chronic pain and a history of trauma ($N = 513$). We also performed descriptive analysis on participants' demographics, military history, and cannabis use. Participants with a cannabis prescription and/or who attended talk therapy tended to have higher PTSD severity than those who did not. Cannabis use, sex, route of administration, THC to CBD ratio, and grams per day, were not significantly correlated with PTSD-related outcomes. However, descriptive analysis showed that the majority of those who used cannabis reported that it benefited their mental health. We speculate that veterans with more severe PTSD are more likely to seek out treatment in the form of prescribed cannabis or talk therapy; and that the perceived effect of cannabis on PTSD differs from the measured effect due to cannabis only causing a short-term reduction in PTSD symptoms.

CORRESPONDING AUTHOR:
Mitchell R. Sheehy
Dept. of Psychology, Memorial University of Newfoundland, St. John's, NL, Canada
mrs283@mun.ca

KEYWORDS:
veterans; chronic pain; PTSD; cannabis; mental health; military

TO CITE THIS ARTICLE:
Sheehy, M. R., Storey, D. P., Rash, J. A., Tippin, G. K., Parihar, V., & Harris, N. (2025). Cannabis Use Characteristics and PTSD-Related Outcomes Among Canadian Veterans With Chronic Pain. *Journal of Veterans Studies*, 11(1), pp. 30–46. DOI: https://doi.org/10.21061/jvs.v11i1.582

Posttraumatic stress disorder (PTSD) is a mental health condition that may develop in response to past trauma (American Psychiatric Association, 2022). Military veterans are at high risk of developing PTSD with 7.6–13.1% of regular force Canadian Armed Forces (CAF) veterans meeting PTSD criteria compared to only 1.3–5.2% of the general Canadian population after adjusting for age and sex differences (Gauvin et al., 2021; Thompson et al., 2015). This increased risk of PTSD is likely the result of military-related trauma, with 97% of Canadian veterans with PTSD attributing their diagnosis to prior military service (Thompson et al., 2011). Higher exposure to certain traumatic events may cause PTSD presentation in veterans to differ from civilians (Lehavot et al., 2018). For example, combat trauma may produce more negative alterations in cognition and mood than other forms of trauma (Graham et al., 2016). PTSD in veterans is also associated with a range of negative outcomes such as chronic pain, respiratory issues, sleep disturbance, lower life satisfaction, poorer relationship functioning, occupational impairment, and other forms of psychological disorder (Benedict et al., 2020; El-Gabalawy et al., 2018; Schnurr et al., 2009; Smith et al., 2016). For example, United States (US) veterans with PTSD were significantly more likely to have an alcohol use disorder (55% vs. 33%), substance use disorder (SUD; 27% vs. 8%), mood disorder (62% vs. 16%), and/or anxiety disorder (49% vs. 11%) compared to veterans without PTSD (Smith et al., 2016). Recently, Canadian veterans have expressed interest in using cannabis as a form of treatment for PTSD (Atlas Institute, 2022). However, cannabis is not currently mentioned or recommended in clinical practice guidelines for the treatment of PTSD (American Psychological Association, 2017; US Department of Veterans Affairs & Department of Defense, 2017).

Cannabis use is common among Canadian veterans, with 47% of veterans using cannabis consistently for 1 or more years (Sterniczuk & Whelan, 2016). Currently, Veterans Affairs Canada (VAC) will reimburse Canadian veterans for up to 3 g of medicinal cannabis per day and up to 10 g per day if approved by a medical specialist (VAC, 2019). Since Canada legalized recreational cannabis use in 2018 (Cannabis Act, 2018), funding for medical cannabis reimbursement by VAC has increased substantially, growing from $51 million in the 2017–2018 fiscal year to $168 million in the 2022–2023 fiscal year (VAC, 2023). However, evidence for the effectiveness of cannabis in treating PTSD is equivocal (Bonn-Miller et al., 2021; Nacasch et al., 2023; Wilkinson et al., 2015).

The pharmacological effects of cannabis are complex, with cannabis containing hundreds of potentially psychoactive compounds (Klumpers & Thacker, 2019). One of the most abundant of these compounds is the cannabinoid delta-9-tetrahydrocannabinol (THC) which appears to be responsible for cannabis's intoxicating effects (Drennan et al., 2021). THC may produce undesired effects such as temporary cognitive impairment, anxiety, psychomimetic behaviour, and addiction (Arkell et al., 2019; Morgan et al., 2018; Zehra et al., 2018). However, certain forms of THC may have medicinal use for conditions such as insomnia and neuropathic pain (Jetly et al., 2015; Sainsbury et al., 2021). Another cannabinoid of interest is cannabidiol (CBD), a non-intoxicating anxiolytic that produces little to no adverse reactions (Han et al., 2024; Lo et al., 2024). The effects of THC and CBD may differ with dosage, with one study finding a parabolic relationship between THC levels and acute pain relief (Wallace et al., 2007). Cannabinoids may also impact one another's effects. For example, low and high doses of CBD may enhance and ameliorate the intoxicating effects of THC, respectively (Solowij et al., 2019). Conversely, CBD may not impact THC's other effects, such as cognitive impairment and psychomimetic behaviour (Arkell et al., 2019; Morgan et al, 2018). The onset and duration of cannabis's effects may differ based on the route of administration. When cannabis is inhaled, THC quickly reaches the brain producing a high within minutes (Fabritius et al., 2013). Conversely, ingestion produces a delayed high that tends to last longer than inhalation (Schlienz et al., 2020). Ingested and inhaled cannabis may also produce differential psychoactive effects, as ingested THC is more readily metabolized into 11-hydroxy-THC, a stronger form of THC (Klumpers & Thacker, 2019). Another route of administration is absorption, such as in topical creams. These products are often taken medicinally, though their efficacy is unconfirmed (Mahmood et al., 2022). As opposed to inhaled and ingested cannabis, there is no evidence that topically absorbed cannabis produces any psychoactive effects.

Canadians with PTSD are twice as likely to use cannabis compared to those without PTSD (28.2% vs. 11.2% respectively; Lake et al., 2020). Some theorists suggest that those with PTSD may engage in cannabis use as a form of self-medication to temporarily alleviate PTSD symptoms (Khantzian, 1985, 1997). Some evidence supports this theory, with one study showing a reduction in self-reported PTSD symptoms by up to 50% immediately after the use of medicinal cannabis (LaFrance et al., 2020). However, other evidence suggests that those who use cannabis may be more likely to develop PTSD or have increased PTSD severity. For example, longitudinal studies on US veterans have found that cannabis use predicted greater PTSD severity, violent behaviour, and suicidality while cannabis cessation was associated with a reduction in PTSD severity, violent behaviour, and suicidality (Manhapra et al., 2015; Metrik et al., 2022; Wilkinson et al., 2015). However, some of these

findings could be explained by those with higher severity PTSD seeking out cannabis rather than cannabis worsening PTSD symptoms. Medicinal cannabis use may also put veterans at risk of developing a cannabis use disorder, as veterans with PTSD are at risk of developing SUDs (Smith et al., 2016).

Conversely, other research suggests that cannabis use may help alleviate PTSD symptoms. Multiple studies have reported that cannabis and nabilone, a synthetic form of THC, can improve sleep quality among those with PTSD (Fraser, 2009; Jetly et al., 2015; Nacasch et al., 2023). Additionally, longitudinal studies have observed that medicinal cannabis use is associated with improved quality of life, as well as reduced depression, anxiety, and PTSD severity at 4 and 10-month follow-ups (Chan et al., 2017; Drost et al., 2017). A retrospective chart review of Canadian veterans found that medicinal cannabis use was associated with a reduction in PTSD severity, suicidal ideation, and pain (Smith et al., 2017). Both medicinal THC and CBD for the treatment of PTSD are well tolerated and have resulted in reduced PTSD severity when paired with other treatments (Elms et al., 2019; Roitman et al., 2014). Finally, cannabis may offer a more tolerable replacement for medications with more unwanted side effects such as antidepressants (Smith et al., 2017; Storey et al., 2023).

What is causing these equivocal findings? One possibility is that the relationship between cannabis and PTSD is not just based on whether cannabis is used, but how cannabis is used. For example, much of the reviewed research on recreational cannabis found a positive correlation between cannabis use and PTSD severity (e.g., Manhapra et al., 2015; Metrik et al., 2022; Wilkinson et al., 2015), while research on medicinal cannabis found a negative correlation (e.g., Chan et al., 2017; Drost et al., 2017; Smith et al., 2017). Thus, medicinal and recreational use may have differential relationships with PTSD. It is also possible that other cannabis use characteristics such as route of administration, THC to CBD ratio (TBD:CBD), and grams of cannabis consumed per day (grams/day) could modify the relationship between cannabis use and PTSD.

To our knowledge, no studies have yet investigated whether differences in cannabis use characteristics are associated with differences in PTSD outcomes. To address this research gap, we performed a secondary analysis using data from a large cross-sectional study of medicinal cannabis use among Canadian veterans living with chronic pain. Chronic pain (i.e., pain that lasts 3 or more months) and PTSD are often comorbid with one another (Kind & Otis, 2019). Currently, medicinal cannabis is a conditionally recommended treatment for certain types of chronic pain (Allan et al., 2018). Due to its potential to treat both PTSD and chronic pain, some Canadian veterans have expressed interest in using cannabis to treat comorbid PTSD and chronic pain simultaneously (Storey et al., 2023). Due to the common occurrence of PTSD and cannabis use among those with chronic pain, we believed this sample would prove adequate for our investigation.

The objectives of the current study were: to determine if differences in cannabis use and cannabis use characteristics are associated with differences in Canadian veterans' PTSD severity; and to determine if differences in cannabis use and cannabis use characteristics are associated with differences in PTSD sub-dimensions and PTSD-related conditions such as depression, anxiety, and insomnia (Benedict et al., 2020; Smith et al., 2016). Specifically, the present study will address the following research questions:

1. Is cannabis use status (never, past, or current user) associated with PTSD severity, psychological distress, and/or insomnia?
2. Is cannabis use status associated with specific outcomes among the *Diagnostic and statistical manual of mental disorders* (DSM-5; American Psychiatric Association, 2022) PTSD symptom clusters?
3. Among cannabis users, are different cannabis use characteristics (i.e., medicinal vs. recreational use, route of administration, THC:CBD ratio, and grams/day) associated with PTSD severity, psychological distress, and/or sleep insomnia?
4. Among cannabis users, are different cannabis use characteristics associated with specific outcomes among the DSM-5 PTSD symptom clusters?

METHODS

PARTICIPANTS

Participants were recruited through: the Chronic Pain Center of Excellence for Canadian Veterans mailing list, comprised of individuals who self-identified as Canadian veterans and had agreed to participate in research; and targeted advertisements dispersed on Facebook via the Sussex Strategy Group. All recruitment ads and emails were provided in English and French and included a direct link to the study's Qualtrics XM page. Participants received either a $50 gift card for Amazon or Tim Hortons after completing the survey as compensation. Participants were self-identified Canadian veterans (i.e., former members of the CAF who completed basic training and were discharged) with chronic pain who were 18 years of age or older and were able to complete a questionnaire over the Internet. Veterans without access to the Internet or who could not read and write in English or French were not eligible for participation.

MEASURES

The survey used in this study consisted of a range of self-report measures covering participants' demographic characteristics, military service, medical history, and cannabis use characteristics. Several validated psychometric measures of pain, depression, anxiety, PTSD, and sleep disturbance were included in the survey. The psychometric measures relevant to the current analysis were the Primary Care PTSD Screen for DSM-5 (PC-PTSD-5), the PTSD Checklist for DSM-5 (PCL-5), the Insomnia Severity Index (ISI), the Patient Health Questionnaire (PHQ-9), and the General Anxiety Disorder Scale (GAD-7). All survey items were optional.

Cannabis Use Characteristics

Several characteristics of cannabis use were identified as factors that could potentially mediate the relationship between PTSD and cannabis use. The first was whether a veteran used cannabis medicinally or recreationally, as cannabis's effects are often different between studies that focused on recreational use (e.g., Wilkinson et al., 2015) versus medicinal use (e.g., Drost et al., 2017; Smith et al., 2017). However, cannabis use is often stigmatized (Storey et al., 2023) which may motivate those who use cannabis recreationally to justify their use by claiming it as medicinal. To control for this possibility, recreational and medicinal use was determined based on whether participants reported having a prescription for cannabis. The second variable of interest was route of administration, as this can impact the timing of drug action, the potential for intoxication, and the way cannabinoids are metabolized (Fabritius et al., 2013; Klumpers & Thacker, 2019; Schlienz et al., 2020). The third variable of interest was the THC:CBD ratio that a veteran primarily uses, as THC and CBD have differential effects, and augment the effects of one another (Solowij et al., 2019). The final variable studied was grams/day of cannabis consumption, as cannabis's effects may change based on dosage (Wallace et al., 2007).

PC-PTSD-5

The screening question from the PC-PTSD-5 was used to determine if participants met criterion A for a diagnosis of PTSD as defined by the DSM-5 (Prins et al., 2016). Specifically, this question asked: "Sometimes things happen to people that are unusually or especially frightening, horrible, or traumatic. For example: a serious accident or fire, a physical or sexual assault or abuse, an earthquake or flood, a war, seeing someone be killed or seriously injured, having a loved one die through homicide or suicide. Have you ever experienced this kind of event? Yes or No". A response of 'Yes' indicated that a participant met criterion A for a diagnosis of PTSD.

PCL-5

The PCL-5 is a 20-item, self-report measure designed to screen, provisionally diagnose, and monitor the severity of PTSD symptoms (Blevins et al., 2015). Each item on the PCL-5 corresponds to a symptom of PTSD listed in the DSM-5, with items 1–5 corresponding to intrusive symptoms (criterion B); items 6–7 corresponding to avoidance symptoms (criterion C); items 8–14 corresponding to negative alterations in cognition and mood (criterion D); and items 15–20 corresponding to alterations in arousal and reactivity (criterion E). Respondents rate how much they were bothered by each symptom in the past month on a scale of 0–4, with higher scores indicating greater symptom severity. PCL-5 scores range from 0–80, with scores of 31–33 having been recommended as PTSD cutoff scores for veteran populations (Bovin et al., 2016). The PCL-5 has been shown to have good internal consistency ($\alpha = .94$), test-retest reliability ($r = .82$), convergent validity, and divergent validity in veteran populations (Blevins et al., 2015; Bovin et al., 2016).

PHQ-ADS

The Patient Health Questionnaire Anxiety and Depression Scales (PHQ-ADS) is a 17-item composite questionnaire comprised of the PHQ-9 and the GAD-7 (Kroenke et al., 2016). Combining the PHQ-9 and GAD-7 total scores into a single composite score is theoretically sound and provides several advantages. For example, depression and anxiety are frequently comorbid, correlate highly, are effectively treated by many of the same interventions, and are trans-diagnostically encompassed by an overarching construct of psychological distress (Kroenke et al., 2016). From a methodological standpoint utilizing the PHQ-ADS also allowed us to increase the power of the current study's analyses by lowering the number of outcome variables. PHQ-ADS scores range from 0–48, with scores of 10, 20, and 30 corresponding to mild, moderate, and severe symptoms of psychological distress respectively. The PHQ-ADS has been shown to have good internal consistency ($\alpha = .88$) and convergent validity with other measures of depression and anxiety such as the Short Form Health Survey (Kroenke et al., 2016).

The PHQ-9 is used to assess depressive symptoms (Kroenke et al., 2001), while the GAD-7 is designed to detect generalized anxiety disorder (GAD) symptoms (Spitzer et al., 2006). The PHQ-9 and GAD-7 are self-administered questionnaires that ask respondents how often they have experienced a certain depressive or anxious symptom during the last 2 weeks, respectively. Each question is answered on a scale of 0–3 with higher scores representing more severe symptoms. PHQ-9 and GAD-7 scores range from 0–27, and 0–21, respectively. PHQ-9 and GAD-7

scores of 5, 10, and 15 correspond to mild, moderate, and severe symptoms of depression and anxiety, respectively. Both tests have good internal consistency (PHQ-9, α = .89; GAD-7, α = .92), test-retest reliability (PHQ-9, r = .84; GAD-7, *ICC* = .83), and correlate strongly with functional impairment (Kroenke et al., 2001; Spitzer et al., 2006).

ISI

The ISI is a 7-item self-report measure used to assess insomnia (Bastien et al., 2001). Respondents answer items related to their insomnia problems, sleep satisfaction, insomnia-related functional impairment, noticeability of sleep problems to others, and worry caused by sleep problems on a scale of 0–4, with higher scores indicating more severe sleep problems. Total scores range from 0–28, with a score of 15 or above indicating clinically significant insomnia (Bastien et al., 2001). The ISI shows good internal consistency (α = .74) and convergent validity with other insomnia measures, such as sleep diaries (Morin et al., 2011).

STATISTICAL ANALYSIS

Since the purpose of this study was to investigate how cannabis use and cannabis use characteristics impact PTSD-related outcomes in Canadian veterans, only participants who reported experiencing a traumatic event via the PC-PTSD-5 screening question were included in the analyses. We did not require participants to meet a certain cutoff score on the PCL-5 for inclusion, as the effects of trauma exist on a spectrum and cannot be cleanly delineated by a single cutoff score.

Basic descriptive analysis was performed on participants' demographic features, military history, and cannabis use. Due to violations of univariate and multivariate normality, robust non-parametric statistical methods were used for our MANOVAs (Friedrich et al., 2019; Wilcox, 2017). Non-parametric MANOVAs were performed with the R package "`MANOVA.RM`" (Friedrich et al., 2019). Specifically, a modified MANOVA-type statistic (MATS) was run using a parametric bootstrap procedure to calculate test statistics and p values. If a MANOVA had any significant main effects or interactions ($p < .05$), additional MANOVAs were performed separately for each outcome variable with the significant factor or interaction included as the only predictor variable. The Benjamini-Hochberg method was used to adjust for the false discovery rate when performing these additional MANOVAs (Benjamini & Hochberg, 1995). If the outcomes of the additional MANOVAs were significant ($p < .05$) after the Benjamini-Hochberg adjustment, a Tukey post hoc test was performed. MANOVA was chosen over regression as it allows for the testing of multiple dependent variables simultaneously while accounting for interaction effects and correlations among predictor and outcome variables. It also protects against inflated type I error rates due to multiple tests of correlated outcome variables (Tabachnick & Fidell, 2019).

To address the first research question, a 3 × 2 × 2 MANOVA was conducted to infer whether PTSD severity, psychological distress, and insomnia varied as a function of cannabis use status (never, past, or current), talk therapy attendance (yes or no), and sex (male or female). To address the second research question, another 3 × 2 × 2 MANOVA was conducted to infer whether individual PTSD symptom clusters (B, C, D, E) varied as a function of the same predictor variables. Since talk therapy attendance could have a large impact on PTSD-related outcomes, talk therapy attendance (yes or no) was included as a cofactor for these analyses.

For research questions three and four, only the subset of participants who endorsed current cannabis use were included. To address the third research question four separate MANOVAs were conducted to infer whether PTSD severity, psychological distress, and insomnia varied as a function of cannabis prescription (yes or no), route of administration (inhaled, ingested, absorbed, or multiple routes), THC:CBD ratio (low, equal, or high), and grams/day of cannabis consumption (<3 g, 3 g, or >3 g). Sex (male or female) was included as a predictor in each of the four MANOVAs. To address research question four, four additional MANOVAs were conducted to infer whether PTSD symptom clusters (B, C, D, E) varied as a function of the same predictor variables. Talk therapy attendance was not included as a factor for these analyses due to cell restraints.

The `md.pattern` function in the `MICE` package was used to assess the pattern of missingness in the outcome variables (e.g., PCL-5, ISI, etc.). There were 531 missing values across all variables in the dataframe. The PCL-C variable had the fewest number of missing values (74), and the ISI variable had the largest number (125). Data were determined to be missing completely at random according to Little's (1988) MCAR Test, X^2 (63, N = 509) = 61.708, p = .522. Using R version 4.3.1 missing values for PHQ-ADS, ISI, and the PCL sub-scores were single imputed via the "`imputeEM()`" function from the "`mvdalab`" package (Afanador et al., 2022). The "`imputeEM()`" function iteratively updates missing values through an expectation-maximization (EM) algorithm. Missing values for categorical variables were single imputed using the "`mice()`" function from the "Multivariate Imputation by Chained Equations" ("MICE") package (Van Buuren & Groothuis-Oudshoorn, 2011). Missing values for sex were not imputed as there were no variables that were strong predictors of sex. Thus, participants who did not disclose their sex during the survey (n = 4) were excluded from the MANOVAs due to cell size limitations.

RESULTS

Overall, 600 veterans responded to the original survey. Seven respondents were removed due to low item response (i.e., <25%), clear misrepresentation (e.g., reporting 'years of service' greater than age), or failure to report their cannabis use status. Of the 593 participants remaining, 513 (86%) reported experiencing a traumatic event via the PC-PTSD-5 screening question. Only these participants were included in the following secondary analyses.

DESCRIPTIVE ANALYSIS

Participants' demographic characteristics and how demographic characteristics differ between cannabis use groups can be found in Tables 1 and 2. Of note, no participants in the survey described their sex as intersex or "other," their gender as two-spirited, or their race/ethnicity as Arab.

Table 3 shows PTSD-relevant conditions that veterans reported using cannabis to treat, and how effective they found cannabis to be for these conditions. Of the 328 participants who used cannabis, 229 (70%) reported using cannabis for at least one mental health condition (i.e., PTSD, anxiety, and/or depression). Of the 328 participants who reported currently using cannabis, 262 (80%) reported using cannabis medicinally, 12 (4%) recreationally, 37 (11%) reported using cannabis both medicinally and recreationally, and 17 (5%) did not answer this question. Similarly, 253 (77%) participants

VARIABLE	NON-CANNABIS USERS		NO CANNABIS USE IN PAST 6 MONTHS		CURRENT CANNABIS USERS		COMBINED	
	n	%	*n*	%	*n*	%	*n*	%
Total	115	22.42	70	13.65	328	63.94	513	100
Sex								
Female	21	18.26	14	20.00	45	13.72	80	15.59
Male	93	80.87	56	80.00	280	85.37	429	83.63
Non-disclosed	1	0.87	0	0.00	3	0.91	4	0.77
Race								
White	104	92.86	64	92.75	290	89.78	458	90.87
Black	0	0.00	0	0.00	3	0.93	3	0.60
Indigenous	5	4.46	4	5.80	21	6.50	30	5.95
Asian/Pacific Islander	0	0.00	0	0.00	1	0.31	1	0.20
Hispanic	0	0.00	0	0.00	1	0.31	1	0.20
South Asian	0	0.00	1	1.45	0	0.00	1	0.20
Mixed race	3	2.68	0	0.00	7	2.17	10	1.98
Marital Status								
Single	9	7.96	4	5.80	23	7.01	36	7.06
Common law	18	15.93	10	14.49	33	10.06	61	11.96
Married	64	56.64	43	62.32	203	61.89	310	60.78
Divorced/separated	17	15.04	9	13.04	62	18.90	88	17.25
Widowed	5	4.42	3	4.35	7	2.13	15	2.94
Survey language								
English	97	84.35	64	91.43	313	95.43	474	92.40
French	18	15.65	6	8.57	15	4.57	39	7.60
Highest level of education								
No highschool degree	15	13.39	6	8.57	26	7.98	47	9.25
Highschool	22	19.64	22	31.43	79	24.23	123	24.21
College/trade school	43	38.39	30	42.86	164	50.31	237	46.65
Undergrad degree	20	17.86	8	11.43	42	12.88	70	13.78
Graduate degree	12	10.71	4	5.71	15	4.60	31	6.10
CAF branch								
Army	71	62.83	42	60.87	199	62.58	312	62.40
Navy	21	18.58	8	11.59	57	17.92	86	17.20
Air Force	21	18.58	19	27.54	62	19.50	102	20.40

(Contd.)

VARIABLE	NON-CANNABIS USERS		NO CANNABIS USE IN PAST 6 MONTHS		CURRENT CANNABIS USERS		COMBINED	
	n	%	*n*	%	*n*	%	*n*	%
Rank upon release								
Junior NCM	43	38.39	29	42.03	162	52.43	234	47.76
NCO	39	34.82	32	46.38	117	37.86	188	38.37
Commissioned	30	26.79	8	11.59	30	9.71	68	13.88
Employment								
Unemployed	18	15.65	17	24.29	110	33.54	145	28.72
Student/training	1	0.87	1	1.43	6	1.83	8	1.56
Employed	27	23.48	21	30.00	53	16.16	101	19.69
Retired	69	60.00	31	44.29	159	48.48	259	50.49
Disability								
No	82	71.30	44	62.86	174	53.05	300	58.48
Yes	33	28.70	26	37.14	154	46.95	213	41.52
Mental health condition								
No	39	33.91	22	31.43	72	21.95	133	25.93
Yes	76	66.09	48	68.57	256	78.05	380	74.07

Table 1 Frequency Count and Percentage of Categorical Demographic Variables.

Note. NCM = Non-commissioned member, NCO = Non-commissioned officer. All percentages are calculated as valid percentages (i.e., the proportion of non-missing cases that fall into a certain category).

VARIABLE	NON-CANNABIS USERS	NO CANNABIS USE IN PAST 6 MONTHS	CURRENT CANNABIS USERS	COMBINED
Age	60.07 (8.63)	58.25 (8.59)	57.35 (8.35)	58.08 (8.50)
Year joined CAF	1983 (10.50)	1984 (10.21)	1986 (10.36)	1985 (10.40)
Year released from CAF	2003 (15.49)	2004 (13.93)	2005 (12.67)	2004 (13.50)
Total years of service	20.43 (11.57)	20.98 (11.12)	19.72 (10.73)	20.04 (10.96)
Years since release	20.33 (15.49)	19.20 (13.93)	18.07 (12.67)	18.71 (13.50)

Table 2 Mean and Standard Deviation of Continuous Demographic Variables.

Notes. Numerical data format: Mean (Standard Deviation). Missing cases were excluded.

CONDITION	HAS CANNABIS USE HELPED THE FOLLOWING CONDITIONS							
	CANNABIS USE FOR BELOW CONDITIONS		NO CHANGE		HELPFUL		MADE IT WORSE	
	n	%	*n*	%	*n*	%	*n*	%
PTSD	174	58.59	40	23.95	127	76.05	0	0.00
Depression	142	47.81	14	10.00	125	89.29	1	0.71
Anxiety	185	62.29	15	8.15	164	89.13	5	2.72
Sleep Problems	228	76.77	17	7.56	207	92.00	1	0.44

Table 3 Frequency and Impact of Cannabis Use on Mental Health Conditions in Canadian Veterans Who Use Cannabis, Have Chronic Pain, and Have a History of Trauma.

Note. All percentages are calculated as valid percentages (i.e., the proportion of non-missing cases that fall into a certain category).

who currently used cannabis reported having a cannabis prescription (pre-imputation). Additionally, the majority of those with a cannabis prescription (n = 246, 97%) reported knowing how much cannabis they were prescribed, with only a few users not knowing their prescribed dose (n = 7, 3%). Similarly, most current users reported knowing how much cannabis they used per day (n = 285, 87%), while some users reported not knowing how much they used (n = 33, 10%), and a few users did not wish to disclose this information (n = 10, 3%). Of those who knew how much cannabis they were prescribed per day (n = 256, 97%) the average amount prescribed per day was 4.55 g (*Mode* = 3.00g, *SD* = 2.60 g). Of those who reported how much cannabis they used per day (n = 284, 87%) the average amount of cannabis used per day was 3.52 g (*Modes* = 2.00 g and 3.00 g, *SD* = 2.82 g).

Of the 328 participants who were current cannabis users, the vast majority reported knowing the THC:CBD ratio of the cannabis they used (n = 311, 95%). Specifically, 118 (36%) reported using cannabis with a high THC:CBD ratio, 139 (42%) reported using cannabis with an equal amount of THC and CBD, and 95 (29%) reported using cannabis with a low THC:CBD ratio.

MULTIVARIATE ANALYSIS OF VARIANCE

The imputed mean and standard deviation of outcome variables related to research questions one and two can be found in Table 4. The imputed mean and standard deviation of the outcome variables related to research questions three and four can be found in Table 5. See Appendix A for the correlations between the outcome variables. See Appendix B for the individual cell values of each MANOVA.

Research Questions One and Two

Two MANOVAs were conducted to see if PTSD-related outcomes differed based on cannabis use (see Table 6). Cannabis use and sex were not significantly associated with PCL-5, PHQ-ADS, or ISI scores (p > .05). Conversely, talk therapy attendance was significantly associated with these outcomes (p < .001). Similarly, cannabis use and sex were not significantly associated with PCL-5 symptom cluster scores (p > .05), while talk therapy attendance was (p < .001). When separate MANOVAs were performed with talk therapy attendance as the only factor, it was found that talk therapy attendance significantly correlated with all outcome measures after controlling for family-wise error rate with the Benjamini-Hochberg method (p < .001). Post hoc Tukey tests showed that those who go to talk therapy tended to have higher PCL-5, PHQ-ADS, ISI, and PCL-5 cluster scores than those who do not go to talk therapy. Table 7 shows the mean difference in outcome variable scores between those who attended talk therapy and those who did not.

The interaction between cannabis use and talk therapy was significantly associated with PCL-5 symptom cluster scores (p = .043); however, this interaction did not remain significant after performing the Benjamini-Hochberg adjustment and thus no post hoc tests were performed.

Similarly, a significant three-way interaction between cannabis use, talk therapy attendance, and sex was also found to be associated with PCL-5 symptom cluster scores (p = .029). After performing the Benjamini-Hochberg adjustment it was found that this three-way interaction only significantly impacted PCL-D scores (p = .022). However, a

VARIABLE	*n*	PCL-5	PCL-B	PCL-C	PCL-D	PCL-E	PHQ-ADS	ISI
Cannabis use								
Never	114	32.88 (17.57)	7.92 (5.03)	3.67 (2.32)	11.00 (6.71)	10.29 (5.32)	20.55 (10.54)	14.78 (6.14)
Non-current	70	34.54 (17.72)	7.75 (5.05)	3.60 (2.59)	12.11 (6.96)	11.08 (5.04)	21.58 (10.65)	15.24 (4.91)
Current	325	37.00 (16.82)	8.51 (4.73)	4.01 (2.23)	12.79 (6.54)	11.69 (5.20)	22.47 (10.17)	15.39 (5.88)
Sex								
Female	80	39.09 (15.89)	8.69 (4.87)	4.32 (2.29)	14.12 (6.15)	11.97 (4.59)	24.29 (8.99)	16.77 (4.61)
Male	429	35.12 (17.35)	8.20 (4.84)	3.80 (2.30)	11.95 (6.71)	11.17 (5.34)	21.48 (10.51)	14.94 (5.97)
Talk therapy attendance								
No	244	28.63 (15.65)	6.74 (4.55)	3.12 (2.21)	9.58 (6.05)	9.19 (4.74)	18.22 (9.39)	14.19 (5.57)
Yes	265	42.29 (15.88)	9.69 (4.68)	4.58 (2.17)	14.79 (6.22)	13.23 (4.91)	25.32 (9.99)	16.19 (5.88)

Table 4 Mean and Standard Deviation of PCL-5, PHQ-ADS, ISI, and PCL-5 Symptom Cluster Scores across Predictor Variables in Canadian Veterans with Chronic Pain and a History of Trauma.

Notes. Numeical data format: Mean (Standard Deviation). Those who did not disclose their sex (n = 4) were excluded from analysis due to this group's inclusion violating assumptions of the MATS (i.e., their inclusion created factor level combinations with less than two observations).

	n	PCL-5	PCL-B	PCL-C	PCL-D	PCL-E	PHQ-ADS	ISI
Cannabis Prescription								
No	68	32.48 (17.01)	7.38 (4.77)	3.68 (2.24)	11.13 (6.37)	10.29 (4.99)	21.42 (9.46)	14.54 (5.79)
Yes	257	38.30 (16.60)	8.82 (4.68)	4.11 (2.22)	13.27 (6.52)	12.10 (5.21)	22.78 (10.32)	15.56 (6.04)
Preferred route of administration								
Inhaled	100	36.08 (16.34)	8.38 (4.55)	3.90 (2.18)	12.64 (6.30)	11.16 (5.28)	22.35 (9.79)	14.77 (6.27)
Ingested	101	36.07 (16.19)	8.09 (4.49)	3.71 (2.29)	12.29 (6.33)	11.98 (5.16)	21.90 (9.83)	15.61 (5.89)
Absorbed	29	33.28 (20.62)	7.06 (5.12)	4.09 (2.56)	11.18 (8.35)	10.95 (5.66)	20.96 (11.37)	14.79 (6.02)
Multiple	95	40.38 (16.48)	9.56 (4.92)	4.46 (2.08)	14.09 (6.27)	12.27 (5.03)	23.75 (10.47)	15.86 (5.82)
THC:CBD ratio								
Low	82	37.55 (16.68)	8.60 (4.79)	4.02 (2.23)	13.11 (6.59)	11.83 (4.79)	22.25 (8.66)	16.08 (5.08)
Equal	123	35.66 (17.12)	8.57 (4.76)	3.99 (2.27)	11.91 (6.64)	11.19 (5.43)	21.62 (10.81)	15.08 (6.26)
High	120	38.23 (16.66)	8.41 (4.70)	4.06 (2.21)	13.57 (6.33)	12.18 (5.24)	23.55 (10.37)	15.13 (6.29)
Grams/day								
<3 grams	152	35.37 (17.35)	8.08 (5.09)	3.70 (2.34)	12.15 (6.62)	11.44 (5.09)	22.00 (10.30)	15.11 (5.95)
3 grams	64	38.70 (17.18)	8.68 (4.53)	4.33 (2.16)	13.33 (6.65)	12.36 (5.61)	23.59 (10.02)	15.81 (6.42)
>3 grams	109	38.52 (15.76)	9.03 (4.30)	4.29 (2.07)	13.48 (6.30)	11.72 (5.14)	22.55 (10.05)	15.42 (5.83)

Table 5 Mean and Standard Deviation of PCL-5, PHQ-ADS, ISI, and PCL-5 Symptom Cluster Scores across Predictor Variables in Canadian Veterans Who Use Cannabis, Have Chronic Pain, and Have a History of Trauma.

Notes. Numerical data format: Mean (Standard Deviation). Those who did not disclose their sex ($n = 3$) were excluded from analysis due to this group's inclusion violating assumptions of the MATS (i.e., their inclusion created factor level combinations with less than two observations).

PREDICTOR	MANOVA	
	MATS[a]	*p*
Cannabis use MANOVA for PCL-5, PHQ-ADS, and ISI		
Cannabis use	10.29	.287
Talk therapy	88.78	**<.001**
Sex	4.00	.332
Cannabis use * Talk therapy	15.00	.138
Cannabis use * Sex	9.04	.340
Talk therapy * Sex	1.28	.712
Cannabis use * Talk therapy *Sex	15.41	.136
Cannabis use MANOVA for PCL-5 symptom cluster scores		
Cannabis use	21.95	.094
Talk therapy	166.71	**<.001**
Sex	4.15	.415
Cannabis use * Talk therapy	29.78	**.043**
Cannabis use * Sex	3.78	.797
Talk therapy * Sex	4.69	.370
Cannabis use * Talk therapy *Sex	34.75	**.029**

Table 6 MANOVAs Investigating How Cannabis Use, Talk Therapy, and Sex Impact PCL-5, PHQ-ADS, ISI, and PCL-5 Symptom Cluster Scores in Canadian Veterans Who Have Chronic Pain and a History of Trauma.

Note. Those who did not disclose their sex ($n = 4$) were excluded from analysis due to this group's inclusion violating assumptions of the MATS (i.e., their inclusion created factor level combinations with less than two observations). Statistically significant *p* values are bolded (i.e., $p < .05$).

[a]A MATS score quantifies the relative difference between two means and performs well with data that has homogeneous variances/covariances and non-normal distributions.

MEASURE	MEAN DIFFERENCE	95% CI	*P*
Talk therapy Yes – No			
PCL-5 Total	13.66	[10.93, 16.40]	<.001
PCL B	2.95	[2.15, 3.75]	<.001
PCL C	1.47	[1.09, 1.85]	<.001
PCL D	5.21	[4.14, 6.27]	<.001
PCL E	4.04	[3.20, 4.88]	<.001
PHQ-ADS	7.10	[5.42, 8.79]	<.001
ISI	2.01	[1.01, 3.00]	<.001

Table 7 Post hoc Analysis on Main Effect of Talk Therapy Attendance on Participants' PCL-5, PHQ-ADS, ISI, and PCL-5 Symptom ClusterScores in Canadian Veterans Who Have Chronic Pain and a History of Trauma.

Note. Shown *p* values were adjusted by the Benjamini-Hochberg adjustment to control for family-wise error rate.

Tukey's post hoc on the PCL-D cluster showed that no cells significantly differed from one another ($p > .05$).

Research Questions Three and Four

MANOVAs were conducted on the subset of participants who endorsed cannabis use to investigate how factors related to cannabis use such as having a cannabis prescription, preferred route of administration, preferred THC:CBD ratio, and grams/day impact PTSD-related outcomes among participants who are current cannabis users (Table 8).

Whether or not active cannabis users had a cannabis prescription was significantly associated with all outcome variables ($p = .017$). After performing several MANOVAs with cannabis prescription as the sole factor and performing the Benjamini-Hochberg adjustment, it was found that cannabis prescription was significantly associated with PCL-5 total scores, as well as scores on the PCL-B, PCL-D, and PCL-E clusters ($p < .05$). However, whether participants had a cannabis prescription did not significantly correlate with PHQ-ADS, ISI, or PCL-C subscale scores ($p > .05$). Post hoc Tukey tests showed that participants with a cannabis prescription tend to have higher PCL-5 total scores, as well as higher PCL-B, PCL-D, and PCL-E cluster scores. Table 9 shows the mean difference in significant outcome variables between participants with, and without, a cannabis prescription.

Participants' preferred THC:CBD ratio and the interaction between THC:CBD ratio and sex were significantly correlated with PCL-5, PHQ-ADS, ISI, and PCL symptom cluster scores ($p < .05$). However, neither remained significant after correcting for family-wise error rate. Preferred route of cannabis administration, grams/day, and sex were not significantly correlated with any outcome variables ($p > .05$).

PREDICTOR	MANOVA	
	MATS[a]	*p*
2 × 2 MANOVAs for cannabis prescription and sex		
Outcomes: PCL-5, PHQ-ADS, and ISI		
Cannabis prescription	15.66	**.017**
Sex	0.91	.776
Prescription * Sex	3.71	.317
Outcomes: PCL-5 symptom clusters		
Cannabis prescription	23.29	**.017**
Sex	1.63	.707
Prescription * Sex	2.59	.547
2 × 4 MANOVAs for route of administration and sex		
Outcomes: PCL-5, PHQ-ADS, and ISI		
Cannabis route	12.07	.292
Sex	1.43	.639
Route * Sex	6.02	.697
Outcomes: PCL-5 symptom clusters		
Cannabis route	27.51	.099
Sex	1.34	.680
Route * Sex	9.87	.571
2 × 4 MANOVAs for THC:CBD ratio and sex		
Outcomes: PCL-5, PHQ-ADS, and ISI		
THC:CBD	19.18	**.027**
Sex	5.20	.182
THC:CBD * Sex	17.65	**.036**
Outcomes: PCL-5 symptom clusters		
THC:CBD	31.96	**.013**
Sex	3.68	.377
THC:CBD * Sex	34.15	**.010**
2 × 4 MANOVAs for grams/day and sex		
Outcomes: PCL-5, PHQ-ADS, and ISI		
Grams/day	1.08	.973
Sex	1.32	.688
Grams/day * Sex	3.59	.723
Outcomes: PCL-5 symptom clusters		
Grams/day	6.07	.575
Sex	2.66	.511
Grams/day * Sex	7.50	.467

Table 8 Multiple MANOVAs Investigating the Impact of Cannabis Prescription, Route of Administration, THC:CBD Ratio, and Grams/day on PCL-5, PHQ-ADS, ISI, and PCL-5 Symptom Cluster Scores in Canadian Veterans Who Use Cannabis, Have Chronic Pain, and Have a History of Trauma.

Note. Those who did not disclose their sex ($n = 3$) were excluded from analysis due to this group's inclusion violating assumptions of the MATS (i.e., their inclusion created factor level combinations with less than two observations). Statistically significant *p* values are bolded (i.e., $p < .05$).

[a]A MATS score quantifies the relative difference between two means and performs well with data that has homogeneous variances/covariances and non-normal distributions.

MEASURE	MEAN DIFFERENCE	95% CI	*p*
Cannabis prescription Yes – No			
PCL-5 total	5.83	[1.28, 10.38]	.042
PCL B	1.44	[0.16, 2.72]	.041
PCL D	2.14	[0.42, 3.86]	.034
PCL E	1.81	[0.46, 3.16]	.034

Table 9 Post hoc Analysis of the Main Effect of Cannabis Prescription on PCL-5 and Relevant PCL-5 Symptom Clustersin Canadian Veterans Who Use Cannabis, Have Chronic Pain, and Have a History of Trauma.

Note. Shown *p* values were adjusted by the Benjamini-Hochberg adjustment to control for family-wise error rate.

DISCUSSION

We investigated whether differences in cannabis use and cannabis use characteristics were associated with differences in PTSD-related outcomes in a sample of Canadian veterans with chronic pain. We found that cannabis use was not associated with PTSD severity, psychological distress, or insomnia. This finding is consistent with past research on Canadian veterans that did not find a relationship between cannabis use and PTSD severity (e.g., Sterniczuk & Whelan, 2016). However, this finding is inconsistent with research that has found cannabis use to be associated with both worsened (e.g., Manhapra et al., 2015) and improved PTSD-related outcomes (e.g., Smith et al., 2017). Overall, our results add to the inconclusive literature surrounding the relationship between PTSD and cannabis use.

Cannabis use not being associated with PTSD-related outcomes is inconsistent with the observation that most participants who reported using cannabis for PTSD-related conditions found it to be helpful (Table 3). Past research has also observed that Canadian veterans perceived medicinal cannabis as helpful for mental health conditions such as PTSD (Valikhanova et al., 2023). The inconsistency between veterans' perceived effect of cannabis on mental health and the measured effect could be interpreted in several ways. First is that cannabis use has no impact on PTSD severity but those who use cannabis perceive that it does. Second, cannabis use may be effective at treating PTSD, but those who use cannabis have more severe PTSD that becomes comparable to nonusers as a result of cannabis use. However, this explanation may be unlikely as cannabis's efficacy in treating PTSD has not been found to differ from placebo (Bonn-Miller et al., 2021).

Finally, cannabis use may provide temporary symptom relief but not affect long-term PTSD severity. This would explain why those who use cannabis report that it helps treat PTSD symptoms but why validated measures such as the PCL-5 often fail to find a relationship between cannabis use and PTSD. This explanation is consistent with research that has reported that acute cannabis use lowers PTSD-related symptoms in the short-term but has no observable effect on PTSD severity in the long-term (LaFrance et al., 2020). Because of this, future studies may benefit from the inclusion of measures that specifically focus on the short-term effects of cannabis use, or by using techniques such as momentary ecological assessment to investigate the immediate effects of cannabis use in natural environments.

TALK THERAPY

Participants who attended talk therapy had more severe symptoms in all outcomes measured. Previous studies have reported that trauma-focused therapy attendance is associated with exacerbation of PTSD symptoms in a minority of individuals (Larsen et al., 2016; Walker et al., 2020). However, this exacerbation is temporary and those who experience it often show a reduction in PTSD severity over the course of treatment. So, although the higher symptoms found in the talk therapy attendance group may be partially explained by trauma-focused therapy attendance, it is likely that this trend is also due to those with higher-severity PTSD symptoms being more likely to seek treatment.

It was also found that the interaction between cannabis use and talk therapy attendance, and the three-way interaction between cannabis use, talk therapy attendance, and sex, were significantly associated with PCL-5 symptom clusters. However, these interactions did not remain significant during follow-up analyses. One possible explanation behind these interactions is that cannabis use may modulate the effect of talk therapy. For example, previous studies have found that acute and chronic cannabis use may facilitate and suppress fear extinction respectively (Papini et al., 2017; Raymundi et al., 2020). However, other studies have found that cannabis use has no impact on the efficacy of trauma-focused psychotherapies (Ruglass et al., 2017). Given veterans' interest in cannabis as a form of PTSD treatment, more research is needed on how cannabis use impacts different forms of psychotherapy.

CANNABIS USE CHARACTERISTICS

Participants with cannabis prescriptions tended to have more severe PTSD symptoms than those who use cannabis without a prescription. Specifically, those with cannabis prescriptions had more severe intrusive symptoms (PCL-B),

negative alterations to cognition and mood (PCL-D), and arousal symptoms (PCL-E). This could suggest that medicinal cannabis use (i.e., prescribed cannabis) worsens PTSD outcomes, however, it seems more likely that those with severe PTSD are more prone to seek out and/or be approved for prescribed cannabis. However, Additional longitudinal research would be needed to confirm this explanation. Interestingly, prescription cannabis use was not associated with the avoidance (PCL-C) symptom cluster. This may indicate that prescription cannabis users are trying to treat PTSD symptoms rather than using cannabis as a means of avoidance. However, the restricted range of the PCL-C cluster may not have allowed enough variability between groups to detect meaningful differences in avoidance symptoms.

Cannabis prescription was used instead of self-reported medicinal cannabis use to avoid response bias due to potential cannabis stigma. Indeed, more respondents claimed to be using cannabis medicinally, or medicinally and recreationally (n = 299) than had a cannabis prescription (n = 257). However, it is also possible that some cannabis users may be trying to self-medicate but are unable to obtain a cannabis prescription. Thus, the higher number of participants claiming medicinal cannabis use compared to those with a cannabis prescription may be a result of both self-medication and stigma avoidance. Conversely, it is also possible that prescribed cannabis could be used recreationally instead of medicinally. When considering all these factors, our ability to accurately distinguish recreational use from medicinal use may be limited. Thus, differences observed between these groups should be interpreted with caution.

Participants' preferred route of administration and grams/day of cannabis consumption were not significantly associated with any PTSD-related outcomes. However, preferred route of administration did approach significance for the PCL-5 symptom clusters. As per Table 5, a numerical trend can be seen where a preference for absorbed cannabis is associated with a lower level of global psychopathology. This is likely because those who are using cannabis via absorption are doing so for physical rather than psychological effects. Although veterans' average cannabis consumption was not associated with PTSD severity, dosage may still influence the short-term effects of cannabis on PTSD. For example, higher doses of cannabis have been found to produce larger short-term reductions in anxiety and intrusive symptoms (LaFrance et al., 2020).

DEMOGRAPHICS

There were no significant sex differences or interactions observed. However, genuine differences between male and female participants may not have been detectable due to the low number of women in our sample. Additionally, men and women may differ in their response to cannabis in other ways. For example, the acute effects of cannabis on PTSD symptoms differ by gender (LaFrance et al., 2020). Furthermore, although not investigated here due to cell size restraints, the relationship between cannabis use and PTSD may differ in gender minorities. Because of these reasons, future studies should continue to investigate the role sex and/or gender may play in the relationship between cannabis use and PTSD.

Interestingly, current cannabis users showed a higher rate of unemployment (33.54%) than past (24.29%) and never users (15.65%; Table 1). However, the association between these two variables may be explained by the relationship between cannabis use and disability (Table 1), as current cannabis users were more likely to have a disability that precluded their ability to work (46.95%) than past (37.14%) and never users (28.70%).

LIMITATIONS

This study had several limitations. The largest limitation was our cross-sectional design, which precludes our ability to determine the presence or direction of causality between cannabis use and PTSD. Future studies may benefit from longitudinal designs which would provide stronger evidence of causality and show how PTSD and cannabis use can impact each other's development over time. The generalizability of the current study's findings may be limited to Canadian veterans with chronic pain and PTSD and may not be applicable to Canadian veterans in general or other populations suffering from PTSD. Generalizability could also be limited due to participants self-selecting, and thus our results may not be representative of Canadian veterans with chronic pain at large. Our use of self-report measures may have obfuscated differences between PTSD symptom clusters as self-report measures of PTSD are not as effective at differentiating between similar symptoms as diagnostic interviews are (Rosencrans et al., 2024). Our current results are also limited by our binary operationalization of talk therapy attendance (i.e., yes or no). Thus, we were not able to investigate how different forms of talk therapy (e.g., group vs. individual, manualized vs. non-manualized, etc.) and one's adherence to talk therapy impacts the relationship between talk therapy, PTSD, and cannabis use. Finally, we did not test to see if participants' responses were impacted by socially desirable responding, which may have affected responses to questions concerned with stigmatized topics such as mental health and substance use.

CONCLUSION

Several promising avenues for future research were identified in the current study. For example, both talk therapy attendance and prescription cannabis use were associated

with more severe PTSD-related outcomes. Although it is likely that veterans with more severe symptoms are more prone to seek out mental health support through talk therapy and/or medicinal cannabis, more longitudinal research is needed to better understand these associations. Additionally, longitudinal designs may help clarify the efficacy and suitability of cannabis in treating PTSD, as well as clarify which cannabis use characteristics are associated with better or worse outcomes. Investigating how cannabis use mediates the effectiveness of talk therapy may also be promising. Finally, future research may benefit from the inclusion of measures that specifically assess the short-term effects of cannabis use, that measures such as the PCL-5 are not designed to detect.

ADDITIONAL FILES

The additional files for this article can be found as follows:

- **Appendix A.** Tables A1 to A2. DOI: https://doi.org/10.21061/jvs.v11i1.582.s1
- **Appendix B.** Tables B1 to B5. DOI: https://doi.org/10.21061/jvs.v11i1.582.s2

ETHICS AND CONSENT

The current study, and the study on which this secondary analysis was based, were both approved by the Hamilton Integrated Research Ethics Board (HiREB; project # 15279). All participant data was stored on an encrypted Qualtrics file format on a secure server at Hamilton Health Sciences (HHS) before being anonymized after data collection had been completed.

ACKNOWLEDGEMENTS

David Storey is supported in part by funding from the Social Sciences and Humanities Research Council.

Social Sciences and Humanities Research Council of Canada | Conseil de recherches en sciences humaines du Canada | Canada

FUNDING INFORMATION

The present study was conducted as part of the research project: "Veterans Cannabis Therapy Outcome Registry" (VECTOR), a multi-phase project designed to study the efficacy of cannabis as a treatment for chronic pain in Canadian veterans and was conducted in conjunction with the Hamilton Health Sciences Pain Clinic and funded by the Chronic Pain Center of Excellence for Canadian Veterans.

COMPETING INTERESTS

Mitchell Sheehy and David Storey, as veterans of the CAF, both receive financial benefits through VAC. However, neither have previously nor are currently receiving reimbursement for medicinal cannabis through VAC. The authors have no other competing interests to declare.

AUTHOR AFFILIATIONS

Mitchell R. Sheehy orcid.org/0009-0002-5079-5529
Dept. of Psychology, Memorial University of Newfoundland, St. John's, NL, Canada
David P. Storey orcid.org/0000-0001-5757-6922
Dept. of Psychology, Memorial University of Newfoundland, St. John's, NL, Canada
Dr. Joshua A. Rash orcid.org/0000-0003-0927-0712
Dept. of Psychology, Memorial University of Newfoundland, St. John's, NL, Canada
Dr. Greg K. Tippin orcid.org/0000-0001-5995-0076
Michael G. DeGroote Pain Clinic, Hamilton Health Sciences, Hamilton, ON, Canada; Dept. of Psychiatry & Behavioural Neurosciences, McMaster University, Hamilton, ON, Canada
Dr. Vikas Parihar orcid.org/0000-0002-3369-5908
Michael G. DeGroote Pain Clinic, Hamilton Health Sciences, Hamilton, ON, Canada; Dept. of Anaesthesia, McMaster University, Hamilton, ON, Canada
Dr. Nick Harris orcid.org/0000-0003-3779-4302
Dept. of Psychology, Memorial University of Newfoundland, St. John's, NL, Canada

REFERENCES

Afanador, N. L., Tran, T., Blanchet, L., & **Baumgartner, R.** (2022, October 5). *mvdalab: Multivariate Data Analysis Laboratory*. The Comprehensive R Archive Network. https://CRAN.R-project.org/package=mvdalab

Allan, G. M., Ramji, J., Perry, D., Ton, J., Beahm, N. P., Crisp, N., Dockrill, B., Dubin, R. E., Findlay, T., Kirkwood, J., Fleming, M., Makus, K., Zhu, X., Korownyk, C., Kolber, M. R., McCormack, J., Nickel, S., Noël, G., & **Lindblad, A. J.** (2018). Simplified guideline for prescribing medical cannabinoids in primary care. *Canadian Family Physician, 64*(2), 111–120. https://pubmed.ncbi.nlm.nih.gov/29449241/

American Psychiatric Association. (2022). Trauma- and stressor-related disorders. In American Psychiatric

Association (Ed.), *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). https://doi.org/10.1176/appi.books.9780890425787.x07_Trauma_and_Stressor_Related_Disorders

American Psychological Association. (2017). *Clinical practice guideline for the treatment of posttraumatic stress disorder (PTSD) in adults*. https://www.apa.org/ptsd-guideline/ptsd.pdf

Arkell, T. R., Lintzeris, N., Kevin, R. C., Ramaekers, J. G., Vaney, R., Irwin, C., Haber, P. S., & **McGregor, I. S.** (2019). Cannabidiol (CBD) content in vaporized cannabis does not prevent tetrahydrocannabinol (THC)-induced impairment of driving and cognition. *Psychopharmacology, 236*(9), 2713–2724. https://doi.org/10.1007/s00213-019-05246-8

Atlas Institute. (2022). *Insights into veteran and veteran family experiences with cannabis and mental health*. https://atlasveterans.ca/documents/cannabis-dialogue-series-summary-en.pdf

Bastien, C. H., Vallières, A., & **Morin, C. M.** (2001). Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Medicine, 2*(4), 297–307. https://doi.org/10.1016/S1389-9457(00)00065-4

Benedict, T. M., Keenan, P. G., Nitz, A. J., & **Moeller-Bertram, T.** (2020). Post-traumatic stress disorder symptoms contribute to worse pain and health outcomes in veterans with PTSD compared to those without: A systematic review with meta-analysis. *Military Medicine, 185*(9–10), e1481–e1491. https://doi.org/10.1093/milmed/usaa052

Benjamini, Y., & **Hochberg, Y.** (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society. Series B, Methodological, 57*(1), 289–300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & **Domino, J. L.** (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation: Posttraumatic stress disorder checklist for DSM-5. *Journal of Traumatic Stress, 28*(6), 489–498. https://doi.org/10.1002/jts.22059

Bonn-Miller, M. O., Sisley, S., Riggs, P., Yazar-Klosinski, B., Wang, J. B., Loflin, M. J. E., Shechet, B., Hennigan, C., Matthews, R., Emerson, A., & **Doblin, R.** (2021). The short-term impact of 3 smoked cannabis preparations versus placebo on PTSD symptoms: A randomized cross-over clinical trial. *PloS One, 16*(3), e0246990. https://doi.org/10.1371/journal.pone.0246990

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & **Keane, T. M.** (2016). Psychometric properties of the PTSD checklist for diagnostic and statistical manual of mental disorders-fifth edition (PCL-5) in veterans. *Psychological Assessment, 28*(11), 1379–1391. https://doi.org/10.1037/pas0000254

Cannabis Act, SC 2018, c 16. (2018). https://laws-lois.justice.gc.ca/eng/acts/C-24.5/FullText.html

Chan, S., Blake, A., Wolt, A., Wan, B. A., Zaki, P., Zhang, L., Lam, H., Slaven, M., Shaw, E., Deangelis, C., Ganesh, V., Malek, L., Chow, E., & **O'Hearn, S.** (2017). Medical cannabis use for patients with post-traumatic stress disorder (Ptsd). *Journal of Pain Management, 10*(4), 385–396. https://www.proquest.com/docview/2190033274?sourcetype=Scholarly%20Journals

Drennan, M. L., Karoly, H. C., Bryan, A. D., Hutchison, K. E., & **Bidwell, L. C.** (2021). Acute objective and subjective intoxication effects of legal-market high potency THC-dominant versus CBD-dominant cannabis concentrates. *Scientific Reports, 11*(1), 21744. https://doi.org/10.1038/s41598-021-01128-2

Drost, L., Wan, B. A., Blake, A., Chan, S., Wolt, A., Ganesh, V., Zhang, L., Slaven, M., Shaw, E., Deangelis, C., Lam, H., Zaki, P., Malek, L., Chow, E., & **O'hearn, S.** (2017). Efficacy of different varieties of medical cannabis in relieving symptoms in post-traumatic stress disorder (Ptsd) patients. *Journal of Pain Management, 10*(4), 415–422. https://openurl.ebsco.com/EPDB%3Agcd%3A8%3A16750792/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A129041545&crl=c&link_origin=www.google.com

El-Gabalawy, R., Blaney, C., Tsai, J., Sumner, J. A., & **Pietrzak, R. H.** (2018). Physical health conditions associated with full and subthreshold PTSD in U.S. military veterans: Results from the national health and resilience in veterans study. *Journal of Affective Disorders, 227*, 849–853. https://doi.org/10.1016/j.jad.2017.11.058

Elms, L., Shannon, S., Hughes, S., & **Lewis, N.** (2019). Cannabidiol in the treatment of post-traumatic stress disorder: A case series. *The Journal of Alternative and Complementary Medicine, 25*(4), 392–397. https://doi.org/10.1089/acm.2018.0437

Fabritius, M., Chtioui, H., Battistella, G., Annoni, J-M., Dao, K., Favrat, B., Fornari, E., Lauer, E., Maeder, P., & **Giroud, C.** (2013). Comparison of cannabinoid concentrations in oral fluid and whole blood between occasional and regular cannabis smokers prior to and after smoking a cannabis joint. *Analytical and Bioanalytical Chemistry, 405*(30), 9791–9803. https://doi.org/10.1007/s00216-013-7412-1

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*(1), 84–88. https://doi.org/10.1111/j.1755-5949.2008.00071.x

Friedrich, S., Konietschke, F., & **Pauly, M.** (2019). Resampling-based analysis of multivariate data and repeated measures designs with the R package MANOVA.RM. *The R Journal, 11*(2), 380–400. https://doi.org/10.32614/RJ-2019-051

Gauvin, D. E., Wolfson, C., Aiken, A. B., Feinstein A., Raina, P., & **VanTil, L. D.** (2021). Correlates of posttraumatic stress disorder among veterans in the Canadian longitudinal study on aging. *Journal of Military, Veteran and Family Health, 8*(1), 38–55. https://doi.org/10.3138/jmvfh-2021-0030

Graham, J., Legarreta, M., North, L., DiMuzio, J., McGlade, E., & **Yurgelun-Todd, D.** (2016). A preliminary study of DSM–5 PTSD symptom patterns in veterans by trauma type. *Military Psychology, 28*(2), 115–122. https://doi.org/10.1037/mil0000092

Han, K., Wang, J.-Y., Wang, P.-Y., & **Peng, Y.-C.-H.** (2024). Therapeutic potential of cannabidiol (CBD) in anxiety disorders: A systematic review and meta-analysis. *Psychiatry Research, 339*, 116049. https://doi.org/10.1016/j.psychres.2024.116049

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. https://doi.org/10.1016/j.psyneuen.2014.11.002

Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *The American Journal of Psychiatry, 142*(11), 1259–1264. https://doi.org/10.1176/ajp.142.11.1259

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry,* 4(5), 231–244. https://doi.org/10.3109/10673229709030550

Kind, S., & **Otis, J. D.** (2019). The interaction between chronic pain and PTSD. *Current Pain and Headache Reports, 23*(12), 1–7. https://doi.org/10.1007/s11916-019-0828-3

Klumpers, L. E., & **Thacker, D. L.** (2019). A brief background on cannabis: From plant to medical indications. *Journal of AOAC International, 102*(2), 412–420. https://doi.org/10.5740/jaoacint.18-0208

Kroenke, K., Spitzer, R. L., & **Williams, J. B. W.** (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kroenke, K., Wu, J., Yu, Z., Bair, M. J., Kean, J., Stump, T., & **Monahan, P. O.** (2016). Patient health questionnaire anxiety and depression scale: Initial validation in three clinical trials. *Psychosomatic Medicine, 78*(6), 716–727. https://doi.org/10.1097/PSY.0000000000000322

LaFrance, E. M., Glodosky, N. C., Bonn-Miller, M., & **Cuttler, C.** (2020). Short and long-term effects of cannabis on symptoms of post-traumatic stress disorder. *Journal of Affective Disorders, 274*, 298–304. https://doi.org/10.1016/j.jad.2020.05.132

Lake, S., Kerr, T., Buxton, J., Walsh, Z., Marshall, B. D., Wood, E., & **Milloy, M. J.** (2020). Does cannabis use modify the effect of post-traumatic stress disorder on severe depression and suicidal ideation? Evidence from a population-based cross-sectional study of Canadians. *Journal of Psychopharmacology (Oxford), 34*(2), 181–188. https://doi.org/10.1177/0269881119882806

Larsen, S. E., Wiltsey Stirman, S., Smith, B. N., & **Resick, P. A.** (2016). Symptom exacerbations in trauma-focused treatments: Associations with treatment outcome and non-completion. *Behaviour Research and Therapy, 77*, 68–77. https://doi.org/10.1016/j.brat.2015.12.009

Lehavot, K., Katon, J. G., Chen, J. A., Fortney, J. C., & **Simpson, T. L.** (2018). Post-traumatic stress disorder by gender and veteran status. *American Journal of Preventive Medicine, 54*(1), e1–e9. https://doi.org/10.1016/j.amepre.2017.09.008

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198–1202. https://doi.org/10.1080/01621459.1988.10478722

Lo, L. A., Christiansen, A. L., Strickland, J. C., Pistawka, C. A., Eadie, L., Vandrey, R., & **MacCallum, C. A.** (2024). Does acute cannabidiol (CBD) use impair performance? A meta-analysis and comparison with placebo and delta-9-tetrahydrocannabinol (THC). *Neuropsychopharmacology, 49*(9), 1425–1436. https://doi.org/10.1038/s41386-024-01847-w

Mahmood, F., Lim, M. M., & **Kirchhof, M. G.** (2022). A survey of topical cannabis use in Canada. *Journal of Cutaneous Medicine and Surgery, 26*(2), 156–161. https://doi.org/10.1177/12034754211059025

Manhapra, A., Stefanovics, E., & **Rosenheck, R.** (2015). Treatment outcomes for veterans with PTSD and substance use: Impact of specific substances and achievement of abstinence. *Drug and Alcohol Dependence, 156*, 70–77. https://doi.org/10.1016/j.drugalcdep.2015.08.036

Metrik, J., Stevens, A. K., Gunn, R. L., Borsari, B., & **Jackson, K. M.** (2022). Cannabis use and posttraumatic stress disorder: Prospective evidence from a longitudinal study of veterans. *Psychological Medicine, 52*(3), 446–456. https://doi.org/10.1017/S003329172000197X

Morgan, C. J. A., Freeman, T. P., Hindocha, C., Schafer, G., Gardner, C., & **Curran, H. V.** (2018). Individual and combined effects of acute delta-9-tetrahydrocannabinol and cannabidiol on psychotomimetic symptoms and memory function. *Translational Psychiatry, 8*(1), 181. https://doi.org/10.1038/s41398-018-0191-x

Morin, C. M., Belleville, G., Bélanger, L., & **Ivers, H.** (2011). The insomnia severity index: Psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep, 34*(5), 601–608. https://doi.org/10.1093/sleep/34.5.601

Nacasch, N., Avni, C., & **Toren, P.** (2023). Medical cannabis for treatment-resistant combat PTSD. *Frontiers in Psychiatry, 13*, 1014630. https://doi.org/10.3389/fpsyt.2022.1014630

Papini, S., Ruglass, L. M., Lopez-Castro, T., Powers, M. B., Smits, J. A. J., & **Hien, D. A.** (2017). Chronic cannabis use is associated with impaired fear extinction in humans. *Journal of Abnormal Psychology, 126*(1), 117–124. https://doi.org/10.1037/abn0000224

Prins, A., Bovin, M. J., Smolenski, D. J., Marx, B. P., Kimerling, R., Jenkins-Guarnieri, M. A., Kaloupek, D. G., Schnurr, P. P., Kaiser, A. P., Leyva, Y. E., & **Tiet, Q. Q.** (2016). The primary care PTSD screen for DSM-5 (PC-PTSD-5): Development and evaluation within a veteran primary care sample. *Journal of General Internal Medicine, 31*(10), 1206–1211. https://doi.org/10.1007/s11606-016-3703-5

Raymundi, A. M., da Silva, T. R., Sohn, J. M. B., Bertoglio, L. J., & **Stern, C. A.** (2020). Effects of Δ 9-tetrahydrocannabinol on aversive memories and anxiety: A review from human studies. *BMC Psychiatry, 20*(1), 420. https://doi.org/10.1186/s12888-020-02813-8

Roitman, P., Mechoulam, R., Cooper-Kazaz, R., & **Shalev, A.** (2014). Preliminary, open-label, pilot study of add-on oral Δ- tetrahydrocannabinol in chronic post-traumatic stress disorder. *Clinical Drug Investigation, 34*(8), 587–591. https://doi.org/10.1007/s40261-014-0212-3

Rosencrans, P. L., Zoellner, L. A., & **Feeny, N. C.** (2024). A network approach to posttraumatic stress disorder: Comparing interview and self-report networks. *Psychological Trauma: Theory, Research, Practice and Policy, 16*(2), 340–346. https://doi.org/10.1037/tra0001151

Ruglass, L. M., Shevorykin, A., Radoncic, V., Smith, K. M. Z., Smith, P. H., Galatzer-Levy, I. R., Papini, S., & **Hien, D. A.** (2017). Impact of cannabis use on treatment outcomes among adults receiving cognitive-behavioral treatment for PTSD and substance use disorders. *Journal of Clinical Medicine, 6*(2), 14. https://doi.org/10.3390/jcm6020014

Sainsbury, B., Bloxham, J., Pour, M. H., Padilla, M., & **Enciso, R.** (2021). Efficacy of cannabis-based medications compared to placebo for the treatment of chronic neuropathic pain: a systematic review with meta-analysis. *Journal of Dental Anesthesia and Pain Medicine, 21*(6), 479–506. https://doi.org/10.17245/jdapm.2021.21.6.479

Schlienz, N. J., Spindle, T. R., Cone, E. J., Herrmann, E. S., Bigelow, G. E., Mitchell, J. M., Flegel, R., LoDico, C., & **Vandrey, R.** (2020). Pharmacodynamic dose effects of oral cannabis ingestion in healthy adults who infrequently use cannabis. *Drug and Alcohol Dependence, 211*, 107969. https://doi.org/10.1016/j.drugalcdep.2020.107969

Schnurr, P. P., Lunney, C. A., Bovin, M. J., & **Marx, B. P.** (2009). Posttraumatic stress disorder and quality of life: Extension of findings to veterans of the wars in Iraq and Afghanistan. *Clinical Psychology Review, 29*(8), 727–735. https://doi.org/10.1016/j.cpr.2009.08.006

Smith, P. A., Chan, S., Blake, A., Wolt, A., Zhang, L., Wan, B. A., Zaki, P., Lam, H., Deangelis, C., Slaven, M., Shaw, E., Ganesh, V., Malek, L., Chow, E., & **O'Hearn, S.** (2017). Medical cannabis use in military and police veterans diagnosed with post-traumatic stress disorder (PTSD). *Journal of Pain Management, 10*(4), 397–405.

Smith, S. M., Goldstein, R. B., & **Grant, B. F.** (2016). The association between post-traumatic stress disorder and lifetime DSM-5 psychiatric disorders among veterans: Data from the national epidemiologic survey on alcohol and related conditions-III (NESARC-III). *Journal of Psychiatric Research, 82*, 16–22. https://doi.org/10.1016/j.jpsychires.2016.06.022

Solowij, N., Broyd, S., Greenwood, L-M., van Hell, H., Martelozzo, D., Rueb, K., Todd, J., Liu, Z., Galettis, P., Martin, J., Murray, R., Jones, A., Michie, P. T., & **Croft, R.** (2019). A randomised controlled trial of vaporised Δ 9-tetrahydrocannabinol and cannabidiol alone and in combination in frequent and infrequent cannabis users: acute intoxication effects. *European Archives of Psychiatry and Clinical Neuroscience, 269*(1), 17–35. https://doi.org/10.1007/s00406-019-00978-2

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & **Löwe, B.** (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Sterniczuk, R., & **Whelan, J.** (2016). Cannabis use among Canadian Armed Forces veterans. *Journal of Military, Veteran and Family Health, 2*(2), 43–52. https://doi.org/10.3138/jmvfh.3836

Storey, D. P., Keeler-Villa, N. R., Harris, N., Anthonypillai, J., Tippin, G. K., Parihar, V., & **Rash, J. A.** (2023). Views on and experiences with medicinal cannabis among Canadian Veterans who live with pain: A qualitative study. *Canadian Journal of Pain, 7*(1), 2232838. https://doi.org/10.1080/24740527.2023.2232838

Tabachnick, B. G., & **Fidell, L. S.** (2019). *Using multivariate statistics* (7th ed.). Pearson.

Thompson J., MacLean, M. B., Til, L. V., Sweer, J., Poirier, A., & **Pedlar, D.** (2011, January 4). *Survey on transition to civilian life: Report on regular force veterans*. Research Directorate, Veterans Affairs Canada. https://publications.gc.ca/collections/collection_2011/acc-vac/V32-231-2011-eng.pdf

Thompson, J., VanTil, L., Sweet, J., Poirier, A., McKinnon, K., Dursun, S., Sudom, K., Zamorski, M., Sareen, J., Ross, D., Hoskins, C., & **Pedlar, D.** (2015, March 19). *Canadian Armed Forces veterans: Mental health findings from the 2013 life after service survey*. Research Directorate, Veterans Affairs Canada. https://publications.gc.ca/collections/collection_2016/acc-vac/V32-260-2016-eng.pdf

US Department of Veterans Affairs & Department of Defense. (2017). *VA/DoD clinical practice guideline for the management of posttraumatic stress disorder and acute stress disorder* (Version 3.0). https://www.healthquality.va.gov/guidelines/MH/ptsd/VADoDPTSDCPGFinal012418.pdf

Valikhanova, G., Kato, Y., Fitzcharles, M-A., Ware, M., Da Costa, D., Lowensteyn, I., Cheung, H. S., & **Grover, S.** (2023). Medical cannabis use among Canadian veterans and non-veterans: A national survey. *Integrative Medicine Reports, 2*(1), 120–128. https://doi.org/10.1089/imr.2023.0022

Van Buuren, S., & **Groothuis-Oudshoorn, K.** (2011). Mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software, 45*(3), 1–67. https://doi.org/10.18637/jss.v045.i03

Veterans Affairs Canada. (2019, October 17). *Reimbursement policy for cannabis for medical purposes*. https://www.veterans.gc.ca/eng/about-vac/legislation-policies/policies/document/2461

Veterans Affairs Canada. (2023, May 30). *Cannabis for medical purposes*. https://www.veterans.gc.ca/eng/about-vac/research/research-directorate/publications/reports/cmp

Walker, R. S. W., Marks, E. H., Jaeger, J., Duax, J. M., Feeny, N. C., & **Zoellner, L. A.** (2020). Imaginal exposure exacerbation revisited: Deconstructing patient characteristics associated with worse reactions to the initiation of imaginal exposure in PTSD. *Behaviour Research and Therapy, 135*, 103747. https://doi.org/10.1016/j.brat.2020.103747

Wallace, M., Schulteis, G., Atkinson, J. H., Wolfson, T., Lazzaretto, D., Bentley, H., Gouaux, B., & **Abramson, I.** (2007). Dose-dependent effects of smoked cannabis on capsaicin-induced pain and hyperalgesia in healthy volunteers. *Anesthesiology (Philadelphia), 107*(5), 785–796. https://doi.org/10.1097/01.anes.0000286986.92475.b7

Wilcox, R. R. (2017). *Introduction to robust estimation and hypothesis testing* (4th ed.). Elsevier.

Wilkinson, S. T., Stefanovics, E., & **Rosenheck, R. A.** (2015). Marijuana use is associated with worse outcomes in symptom severity and violent behavior in patients with posttraumatic stress disorder. *The Journal of Clinical Psychiatry, 76*(9), 1174–1180. https://doi.org/10.4088/JCP.14m09475

Zehra, A., Burns, J., Liu, C. K., Manza, P., Wiers, C. E., Volkow, N. D., & **Wang, G. J.** (2018). Cannabis addiction and the brain: A review. *Journal of Neuroimmune Pharmacology, 13*(4), 438–452. https://doi.org/10.1007/s11481-018-9782-9

TO CITE THIS ARTICLE:
Sheehy, M. R., Storey, D. P., Rash, J. A., Tippin, G. K., Parihar, V., & Harris, N. (2025). Cannabis Use Characteristics and PTSD-Related Outcomes Among Canadian Veterans With Chronic Pain. *Journal of Veterans Studies,* 11(1), pp. 30–46. DOI: https://doi.org/10.21061/jvs.v11i1.582

Submitted: 06 July 2024 **Accepted:** 23 November 2024 **Published:** 27 January 2025