Cannabis Use and Psychotherapeutic Outcomes for PTSD in Canadian Military and Veterans

by

Martine Southall

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University of Manitoba

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Abstract

Canadian Armed Forces (CAF) members and veterans are increasingly choosing cannabis to manage mental health symptoms, including those of Post-Traumatic Stress Disorder (PTSD). Although psychotherapeutic treatments are recommended for PTSD, there is a lack of high-quality research regarding the potential impacts of cannabis use on treatment outcomes. The little research that has examined cannabis use and psychotherapeutic treatment for PTSD has produced mixed results. There is also a lack of detailed information on cannabis use characteristics (e.g., frequency, THC potency, CBD:THC ratio) of CAF members and veterans and how these may relate to treatment outcomes. Further, little is known about CAF members' and veterans' experiences of cannabis use during psychotherapeutic treatment. This study utilized a pre-post-follow-up design to examine psychotherapeutic treatment outcomes of 11 treatment-seeking CAF members and veterans with clinical or sub-clinical PTSD. Multilevel modelling was used to compare outcomes of those who use cannabis (n = 4), and those who did not use cannabis (n = 7). No statistically significant results were found, however the comparison was of low power due to sample size. A regression analysis examined the potential relationships between cannabis-use characteristics and PTSD symptoms at pre-treatment (which included all participants who for whom there was adequate data), however, again, there were no statistically significant results and the analysis was of low power (n = 9). Descriptive results on cannabis use characteristics highlighted a high degree of heterogeneity even in the small sample suggesting that future research that measures cannabis in a more detailed way may aid in clarifying the currently mixed findings. Thematic analysis of open-ended questions highlighted several important themes regarding factors influencing cannabis use decisions and experiences. Careful consideration of both benefits and drawbacks of cannabis, as well as personal beliefs and history,

appear to play important roles in cannabis use choices and experiences. Clinicians could benefit from the knowledge that cannabis use varies considerably in this population, and from understanding factors that may relate to their clients' cannabis use decisions and experiences. Clinicians could use themes identified in this study as starting points for more informed conversations around cannabis use with clients.

Keywords: Canadian Armed Forces, military, veterans, cannabis use, psychotherapy, PTSD

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Cannabis Use and Psychotherapeutic Outcomes for PTSD in Canadian Armed Forces Veterans

Canadian Armed Forces members and veterans face elevated rates of Post-Traumatic Stress Disorder (PTSD) compared to the general population, with an estimated prevalence of 23 to 26% (Sareen et al., 2021; Sweet et al., 2020), compared to 9.2% prevalence in the general population (Van Ameringen et al., 2008). Increasingly, CAF veterans have turned to medical cannabis to cope with mental health symptoms. Veterans Affairs Canada in 2021 reimbursed a record 17,495 clients for cannabis for medical purposes (VAC, 2022). Positive associations are found between Canadian veterans' use of medical cannabis and the presence of PTSD (Reyes-Velez et al., 2021).

Literature examining the relationship between mental health and cannabis use in military populations highlights the need for better research and stronger evidence to inform guidance on cannabis use during mental health treatment. There is mixed evidence of associations between cannabis use and severity and course of PTSD (Bonn-Miller et al., 2022; Botsford et al., 2020). Specific to veterans, there is evidence indicating strong associations between cannabis use and poor mental health in general, including symptoms of PTSD. A systematic review by Turna and MacKillop (2021) detailed evidence of associations between cannabis use and various mental disorders as well as higher symptom severity and potentially poorer treatment responses (e.g., lower levels of improvement in symptoms from pre- to post-treatment) for PTSD specifically. Critically, however, Turna and Mackillop echo authors of meta-analyses and systematic reviews on cannabis use and mental health who note the lack of longitudinal, well-controlled studies. This lack of high-quality research means that evidence is far from conclusive in supporting causation. Rather, the relationship between cannabis use and PTSD may be because military

members and veterans with more severe psychopathology are more likely to use cannabis (Botsford et al., 2020; Hasin & Walsh, 2020; Kuhns et al., 2021), or there may be other factors which account for this association.

Beyond the merely associative nature of existing evidence, there are additional complicating factors that preclude its direct application to the context of CAF members and veterans undergoing psychotherapeutic treatment. First, almost all studies draw on American veteran samples who may differ in important ways from Canadian veteran samples. Alcohol use is frequently cited as a co-occurring disorder among American veterans according to the Turna and MacKillop review (2021), but in a Canadian study (Reyes-Velez et al., 2021) heavy alcohol use was not associated with cannabis use among Canadian veterans reimbursed for medical cannabis. Second, studies that find associations between cannabis use and poor PTSD outcomes frequently dichotomize participants into categories of either cannabis use or no use (e.g., Wilkinson et al., 2015), or focus on Cannabis Use Disorder (CUD) rather than cannabis use generally (e.g., Turna & MacKillop, 2021). Several studies (e.g., Chung et al., 2023; Sagar et al., 2021) highlight the problematic nature of applying standard diagnostic criteria for CUD to medical/therapeutic cannabis users. Third, critical characteristics of cannabis use tied to mental health outcomes, such as frequency, THC potency, and CBD content relative to THC content (Fischer et al., 2022), are almost entirely missing from the literature to date – little is known about these characteristics of cannabis use in military and veteran populations.

These three limitations to the existing literature may explain why there is no consensus regarding cannabis use and psychotherapeutic treatment outcomes. Indeed, while some studies have shown that cannabis relates to poorer treatment outcomes for PTSD (e.g., Bonn-Miller et al., 2013a; Wilkinson et al., 2016), other studies have shown no negative impact of cannabis use

on psychotherapeutic treatment outcomes in veterans being treated for PTSD (e.g., Petersen et al., 2021; Ruglass et al., 2017).

To date, the need for more detailed and in-depth research on cannabis use as it relates to psychotherapeutic PTSD treatment experiences and outcomes has not been adequately addressed. With the current legalization and increasing utilization of cannabis among veterans, there exists a unique and important opportunity to gather data from CAF members and veterans already using cannabis. An important question to answer is how cannabis use frequency and potency (as it relates to both THC and CBD content) relates to improvements (or lack thereof) in functioning and well-being following psychotherapeutic treatment for PTSD.

PTSD and Psychotherapeutic Treatment in Military and Veterans

An understanding of PTSD in CAF military and veterans is important to determine why and how these individuals seek to alleviate the symptoms of this disorder through cannabis use. PTSD is defined by the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* [DSM-5], American Psychiatric Association [APA] 2013) as a disorder comprised of four symptom clusters: intrusions, avoidance, mood and thought changes, and hyperarousal. To be diagnosed with (or screen positive for a likely diagnosis of) PTSD, individuals must have 1-2 symptoms from each symptom cluster, and must have witnessed a traumatic event that meets specific defined criteria (APA, 2013).

Military and veteran populations have a higher prevalence of PTSD than the general population –a higher prevalence has been found in both American and Canadian samples (Richardson et al., 2011; Thompson et al., 2016). In Canadian samples, recent estimates of prevalence of PTSD range from 21-26% (Sareen et al., 2021; Sweet et al., 2020) in comparison to 9% in the general Canadian population (Van Ameringen et al., 2008). A likely explanation for

this elevated prevalence of PTSD in military populations is increased exposure in the course of operational duties to potentially traumatic events (i.e., exposure to death or threat to life, serious injury, or sexual violence; APA 2013). Further, combat trauma, relative to other types of traumas, appears to be more strongly associated with the development and severity of PTSD (Guinea et al., 2018), and combat trauma exhibits a dose-response pattern wherein repeated exposures are associated with higher risk of developing PTSD (Sareen et al., 2017) and greater symptom severity (Jakob et al., 2017).

Within the Canadian military population, there are additional risk factors for the development of PTSD, and PTSD itself is associated with numerous negative health outcomes. Demographic variables associated with PTSD in the Canadian military population include identifying as female, being a junior non-commissioned member, and being in land operations rather than air operations (Mota et al., 2021). In line with the dose-response pattern, increasing exposures to potentially traumatic events are also associated with PTSD (Mota et al., 2021) as well as higher likelihood of having both PTSD and an additional psychiatric diagnosis (Richardson et al., 2019). Transitioning from active service to veteran status is associated with both new-onset and persistent courses of PTSD (Mota et al., 2021). Further, positive screens for PTSD rose from 15.6% to 18.3% in *Life After Service Studies* between 2013 to 2016 (VanTil et al., 2017), indicating there may be a trend of increasing PTSD among CAF veterans. PTSD also tends to be frequently co-morbid with mood and anxiety disorders (Sareen et al., 2021) as well as physical health conditions (Sommer et al., 2019), suggesting that CAF members and veterans with PTSD may face a larger burden of both physical and psychological symptoms.

Encouragingly, there is considerable evidence for effective psychotherapeutic treatment for PTSD, and that CAF members and veterans seek such treatment. Approximately two thirds of

CAF members with PTSD sought treatment for their condition (Fikretoglu et al., 2007), and the presence of PTSD is associated with increased mental healthcare utilization in Canadian military populations (Mota et al., 2021). Trauma-focused therapies (TFT), in which the processing of traumatic events is facilitated and is a central goal of therapy (Schnurr, 2016), are the first-line therapies strongly recommended for PTSD (Schrader & Ross, 2021). TFT therapies, including Cognitive Processing Therapy (CPT), Written Exposure Therapy (WET), Prolonged Exposure Therapy (PET), and Eye-Movement Desensitization and Reprocessing Therapy (EMDR), typically use some type of exposure to the memory of the traumatic event to help the individual process the memory and related thoughts and emotions (Schnurr, 2016; Schrader & Ross, 2021). Although guidelines for specific TFTs vary, all guidelines strongly support TFTs as a first-line treatment (Forbes et al., 2010) and these guidelines are supported by meta-analyses and systematic reviews (e.g., Cusak et al., 2015; Lee et al., 2016).

It is important to note that military members and veterans generally respond more poorly to TFTs than the general population (Watts et al., 2013). There is evidence that, within veteran populations, factors including severity of symptoms, higher levels of comorbidity (e.g., with depression), and psychiatric medication use may relate to poorer treatment outcomes (Haagen et al., 2015, McLean et al., 2022). Additionally, there is inconsistent meta-analytic evidence that some demographic variables may impact treatment efficacy –age, substance use, (McLean et al., 2022) and gender (Watts et al., 2013) all have been shown to potentially relate to treatment outcomes. Further, in one meta-analysis group treatments were shown to have reduced efficacy relative to individual treatments (Haagen et al., 2015). However, despite these factors, treatment gains and maintenance at follow-up are still demonstrated in military and veteran populations receiving TFTs for PTSD (McLean et al., 2022). Thus, although they may be more challenging

to treat and experience more severe symptoms, engagement with psychotherapeutic treatment is typically beneficial for military members and veterans. Factors within the military population that relate to treatment outcomes warrant further examination and may provide insight into increasing treatment efficacy.

Cannabis Use and Mental Health

Authors of *Lower Risk Cannabis Use Guidelines* (Fischer et al., 2021), a literature review with the intention of summarizing and guiding cannabis use decisions, caution that frequency of use of cannabis beyond twice a week, high THC potency (above 20%), and high THC:CBD ratios, are risky cannabis use characteristics with ties to negative outcomes in cognitive and mental health. Although these guidelines represent a strong summary of the literature, they err on the side of caution, rely heavily on associations, and are geared towards risks to younger individuals and in the context of recreational cannabis use.

Cannabis use is a risk factor for psychotic symptoms (Botford et al., 2020; Hasin & Walsh, 2020). High potency and high frequency cannabis use characteristics are associated with higher rates of psychosis (Leadbeater et al. 2018; Petrelli et al., 2022). Frequent and higher potency cannabis use is associated with increased acute cognitive deficits, although deficits generally subside with periods of abstinence (Curran et al., 2016; Sagar & Gruber, 2018).

The evidence for a relationship between cannabis use and non-psychotic mental disorders in adult populations is murky at best. Systematic reviews consistently note the evidence is mixed for associations between depression and anxiety and cannabis use (Botsford et al., 2020; Hasin & Walsh, 2020; Kuhns et al., 2021). Authors of a systematic review of cannabis potency (Petrelli et al., 2022) reported similar findings of mixed to no evidence supporting links with anxiety and depression.

The idea that individuals experiencing mental health challenges choose to use cannabis to manage these challenges is strongly supported. Management of mental health symptoms is consistently reported to be the most frequently reported reason people use medical cannabis (Bonn-Miller et al., 2013b; Rup et al., 2022; Turna et al., 2020; Walsh et al., 2013). Given elevated prevalence of mental health concerns in Canadian military and veterans (Sareen et al., 2021; Sweet et al., 2020), it is not surprising that the same motives for cannabis use are frequently cited amongst veterans: they are often choosing to use and perceiving benefits from cannabis to manage mental health symptoms (e.g., depression, anxiety, mood concerns, sleep concerns), and PTSD symptoms specifically (Kang et al., 2020; Loflin et al., 2018; Sterniczuk & Whelan, 2016).

Despite self-reported benefits by users, evidence on the potential therapeutic efficacy of cannabis is also mixed. Meta-analytic evidence has found a lack of support for the view that cannabis is a promising treatment for depression, and a relatively weak, but present degree of evidence for the view that cannabis is a promising treatment for anxiety (Black et al., 2019). However, evidence for cannabis as a treatment for PTSD is worth a second look. Although authors of numerous studies have found associations between cannabis use and PTSD symptom severity in veterans (e.g., Hill et al., 2021; Livingston et al., 2022; Metrik et al., 2016), authors of other studies have provided tentative evidence that cannabis may alleviate PTSD symptoms (Bonn-Miller et al., 2022; Hindocha et al., 2020; Walsh et al., 2017). Authors of a qualitative study of veterans with PTSD highlighted a range of benefits of cannabis, including reduction of anxiety and depression, and noted that those veterans described cannabis as an aid in introspection and engagement with traumatic memories (Elliot et al., 2015).

Although Turna and McKillop (2019) identified numerous associations between cannabis use and negative outcomes in veterans with PTSD, a complicating factor they acknowledged is that studies evaluating therapeutic use are scarce. Authors of a recent qualitative study focusing on medical cannabis use in veterans highlighted a range of benefits compared to other medications, including better sleep, less irritability, and less side-effects. Krediet et al. (2020), the authors of that study, made the important point that purposeful and controlled doses are not comparable to uncontrolled or problematic use. Underscoring their point, there have been criticisms of the diagnosis of CUD in those who use cannabis medically – highlighting that increased tolerance can mean reduced cognitive deficits, and that tolerance/withdrawal systems can result in a diagnosis of CUD in the absence of cannabis related problems (Sagar et al., 2021; Chung et al., 2023). These may be important factors to consider especially among treatment seeking veterans who may already be using cannabis mainly for therapeutic purposes – and call into question whether many findings of CUD being associated with negative mental health outcomes reflect individuals using cannabis medically.

Cannabis Use and Perceptions in Veterans

The same military and veteran populations who face challenges with mental health and PTSD are increasingly using cannabis to manage their symptoms. Thirty-seven veterans were reimbursed for medical cannabis in 2011-12; that number soared to a record 18,388 clients by 2021-22, representing 153 million dollars reimbursed to veterans by the Government of Canada, and approximately 19 million grams of cannabis (VAC 2022). This increasing cannabis use by veterans in Canada is mirrored in the US (Hill et al., 2021; Teeters et al., 2017).

Increased use of cannabis can be attributed in part to veterans' perceptions of the benefits of cannabis use. Veterans view cannabis as less harmful than other substances

(Wilkinson et al., 2016), and see cannabis as a potential alternative to other medications and substances (Clary et al., 2021). In line with these perceptions, veterans report reasons for and perceived benefits of cannabis use that include improved sleep, pain management, better quality of life, relaxation/emotional calm, and management of anxiety and PTSD (Kang et al., 2020; Sterniczuk & Whelan, 2016). Although there is little information on military and veterans' specific cannabis use behaviours, American researchers (Loflin et al., 2019) found that veterans with access to free medical cannabis tend to consume cannabis with higher THC levels, typically use cannabis multiple times a day, and report that cannabis improves their symptoms of mental disorder(s).

Despite perceptions of the benefits of cannabis use, there may be reasons to look more closely at cannabis use as it relates to PTSD symptom management. Although improvements/benefits are frequently reported, expectations that cannabis will be beneficial for mental health symptoms appear to play a significant role in those reports. Cannabis use expectancies fully mediated benefits of cannabis use in one study, and those with higher PTSD symptom severity used more cannabis (Earleywine & Bolles, 2014).

Cannabis Use and Psychotherapeutic Treatment Outcomes

Despite mixed evidence for its efficacy, CAF veterans experiencing mental health challenges are increasingly using cannabis A recent study examining cannabis use in a treatment seeking CAF sample found that approximately 45% used cannabis at time of intake (St. Cyr et al., 2023). Similarly, Ecker et al. (2019) found American veterans with co-occuring CUD and mental health disorders were more likely to use mental health services than those veterans without CUD. Taken together, these findings highlight the significant number of individuals within military populations who use cannabis and who seek and utilize mental health services,

underscoring the importance of further examination of mental health service efficacy for veterans who use cannabis. Although some researchers (e.g., Wilkinson et al., 2015) identified poorer response to psychotherapeutic treatment for PTSD in cannabis users, other authors (e.g., Petersen et al., 2021) reported no difference in clinical outcomes between non-users and those who used cannabis during treatment. Ruglass et al. (2017) found cannabis use to be associated with higher PTSD symptom severity early in treatment, but lower symptom severity at the end of treatment.

These mixed findings form the basis for calls for prioritizing research on cannabis use during psychotherapeutic treatment in CAF members and veterans. A working group of researchers at the *Canadian Institute for Military and Veteran Health Forum,* tasked with evaluating priorities for the potential of cannabis use in management of CAF members and veterans' PTSD and chronic pain, highlighted the need to understand how cannabis use might impact concurrent psychotherapeutic treatment (Richardson et al., 2019). A 2019 subcommittee of *Veterans Affairs* released a report in response to Canadian veterans' increasing use of medical cannabis and the inadequacy of current research to inform evidence-based guidelines for medical cannabis use. The experts who contributed agreed that psychotherapeutic treatments are necessary, but some experts suggested cannabis may allow veterans to better tolerate these treatments, while other experts opined that treatment motivation and effort could be hindered by cannabis use (Subcommittee on Veterans' Affairs, 2019). These mixed opinions regarding cannabis use and mental health, and cannabis use and its relationship to psychotherapeutic PTSD treatment outcomes, highlight the critical need to better inform clinical recommendations on cannabis use in this context.

Objectives and Hypotheses

Although there are reasons for caution regarding cannabis use amongst CAF members and veterans with PTSD, there are also many gaps in the literature. The primary objective of the present study was to examine if CAF members and veterans who use cannabis at varying frequencies differ in their responses to psychotherapeutic treatment for PTSD. Due to limited sample size, analyses regarding treatment outcomes focused on comparing individuals who used cannabis to those who did not. While the extant literature suggests detrimental effects related to higher THC potency but potentially positive (or at least attenuating) effects related to higher CBD:THC ratios, these cannabis characteristics have yet to be examined in the context of veterans using cannabis during psychotherapeutic treatment for PTSD. Thus, a secondary aim of this study was to ascertain whether cannabis use frequency (measured continuously), estimated THC dose/potency, and estimated CBD:THC ratio predict symptoms at pre-treatment, and psychotherapeutic treatment outcomes. Due to the limited sample size, only analyses focused on pre-treatment were performed. Additionally, there is a lack of recent studies aimed at understanding the perspectives of CAF members and veterans with PTSD regarding their cannabis use patterns and experiences. Such information may be critical to place research findings in context and to include the lived experiences of CAF members and veterans who use cannabis. Tertiary aims of this study were thus to report on descriptive details of CAF members' and veterans' cannabis use characteristics, and to explore their reasons for cannabis use, their past experiences of withdrawal, and their cannabis use during treatment for PTSD.

Related to the first objective, I hypothesized that CAF members and veterans who used cannabis would have poorer treatment outcomes relative to veterans who did not use cannabis. For the second objective, I hypothesized that higher frequency cannabis use would predict more

severe symptoms at pre-treatment; higher estimated THC dose/ratio would predict higher symptom severity at pre-treatment; and that higher estimated CBD:THC ratio would predict lower symptom severity at pre-treatment among cannabis users.

Methods

Participants

This study was approved by the Human Research Ethics Board at the University of Manitoba (HS25716, H2022:330). All participants were provided with an informed consent form prior to being enrolled in the study and completing study measures, and prior to any data being extracted for study purposes from their electronic medical records [EMR]. The consent form discussed confidentiality and specified the data to be extracted from their EMR. Eligibility criteria for the study included: being an active or veteran member of the Canadian Armed Forces; being over the age of 18; having been referred to the Winnipeg Operational Stress Injury Clinic for treatment; seeking treatment for PTSD (and have thus received a diagnosis of PTSD or Other-Specified Trauma or Stressor Related Disorder); and completing the online consent form via the E-Consent framework on RedCap. Exclusion criteria for the study included: current uncontrolled or untreated psychosis; significant suicide risk; and significant cognitive impairment.

Seventeen active Canadian Armed Forces members and veterans consented to participate in the study. These individuals were drawn from a pool of patients who consented to be contacted for research related to cannabis use at the point of intake at the Operational Stress Injury Clinic (OSIC) and had been determined to be ready to begin a structured psychotherapeutic treatment for posttraumatic stress disorder (PTSD). Of these initial 17

participants, one did not begin treatment for PTSD at the OSIC and thus did not complete measures at any timepoint.

The final sample thus consisted of 16 participants, the majority being male (n = 12, 75%), with an average age of 44 years (SD = 7.3). Slightly less than half (n = 7, 43%) were veterans of the CAF, with the remaining participants being actively serving CAF members. All of the individuals in this sample completed the consent process and pre-treatment measures and were thus included in the analyses focused on data collected at the pre-treatment time point (e.g., the qualitative analysis, and first set of regression analyses). Of these 16 individuals, 11 had completed treatment at the time of data analysis and were thus included in all the analyses conducted. Three were still receiving treatment and had thus not completed the post-treatment measures at the time of data analysis. Additionally, two had started a trauma focused treatment at the OSIC and completed pre-treatment measures, but either dropped out of treatment or their had treatment had switched focus after the first session and were thus only included in the pre-treatment analyses.

Procedure

Recruitment proceeded via contact by the PI who described the study to those who had consented to be contacted. For those who expressed willingness to participate, the PI went through the screening questionnaire items with them over the phone. One participant screened out due to self-endorsed high suicide risk. All other potential participants screened in, and the PI then obtained informed consent (See Appendix A). Once informed consent was obtained, the PI accessed participants' EMR and extracted demographic information as well as the type of psychotherapeutic treatment that was to be administered. The PI then created a study ID in RedCap for the participant and scheduled the versions of the Cannabis Use Questionnaire (CUQ;

see Appendix B) to be sent out the week they were set to begin their psychotherapeutic treatment, the week that their treatment ended, and one month after their treatment completion. There was variation in the time that participants took to respond to the measure, but all responded within two weeks of their first treatment date which was deemed an acceptable timeframe.

All participants proceeded to begin a structured trauma-focused treatment, which is standard first-line treatment for PTSD at the OSIC. Treatments included CPT, WET, EMDR and PE. Post-treatment data were collected when: a) the participant completed the trauma focused treatment and was discharged or proceeded to treatment with a different focus b) the participant completed at least five sessions of a trauma focused treatment and switched to another treatment focus as a result of resolved trauma symptoms or c) a participant completed two full trauma-focused treatments. The above post-treatment time-points were associated with substantial variation in the course and type of treatment participants received, which is consistent with the goals of the clinic to meet the needs of clients and adjust treatment to meets these needs as necessary. The PI accessed a patient's EMR at each of the three time points to extract their Outcome Questionnaire-45 (OQ-45; see Appendix C) and PTSD Checklist for DSM-5 (PCL-5; see Appendix D) scores.

Measurement and Variable Selection Issues Related to Cannabis Use

Measuring Cannabis Use

Measurement of cannabis use and related characteristics has received increasing attention as more countries move towards legalization. The *iCann Toolkit* (Lorenzetti et al., 2021) contains recently published expert guidelines on measuring cannabis use in various populations and seeks to address the challenges associated with measuring cannabis use. The iCann Toolkit

recommends the use of tools that examine detailed aspects of cannabis use. Self-report measures of cannabis use that gather such detailed methods have been designed and validated, such as the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU; Cutler & Spradlin, 2017) and the Cannabis Engagement Assessment (Schluter & Hodgins, 2022). However, these self-report measures fail to gather information on variables of particular relevance to this study and its population (e.g., CBD content; medical/recreation use; frequency/intensity of intoxication). Additionally, these measures do not always include or group cannabis administration methods in ways that are easily interpretable or cover all possible methods of administration currently available for purchase in Canada.

The Cannabis Use Questionnaire (CUQ) was used to measure cannabis use and cannabis use characteristics in the current study. The CUQ measure was developed specifically for this study to measure cannabis use characteristics such as frequency of use and potency. The CUQ also gathered information relevant to psychotherapeutic outcomes in veteran populations. The CUQ was designed to be feasible within this population and for a survey/self-report study design while meeting recommended guidelines for measuring cannabis use and related characteristics.

In line with the recommended guidelines, the CUQ starts with a yes/no question about cannabis use, and then asks for frequency of use in the past month (quantified in days), the last time the respondent used cannabis, and detailed information about the respondent's cannabis use. Information was gathered based on up to five products, and respondents answered questions specific to each product including past month frequency of use (allowing for multiple sessions per day), THC and CBD concentration, net weight of the product, and the estimated amount of time the full amount of the product would last, based on current use patterns. In this way, the CUQ provided information on frequency of use by using similar items to other validated

questionnaires such as the DFAQ and the CAE (e.g., asking about number of days used in the past 30 days). Additionally, the CUQ provided information about potency of various products used in a flexible format that allows for responses from those familiar with the metric of percentage of THC and CBD in their products (which is how other measures such as the DFAQ-CU and the CAE typically ask about THC potency), while also providing guidance on where to find information on package labels that represents potency in CBD or THC milligrams/gram for a given product. These two metrics can be converted to one another readily but have the option to provide either increases flexibility in gathering potency information from respondents who may understand and/or have access to these different metrics. Given that frequency of use and potency are both quantitative values measuring true amounts of CBD and THC and are asked about in similar ways to existing validated measures (e.g., the DFAQ-CU and the CAE), the CUQ demonstrates content validity and face validity in terms of it's measures of this characteristics.

Importantly, the above-noted questions added information on CBD content and, by extension, the CBD:THC ratio of the products that were used. Veterans may be medically authorized and/or may choose to use products with only/primarily CBD and with negligible THC (such as per the recommended first step in a recently published clinical practice guideline for using therapeutic cannabis to treat chronic pain; Busse et al., 2021). Given that CBD is not psychoactive and lower-risk use guidelines note that high CBD:THC ratio products may present a lesser risk than higher concentration THC-dominant products (Fischer et al., 2022), CBD content represents a potential important factor in understanding how differing cannabis use characteristics impact psychotherapeutic outcomes.

There is little information about characteristics of cannabis use in the military and veteran population that may be relevant to psychotherapeutic outcomes. No known existing questionnaire asks whether respondents' cannabis use is medical and/or recreational, yet recent research has found potentially relevant differences among these subgroups of users (Turna et al., 2020). The subjective effects of cannabis (e.g., level of intoxication) were also deemed important to consider. According to the currently accepted low risk cannabis use guidelines, higher subjective intoxication (typically related to higher THC potency) is related to more negative mental health outcomes (Fischer et al., 2022). Although the Lower Risk Use Guidelines note that higher potency products are associated with cognitive impairment (Fischer et al., 2022), other research has found little difference in impairment when comparing lower to much higher potency concentrates (Bidwell et al., 2020). In line with the secondary goal of this study, to increase both the breadth and depth of knowledge on how veterans and military members with PTSD are using cannabis, the CUQ contained items on various methods of use that are up to date with the cannabis products typically available in Canada, along with information on strain type (i.e., Indica, Sativa, or Hybrid). Relatedly, one additional reason for the product-by-product design of the Cannabis Use Questionnaire is that it asked about primary purpose(s) for each product the respondent reported using. This allowed for the possibility that individuals might use different products for different purposes and let them self-define the purpose of each product.

An additional concern with existing questionnaires was that, for inhaled products, the questionnaires typically asked individuals to report on how many "hits" or "puffs" they took of the product, which some individuals are unable to recall accurately (Schluter & Hodgins, 2022). To account for this problem, the CUQ uses a similar approach to the TFLB in asking respondents to report on their past 30 days of use; however, instead of day-to-day estimates, the CUQ asks

for information based on product-by-product estimates. Questions included how many sessions the product was used for, the net weight or total amount in the product package, and how long this amount of product would last based on typical/current use (i.e., use as reported). In this way, an estimate of the average amount of product used per session (i.e., dose) could be calculated when the relevant information was provided. Further, the estimated total THC and CBD consumed in the month, including all products reported on, could also be calculated with this information. These calculations allowed for a more precise understanding of the amounts of THC and CBD veterans were using both during one session and over the past 30 days.

When considered in combination with 1) the findings that other self-report measures similar to the CUQ such as the DFAQ-CU and the CAE report good convergent validity with the TFLB (Cuttler & Spradlin 2017; Schluter & Hodgins, 2022), and 2) the reports of individuals who pilot tested the CUQ that its questions were easy to answer, I did not anticipate issues with respondents being able to report reasonably accurate cannabis use information on the CUQ.

Covariate Selection

Given assignment to groups was not random but based on self-reported cannabis use frequency, covariate selection was guided by demographic differences amongst groups and factors that may be reasonably expected to vary along with cannabis use and/or to impact psychotherapeutic treatment. Based on prior research, covariates thus included age, gender, and treatment type (i.e., group or individual treatment).

Primary Measures

Cannabis Use / Predictor Variables

The Cannabis Use Questionnaire (Appendix B) was designed specifically for this study and was used to gather detailed information on both clinically relevant cannabis use

characteristics, and descriptive information about veterans' cannabis use patterns. Variables included in the analyses (i.e., frequency of use, THC and CBD potency) were measured using questions similar to existing validated measures, and typically reflected estimates of real quantities (i.e., number of days, percents or milligrams/gram of THC and CBD). Regarding the ease of use of this novel measure, no clarifying questions were asked of the PI, and 60% (n = 6) of the participants who reported cannabis use at any time point were able to provide adequate information to complete the planned estimates and computations described below. The remaining individuals reported not knowing concentrations of enough of the products they used, such that estimations were not possible. In these instances, data were treated as missing and were excluded from the relevant analyses.

Frequency of Use. Frequency of use was measured by responses to the question "how many days have you used cannabis in the last month?". As this question only appeared for individuals who use cannabis, the expected range was from 1 (rather than 0) to 31. This question is recommended by the iCann Toolkit to measure past-month cannabis use continuously (Lorenzetti et al., 2021), and other well-validated measures use the same or a similar question to measure past-month cannabis use frequency (i.e., the DFAQ-CU, Cutler & Spradlin, 2017; the CAE, Schluter & Hodgins, 2022). This question was intended to be used to separate into three cannabis frequency groups; however, due to the limited sample size the groups were collapsed into cannabis users and non-users.

Additional information on cannabis use frequency was derived from the product specific questions: "How many days in the last month have you used this product" and "On days you typically use this product, how many times in one day, separated by at least two hours, would you typically use it?" (based on wording/time frame drawn from the CAE). This information was

used to estimate total sessions in one month as follows: (days used in last month * typical sessions in a day). For individuals who reported using multiple products, the sum of the above computation for all products was used to estimate sessions per month (e.g., (days product A used in last month * typical sessions using product A in a day) + (days product B used in last month * typical sessions using product B in a day) …). This calculation provided a more sensitive estimation of frequency, as it was able to better account for individuals who used cannabis multiple times per day.

THC Concentration / Average dose per use and CBD Concentration / Average dose per use. The CUQ asked for THC and CBD concentrations in a product-by-product manner. For products intended to be inhaled where THC and CBD concentrations would be measured in milligrams per gram (i.e., flower; joints; concentrate products), the CUQ asks for either a THC and CBD percent (which some individuals may be familiar with), or the mg/g values from the label. THC and CBD percentages can be converted to mg/g and vice-versa (e.g., 50mg/g THC would be 5% THC; if you had one gram of flower, it would contain 50mg total of THC). Additionally, the measure asks for the net weight of the package of the product, and an estimate of how long the package of product would last the individual based on their current use. Using this information, an approximate dose per session for both CBD and THC was calculated.

As an example, an individual had a package of 10 one-gram joints (i.e., containing a net weight of 10 grams of cannabis) that had 10% THC and 10% CBD, they reported using this product 10 days over the past month, once one each of those days, and they reported that this package would last them approximately 60 days based on their current use. Based on their report, they use this product for approximately 10 sessions out of 30 days and would expect the product to last for 60 days – thus, they would get about 20 total sessions out of this amount. Dividing the

100mg of THC and CBD over 20 sessions, we would estimate that they are consuming an approximate dose of 5mg of THC and 5mg of CBD per session when they use this product.

The total THC and CBD that would be available once the product was activated was divided by the number of sessions the individual expected to use the product for. Where individuals reported more than one product, an average dose per session across all products was computed by the following procedure: a) multiplying the average dose per session for each product by the number of sessions that product was used for, and b) summing the resulting products and c) diving by the total number of sessions. Topical preparations were excluded from this computation. Where individuals did not report all the required information, the computation was carried out if there was adequate information reported for 80% of cannabis sessions or more. Where there was less information (e.g., concentration for only some products that did not meet the 80% of session threshold, or no concentration information), these data were treated as missing, and the case was excluded from relevant analyses.

CBD:THC Ratio. The CBD:THC ratio was estimated by dividing the average dose of CBD by the average dose of THC found via the computations described above. This calculation is because the formula used to compute the average doses of THC and CBD takes into account each product and the number of sessions it is used for, thus representing a pooled estimate of both THC and CBD use.

Where individuals did report all the required information, the computation was carried out if there was adequate information reported for 80% of cannabis sessions or more. Where there was less information (e.g., concentration for only some products that did not meet the 80% of session threshold, or no concentration information), these data were treated as missing, and the case was excluded from the analysis.

Method of Administration. The CUQ asked an initial question regarding types of products used, as well as product by product questions to allow for the estimations/calculations of CBD and THC for each product as noted above. Products included: dried flower, pre-rolled joints, edible candies/beverages, edible oils, vape pens/cartridges, concentrates (i.e., shatter, hash, resin), topical preparations, and other (with a response box to indicate type of product).

Subjective Intoxication. Subjective intoxication was measured with a single item that appears for each product respondents report using in the past month – "How 'high' do you normally feel with your typical use of this product", with the following Likert scale responses: 0) not at all high, 1) a little bit high, 2) moderately high, 3) very high, and 4) extremely high. A similar question was included on the DFAQ-CU (Cuttler & Spradlin, 2017) for purposes of additional description/exploration of current intoxication. That question was added to the CUQ to aid in understanding patterns that may emerge related to potency of THC use, especially considering significant individual differences in how people respond to THC (Grotenhermen, 2003). For individuals who reported more than one product, ratings were averaged across products reported for each time-point.

Purpose of Use (Medical/Recreational). Respondents were asked for each product they report "Do you use this product for medical purposes, recreational purposes, or both (check all that apply)?" reported. This information was reported as a categorical variable with three values: medical use (for those who only indicated medical use for all products reported), recreational use (for those who only indicated recreational use for all products reported) or medical and recreational use (for those who indicated both purposes).

Qualitative Information

Cannabis Use Decisions. The Pre-Treatment version of the CUQ included the question "Please explain why you decided to use or not to use cannabis - what did you consider in making your decision?". This question was included to gather qualitative data on military and veterans' decisions to use cannabis. Responses were analyzed thematically.

Cannabis Withdrawal Experiences. The Pre-Treatment version of the CUQ included the question "If you have you ever tried to reduce or stop your use of cannabis, what was your experience like?". This question was included to gather qualitative data on military and veterans' experiences of any attempts to reduce cannabis use. Responses were analyzed thematically.

Experiences of Cannabis Use During Treatment. The post-treatment version of the CUQ includes the question "Please describe any impacts (positive or negative) that cannabis use had on you during treatment". This question was included to gather qualitative data on military and veterans' experiences of cannabis use during treatment, and potential perceived benefits or drawbacks of use in their treatment process. Responses were analyzed thematically.

Outcome Variables

PTSD Symptoms – The PCL-5. The PTSD Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (Appendix D; Weathers, Litz, et al., 2013) is a brief self-report measure that asks individuals to rate the extent to which they have been bothered by each symptom of PTSD (as described in the DSM-5) over the past month. The PCL-5 consists of 20 items (e.g., "Avoiding memories, thoughts, or feelings related to the stressful experience"), and asks individuals to rate how much they have been bothered by each specific symptom on a scale from 0 to 4, where 0 is not at all and 4 is extremely. The PCL-5 has been found to have good internal consistency ($\alpha = 0.96$) and test-retest consistency ($r = 0.84$), as well as good

convergent and discriminant validity (Bovin et al., 2016). The PCL-5 was used in this study to assess PTSD symptoms of participants at pre-treatment, post-treatment, and at one month follow-up. At each time point, the PCL-5 demonstrated good to excellent internal consistency (α = .83 to α = .97). Change scores in the PCL-5 measure from pre- to post-treatment (n = 10, M = 5.6, SD = 10.2) and from post-treatment to follow-up (n = 8, M = 1.4, SD = 10.2) were also computed.

Psychosocial Functioning – The OQ-45. The Outcome Questionnaire-45 (Lambert et al., 1996) is a measure designed to track progress and response to treatment for psychotherapy patients. Responses are formatted as a 5-point Likert scale (0= never, 4= always). The OQ-45 aims to broadly capture a patient's current level of mental health functioning with a focus on mental health symptomatic distress (e.g., "I feel no interest in things"), interpersonal problems (e.g., "I have frequent arguments"), and daily role functioning (e.g., "I find my work/school satisfying") (Lambert et al., 1996; Lambert, 2015). The Administration and Scoring manual for the measure reports an excellent internal consistency reliability rating (Cronbach's alpha = 0.93) (Lambert et al., 2013). The OQ-45 has also demonstrated high concurrent validity to measures of anxiety, depression, and global distress (Lambert et al., 1996). An additional strength of the OQ-45 is its empirically derived cut-off score of 63, which differentiates between clinical and community populations, with 84% sensitivity and 74% specificity, as well as having a reliable change index of 14 (Lambert et al., 1996) that meets Jacobson and Truax's (1991) commonly accepted definition of clinically significant change. The OQ-45.2 was chosen as a secondary outcome measure for this study to gather additional information on general psychosocial functioning at pre-treatment, post-treatment, and at one month follow-up. At each time point, the OQ-45 demonstrated good to excellent reliability (α = .89 to α = .94) Change scores in the OQ-

45 measure from pre- to post-treatment (M = 0.6, SD = 20.0) and from post-treatment to follow-up (M = 4.56, SD = 5.25) were also computed.

Demographic Variables and Covariates

Age, gender, service type (active or veteran) and treatment type (individual or group) were extracted from the electronic medical records of consenting participants.

Study Design

This prospective study used a pre-post-follow up design as well as integrating thematic analysis of open-ended questions to meet three objectives. The first objective was to test the hypothesis that veterans who use cannabis daily will not respond as well to psychotherapeutic treatment for PTSD as those who use cannabis less than daily, or as those who do not use cannabis at all. As a result of the limited sample size, groups were collapsed into those who used cannabis at pre-treatment and those who did not, with the revised hypothesis being that those who were cannabis users at pre-treatment would not respond as well as those who were not cannabis users. This hypothesis was tested using two multi-level models to examine 1) PCL-5 and 2) OQ-45 scores in these two groups at the three time-points. Age, gender, and treatment type were included as covariates. The second objective was to explore how cannabis use characteristics (e.g., frequency of use, THC potency/dose, and CBD:THC ratio) may relate to PTSD symptoms at pre-treatment, as well as treatment outcomes (e.g., change scores from pre- to post-treatment) and maintenance (e.g., change scores from post-treatment to follow-up). Regression analyses were used to examine the relationships at pre-treatment after controlling for age and gender. Analyses of change scores could not be carried out due to the extremely small sample at the latter two time-points. The third objective of the study was to describe cannabis use patterns among military members and veterans with PTSD, and to explore and describe reasons

for participants' cannabis use choices and their experiences with cannabis use. Descriptive analyses of cannabis use characteristics were conducted to provide a clearer picture of cannabis use in this group. Thematic analysis of open-ended questions was conducted to develop descriptions and organization of themes that emerged from the qualitative data gathered in participant responses.

Results

Statistical analyses were conducted using SPSS version 28.0. A target sample size of 45 was established based on power analyses using G*Power (Faul et. al., 2007). As such, the current study was underpowered, and results reflect the limited sample size that was obtained. Where there are statistically significant results, conclusions cannot be drawn due to the inflated risk of error because of the small sample size. Prior to conducting the main analyses, data screening and preparation were conducted. Examination of descriptive statistics for all variables was a first step. A summary of the descriptive statistics of the sample demographics as well as symptom severity at each time-point can be found in Table 1. Treatment regarding missing data differed by analysis and is detailed in each section. One potential outlier was identified (a particularly low OQ-45 score at follow-up), but that outlier was retained as it likely captured a true score. Assumptions of normality were tested through examination of boxplots, histograms, and measures of kurtosis and skewness. Although there was a degree of skewness present for some variables, this was likely due to the limited sample and normality was still deemed acceptable considering this limitation. Reliabilities for the OQ-45 and the PCL-5 were calculated using Cronbach's alpha, a measure of internal consistency.

Table 1

Demographics and Symptom Severity of Sample by Timepoint

Variable	Pre-Treatment	Post-Treatment	Follow-Up
Total N	16	11	10
Gender: male (%)	12 (75%)	8 (72.7%)	8 (80%)
Age: Mean (SD)	44 (7.3)	43.5 (7.4)	43.5 (7.8)
Service Status: veteran (%)	7 (43.8%)	4 (36.4%)	4 (40%)
Treatment Type: Ind (%), missing	11 (68.8%), 2	8 (72.7%), 0	7 (70%), 0
Cannabis Use: Yes (%), missing	9 (56.3%), 0	4 (36.4%), 1	2 (20%), 2
PCL-5 Score: Mean (SD), missing	44.25 (11.0), 0	35.60 (17.1), 0	35.38 (19.1), 2
OQ-45 Score: Mean (SD), missing	86.20 (16.5), 1	82.8 (23.5), 1	77.78 (23.0), 1

Quantitative Analyses

Comparison of Treatment Outcomes between Cannabis Use Groups

Two random-intercept multilevel models were employed to examine PCL-5 and OQ-45 scores between those who use cannabis (n = 4) and those who do not (n = 7). Multilevel models allow for missing data, and thus all cases that had data for at least two time-points (e.g., the full sample as noted above) were retained for the analyses to avoid further reducing the sample size. In these multi-level models, time (T^1 = pre-treatment, T^2 = post-treatment, and T^3 = follow-up) was a level 1 (i.e., individual level) variable, and cannabis use (or no use) was a level 2 (i.e., group level) variable. Age, gender, and treatment type were added as level 1 covariates.

Table 2 presents the models for the PCL-5. In the first model with time and group, there were no statistically significant effects of group or time, or the interaction of group*time. There was statistically significant residual covariance between the time periods. The residual variance was also statistically significant. Together, the results for the residual variance and covariance imply additional predictors are needed. Age was added as a predictor in a second model. In the second model, time and age were statistically significant predictors. Group and the interaction of group*time were not statistically significant. The residual variance, but not the residual covariance, was statistically significant. In a third model that added gender, time and age were statistically significant predictors. Gender, group and the interaction of group by time were not statistically significant. Again, the residual covariance remained statistically significant while the residual variance was not. Finally, the fourth model added treatment type. In that fourth model, only time was a statistically significant predictor. The same pattern held for the residual variance and covariance. Thus, the PCL-5 scores as a measure of PTSD symptoms declined over time in therapy and with greater age.

Table 2

Results of Multilevel Model 1: Outcome Variable PCL-5

Parameter	Model 1	Model 2	Model 3	Model 4
Fixed Effects				
Intercept	60.28***	15.47**	15.10**	15.14**
Group	.16	.00	.00	.00
Time	3.29[a]	3.69*	3.61[a]	3.77*
Age		5.65*	5.46[a]	4.91[a]
Gender			.53	.00
Trt Type				1.58
Group * Time	.435	.479	.46	.58
AIC	187.41	182.04	175.37	167.39
Random Effects				
τ	214.19*	135.88[a]	144.28[a]	130.80
σ^2	41.77**	41.65**	41.80**	41.97**

[a] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Note. Values for main effects and interactions are *F*s; Values for covariance parameters are estimates.

Caution must be taken when interpreting these results due to the limited sample size. However, the finding that time was a statistically significant predictor is in line with the expected result that participants' scores on the PCL-5 would improve with treatment. Other statistically significant effects may be the product of the small sample size; thus, conclusions cannot be made with certainty. Notably, group was not a statistically significant predictor in the analysis. If the sample size was adequate, this outcome would suggest that cannabis use did not predict treatment outcomes. However, an adequately powered analysis is required to have a valid result before being able to reach this conclusion.

Table 3 presents the models for the OQ-45. In the first model with time and group, there were no statistically significant effects of group or time, or the interaction of group*time. The residual covariance between the time periods approached statistical significance. The residual variance was statistically significant. Together, the results for the residual variance and covariance imply additional predictors are needed. Age was added a predictor in a second model. Similarly to the first model, no predictors were statistically significant. The residual variance, but not the residual covariance, was statistically significant. In a third model that added gender, again, no predictors were statistically significant. Again, the residual covariance remained statistically significant while the residual variance was not. Finally, the fourth model added treatment type. In that fourth model, the same pattern held, with no predictors reaching statistical significance, and the residual variance, but not covariance, was statistically significant. Thus, for the OQ-45 scores, none of the predictor variables included were found to be predictors of score. In contrast to the PCL-5 models, time did not predict changes in general psychosocial functioning as represented by OQ-45 scores.

Table 3

Results of Multilevel Model 2: Outcome Variable OQ-45

Parameter	Model 1	Model 2	Model 3	Model 4
Fixed Effects				
Intercept	139.64***	9.95**	12.70**	10.77*
Group	.00	.08	.14	.13
Time	.41	.43	.37	.39
Age		1.09	1.56	1.21
Gender			2.02	.72
Trt Type				.25
Group * Time	.15	.16	.15	.15
AIC	208.22	205.52	196.62	189.02
Random Effects				
τ	343.13[a]	338.07	289.18	335.12
σ^2	139.43**	139.56**	139.45**	139.76**

[a] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Note. Values for main effects and interactions are *F*s; Values for covariance parameters are estimates.

As with the PCL-5 scores, caution must be taken when interpreting these results due to the limited sample size. Similar to the results of the PCL-5, group was not a statistically significant predictor in the analysis. Again, as with the prior results, if the sample size was adequate, this outcome would suggest that cannabis use did not predict treatment outcomes, but this conclusion cannot be drawn from the current data due to the analysis being significantly underpowered because of the small sample size.

Examination of Relationship Between Cannabis Use and PTSD Symptoms

Two sets of linear regressions analyses examining data from pre-treatment, one set using PCL-5 scores as the outcome variable, and the second using OQ-45 scores as the outcome variable, were planned to examine how cannabis use characteristics related to 1) pre-treatment symptoms 2) pre- to post-treatment change scores (e.g., treatment outcomes) and 3) post-treatment to follow-up change scores (e.g., maintenance of treatment outcomes). Age and gender were to be present in each, and one of the three cannabis characteristics of interest was to be the third predictor. Only individuals in the sample who used cannabis were included in these analyses. As only four participants who used cannabis finished treatment and data were missing for at least one of these four individuals for each of the analyses (e.g., no post-treatment data, limited information about cannabis use provided), regression analyses could not be completed as a regression with interpretable results cannot be done with less than four cases. Thus, analyses were only carried out for the pre-treatment time point.

Prior to analyses, Q-Q plots for all variables were inspected and indicated acceptable normality for all variables. Additionally, P-P Plots and scatterplots of residuals were generated for each regression, and which confirmed assumptions of normality and homoscedasticity for all analyses. VIF values were also acceptable, and there were no concerns with multicollinearity

between predictor variables. Notably, all regressions were underpowered, meaning that results cannot be interpreted as conclusive, meaningful relationships may have been undetected, and statistically significant results may be the product of inflated Type I error rates.

The first regression conducted with the PCL-5 pre-treatment score as the outcome variable included frequency of use (continuous, in number of sessions per month) as the main predictor of interest. All individuals who reported pre-treatment cannabis use were included (n = 9). The overall model was not statistically significant, $F(3, 5) = .47$, $p = .71$, $R^2 = .22$, and had no statistically significant predictors. The second regression focused on PCL-5 pre-treatment scores included average THC dose, again alongside age and gender. Only individuals who provided adequate information to compute an average THC dose per session were included (n = 6). Again, the overall model was not statistically significant, $F(3, 2) = .54$, $p = .70$, $R^2 = .45$, and had no statistically significant predictors. Finally, the third model in this set which focused on PCL-5 pre-treatment scores included CBD:THC ratio at the cannabis characteristic of interest and was again included alongside age and gender as a predictor. The sample size was the same as the second model (n = 6). Following the pattern of the first two models, the model was not statistically significant, $F(3, 2) = .64$, $p = .66$, $R^2 = .48$, and had no statistically significant predictors. If the above analyses had the necessary power, these results would suggest that age, gender, cannabis uses frequency, average dose of THC used per session, and CBD:THC ratio would not meaningfully predict the severity of PTSD scores prior to participants beginning treatment, however an adequate sample would be required to state this conclusively.

The second set of regressions focused on the same predictor variables, but instead included OQ-45 scores at pre-treatment as the outcome variable. For the first model, which again focused on cannabis use frequency measured in sessions per month, one individual was excluded

due to missing data (n = 8). The overall model was not statistically significant, $F(3, 4) = 1.54$, $p = .34$, $R^2 = .54$, and had no statistically significant predictors. The second regression in this set included average THC dose, again alongside age and gender. Only individuals who provided adequate information to compute an average THC dose per session were included (n = 5). Again, the overall model was not statistically significant, $F(3, 1) = 7.32$, $p = .26$, $R^2 = .96$, and had no statistically significant predictors. Finally, the third model in this set included CBD:THC ratio as the cannabis characteristic predictor of interest with age and gender (n = 5). As with the previous models, the overall model was not statistically significant $F(3, 1) = 7.36$, $p = .26$, $R^2 = .96$, and had no statistically significant predictors. With an adequate sample size, these results would suggest that psychosocial functioning at pre-treatment, as measured by the OQ-45, is not predicted by age, gender, cannabis uses frequency, average dose of THC used per session, or CBD:THC ratio. However, the limit sample size means this conclusion cannot be reached with the data available at the time of analysis.

Descriptive Analyses: Cannabis Use and Group Characteristics

Descriptive statistics inclusive of range, minimum, maximum, mean, and standard deviation for the cannabis use characteristics disaggregated by time-point can be found in Table 4, along with the total number of individuals who reported enough information to estimate each statistic. The range present within these characteristics, particularly for number of sessions per month and average THC dose, is particularly notable and highlights the heterogeneity of cannabis use patterns even across users who may, if only looking at days used per month, initially seem similar in their cannabis use patterns. Subjective intoxication was relatively low, with the mean scores generally being closest to a rating of 1 or “a little bit high”.

Table 4
Cannabis Use Descriptive Statistics

Characteristic	*N*	Range	Minimum	Maximum	*M*	*SD*
Cannabis Frequency T^1	9	138.00	13	151	43.50	49.25
Cannabis Use Days T^1	9	20	10	30	19.89	7.75
THC Dose T^1	8	300	0	300	106.72	130.33
CBD Dose T^1	7	24.79	0	24.79	10.62	11.08
CBD:THC T^1	7	4.67	0	4.67	1.05	1.74
Subjective Intoxication T^1	9	3.00	0	3.00	.99	1.04
Cannabis Frequency T^2	4	120	1	121	40.25	54.66
Cannabis Use Days T^2	4	29	1	30	14.5	11.96
THC Dose T^2	2	234.52	234.52	5	239.52	165.82
CBD Dose T^2	2	5.76	6	11.67	8.83	4.00
CBD:THC T^2	2	1.15	.05	1.2	.62	.81
Subjective Intoxication T^2	4	1.00	1.00	2.00	1.38	0.48
Cannabis Frequency T^3	2	14.00	12.00	26.00	19.00	9.98
Cannabis Use Days T^3	2	3	12	15	13.	2.12
Subjective Intoxication T^3	2	1.0	1.0	2.0	1.5	.71

Note. Cells with only one case excluded.

Across all time points and all cannabis users, a total of 34 different cannabis products were used. Of these products, edible food type products were most common (10, 29%), followed by dried flower (8, 23.5%), topical preparations (4, 11.76%), edible oils/capsules (3, 8.82%), joints (2, 5.88%) vapes/vape cartridges (2, 5.88%) and Nabilone (1, 2.94%). Three products did not have a type indicated. The most used method of administration among products was ingestion, with 55.8% of products reported on being ingestible/edible preparations. Following this, inhalation was the most common method of administration by products reported, with 35.29% of products being consumed this way. Regarding purpose of use, six individuals (66%) reported exclusive medical use across all products, while the remaining three individuals (33%) reported some combination of medical and recreational use.

Regarding characteristics of those who used cannabis, the mean age among cannabis users was 45 years of age (*SD* = 7.39). The majority were male (*n* = 7, 70%). Active and veteran members of the CAF were evenly represented in the cannabis use group (both *n* = 5). The average PCL-5 score before treatment in this group was 45.9 (*SD* = 8.39), which is well above the clinical cut-off of 33 on this measure which is indicative of probable PTSD. The average OQ-45 score at pre-treatment was 86.78, which is well above the level of distress typically present in a non-treatment seeking population.

Thematic Analysis of Cannabis Use Reasons & Experiences

Qualitative data from open ended questions surrounding cannabis use decisions, experiences of withdrawal, and experience of cannabis use during treatment were analyzed using the six phases of Braun and Clarke's Reflexive Thematic Analysis methodology (Braun & Clarke 2006; Braun & Clarke 2019). The specific questions participants responded to at pre-treatment were "Please explain why you decided to use or not to use cannabis - what did you

consider in making your decision?" and "If you have you ever tried to reduce or stop your use of cannabis, what was your experience like?" (n = 16 responders), and at post-treatment "Please describe any impacts (positive or negative) that cannabis use had on you during treatment." (n = 10 responders). The goal of this analysis was to identify and describe participants' own experiences of cannabis use and their reasons for choosing to use or not use cannabis. The analysis was carried out using the stepwise process described by Braune and Clarke (2006), and following the example provided by Byrne (2022). To reduce potential bias and increase rigour of the analysis, three independent coders, the author (MS), her advisor (PH), and an additional research assistant (TL) worked on the analysis.

The coders met three times to discuss choices in analytic approach, initial coding, initial structures of themes, and refined structure of themes. The coders also provided additional feedback on the write-up during later stages of the analysis. During the first meeting, the coders discussed the methodology to be used and agreed on specific details prior to beginning the analysis, as recommended by Braune & Clarke (2006). This first meeting resulted in the coders agreeing to take 1) a realist and semantic approach to description of the data, aiming to stay close to participants' own described experiences and thus interpret meanings in a straightforward way, 2) aiming to produce a rich description of the data as a whole given the small sample size and aims of the study, and 3) using a combination of an inductive and deductive approach, where the responses were treated as the primary source of meaning and patterns to be described but descriptions should indicate the specific questions that prompted responses as necessary to provide guidance for interpreting and clarifying meaning.

The first phase of the analysis proceeded after this initial meeting and included all coders receiving the dataset and reading and re-reading the data to familiarize themselves with it. Then,

coders each took notes on their initial impressions of the data and proceeded to phase 2, generating the first set of codes. At this stage, reflexivity as it pertains to views on cannabis as well as the population being studied was prompted via each coder reflecting and writing a brief statement about their views on this issue. During the second meeting, the coders shared their perspectives on cannabis use and the population. Each had differing levels of experience with the population, ranging from early but enthusiastic involvement in research, to additional research experience, to longer term research and clinical experience. Two of the coders shared that they were open to cannabis use, with the third sharing a more cautious perspective. The coders were asked to make note of any reflections on their perspectives and how they coded/completed their analysis, for future discussion. The coders then moved to phase three, generating themes, started with sharing their initial codes and discussing how they categorized them, and coming to consensus regarding an initial thematic structure.

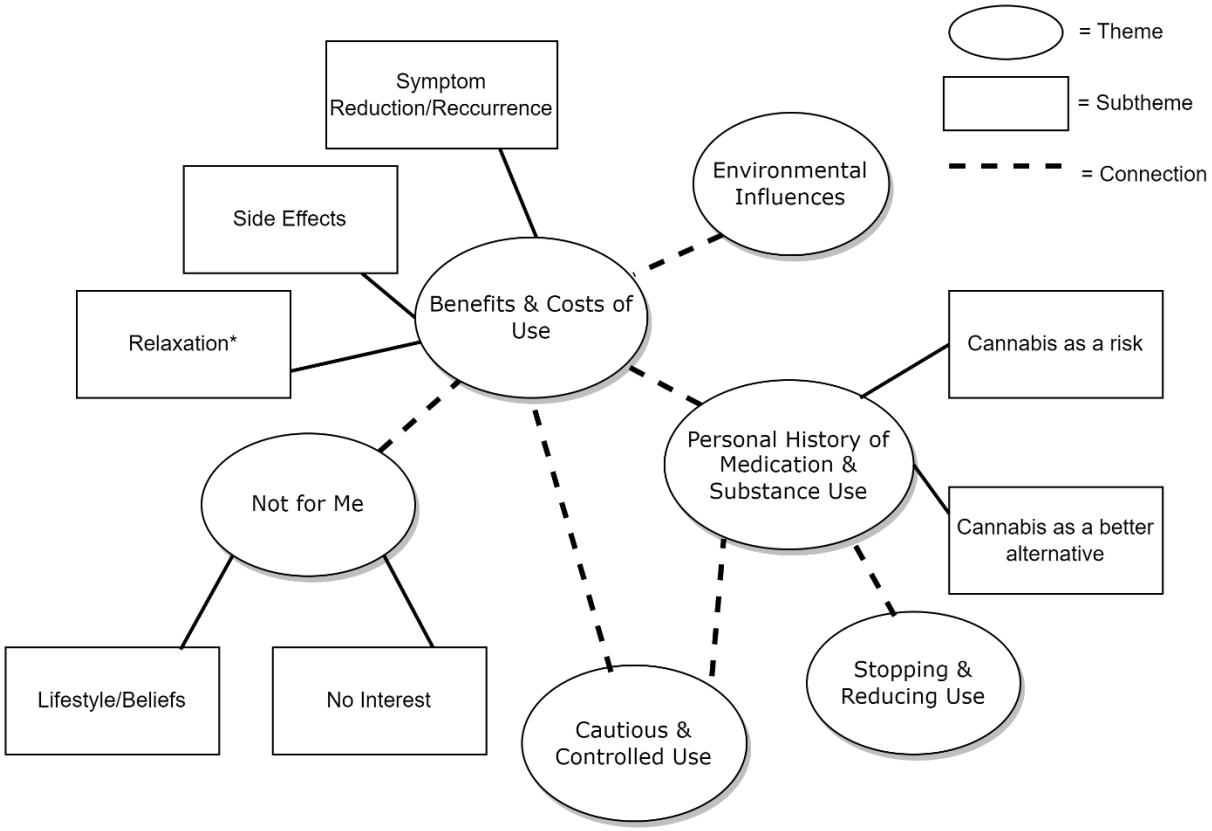
Each coder then sorted all the codes into the agreed upon structure, and analysis moved to phase 4, in which coders were asked to critically examine the thematic structure as they sorted each of the codes into the potential themes. Coders each considered what the optimal structure of themes should be, based on this organization as well as their interpretation of the patterns of meaning in the data and relevance to the research aims.

The coders met and discussed how they sorted the codes and how this informed the potential thematic structure. The coders came to a consensus that themes should be broad and apply across questions, and discussed where subthemes were applicable and where they did not aid in structuring the data. Additionally, coders agreed on initial names for themes with the acknowledgement that alternative names and definitions could be introduced during the final feedback phase if necessary.

During the final phases of analysis, the author created a thematic map (see Figure 1) based on the structure agreed upon by the coders. Additionally, the author wrote up the initial descriptions of the themes. This thematic map and write-up were then sent to the other two coders for feedback, and each coder was asked to identify a representative quote from the data for each theme and subtheme to be integrated into the final write up. The analysis resulted in six interconnected themes: benefits and costs of use; cautious and controlled use; personal substance and medication use history; slowing and stopping use; environmental influences; and not for me.

Figure 1

Thematic Map of Cannabis Use Decisions & Experiences



Theme 1: Benefits and Costs of Cannabis Use

The first theme centered on participants' identification of both the benefits and costs of cannabis use. One participant's response summarized the reality reflected within and across responses, that there are various benefits of use but that participants recognized drawbacks as well: "I find it a constant balance to manage my issues while not over medicating. I enjoy the ability to adjust and use as required... But it is not without its limitations". In line with this recognition, and the fact that examples of this theme were identified in response to all three questions posed, we conceptualized the benefits and costs of cannabis use broadly but organized them into three specific subthemes that each contained their own positive and negative aspects: symptom reduction/recurrence, relaxation*, and side-effects.

The first subtheme, symptom reduction/recurrence, relates to the various physical and/or psychological symptoms that participants described cannabis as helping with, and which they also described as returning when they ceased use. In line with the above descriptive data, participants noted numerous physical and/or psychological symptoms that improved with cannabis use. These included reductions in physical pain, increase in appetite and weight that had been impacted by chronic illness, and improvements in sleep. The latter symptom may be conceptualized as both physical and psychological; indeed, one participant specifically referred to an improvement in PTSD-related nightmares, while others described a more general aid in helping relax in the evening, presumably leading to an easier time falling asleep. Other participants noted the benefits for PTSD symptoms and triggers more generally, as well as one who noted benefits for anxiety. One individual broadly described cannabis as providing "an increase in quality of life that I didn't know I could achieve". This reflection seems to capture the wide range of improvement in symptoms that participants noted as reasons they used cannabis,

however it is notable that participants noted that these benefits, in some cases, depended on continuing cannabis use; indeed, one participant's response captured a similarly wide range of symptom recurrence when stopping use: "couldn't sleep, edgy and overall an a**hole…Just a better, kinder person smoking it". Similarly, a few participants noted that nightmares returned, and sleep worsened when they ceased use.

The second subtheme, relaxation*, was again present across answers to all three questions, however the * indicates important details in the reflexive interpretation of the responses, and the consideration of the context of treatment for PTSD. Relaxation was described in the context of trying to sleep, as well as specifically in the context of treatment (e.g., in response to the third question). The discussions around this theme were informed by PH's knowledge of PTSD symptoms and the importance of exposure as one aspect of treatment. This treatment component is what makes trauma-focused treatments challenging but is an integral part of their effectiveness – individuals are encouraged to face difficult internal experiences, including tension and distress, in order to process them and reduce their ongoing impact. Thus, relaxation*, although it could potentially be a benefit, may also reflect a potential barrier to treatment if participants are using it to create relaxation when they need to move through the distress for effective treatment. One participant included both aspects of cannabis use in their reflection: "[cannabis use] stalled processing on one hand, but also helped me to relax at times too, and change my perception".

The final subtheme within this first theme relates to side-effects. Participant responses showed a pattern of understanding that cannabis use, even when beneficial, was not without drawbacks in the form of unwanted symptoms. Participants noted increased dehydration, constipation, and anxiety. One patient seemed to only recognize the side-effects upon reducing

use, reporting “I notice[d] that I was less paranoid and had less rumination”. Interestingly, a few participants noted that the psychoactive effects of cannabis were a drawback, as they did not enjoy the feeling of being “high”. This appears to be in line with the descriptive data previously described, where most individuals did not endorse a high degree of subjective intoxication from the dose they were using and suggests avoiding or minimizing the “high” feeling may be a deliberate dosing consideration.

Taken together, the subthemes of this first and the most important theme that emerged from the responses suggest an overall awareness and attention to the drawbacks of cannabis use. Participants’ responses did not reflect a perception of cannabis as a panacea without drawbacks, but rather reflected understandings of the positive and negative results of cannabis use. This understanding connects to the each of the remaining themes in distinct ways and was also reflected in how participants managed their cannabis use, as described in the second theme.

Theme 2: Cautious and Controlled Cannabis Use

As participants acknowledged the potential drawbacks of cannabis use, several also identified careful consideration of these drawbacks and as informing their approach to use. Responses suggested careful consideration informed by acknowledgment of and vigilance for risks, including dependence. One individual identified cannabis as “less dangerous” than other options, presumably acknowledging that there is still some level of risk and in particular identified how this informed their use choices: “I don’t smoke or vape due to a love of running. I control amount consumed and monitor or note when I used cannabis. I do not use it recreationally”. The aspect of the controllability and management of cannabis use was identified by other participants as well, one simply stating “can control it” as a reason for use, while another described taking monthly tolerance breaks to manage potential dependence. One

individual described a concern as they felt they were moving from "from 'needing it' to 'wanting it'" stating "I now set aside 3 capsules in a weekly pill pack with my night time supplement routine. It helps me track what and when I'm taking." This participant went on to describe how they pay attention to certain feelings as a marker for re-assessing their use. Overall, this theme highlighted a general pattern of caution that appeared to be based on an awareness of potential risks of cannabis use, as well as strategies several individuals had put in place to mitigate these risks. The fact that cannabis use can be controlled and adjusted in a way that allows individuals to enact such strategies appeared to be an important aspect of cannabis use for several individuals. This ease of adjustment appeared to extend to the choice of whether to reduce or stop using cannabis entirely.

Theme 3: Stopping and Reducing Cannabis Use

As noted above, some individuals identified specific reductions or breaks in their cannabis use as a strategy to manage use. Others specified their own "signals" that they need to stop and re-assess their use. Importantly, when participants did note a time, they tried to stop or reduce their cannabis use, most commented that this was a relatively smooth process. Participants described having "no problems" and finding stopping "very easy". Some specified this was because they did not have dependence on cannabis. Although some participants noted recurrence of certain symptoms, most did not identify any notable challenges or symptoms of withdrawal when they stopped using cannabis. Several noted that they stopped cannabis use during treatment, potentially because of discussion with their clinicians regarding potential impacts on therapy. Overall, this theme suggests that stopping cannabis use may be a relatively easy task for most of the participants in this study who used cannabis. This aspect of cannabis as

a substance/treatment appears to be an important characteristic of cannabis, particularly when considered in comparison to some of the alternatives, for study participants who used cannabis.

Theme 4: Personal Substance Use and Medication History

The fourth theme identified relates to how participants' views on and approaches to cannabis were informed by their own personal history with medication and substance use. This consideration appeared to take participants in one of two directions, which were defined as subthemes: cannabis as a better alternative, and cannabis as a risk. Regarding the former, several participants described cannabis as superior in some way to other previously used substances: "It's better than opiates. History of substance use disorder with opiates and other OTCs. Cannabis is a less dangerous option…". Other participants described the feeling as being better than drinking, and identified cannabis being "natural, non-chemical" (presumably in comparison to alternatives) as a reason for use. One individual specified that conventional medication did not work for their PTSD related nightmares, but cannabis was an effective treatment, while another appreciated being able to reduce other medications because of cannabis use. Within these responses, participants seemed to describe both increased benefits and harm-reduction as reasons why cannabis was better than other choices. Further, this subtheme highlights the fact that participants were often coming to cannabis use after trying alternatives to cope with symptoms.

However, the second subtheme also illustrated that this experience did not lead to the decision to use cannabis for all participants. Several participants noted previous problematic substance use as leading to a decision not to try cannabis, with one stating "I'm a recovering alcoholic, been sober for 14 years. And even though I support both medicinal and recreational cannabis use there is a little something in the back of my mind that makes me think that if I started smoking cannabis I would go back to drinking again". Another noted that they previously

quit cannabis after historic "uncontrollable use". Again, reflection and consideration are evidenced in both subthemes, resulting in differing cannabis use choices. This echoes the findings of the previous themes, demonstrating that while individuals' cannabis use choices may vary, most appear to involve careful consideration, in this case, of alternatives/previous experience.

Theme 5: Environmental Influences

Individuals are not only considering their own history when making cannabis use decisions but are integrating information and recommendations from various sources. Indeed, participants identified numerous sources of external influence on their decisions to use cannabis. Recommendations from professionals were present in responses to the "reasons to use" question, and participants identified doctors and other healthcare providers as trusted individuals who recommended cannabis. One individual noted "While in therapy for PTSD my therapist, physiotherapist, general practitioner, Veterans affairs workers and brothers in arms, all swore that if used correctly, helped with many symptoms…". In addition to the providers, this quote highlights other important aspects identified by participants: peer experiences/recommendations, and the knowledge that cannabis was prescribed to themselves or others they know. It appears that the prescription/recommendation element was particularly influential for those who decided to use cannabis, potentially resulting from the "sanctioned" nature of medicinal cannabis use. In line with this, one person noted that the legalization of cannabis influenced their decision to try it. This increasing acceptability of cannabis use and the resulting discussions and sharing of knowledge and experiences of cannabis use appears to have an important role in how individuals view it, and their willingness to try it. However, it is important to note that this did not extend to

all participants. Approximately half of the participants included in the analysis chose not use cannabis.

Theme 6: It's not for me.

About half of the respondents did not use cannabis, and provided some reasons and considerations for their choice that could be grouped into two distinct subthemes: 1) lifestyle and/or beliefs and 2) lack of interest. In the former category, individuals stated things like "I have never been a cannabis user", "lifestyle and beliefs not to use cannabis", and "a former career in law enforcement" as reasons they chose not to use. These responses reflect a degree of belief or identity that is incongruent with cannabis use. In addition to these, other lifestyle factors that function as barriers were also identified, including having children to care for, jobs that did not allow for cannabis use, and the high cost of cannabis. The second subtheme relates to somewhat more succinct answers: I did not want to, or had no interest. This theme reflects the variation of internal and external factors that influence individuals not to use cannabis, mirroring the factors and multiple considerations that those who do choose to use also consider.

Overall, this thematic analysis, despite having relatively short responses and a small sample size, emphasized that although there is considerable variation in the reasons participants use cannabis and their experiences and choices surrounding cannabis use, some patterns can be identified. Many of these patterns reflect a nuanced consideration of cannabis use. Although these is considerable worry identified about potential for misuse in the literature focused in military and veteran populations, it is an encouraging finding to note that within this group of participants, the approach to use appeared to be rooted in an awareness of benefits and costs, efforts to use in a cautious and controlled manner, and integration of available information from personal experience and external sources. Although some individuals identified factors relevant

to treatment, there were relatively few answers to the questioned focused on this because of the limited amount of treatment completers. The implications of these findings in the wider literature of cannabis use and the other findings of the study are discussed below.

Discussion

This study is a first step in answering calls for research about the potential impact of cannabis use during psychotherapeutic treatment for veterans and military members. The objectives of this study were 1) to compare PTSD treatment outcomes between CAF active members and veterans who used cannabis daily, those who used cannabis less than daily, and those who did not use cannabis 2) to explore relationships between cannabis use characteristics (specifically frequency of use in sessions per month, THC potency, and CBD:THC ratio) and pre-treatment symptoms, treatment outcomes and maintenance of treatment outcomes, and 3) Describe the cannabis use characteristics and patterns of Canadian Armed Forces members and veterans with PTSD as well as explore their reasons for cannabis use choices and their own cannabis use experiences. The small final sample size meant the first two objectives were not able to be met with the data available at the time of analysis. The sample needed to be collapsed into two groups (cannabis users and non-users), and the resulting sample was still too small to be able to run adequately powered tests of the hypothesis that those who did not use cannabis would have better treatment outcomes than those who did use cannabis via the multi-level models employed for this purpose. Similarly, the limited number of cannabis users in the small sample also meant that the regression analyses exploring the relationships between cannabis use characteristics and pre-treatment symptoms, treatment outcomes, and maintenance were either underpowered (for pre-treatment) or could not be conducted (for treatment outcomes and maintenance). Despite these limitations, the fine-grained nature of the cannabis use data that was

collected highlighted some important factors in cannabis use patterns that may be overlooked by the current literature. Notably, the product-by-product method of collecting cannabis use information shed light on the high degree of heterogeneity in cannabis use patterns, even within the relatively small sample, which has important implications for the ways that cannabis use is often measured in studies that focus on the relationship between cannabis use and mental health. Although the novel measure used to collect cannabis use information has not been validated, the study also demonstrates the feasibility of use of this measure and its strength in collecting more fine-grained cannabis use data than previous measures which allowed for detection of heterogeneity in cannabis use patterns. The third objective of the study was met as it relates to the cannabis use choices and experiences described by the participants. The themes described shed light on what factors were relevant to cannabis use decisions, how they considered and integrated these factors into their cannabis use decisions, and their own experiences with cannabis use.

The hypotheses related to the first objective were not supported, although it should be noted that the small sample size did not allow for valid hypothesis testing as previously described. The initial hypothesis was that those who used cannabis daily would respond more poorly to treatment than those who used it less than daily, and those who did not use cannabis. Based on the data available at the time of analysis, the decision was made to collapse the two groups who did use cannabis into one group, and the revised hypothesis was that cannabis users would respond more poorly to treatment than those who did not use cannabis. The results showed no statistically significant effect of the cannabis use group related to treatment outcomes in terms PTSD symptoms, or general psychosocial functioning. Regarding the former finding, if the sample size were adequate, this would replicate results of some previous research (e.g.,

Petersen et al., 2021) showing no differences in treatment outcomes for PTSD between cannabis users and non-users and would be additional support for this conclusion in light of other studies that have found the opposite to be true (e.g., Wilkinson et al., 2015). Although the study did collect cannabis use data at all three time points, the sample was not adequate for analyses regarding cannabis use at post-treatment in relation to treatment outcomes as tested by Ruglass and colleagues (2017), however a larger sample size could potentially lend itself to this type of analysis in order to confirm their finding that cannabis use was related to higher symptom severity at pre-treatment, but lower symptom severity at post-treatment. In future when an adequate sample size is available for analysis that allows for valid testing of the cannabis use groups as initially described, results may aid in clarifying the presently mixed results, however treating cannabis use as continuous and using a more sensitive measure (i.e., sessions per month rather than days used) may be a better alternative to groups and better suit the naturalistic study design. Notably, age was a significant predictor for PTSD symptoms, but not for OQ-45 symptoms. Again, this finding cannot be considered valid due to the sample size, but it does suggest that age should be retained as a covariate in future research as it may relate to treatment outcomes, as found by previous meta-analytic research on PTSD treatment in this population (McLean et al., 2022). An additional finding of note was that time (i.e., pre-treatment, post-treatment, and follow-up) was a significant predictor for the analysis focused on PTSD symptoms, but not general psychosocial functioning (as measured by the OQ-45), meaning that although PTSD symptoms changed from pre- to post-treatment and follow-up as expected, psychosocial functioning did not. Although this is most likely attributable to the small sample size, in future adequately powered analyses, attention should be paid to whether this difference persists and if it relates to cannabis use, as a general measure of psychosocial functioning may be

more sensitive to potential impacts of cannabis use in various life areas and may be more robust to effects of cannabis use expectancies (i.e., people expecting their PTSD symptoms to reduce over time with continued cannabis use; Earleywine & Bolles, 2014) than a PTSD specific measure.

Hypotheses relating to the second objective were also unsupported, again due to the inability of the sample to support valid testing. Hypotheses were that, among cannabis users, 1) higher frequency (in sessions per month) would predict higher symptom severity at pre-treatment and poorer treatment outcomes 2) higher average THC dose per session would predict higher symptom severity at pre-treatment and predict poorer treatment outcomes and 3) a higher ratio of CBD:THC would predict reduced symptom severity at pre-treatment and better treatment outcomes. This objective was primarily exploratory, and hypotheses were based on previous findings from meta-analytic and review studies that, while being mixed, have found associations between high frequency/THC potency cannabis use and poor cognitive and mental health outcomes, and potential attenuating effects and lack of psychoactive effects of CBD (e.g., Black et al., 2019; Fischer et al., 2021). Only pre-treatment analyses could be carried out, and no statistically significant effects were found for the cannabis characteristics, or for the covariates of age and gender. As with the first objective, an adequate sample is needed to reach a valid conclusion regarding these aspects of cannabis use and their potential impacts on treatment. Such a conclusion may aid in further clarifying the mixed results in the current literature regarding impacts of cannabis use on psychotherapeutic treatment for PTSD, as differences in these cannabis use characteristics that have not been measured in other studies may reflect unexamined sources of variance that may be contributing to a lack of conclusive findings.

Supporting this idea, even in the small sample, the range present in each of the three cannabis use characteristics was substantial. For example, the lowest estimated dose of THC used during one session for products that contained any THC was 5mg, whereas the highest was 300mg. Further, when sessions per month were estimated accounting for individuals who used cannabis multiple times per day (and sometimes multiple products, multiple times per day), a much broader range of frequency of use was evident when compared to responses of how many days participants used cannabis over the past month. Critically, there were multiple products reported that were primarily CBD products with negligible THC content which resulted in some individuals having a significantly higher CBD:THC ratio, where for others this ratio was effectively zero (e.g., they consumed no CBD). The novel measure used in this study provided the fine-grained measurement needed to detect these differences. In each of the previous studies examining the impact of cannabis use on psychotherapeutic outcomes for PTSD, these differences would not have been captured in the cannabis use measures/operational definitions employed. Each of these studies either compared use/no use groups (e.g., Petersen et al., 2021, Wilkinson et al., 2015) or measured cannabis frequency in days used (Ruglass et al., 2017). One additional study focusing on outcomes for psychotherapeutic treatment of several anxiety disorders including PTSD included frequency groups where frequent use was defined as twice a week or more (Oulette et al., 2022).

Although it is not known to what degree the heterogeneity in cannabis use characteristics reflected in the current sample is present in other studies completed to date, the potential for extremely different use patterns (e.g., someone who uses a primarily CBD product once per day vs. someone who uses a high concentration THC product several times per day) being equated with each other is possible. In considering these two patterns as an example, beyond the

previously reviewed different risk and mental health associations, Feingold (2020) provided a review of some *potential* effects of cannabis use on mediators of change of psychological treatment such as decreased motivation, cognitive impairments, and potential use as an avoidance tactic. In considering each of these in the context of the two example patterns, differential impacts to the therapeutic process would likely be expected. Even beyond this, in their naturalistic study of individuals who use medical cannabis, Cuttler, Spradlin & McLaughlin (2018) found different impacts of cannabis on mental health dependent on THC and CBD doses combined, giving additional sources of variance to consider in terms of how cannabis may relate to treatment outcomes. Taken together, the high heterogeneity of cannabis use patterns found in this small sample highlight the need for more detailed measures of cannabis use to clarify its potential impact on psychotherapeutic outcomes.

The third objective of this study was focused on exploring the reasons for cannabis use choices, and the experiences with cannabis use in this sample of treatment-seeking Canadian military and veterans with PTSD. Six main themes, some with subthemes, were identified from the responses to open-ended questions: benefits and costs (subthemes: symptom reduction/recurrence, relaxation*, and side effects); cautious and controlled use; stopping and reducing use; personal substance use and medication history (subthemes: cannabis as a risk and cannabis as a better alternative); environmental influences; and not for me (subthemes: lifestyle/beliefs and no interest). The benefits of use identified in this sample and described in the first subtheme were in line with prior research focused on this population in both Canadian (Sterniczuk & Whelan, 2016) and American (Kang et al., 2020) samples, including improved sleep, pain management, better quality of life, relaxation/emotional calm, and management of anxiety and PTSD. Further, the themes generated share commonalities with a Dutch sample of

veterans who similarly described a view of cannabis as a medicine that allowed them to manage symptoms and who did not express an urge to "get high", and noted views related to past substance and medication use that reflected cannabis being a better alternative and a potential risk, in addition to citing many of the previously described benefits (Kriedet et al., 2020). One study with a focus on Canadian veterans with chronic pain, which was published after this study began, also found similar reasons for use (i.e., management of mental and physical symptoms), as well as benefits related to overall quality of life, being a better alternative to other substances, as well as concerns related to similar side effects (Storey et al., 2023). Taken together with the results from the current study, the repetition of findings among qualitative studies speaks to an array of perceived benefits of cannabis use as well as an awareness of the drawbacks/side effects, and some potential concerns. The present study adds to this body of research with a novel emphasis on the careful consideration of cannabis use that was present amongst participants and a connection amongst the themes identified. Participants understood cannabis in comparison to other substances, in consideration of positive experiences of peers and recommendations from others, in the context of their own personal history and lifestyle, and as a potential choice that may or may not be right for them and may require attention and adjustment as needed. Caution and acknowledgement of drawbacks and side effects as well as strategies to mitigate potential dependence were also notable in cannabis experiences, as was openness to stopping cannabis use during psychotherapeutic treatment. These results, when taken together with other studies, suggest that individuals who are using cannabis not only perceive benefits, but are aware of and/or open to understanding drawbacks (including as they relate specifically to psychotherapeutic treatment), and to considering adjustments as necessary. Given that the overall findings regarding cannabis use in these populations are mixed but provide reasons for caution

(e.g., Turna & MacKillop, 2021), it is encouraging that caution is being taken by individuals who use cannabis. Further, the findings of qualitative studies taken together with the few studies that found cannabis may be beneficial for PTSD symptoms (Bonn-Miller et al., 2022; Hindocha et al., 2020; Walsh et al., 2017) and population level studies of medicinal cannabis users that have found reduced use of opioids, nicotine, and alcohol (Lucas et al., 2020, Lucas et al., 2021a, Lucas et al., 2021b) as well as a reduced association between PTSD and suicidal ideation (Lake et al., 2020) provide a compelling case for both harm-reduction and a therapeutic view to cannabis use in this population. As noted by Storey and colleagues (2023), there is a need for clarification given the benefits reported by CAF and veteran cannabis users, and the unclear findings of quantitative research. As evidenced by the current study, there is openness to information around cannabis use, and yet there is a lack of information available to answer these questions.

There are several implications of the current study that relate to clinical work with this population. Notably, clinicians should be aware of the variability in cannabis use that is present in CAF members and veterans with PTSD. This study demonstrated that even daily cannabis use can look very different and present different potential impacts to the treatment process between different clients. As such, a conversation around current cannabis use patterns combined with relevant psychoeducation on specific mechanisms of treatment may be a more beneficial approach, especially with clients who perceive multiple benefits of their cannabis use. Although the quantitative evidence to on which to base these conversations is limited, the themes identified within this sample provide helpful information for such conversations as well. As an example, there appeared to be openness to stopping use during treatment, and relative ease of doing so among the sample, which may be encouraging for patients. Alternatively, clinicians might

consider encouraging the kind of attentiveness to side-effects and management strategies demonstrated in this sample in clients who wish to continue their cannabis use during treatment, to allow for collaborative discussions around adjustments if there are impacts to the therapeutic process. Finally, it is helpful for individuals who are considering or using cannabis to know of some side-effects they may wish to watch out for, as well as the broader context of cannabis use becoming more acceptable and even more frequently recommended, but also still a choice that many individuals choose not to make for a variety of reasons.

This study has several significant limitations. Firstly, as previously noted, the study did not reach it's target sample size, and thus quantitative analyses were underpowered and did not provide conclusive results that allowed for the first two objectives to be reached. Early estimations of proportions of individuals consenting to contact about the research were approximately 50%, however further data (e.g., proportion of individuals who used cannabis who did not consent to be contacted) was not based on the lack of consent. This introduces a potential source of bias, as it may be that individuals who consented to be contacted were more open about cannabis use or had more positive views on it than those who did not consent to be contacted regarding the research, or they may have wished to portray themselves and/or their cannabis use in a positive light. Additionally, the use of a novel measure and measurement approach of estimating an average dose of THC and CBD created potential sources of error and missing data. Specifically, some individuals were not able to answer all the questions, thus estimations could not be made, and some individuals answered questions in a way that was not intended, thus interpretations needed to be made. Further, the estimations could not account for the possibility that individuals used multiple cannabis products in one session, or for the use of more than five products per month. Additionally, regarding the qualitative analyses, the text-response format

potentially limited the depth of information obtained. The naturalistic approach to the research also resulted in a high degree of variability in length of treatment, and treatment type/dose could not be included as a covariate due to the already limited sample size, introducing another potential source of variance that was unexplained. Despite these limitations, this study had several strengths. Notably, although the naturalistic approach did introduce significant variability, the study was also ecologically valid in that it focused on a sample of the population presenting for treatment who were already using or not using cannabis by their own choice. Further, the novel measure and approach to cannabis use allowed for more fine-grained analysis which revealed significant variability of cannabis use characteristics in the sample. Additionally, the open-ended questions asked at two different time points allowed for additional and treatment-relevant qualitative information to be gathered and analyzed, and three different coders each with attention to reflexivity improved the rigour and reduced the bias of the analysis itself.

Regarding future research, as noted, this study highlights several important lines of inquiry. Firstly, in studies focusing on potential impacts of cannabis use on psychotherapeutic treatment outcomes, when considering the significant variability in frequency when measured in sessions per month rather than days per month as well as dose of THC/CBD per use, it is likely that dichotomizing cannabis use or measure frequency in days per month does not provide the level of detail necessary to provide consistent, conclusive results. The concentrations of THC and CBD in products, and a more sensitive measure of frequency, will likely provide important information and better explain the ways in which cannabis use may impact treatment outcomes. Attention to specific mechanisms of treatment in these studies would also be a beneficial addition to better inform recommendations by clinicians, and how they approach and provide psychoeducation to their clients who use cannabis. Additionally, the qualitative results in this

and other studies highlight the need for additional work that is open to the possibility of the benefits of cannabis use, or at least acknowledges a harm-reduction perspective. Finally, the text-response format of the open-ended questions likely limited the depth of the answers and did not allow for probing or clarifying questions. A semi-structured interview format would allow for additional probing questions, which would be particularly useful for gaining information that may be relevant to impacts on the treatment process and mechanisms of change.

This study was limited by the data that was available at the time of analysis, however descriptive and qualitative data contributed relevant and novel information regarding cannabis use in CAF veterans and members with PTSD. Continued data collection will allow for future analyses to meet the objectives outlined and contributing to much needed answers to the question of if and how cannabis use relates to psychotherapeutic outcomes for PTSD.

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Appendix A: Informed Consent

RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM

Title of Study: Cannabis Use and Psychotherapeutic Outcomes in Military, Veterans and RCMP

Protocol number: HS25716(H2022:330)

Principal Investigator: Martine Southall. 2109 Portage Ave, Winnipeg, MB, R3J 0L3 (XXX)XXX-XXXX

Co-Investigator: Dr. Pamela Holens, 2109 Portage Ave, Winnipeg, MB, R3J 0L3, (XXX) XXX-XXXX

You are being asked to participate in a research study. Please take your time to review this consent form and discuss any questions you may have with the study staff. You may take your time to make your decision about participating in this study and you may discuss it with your friends, family or (if applicable) your doctor before you make your decision. This consent form may contain words that you do not understand. Please ask the study staff to explain any words or information that you do not clearly understand.

Purpose of Study

This research study is being conducted to study how cannabis use might impact psychotherapeutic treatment outcomes in military, RCMP and veterans. A total of 270 participants will participate in this study.

Study procedures

This study is a survey-based study designed to gather information about cannabis use and psychotherapeutic treatment in military, veterans, and RCMP members. The study will involve three time points at which data will be collected: prior to started a structured psychotherapeutic treatment at the Clinic, immediately after completing the treatment, and 1 month after completing treatment. Some data will be collected from self-report measures that are routinely administered as part of treatment at the clinic, and other information will be collected via an electronic survey that will be emailed to you at these specific time points.

This study will compare the treatment outcomes of individuals who use cannabis daily with those who use it less than daily and those who do not use cannabis.

If you take part in this study, you are agreeing that we can gather the following information from you and/or your file at the Operational Stress Injury Clinic:

During standard treatment at the Operational Stress Injury Clinic, you will fill out self-report measures that will be given to you before, immediately after, and 1 month after your psychotherapeutic treatment program. These questionnaires assist clinicians in evaluating how you progress during treatment. By agreeing to participate in this study, you are agreeing to let the primary investigator (Martine Southall) access **only the following data** kept on your records at the OSI Clinic:

- Data from the following self-report measures administered to you (as described above): the PCL-5, the PHQ-9, the AUDIT and the OQ-45.
- If you are being treated for chronic pain, data from the following pain questionnaires would also be collected: the MPQ-SF, the PDI, the PCS, the CPAQ-R.
- The type of treatment you will be starting and the anticipated start and end date of your treatment
- demographic information (age/gender/service category)
- Frequency of cannabis use at intake.

In addition to this information, you will be sent an electronic survey in the week before you start treatment, the week you complete your treatment, and 1 month after your treatment has been completed.

This electronic survey will include:

- Questions on cannabis use (example: asking about type and concentration of cannabis products you use)
- open-ended questions about your cannabis use (example: “what are your reasons for using or not using cannabis?”).

Once you have completed the last electronic survey, your participation in this study will be complete.

Participation in the study will be until 1 month after the completion of your therapy program, at which point the follow-up data will be collected.

The researcher may decide to take you off this study if a clinician reports that they feel it is in your best interest not to participate further.

You can stop participating at any time. However, if you decide to stop participating in the study, we encourage you to talk to the study staff first. This ensures that a) if you wish

for your information to be removed from study, the study staff can ensure this is completed and b) if you are feeling distressed or otherwise negatively impacted by the study activities, the staff can ensure this is addressed by a clinician or care provider and make any necessary changes to ensure study participation is not negatively impacting other participants.

The P.I. will disseminate a summary of the results of the research to participants who would like to see it once it has been analyzed, which is expected to be approximately August 2024.

Risks and Discomforts

This study will involve you answering specific and open-ended questions about your cannabis use choices. Reflecting on these questions may cause heighted anxiety or discomfort, especially if you already have discomfort or anxiety related to your cannabis use choices.

Benefits

There may or may not be direct benefit to you from participating in this study. We hope the information learned from this study will benefit other military, veterans and RCMP members being treated for operational stress injuries in the future.

Payment for participation

You will receive no payment or reimbursement for any expenses related to taking part in this study.

Alternatives

You do not have to participate in this study to receive treatment for your condition. Please talk to your regular doctor (or therapist) about all your treatment options.

Confidentiality

Information gathered in this research study may be published or presented in public forums, however your name and other identifying information will not be used or revealed. Where data is extracted from your records at the Operational Stress Injury Clinic, this data will only be stored with an assigned study number for the purposes of the study, not your name, and will not be associated with identifying information or other information included on your record at the OSIC. Where data is collected via electronic (e-mail) survey, the data will be downloaded without your email associated with it, on a weekly basis, and at this point will only be associated with your assigned study number. The survey tool/website used to gather information via electronic survey (RedCap) is approved for use in health research by the University of Manitoba based on its security measures. Further, information from the electronic surveys will be deleted from RedCap once it has been saved to a password protected file at a computer at the OSI Clinic in order to limit the amount of time it is stored on RedCap. Despite efforts to keep your personal information confidential, absolute confidentiality cannot be guaranteed. Your personal information may be disclosed if required by law.

Medical records that contain your identity will be treated as confidential in accordance with the Personal Health Information Act of Manitoba per standard operations at the Operational Stress Injury Clinic.

. The aggregated data collected for this study that has all identifying or potentially identifying information removed and demographic information coded (i.e. your service type, gender, and treatment type would be replaced by a number) may be shared with research colleagues at the Operational Stress Injury clinic or with a research colleague at the University of Regina for the purposes of verifying the data or analysis.

The University of Manitoba Health Research Ethics Board may review records related to the study for quality assurance purposes.

All records will be kept in a locked secure areas in password protected files on password protected computers at the Operational Stress Injury clinic and only those persons identified will have access to these records. Your name and all identifying information will be removed from any version of the dataset to be shared with anyone other than the PI. No information revealing any personal information such as your name, address or telephone number will leave the OSI Clinic.

Voluntary Participation/Withdrawal from the Study

Your decision to take part in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. Your decision not to participate or to withdraw from the study will not affect your care at the Operational Stress Injury clinic. If the study staff or treating clinicians at the Operational Stress Injury Clinic feel that it is in your best interest to withdraw you from the study, they will remove you without your consent.

We will tell you about any new information that may affect your health, welfare, or willingness to stay in this study.

Medical Care for Injury Related to the Study

Although no adverse impacts are expected, any increased distress or other negative impacts resulting from your participation in this study will be addressed in your treatment at the Operational Stress Injury Clinic.

You are not waiving any of your legal rights by signing this consent form nor releasing the investigator(s) or the sponsor(s) from their legal and professional responsibilities.

Questions

You are free to ask any questions that you may have about your rights as a research participant. If any questions come up during or after the study or if you have a research-related injury, contact Dr. Holens at XXX-XXX-XXXX.

For questions about your rights as a research participant, you may contact The University of Manitoba, Bannatyne Campus Research Ethics Board Office at (204) 789-3389

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

Statement of Consent

I have read this consent form. I have had the opportunity to discuss this research study with Martine Southall. I have had my questions answered by them in language I understand. The risks and benefits have been explained to me. I believe that I have not been unduly influenced by any study team member to participate in the research study by any statements or implied statements. Any relationship (such as employer, supervisor or family member) I may have with the study team has not affected my decision to participate. I understand that I will be given a copy of this consent form after signing it. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study.

I understand that information regarding my personal identity will be kept confidential, but that confidentiality is not guaranteed. I authorize the inspection of any of my records that relate to this study by The University of Manitoba Research Ethics Board, for quality assurance purposes.

By signing this consent form, I have not waived any of the legal rights that I have as a participant in a research study.

I agree to be contacted for future follow-up in relation to this study,

Yes □ No □

I would like a summary of the study results once the study has been completed. Yes □ No □

If yes, please provide either a mailing address or an email address where we can send the results: _____

First name: _____

Last name: _____

Click the button below to indicate whether or not you consent to participate in this study

___I consent to this research

___I do not consent to this research

Additional Crisis Resources:

- 24/7 Manitoba *Suicide* Prevention and Support Line: 1-877-435-7170 (toll free)
- 24/7 Mobile Crisis Unit: (204) 940-1781
- Promptly attend the Emergency Department at your local hospital if you experience unusual and severe worsening of your pain or significant thoughts of suicide.

Appendix B: Cannabis Use Questionnaire (All Versions)

Cannabis Use Questionnaire – Pre-Treatment

1. Have you used any Cannabis over the past month?

   ☐Yes

   ☐No

If participant answers "yes", questions 2-18 will appear

If participant answers "no", questions 19-20 will appear

2. **How many days have you used cannabis in the last month? _____**
3. **When was the last time you used cannabis? _____**
   (option to select date from calendar will appear)

4. **Please indicate the types of cannabis products you use (select all that apply):**

   ☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

   ☐ Pre-rolled joints

   ☐Edibles such as gummies, chocolates, teas, beverages

   ☐Edible oils (dropper/capsules/sprays)

   ☐ Vape pens/cartridges

   ☐Concentrates (i.e. Shatter/Hash/Resin)

   ☐Topical Preparations (creams etc)

   ☐Other (please write): _____

5. **How many different cannabis products have you used at least once in the past month (i.e. two different types or packages of dried flower would be two different products)? You will be asked to provide some details about each in the following questions. ____**

The number of times the following question will appear depends on the number of products they have indicated in question (i.e. if the individual inputs "2", the questions will appear twice with labels "Product 1" and then "Product 2").

The following paragraph will appear before the product specific questions:

For each cannabis product you have used at least once in the past month (i.e., two different strains of dried flower would be two different products), please answer as many of the questions below as you can (or as is available on your packaging label):

Note:

Information about strain type, Total THC, and Total CBD are often found on the front label of the package.

Net weight or volume is typically listed in grams or mL and can be found on the front or back of the package.

For products that have a specific amount of THC and CBD per unit and contain multiple units (i.e. packages of multiple joints, candies, capsules, sprays), Total amount of THC per unit/activation and Total amount of CBD per unit/activation are often on the front label of the package, and total number of units for each product may be on the front or back label.

Information about reading cannabis labels can be found here *(link to the Government of Canada webpage, "How to read and understand a cannabis product label)***, or please feel free to contact the PI at (204)831-6128 for assistance.**

If you don't have the product label, please fill in the information that you know or your best guess - some questions will prompt you for equivalent information that you may know.

6. **Product 1: Type**

   ☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

   ☐ Pre-rolled joints

   ☐Edibles such as gummies, chocolates, teas, beverages

   ☐Edibles oils (dropper/capsules/sprays)

   ☐ Vape pens/cartridges

   ☐Concentrates (i.e. Shatter/Hash/Resin)

   ☐Topical Preparations (creams etc)

   ☐Other (please write): _____

7. **Product 1: Do you use this product for medical purposes or for recreational purposes (check all that apply)?:**

   ☐ Medical

☐ Recreational

8. **Product 1: Is there a main purpose for which you use this product, and if so please specify (i.e. to fall asleep, pain management, helps with anxiety, helps with depression, relieves nightmares, to be social, for fun, etc)? _____**

9. **Product 1: Strain Type**

   ☐ Sativa or Sativa Dominant

   ☐ Indica or Indica Dominant

   ☐ Hybrid

   ☐ Not Indicated

10. **Total THC total ___ mg/g (on product label) or estimated percent THC (if you are estimating percent, please include "%"): _____**

11. **Total CBD total ___ mg/g (on product label) or estimated percent CBD (if you are estimating percent, please include "%"): _____**
12. **Net weight or volume (often found on back of package, please include g or ml).**

    If you don't have the package, this can be estimated as the total weight in grams of this product that you started with/purchased at one time. ____

(if pre-rolled joints, edibles, or edible oils)

13. **Total number of units (i.e. total number of candies/capsules/joints in package) _____**

(if edibles or edible oils)

14. **Total THC per unit/activation ____mg on label (i.e. the amount of THC in one capsule/candy, in mg) _____**

15. **Total CBD per unit/activation ____mg on label (i.e. the amount of CBD in one capsule/candy, in mg) _____**

(follow questions apply to all cases)

16. **How many days in the last month have you used this product? _____**

17. **On days you use this product, how many times in one day, separated by at least 2 hours, would you typically use it? _____**

18. **How "high" do you normally feel with your typical use of this product?:**

- not at all high
- a little bit high
- moderately high
- very high
- extremely high

How many days would you expect the total amount of cannabis/cannabis product in one package to last before you ran out (if you continued to use it about as much as you have in the past month)? _____

19. **Please explain why you decided to use or not to use cannabis - what did you consider in making your decision?**

20. **If you have you ever tried to reduce or stop your use of cannabis, what was your experience like?**

Cannabis Use Questionnaire – Post-Treatment

1. Have you used any Cannabis over the past month?

   ☐Yes

   ☐No

If participant answers "yes", questions 2-19 will appear

If participant answers "no", end survey

2. **How many days have you used cannabis in the last month? _____**

3. **When was the last time you used cannabis? _____**
   (option to select date from calendar will appear)

4. **Please indicate the types of cannabis products you use (select all that apply):**

   ☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

   ☐ Pre-rolled joints

   ☐Edibles such as gummies, chocolates, teas, beverages

   ☐Edible oils (dropper/capsules/sprays)

   ☐ Vape pens/cartridges

   ☐Concentrates (i.e. Shatter/Hash/Resin)

   ☐Topical Preparations (creams etc)

   ☐Other (please write): _____

5. **How many different cannabis products have you used at least once in the past month (i.e. two different types or packages of dried flower would be two different products)? You will be asked to provide some details about each in the following questions. ____**

The number of times the following question will appear depends on the number of products they have indicated in question (i.e. if the individual inputs "2", the questions will appear twice with labels "Product 1" and then "Product 2").

The following paragraph will appear before the product specific questions:

For each cannabis product you have used at least once in the past month (i.e., two different strains of dried flower would be two different products), please answer as many of the questions below as you can (or as is available on your packaging label):

Note:

Information about strain type, Total THC, and Total CBD are often found on the front label of the package.

Net weight or volume is typically listed in grams or mL and can be found on the front or back of the package.

For products that have a specific amount of THC and CBD per unit and contain multiple units (i.e. packages of multiple joints, candies, capsules, sprays), Total amount of THC per

unit/activation and Total amount of CBD per unit/activation are often on the front label of the package, and total number of units for each product may be on the front or back label.

Information about reading cannabis labels can be found here *(link to the Government of Canada webpage, "How to read and understand a cannabis product label)***, or please feel free to contact the PI at (204)831-6128 for assistance.**

If you don't have the product label, please fill in the information that you know or your best guess - some questions will prompt you for equivalent information that you may know.

6. **Product 1: Type**

   ☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

   ☐ Pre-rolled joints

   ☐Edibles such as gummies, chocolates, teas, beverages

   ☐Edibles oils (dropper/capsules/sprays)

   ☐ Vape pens/cartridges

   ☐Concentrates (i.e. Shatter/Hash/Resin)

   ☐Topical Preparations (creams etc)

   ☐Other (please write): _____

7. **Product 1: Do you use this product for medical purposes or for recreational purposes (check all that apply)?:**

   ☐ Medical

   ☐ Recreational

8. **Product 1: Is there a main purpose for which you use this product, and if so please specify (i.e. to fall asleep, pain management, helps with anxiety, helps with depression, relieves nightmares, to be social, for fun, etc)? _____**

9. **Product 1: Strain Type**

   ☐ Sativa or Sativa Dominant

   ☐ Indica or Indica Dominant

   ☐ Hybrid

   ☐ Not Indicated

10. **Total THC total ___ mg/g (on product label) or estimated percent THC (if you are estimating percent, please include "%"): _____**

11. **Total CBD total ___ mg/g (on product label) or estimated percent CBD (if you are estimating percent, please include "%"): _____**
12. **Net weight or volume (often found on back of package, please include g or ml).**

    If you don't have the package, this can be estimated as the total weight in grams of this product that you started with/purchased at one time. ____

(if pre-rolled joints, edibles, or edible oils)

13. **Total number of units (i.e. total number of candies/capsules/joints in package) _____**

(if edibles or edible oils)

14. **Total THC per unit/activation ____mg on label (i.e. the amount of THC in one capsule/candy, in mg) _____**

15. **Total CBD per unit/activation ____mg on label (i.e. the amount of CBD in one capsule/candy, in mg) _____**

(follow questions apply to all cases)

16. **How many days in the last month have you used this product? _____**

17. **On days you use this product, how many times in one day, separated by at least 2 hours, would you typically use it? _____**

18. **How "high" do you normally feel with your typical use of this product?:**

- not at all high
- a little bit high
- moderately high
- very high
- extremely high

How many days would you expect the total amount of cannabis/cannabis product in one package to last before you ran out (if you continued to use it about as much as you have in the past month)? _____

19. **Please describe any impacts (positive or negative) that cannabis use had on you during treatment.**

Cannabis Use Questionnaire – 1 Month Follow-Up

1. **Have you used any Cannabis over the past month?**

   ☐Yes

   ☐No

If participant answers "yes", questions 2-7 will appear

If participant answers "no", end survey

2. **How many days have you used cannabis in the last month? _____**

3. **When was the last time you used cannabis? _____**
   (option to select date from calendar will appear)

4. **Please indicate the types of cannabis products you use (select all that apply):**

   ☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

   ☐ Pre-rolled joints

   ☐Edibles such as gummies, chocolates, teas, beverages

   ☐Edible oils (dropper/capsules/sprays)

   ☐ Vape pens/cartridges

   ☐Concentrates (i.e. Shatter/Hash/Resin)

   ☐Topical Preparations (creams etc)

   ☐Other (please write): _____

5. **How many different cannabis products have you used at least once in the past month (i.e. two different types or packages of dried flower would be two different products)? You will be asked to provide some details about each in the following questions. ____**

The number of times the following question will appear depends on the number of products they have indicated in question (i.e. if the individual inputs "2", the questions will appear twice with labels "Product 1" and then "Product 2").

The following paragraph will appear before the product specific questions:

For each cannabis product you have used at least once in the past month (i.e., two different strains of dried flower would be two different products), please answer as many of the questions below as you can (or as is available on your packaging label):

Note:

Information about strain type, Total THC, and Total CBD are often found on the front label of the package.

Net weight or volume is typically listed in grams or mL and can be found on the front or back of the package.

For products that have a specific amount of THC and CBD per unit and contain multiple units (i.e. packages of multiple joints, candies, capsules, sprays), Total amount of THC per unit/activation and Total amount of CBD per unit/activation are often on the front label of the package, and total number of units for each product may be on the front or back label.

Information about reading cannabis labels can be found here *(link to the Government of Canada webpage, "How to read and understand a cannabis product label)***, or please feel free to contact the PI at (204)831-6128 for assistance.**

If you don't have the product label, please fill in the information that you know or your best guess - some questions will prompt you for equivalent information that you may know.

6. **Product 1: Type**

☐ Dried Flower (i.e. for use in bongs, pipes, dry herb vaporizers)

☐ Pre-rolled joints

☐Edibles such as gummies, chocolates, teas, beverages

☐Edibles oils (dropper/capsules/sprays)

☐ Vape pens/cartridges

☐Concentrates (i.e. Shatter/Hash/Resin)

☐Topical Preparations (creams etc)

☐Other (please write): _____

7. **Product 1: Do you use this product for medical purposes or for recreational purposes (check all that apply)?:**

   ☐ Medical

   ☐ Recreational

8. **Product 1: Is there a main purpose for which you use this product, and if so please specify (i.e. to fall asleep, pain management, helps with anxiety, helps with depression, relieves nightmares, to be social, for fun, etc)? _____**

9. **Product 1: Strain Type**

   ☐ Sativa or Sativa Dominant

   ☐ Indica or Indica Dominant

   ☐ Hybrid

   ☐ Not Indicated

10. **Total THC total ___ mg/g (on product label) or estimated percent THC (if you are estimating percent, please include "%"): _____**

11. **Total CBD total ___ mg/g (on product label) or estimated percent CBD (if you are estimating percent, please include "%"): _____**
12. **Net weight or volume (often found on back of package, please include g or ml).**

    If you don't have the package, this can be estimated as the total weight in grams of this product that you started with/purchased at one time. ____

(if pre-rolled joints, edibles, or edible oils)

13. **Total number of units (i.e. total number of candies/capsules/joints in package) _____**

(if edibles or edible oils)

14. **Total THC per unit/activation ____mg on label (i.e. the amount of THC in one capsule/candy, in mg) _____**

15. **Total CBD per unit/activation ____mg on label (i.e. the amount of CBD in one capsule/candy, in mg) _____**

(follow questions apply to all cases)

16. **How many days in the last month have you used this product? _____**

17. **On days you use this product, how many times in one day, separated by at least 2 hours, would you typically use it? _____**

18. **How "high" do you normally feel with your typical use of this product?:**

- not at all high
- a little bit high
- moderately high
- very high
- extremely high

How many days would you expect the total amount of cannabis/cannabis product in one package to last before you ran out (if you continued to use it about as much as you have in the past month)? _____

Appendix C: The PCL-5

Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5)

Weathers FW, Litz BT, Keane TM, Palmieri PA, Marx BP, Schnurr PP. The PTSD checklist for DSM-5 (PCL-5). U.S. Department of Veterans Affairs; 2013. Scale available from the National Center for PTSD at www.ptsd.va.gov

ID: _____ Date: _____

Instructions

The table below lists problems that people sometimes have in response to extremely stressful experiences. **Keeping your worst event in mind**, please read each problem carefully and then circle one of the numbers to indicate how much you have been bothered by that problem **in the past month**.

IN THE PAST MONTH, HOW MUCH WERE YOU BOTHERED BY:	NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (e.g., heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (e.g., people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4

IN THE PAST MONTH, HOW MUCH WERE YOU BOTHERED BY:	NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
9. Having strong negative beliefs about yourself, other people, or the world (e.g., having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (e.g., being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "super-alert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4