Reducing medical cannabis use risk among Veterans: A descriptive study

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Abstract

Background Canadian Veterans experiencing chronic pain report concerns about accessing accurate information on the risks associated with medical cannabis (MC) use. The Lower Risk Cannabis Use Guidelines (LRCUG) were developed to equip individuals who use cannabis recreationally with safer-use strategies. Many of the harm reduction recommendations for recreational cannabis use are relevant and important considerations for MC use. The primary objective of our study was to assess Canadian Veterans' awareness of and interest in the LRCUG, and engagement in potential higher-risk MC use behaviours.

Methods Canadian Armed Forces Veterans living with chronic pain ($N = 582$) were recruited online and through the Chronic Pain Centre of Excellence for Canadian Veterans. Participants completed measures on: cannabis use (never, past, current use), sources of cannabis knowledge, mental health, and awareness of and interest in receiving the LRCUG. Chi-Square and post-hoc analyses characterized the sample and assessed for demographic differences based on cannabis use status and awareness of the LRCUG. Engagement in higher-risk MC use behaviours were aligned to LRCUG recommendations, and detailed descriptively.

Results Veterans who currently use cannabis were more likely to be unemployed ($z = 3.62$, $p < .01$), released as a Non-Commissioned Officer ($z = -3.83$, $p < .01$), and unable to work due a disability ($z = -3.43$, $p < .01$) than Veterans who do not currently use. Less than 30% of Veterans were aware of the LRCUG, with greater awareness among individuals who currently use cannabis ($n = 356$). Engagement in higher-risk MC use behaviours that contradicted LRCUG recommendations ranged from ~9% to ~85%. Approximately 9% of Veterans experienced co-morbid mental health concerns, yet their MC use was not for mental health purposes (LRCUG recommendation #7). Additionally, almost 85% of Veterans engaged in daily MC use (LRCUG recommendation #5). The majority of Veterans who currently use cannabis engaged in two or more higher-risk MC use behaviours (60.2%; LRCUG recommendation #12). Almost half of all Veterans received their cannabis information from a healthcare provider or the internet.

Conclusions Our study suggests the importance of safer use guidelines tailored for MC use. Development of lower-risk MC use guidelines can support prescribing practitioners and Veterans with information needed for safer and better-informed MC use decisions, tailored to patients' needs and circumstances.

Keywords Medical cannabis, Harm reduction, Veterans, Chronic pain, Lower risk cannabis use guidelines

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Limited research has assessed cannabis use behaviours among Canadian Veterans experiencing chronic pain (CP), particularly through a harm reduction lens. Recently, researchers have highlighted the potential value of medical cannabis (MC) in treating CP [1] (i.e., pain lasting > 3 months) and reducing opioid use for CP management [2, 3]. However, given the potential harms of MC use [4], Canadian Veterans need to be equipped with the appropriate information to make informed decisions grounded in harm reduction principles.

Medical cannabis as a treatment for chronic pain

Pharmacological treatments for chronic non-cancer pain continue to expand, and include nonsteroidal anti-inflammatory drugs (NSAIDs) [5], anti-depressants, central nervous system acting drugs (e.g., gabapentin), muscle relaxants, and opioids [5, 6]. While showing slight reductions since its peak in 2011, the prescription of opioids for the management of pain is particularly prevalent in Canada [7–9]. Unfortunately, pharmacological agents rarely result in resolution of persistent pain and are associated with adverse effects that can outweigh potential benefits. For example, a systematic review of 96 trials evaluating the effectiveness of opioids among more than 26,000 patients with chronic pain reported small effects of opioids on pain and physical function, with an estimated 1 in 8 patients experiencing meaningful benefit relative to placebo [10]. Moreover, use of opioids are associated with increased risk of opioid dependence and opioid use disorder [11] and negative side effects (e.g., constipation) [12]. Prescribing practitioners are faced with dilemmas on how to best support their patients in CP management when risks outweigh potential benefits. More recently, MC has been evaluated as a potential treatment for CP with a more favorable benefit to risk ratio.

Although previous literature on the efficacy of MC use for CP management has produced mixed results [13–16], a recent umbrella meta-analysis indicated that MC is associated with a 30% reduction in perceived pain [1]. In Canada, MC was legalized in 2001 under the Marihuana Medical Access Regulations [17], allowing medical practitioners (i.e., physicians) to prescribe MC for select medical conditions. Presently, jurisdictional prescribing practices are guided by provincial and territorial regulatory bodies; however, physicians and nurse practitioners can typically prescribe MC [18]. Although MC has been included in the prescribing scope of select practitioners for over two decades, previous research has continued to identify provider concerns around: (1) insufficient evidence to support prescribing MC for CP management; and (2) inadequate knowledge on MC, including dosing, safety, and outcome-monitoring [19–23]. Interestingly, some providers believe that MC should be used as one of the last-line treatments, which opposes some Veterans' perspectives that MC is a more tolerable pain medication compared to opiates [24]. Of note, cannabis for recreational use was legalized in Canada in 2018 [25], and some individuals who use cannabis recreationally self-medicate for physical and mental health conditions [26].

Prescribers' uncertainty about MC presents an ethical crossroads. They have an obligation to understand and present current evidence to patients to ensure shared decision-making: (1) prioritizes patients' needs and context; (2) appropriately balances benefits and risks; and (3) equips patients with safer MC use strategies [27, 28]. Weighing potential benefits and risks of MC use for CP is particularly nuanced and individualized. Although MC is a harm reduction approach to managing CP with opioids, patients' circumstances, values, and recovery goals [29] may dictate which harm reduction practices are appropriate and feasible to implement.

Chronic pain and cannabis use among Veterans

Cannabis is commonly used among Canadian Veterans, with one study suggesting that approximately half of all Veterans consume cannabis regularly [30]. It is estimated that 41% Veterans in Canada experience CP [31]. In response, Veterans Affairs Canada (VAC) provides MC reimbursement, but does not monitor the conditions being treated (e.g., CP, mental health) [32]. Canadian Armed Forces (CAF) Veterans receive information about available VAC programs upon release [33]. Veterans seeking reimbursement for MC are informed that they must consult with a medical specialist with expertise in the condition for which cannabis is being sought [34]. The medical specialist then consults with the patient, and provides the necessary supporting documentation to VAC. In the 2023-24 fiscal year, ~ 25,000 Canadian Veterans received MC reimbursement [35], representing almost 20% of all CAF Veterans [36].

While the number of Veterans using reimbursed MC for CP is unclear, it is anticipated that a large proportion use MC for CP management, given the prevalence of CP among Veterans [31]. In fact, some Canadian Veterans have reported MC use to successfully manage CP [24, 37], replacing or reducing other pain medications that can carry more serious side effects [24, 37–39].

Potential harms of medical cannabis use

Although evidence exists for the use of MC to treat CP, frequent, high-potency cannabis use has been associated with increased risk of developing anxiety [1, 40], psychotic [41], and cannabis use disorders [42], and may negatively impact cognitive functioning [43–45], reproductive health [46, 47], and pulmonary health (i.e., due to smoking) [48]. Notably, these associations have typically

been studied and observed among individuals using cannabis for recreational purposes.

Research on the potential harms specific to MC use has produced mixed findings, particularly due to low quality evidence [1, 49]. In fact, Mohiuddin and colleagues [4] conducted a systematic review to inform potential risks of MC use for CP; however, the authors included literature on cannabis use for recreational purposes from settings where patients living with chronic pain are most likely to present (e.g., emergency room). The study team candidly highlighted reasons for the dearth of information on potential risks of MC use for CP, including: (1) many randomized control trials (RCTs) fail to assess and report relevant adverse effects; (2) the exposure period in RCTs is brief so longer-term impacts are unknown; and (3) the dose-response relationships are inadequately addressed in the research [4]. Moreover, in Canada, Veterans typically receive a MC dosage of 0.5–3 g (with special authorization required for higher doses). The prescribed doses provided to Veterans tend to exceed doses reported in systematic reviews [49–51]. In light of these limitations, guidelines generally cautiously approach potential harms and continue to detail the risks through the large body of evidence established on risks associated with recreational cannabis use.

Harm reduction approaches to cannabis use

A set of Lower Risk Cannabis Use Guidelines (LRCUG) were established, with recommendations for safer recreational cannabis use [52]. Notably, many of these considerations are relevant to MC use, including: (1) potency of MC product; (2) route of administration; (3) frequency of use; (4) source of cannabis product; (5) genetic predispositions; impacts to (6) cognitive performance; (7) driving; (8) pregnancy; and (9) combination of risk factors. Despite the relevance of the LCRUG, MC has not received similar harm reduction attention. In fact, Canadian researchers, clinicians, and Veterans specifically noted that LRCUG have been made available for recreational cannabis; however, the lack of guidelines on harm reduction approaches for MC use continues to leave a knowledge gap for providers and patients [53].

Encouragingly, Canadian clinical practice MC guidelines for concurrent CP and mental health concerns were recently published, and included harm reduction recommendations [54]. Notably, previous research has suggested that there is, on average, a 17-year gap to translate research into practice [55]. Consequently, it is critical to place greater emphasis on harm reduction and informed decision-making for MC use. Moreover, given that a substantial number of Veterans receive reimbursement for MC each year, and the importance of LRCUG considerations for MC use has remained unaddressed, it is vital to understand Canadian Veterans' awareness of interest in

the LRCUG, and engagement in higher-risk cannabis use behaviours aligning with the LRCUG. As such, we aim to address this gap in the literature.

In the current study, we mapped the potentially higher-risk MC use behaviours assessed onto relevant LRCUG recommendations. We aimed to descriptively detail Canadian Veterans': (1) awareness of the LRCUG; (2) interest in receiving the LRCUG; and (3) engagement in potentially higher-risk MC use behaviours defined in the LRCUG. As a secondary objective we aim to identify differences in demographic characteristics between Veterans that currently use cannabis, previously used cannabis, and have never used cannabis.

Methods

Study design and participant recruitment

We conducted a cross-sectional, descriptive study. Eligible participants included CAF Veterans who were 18+ years of age and were living with CP (i.e., pain lasting > 3 months). Recruitment occurred through the Chronic Pain Centre of Excellence mailing list and targeted Facebook ads made available through the Sussex Strategy Group recruitment service. Participants were recruited between March and August 2023. Interested individuals were directed to the survey platform, Qualtrics, and completed self-report screening questions to confirm eligibility.

Procedures

Individuals reviewed the informed consent form. Veterans who consented to participating completed questionnaires on demographics, cannabis use, mental health, and CP. Surveys were available in English or French. Participants received a $50 gift card (e.g., Amazon). This study was approved by the Hamilton Integrated Research Ethics Board (project #15279).

Measures

Demographics Demographics were collected on participants' sex, province/territory of residence, relationship status, employment status, educational attainment, and disability status. Participants were also asked which branch of the CAF they served in and whether they were a Commissioned Officer at the time of release. Officer Cadets were coded as Commissioned Officers.

Chronic pain Participants completed a series of measures to assess the intensity of pain, type of pain, and impacts on functioning. The Pain Catastrophizing Scale [56] assessed catastrophizing about anticipated or experienced pain. Scores range from 0 to 54, with higher scores suggesting greater catastrophizing. The Pain DETECT Questionnaire [57] was used to assess intensity of pain in the previous four weeks on a 10-point scale (0 = none, 10 = max).

The Pain Disability Index [58] evaluated the impacts of CP on functioning (e.g., family/home responsibilities, social activity, occupation, sexual functioning, etc.). Scores range from 0 to 70, with higher scores suggesting greater impacts of disability-related pain. Participants also indicated medical and therapeutic interventions currently being received for CP management (e.g., infusions, injects, surgery, physiotherapy, massage therapy).

Cannabis use and sources of cannabis knowledge Participants were asked if they *use cannabis* (never, past, current use). Veterans who currently use cannabis were asked to report: (1) their indication for use (i.e., medical, non-medical, or both); (2) reasons for beginning use (e.g., reduce opioid use); (3) if cannabis improved their pain intensity; (4) grams of cannabis prescribed and consumed; (5) THC to CBD ratio (i.e., high THC, equal THC to CBD, low THC); (6) route of administration (e.g., inhaled, ingested, absorbed); (7) frequency of use; (8) cannabis source (e.g., medical supplier); and (9) impairments to concentration, memory, and/or attention. Participants were asked to indicate if cannabis use improved pain intensity. Veterans were asked about their *awareness of the LRCUG* and their interest in receiving further information on the guidelines. Participants also selected their source(s) of cannabis knowledge, including from healthcare providers, the internet, cannabis retailers, family or friends, public health officials, street suppliers, or other sources of knowledge.

Mental health The nine-item Patient Health Questionnaire (PHQ-9) [59] assessed symptoms of *depression*. Scores ranged from 0 to 27, with established clinical cut-offs for depression severity of none-minimal (0–4), mild (5–9), moderate (10–14), moderately-severe (15–19), and severe symptoms (20–27). Symptoms of *anxiety* were measured using the General Anxiety Disorder-7 questionnaire (GAD-7) [60]. Scores ranged from 0 to 21, with established clinical cut-offs for generalized anxiety of none-minimal (0–4), mild (5–9), moderate (10–14), and severe symptoms (15–21). Participants completed the Primary Care *PTSD*-5 screener [61] on if they had experienced a potentially traumatic event. Those who indicated 'yes' completed the 20-item PTSD Checklist for DSM-5 (PCL-5) [62]. Scores of PCL-5 range from 0–80, with scores ≥ 33 exceeding the clinical threshold for PTSD.

Mapping survey questions onto the Lower Risk Cannabis Use Guidelines

Members of the research team (LHL, NH) reviewed the 12 LRCUG recommendations [52] and mapped survey questions about participants' cannabis use behaviours onto relevant recommendations. For instance, the survey question on how frequently participants use cannabis was mapped onto the frequency of cannabis use LRCUG recommendation. This process was completed for each recommendation, with a total of seven of twelve recommendations represented in our research. The broader research team reviewed the mapping of survey questions to LRCUG for consensus.

The LRCUG recommendations that aligned with our survey questions included: potency (Recommendation[R]2), route of administration (R3), frequency of use (R5), cannabis source (R6), impairments to cognitive functioning (R7), co-morbid mental health concerns (R11), and the combination of potential risk-factors (R12).

Data analysis

Missing data were imputed using estimation maximization. *To align study data with LRCUG R11 (co-morbid mental health concerns)*, the PHQ-9, GAD-7, and PCL-5 clinical cut-offs were used to establish if participants had: (1) no identified mental health concerns; (2) one concern with mild symptoms (i.e., mild depression and/or mild anxiety); (3) one concern with moderate to severe symptoms (i.e., moderate to severe anxiety or depression, or PTSD); or (4) two or more mental health concerns (i.e., moderate to severe anxiety and/or depression, PTSD).

Descriptive statistics were utilized to characterize the sample. A series of Chi Squares and cell comparison post-hoc analyses ($z = [\Psi - 0] / SE_{\Psi}$) [63] were conducted to: (1) understand proportional group differences between Veterans who have never used cannabis, previously used cannabis, and currently use cannabis on demographic variables; and (2) compare Veterans' awareness of the LRCUG based on a series of demographic variable proportions. To circumvent a violation of the assumptions of a Chi Square test (i.e., any cells with an expected frequency of 0; more than 20% of cells with an expected frequency of < 5) [64], Veterans who preferred not to identify their sex ($n = 4$), and Veterans from Canadian territories ($n = 4$) were removed from the analyses. An alpha of 0.01 was retained to account for multiple analyses. Analyses were completed using IBM SPSS Statistics V29 [65].

Results

Demographic characteristics of Veterans ($N = 582$) are detailed in Table 1. Most participants identified their sex as male (84.3%), were in a relationship (72.3%), released as Non-Commissioned Members (85.3%), and served in the Army (61.5%). Participants self-reported experiencing pain lasting greater than 3 months in duration, and on average, reported their pain intensity as a 6.41 ($SD = 1.81$) on a 10-point scale (where 10 = maximum pain). Participants' average pain catastrophizing rating ($M = 24.27$, $SD = 11.22$; score range: 0–54) was in the 60th percentile

Table 1 Sample characteristics and Chi Squares for Group Differences on Cannabis Use Status

Sample Characteristic	Cannabis Use Status N (valid %), proportion of characteristic level			Chi Square		Total Sample N (%)
	Never Used	Past Use	Current Use	χ²	p	
Sex						
Male	112 (22.8)	72 (14.7)	307 (62.5)	2.47	0.292	491 (84.3)
Female	25 (27.5)	17 (18.7)	49 (53.8)			91 (15.7)
Area of Canada						
Western Canada (BC, AB, SK, MB)	31 (20.8)	25 (16.8)	93 (62.4)	1.37	0.849	149 (27.0)
Central Canada (ON, QC)	61 (24.8)	35 (14.2)	150 (61.0)			246 (44.6)
Eastern Canada (NS, NB, PEI, NL)	37 (23.6)	21 (13.4)	99 (63.1)			157 (28.4)
Relationship Status						
Single	39 (24.4)	22 (13.8)	99 (61.9)	0.46	0.797	160 (27.7)
In a relationship	95 (22.7)	66 (15.8)	257 (61.5)			418 (72.3)
Employment Status						
Unemployed	21 (13.2)	20 (12.6)	118 (74.2)	22.24	< 0.001**	159 (27.3)
Employed/Student	32 (25.6)	28 (22.4)	65 (52.0)			125 (21.5)
Retired	84 (28.3)	41 (13.8)	172 (57.9)			297 (51.1)
Level of Education						
High school or less	45 (23.3)	34 (17.6)	114 (59.1)	11.15	0.084	193 (33.4)
College or trades school	51 (18.9)	39 (14.4)	180 (66.7)			270 (46.8)
Undergraduate degree	23 (29.5)	11 (14.1)	44 (56.4)			78 (13.5)
Graduate degree	14 (38.9)	5 (13.9)	17 (47.2)			36 (6.2)
Disability Status						
Unable to work due to disability	41 (17.3)	32 (13.5)	164 (69.2)	11.85	0.003**	237 (40.8)
Able to work	96 (27.9)	57 (16.6)	191 (55.5)			344 (59.2)
Member/Officer Status at Time of Release						
Commissioned Officer	34 (41.5)	14 (17.1)	34 (41.5)	18.46	< 0.001**	82 (14.7)
Non-Commissioned Officer/Member	99 (20.8)	74 (15.5)	304 (63.7)			477 (85.3)
CAF Branch						
Army	83 (23.6)	53 (15.1)	215 (61.3)	0.86	0.931	351 (61.5)
Navy	26 (23.9)	15 (13.8)	68 (62.4)			109 (19.1)
Air Force	26 (23.4)	20 (18.0)	65 (58.6)			111 (19.4)
Type of Cannabis Use						
Medical	—	—	287 (85.2)	—	—	—
Non-Medical	—	—	13 (3.9)	—	—	—
Medical and Non-Medical Purposes	—	—	37 (11.0)	—	—	—
Reasons for Starting to Use Cannabis						
Reduce opioid use (pain management)	—	—	158 (45.7)	—	—	—
Reduce intake of other prescription drugs	—	—	202 (58.4)	—	—	—
Symptom relief	—	—	288 (83.2)	—	—	—
Increase focus/concentration	—	—	55 (15.9)	—	—	—
Relaxation	—	—	182 (52.6)	—	—	—
Viewed as natural medicine	—	—	116 (33.5)	—	—	—
Grams Prescribed						
0.5–2 g (less than entitlement)	—	—	43 (16.2)	—	—	—
3 g (entitlement)	—	—	119 (44.7)	—	—	—
4 + grams (special authorization required)	—	—	104 (39.1)	—	—	—
Grams Used (Participants With Prescription)						
0.5–2 g (less than entitlement)	—	—	106 (43.6)	—	—	—
3 g (entitlement)	—	—	54 (21.6)	—	—	—
4 + grams (special authorization)	—	—	90 (36.0)	—	—	—
Grams Used (Participants Without Prescription)						
0.5–2 g	—	—	34 (60.7)	—	—	—
3 g	—	—	8 (14.3)	—	—	—

Table 1 (continued)

Sample Characteristic	Cannabis Use Status N (valid %), proportion of characteristic level			Chi Square		Total Sample N (%)
	Never Used	Past Use	Current Use	χ^2	p	
4 + grams	—	—	14 (25.0)	—	—	—
Demographic Variables	Cannabis Use Status M ± SD			One-Way ANOVA		Total Sample M ± SD
	Never Used	Past Use	Current Use	F	p	
Pain Catastrophizing Scale	23.46 ± 12.19	22.93 ± 11.11	24.90 ± 10.84	1.57	0.208	24.27 ± 11.22
Pain-DETECT Questionnaire	6.48 ± 1.80	6.19 ± 1.70	6.44 ± 1.84	0.79	0.452	6.41 ± 1.81
Pain Disability Index	41.40 ± 12.29	41.75 ± 14.35	44.90 ± 12.47	4.83	0.008*	43.59 ± 12.82
Physical Health Questionnaire-9	11.58 ± 6.00	11.58 ± 6.47	12.92 ± 5.88	3.46	0.032	12.40 ± 6.03
Generalized Anxiety Disorder Questionnaire-7	8.23 ± 5.47	8.19 ± 5.40	9.57 ± 5.13	4.60	0.010*	9.04 ± 5.29
PTSD Checklist for DSM-5	30.50 ± 19.86	32.95 ± 18.45	36.10 ± 18.16	3.37	0.035	34.49 ± 18.66

Note: * $p < .01$, ** $p < .001$, *** $p < .0001$

of pain catastrophizing scores [66]. Further, participants experienced moderate disability associated with the impacts of their pain on their functioning ($M = 43.59$, $SD = 12.82$, score range = 0–70). Participants received various CP treatments, such as medication (excluding cannabis; 49.1%); injections (29.9%); surgery (16.9%); talk therapy (49.0%); physiotherapy or occupational therapy (47.1%); and chiropractor services, massage therapy or acupuncture (50.4%).

Among Veterans who currently use cannabis ($n = 356$, 61.2%), the majority consumed for medical purposes (85.2%), with 11.0% consuming for both medical and non-medical purposes. Of note, among those who consume MC ($n = 283$), 52.6% started consuming cannabis for relaxation (i.e., recreational activity). Further, 82.7% of participants indicated that cannabis reduced their pain intensity. Most demographic characteristics did not differ based on cannabis use status (i.e., never used, past use, current use), including: sex, area of Canada, relationship status, level of education, CAF branch (refer to Table 1).

Significant demographic differences existed between Veterans who had never used cannabis, previously used cannabis, and currently use cannabis based on employment status, commission status (i.e., whether released as a Commissioned Officer), and disability status, refer to Table 2. Post-hoc analyses on employment status highlighted that there was a significantly greater proportion of retired Veterans who had never used cannabis (28.3%) compared to the proportion of unemployed Veterans who had never used cannabis (13.2%). Relatedly, a greater proportion of Veterans who currently use cannabis were unemployed (74.2%) compared to the proportion of Veterans who currently use cannabis that were employed (52.0%) or retired (57.9%). Post-hoc analyses on commission status highlighted that a greater proportion of those released as Non-Commissioned Members currently use cannabis (63.7%) compared to the proportion that released as a Commissioned Officer (41.5%). Finally, post-hoc analyses on disability status suggested that a

greater proportion of Veterans who reported they were unable to work due to a disability were currently using cannabis (69.2%), compared to the proportion of Veterans currently using cannabis who did not report a disability and were able to work (55.5%).

Awareness of and interest in receiving the Lower Risk Cannabis Use Guidelines

Only 28.3% of Veterans ($n = 144$) were aware of the LRCUG. Detailed in Table 3, Veterans' awareness of the LRCUG significantly differed by cannabis use status, such that a greater proportion of Veterans who currently use cannabis were aware of the LRCUG (36.3%), compared to the proportion of Veterans who had never used cannabis (14.2%) or previously used cannabis (17.1%).

Among Veterans who were unaware of the LRCUG, 45.1% ($n = 164$) were interested in receiving information on the guidelines. Notably, among Veterans who were currently using cannabis, only 22% of those who were unaware of the LRCUG were interested in receiving this information. Additional demographic characteristics of Veterans who were unaware, but interested in receiving the LRCUG information are detailed in Table 4.

Cannabis use behaviours and Lower Risk Cannabis Use Guidelines

Potential higher-risk behaviours represented in the sample included use of high THC products (R2), smoking cannabis (R3), daily or almost daily use (R5), acquiring cannabis from an unlicensed seller (R6), impairments to memory and/or attention (R7), cannabis use with co-morbid mental health concerns (R11), and the combination of ≥ 2 potential risk-factors (R12). Findings related to LRCUG recommendations are detailed in Table 5.

Engagement in higher-risk MC use behaviours ranged from ~9% of cannabis users (R11, co-morbid mental health concerns, yet indicated MC use was not for mental health) to ~85% of cannabis users (R5, daily use). Notably, awareness of the LRCUG was relatively low among

Table 2 Chi Square Post-hoc results

$df = 4$, $p = .01$, $\sqrt{}$critical value $= \pm 3.64$			
	Employment Status Group Comparison		
Cannabis Use Status	Group 1 (Proportion)	Group 2 (Proportion)	z
Never users	Unemployed (13.2%)	Employed (25.6%)	-2.62
	Unemployed (13.2%)	Retired (28.3%)	-4.04*
	Employed (25.6%)	Retired (28.3%)	-0.57
Past users	Unemployed (12.6%)	Employed (22.4%)	-2.16
	Unemployed (12.6%)	Retired (13.8%)	-0.37
	Employed (22.4%)	Retired (13.8%)	2.03
Current users	Unemployed (74.2%)	Employed (52.0%)	3.94*
	Unemployed (74.2%)	Retired (57.9%)	3.64*
	Employed (52.0%)	Retired (57.9%)	-1.11
$df = 2$, $p = .01$, $\sqrt{}$critical value $= \pm 3.03$			
	Status at Time of Release Group Comparison		
Cannabis Use Status	Group 1 (Proportion)	Group 2 (Proportion)	z
Never users	Commissioned Officer (41.5%)	Non-Commissioned Member (20.8%)	3.60*
Past users	Commissioned Officer (17.1%)	Non-Commissioned Member (15.5%)	0.35
Current users	Commissioned Officer (41.5%)	Non-Commissioned Member (63.7%)	-3.83*
	Disability Status Group Comparison		
Cannabis Use Status	Group 1 (Proportion)	Group 2 (Proportion)	z
Never users	Unable to work due to disability (17.3%)	Able to work (27.9%)	3.09*
Past users	Unable to work due to disability (13.5%)	Able to work (16.6%)	1.03
Current users	Unable to work due to disability (69.2%)	Able to work (55.5%)	-3.43*
$df = 2$, $p = .01$, $\sqrt{}$critical value $= \pm 3.03$			
	Cannabis Use Status Group Comparison		
LRCUG Awareness	Group 1 (Proportion)	Group 2 (Proportion)	z
Aware of LRCUG	Never Users (14.2%)	Past Users (17.1%)	0.39
	Never Users (14.2%)	Current Users (36.3%)	-15.90*
	Past Users (17.1%)	Current Users (36.3%)	-16.58*

Note: * indicates that the *z* score exceeds the critical value and is significant

participants, ranging from 37.1% (R5, daily consumers) to 78.9% (R11, co-morbid mental health concerns, yet indicated MC use was not for mental health) of participants unaware. Among participants who were unaware of the LRCUG, interest in receiving this information ranged from 44,4% (R5, daily consumers) to 70.0% (R6, consumers acquiring MC from family and friends).

Sources of cannabis use knowledge
The most common sources of receiving cannabis information included: healthcare providers (46.7%), the internet (43.1%), family and friends (30.6%), and cannabis retailers (29.0%). On average, participants endorsed two sources of cannabis information. Refer to Table 6 for additional detail.

Interpretation
Our team aimed to increase understanding of Canadian Veterans': (1) engagement in potential higher-risk MC use behaviours; and (2) awareness of the LRCUG. Findings from our study highlighted that most Veterans living with CP were unaware of the LRCUG, and the majority of Veterans who use MC engage in ≥2 higher-risk MC

use behaviours. These results are particularly important to consider in light of recent qualitative research with Canadian Veterans. Specifically, many Veterans felt that there was a lack of medical knowledge about MC, and they received inadequate guidance on MC use from healthcare professionals [24].

Awareness of and interest in receiving Lower Risk Cannabis Use Guidelines
Overall, approximately 30% of study participants were aware of the LRCUG, with over one-third of Veterans who currently use cannabis reporting awareness. Interestingly, more than half of Veterans who were unaware of the LRCUG and currently using cannabis were not interested in receiving information on these guidelines. It is possible that participants who were unaware of the LRCUG were not interested in receiving this information because they are not presently experiencing concerns with their cannabis use. Additionally, previous research has suggested that Canadian Veterans experience internalized stigma about their MC use [24]. It is possible that individuals experiencing internalized stigma are less likely to express interest in learning about

Table 3 Awareness of the Lower Risk Cannabis Use Guidelines based on sample characteristics

Variable		All Veterans n (%), proportion of variable level		Chi Square		Current Cannabis Users n (%), proportion of variable level	
		Unaware of LRCUG	Aware of LRCUG	χ^2	p	Unaware of LRCUG	Aware of LRCUG
Cannabis Use Status	Never used cannabis	97 (85.8)	16 (14.2)	26.15	< 0.001**	200 (63.7)	114 (36.3)
	Past cannabis user	68 (82.9)	14 (17.1)				
	Current cannabis user	200 (63.7)	114 (36.3)				
Sex	Male	309 (71.9)	121 (28.1)	0.03	0.860	174 (63.5)	100 (36.5)
	Female	56 (70.9)	23 (29.1)			26 (65.0)	14 (35.0)
Area of Canada	Western Canada (BC, AB, SK, MB)	91 (73.4)	33 (26.6)	0.33	0.846	49 (64.5)	27 (35.5)
	Central Canada (ON, QC)	153 (70.5)	64 (29.5)			85 (63.9)	48 (36.1)
	Eastern Canada (NS, NB, PEI, NL)	103 (72.0)	40 (28.0)			57 (62.0)	35 (38.0)
Relationship Status	Single	95 (70.4)	40 (29.6)	0.14	0.712	51 (61.4)	32 (38.6)
	In a relationship	268 (72.0)	104 (28.0)			149 (64.5)	82 (35.5)
Employment Status	Unemployed	102 (73.4)	37 (26.6)	0.41	0.816	71 (68.9)	32 (31.1)
	Employed/Student	76 (69.7)	33 (30.3)			34 (59.6)	23 (40.4)
	Retired	186 (71.5)	74 (28.5)			94 (61.4)	59 (38.6)
Level of Education	High school or less	123 (73.7)	44 (26.3)	1.63	0.654	67 (65.7)	35 (34.3)
	College or trades school	165 (69.6)	72 (30.4)			98 (62.0)	60 (38.0)
	Undergraduate degree	50 (75.8)	16 (24.2)			26 (70.3)	11 (29.7)
	Graduate degree	23 (67.6)	11 (32.4)			8 (50.0)	8 (50.0)
Disability Status	Unable to work due to disability	224 (75.2)	74 (24.8)	4.38	0.036	90 (61.2)	57 (38.8)
	Able to work	140 (66.7)	70 (33.3)			109 (65.7)	57 (34.3)
Member/Officer Status at Time of Release	Commissioned Officer	55 (75.3)	18 (24.7)	0.48	0.488	21 (63.6)	12 (36.4)
	Non-Commissioned Officer/ Member	297 (71.4)	119 (28.6)			171 (64.3)	95 (35.7)
CAF Branch	Army	221 (71.8)	87 (28.2)	0.02	0.989	124 (64.9)	67 (35.1)
	Navy	65 (71.4)	26 (28.6)			34 (59.6)	23 (40.4)
	Air Force	71 (71.0)	29 (29.0)			37 (62.7)	22 (37.3)

Note: * p < .01, ** p < .001, *** p < .0001

harm reduction strategies, as seeking out or discussing harm reduction information may be uncomfortable [67]. Finally, some participants may not have expressed interest in receiving the LRCUG where the guidelines were originally developed for recreational use. It is possible that Veterans would express increased interest in receiving this information if the guidelines were tailored for MC use.

Engagement in potential higher-risk medical cannabis use behaviours

In our sample, most participants used MC several times per day and were unaware of the LRCUG. It is imperative to acknowledge that the level of risk of daily MC use also depends on other factors (i.e., route of administration; daily MC use by smoking vs. applying a cream) [52, 54]. As such, when daily MC use is necessitated, prescribing practitioners have a valuable opportunity to educate patients and collaboratively consider other ways to reduce risks. For instance, the 2024 Bell and colleagues [54] clinical practice guidelines suggested that

oral capsules may provide more efficacious results for CP management, and avoid combustion-related risks.

Over one-third of Veterans used MC products with a high THC to CBD ratio. In alignment with the LRCUG, clinical practice guidelines recommend: (1) starting with low-dose THC products, and slowly titrating to minimum dose needed to achieve the targeted CP management outcome; and (2) integrating CBD-dominant products into the treatment plan to mitigate adverse effects of THC-dominant products [54]. While most Veterans obtained their cannabis through a medical supplier or store/dispensary, over 10% of participants obtained their cannabis from an unlicensed source or family/ friends. Obtaining cannabis from unregulated sources inherently carries greater risks, as cannabis products can include unknown and harmful contaminants [68]. Similarly, cannabis obtained from family or friends may originate from an unregulated source. As such, medical practitioners have a valuable opportunity to relay the value of obtaining MC from regulated sources. The Canadian Cannabis Act regulates the production, distribution,

Table 4 Unaware of but interested in receiving the Lower Risk Cannabis Use Guidelines based on demographic characteristics

Variable		All Veterans n (%), proportion of variable level		Current Cannabis Users n (%), proportion of variable level	
		Not Interested in Receiving LRCUG	Interested in Receiving LRCUG	Not Interested in Receiving LRCUG	Interested in Receiving LRCUG
Cannabis Use Status	Never used cannabis	57 (58.8)	40 (41.2)	109 (54.8)	90 (45.2)
	Past cannabis user	34 (50.0)	34 (50.0)		
	Current cannabis user	109 (54.8)	90 (45.2)		
Sex	Male	168 (54.5)	140 (45.5)	95 (54.9)	78 (45.1)
	Female	32 (57.1)	24 (42.9)	14 (53.8)	12 (46.2)
Area of Canada	Western Canada (BC, AB, SK, MB)	51 (56.0)	40 (44.0)	28 (57.1)	21 (41.7)
	Central Canada (ON, QC)	88 (57.9)	64 (42.1)	49 (58.3)	35 (41.7)
	Eastern Canada (NS, NB, PEI, NL)	52 (50.5)	51 (49.5)	28 (49.1)	29 (50.9)
Relationship Status	Single	50 (53.2)	44 (46.8)	27 (54.0)	23 (46.0)
	In a relationship	148 (55.2)	120 (44.8)	82 (55.0)	67 (45.0)
Employment Status	Unemployed	59 (58.4)	42 (41.6)	38 (54.3)	32 (45.7)
	Employed/Student	43 (56.6)	33 (43.4)	23 (67.6)	11 (32.4)
	Retired	97 (52.2)	89 (47.8)	47 (50.0)	4 (50.0)
Level of Education	High school or less	66 (53.7)	8 (46.3)	40 (59.7)	27 (40.3)
	College or trades school	85 (51.8)	79 (48.2)	52 (53.6)	45 (46.4)
	Undergraduate degree	31 (62.0)	19 (38.0)	13 (50.0)	13 (50.0)
	Graduate degree	15 (65.2)	8 (34.8)	4 (50.0)	4 (50.0)
Disability Status	Unable to work due to disability	77 (55.4)	62 (44.6)	47 (52.8)	42 (47.2)
	Able to work	122 (54.5)	102 (45.5)	61 (56.0)	48 (44.0)
Member/Officer Status at Time of Release	Commissioned Officer	35 (63.6)	20 (36.4)	9 (42.9)	12 (57.1)
	Non-Commissioned Officer/Member	156 (52.7)	140 (47.3)	95 (55.9)	75 (44.1)
CAF Branch	Army	118 (53.6)	102 (46.4)	65 (52.8)	58 (47.2)
	Navy	30 (46.2)	35 (53.8)	15 (44.1)	19 (55.9)
	Air Force	46 (64.8)	25 (35.2)	25 (67.6)	12 (32.4)

and sale of products through regulated sources for quality-control and maintains specific requirements for packing and labelling (e.g., amount of THC and CBD content present). Additionally, MC use among Veterans experiencing co-morbid CP and mental health concerns is complex and nuanced, particularly considering the lack of agreement in evidence on benefits and risks in MC use for mental health [69]. Presenting information on lower-risk MC use behaviours can foster transparent conversations between providers and patients, as patients may experience improved [70], no changes to, or exacerbated mental health concerns [1, 41]. Equipping patients with MC education on the potential individualized mental health outcomes promotes informed decision-making and improved health literacy [71, 72], and can support patients in enhanced self-monitoring for potential adverse effects [73] (e.g., onset of symptoms of anxiety or depression).

Obtaining medical cannabis information
The most commonly endorsed sources of MC information among Veterans were healthcare providers and the internet. This finding further emphasizes the importance of preparing prescribing providers to engage in meaningful conversations with patients that align with best practices. Previous research on communicating evidence to patients has highlighted the importance of balanced discussions on available evidence and uncertainties [74]. Despite the need for additional rigorous research, creating resources for prescribing practitioners with the most up-to-date information can facilitate conversations with accurate information and potential strategies on safer MC use behaviours. Moreover, distribution of online, evidence-based resources (i.e., akin to those developed for the LRCUG) on potentially safer MC use behaviours may help combat the rampant spread of misinformation on the internet [75].

Limitations and implications
The results of our study should be considered in light of several limitations. First, our sample only includes Canadian Veterans living with CP. Results may differ among Veterans without CP who use cannabis recreationally or medically. Second, the sample size is relatively small

Table 5 Alignment between Lower Risk Cannabis Use Guidelines and Veterans' cannabis use behaviours

LRCUG Recommendation	Survey Variable Aligned with LRCUG Recommendation		A All cannabis users, n (%)	B Proportion of A unaware of LRCUG, n (%)	C Proportion of B interested in receiving LRCUG, n (%)
Recommendation #2: PWUC should use 'low-potency' cannabis products	THC to CBD ratio	Low THC to CBD	86 (24.0)	45 (52.3)	18 (40.0)
		Equal THC to CBD	121 (33.7)	70 (57.9)	33 (47.1)
		High THC to CBD	131 (37.0)	76 (58.6)	35 (46.1)
Recommendation #3: All main available modes-of-use options come with some risk for harm; PWUC should refrain from cannabis 'smoking' and employ alternative routes-of-use for pulmonary health protection.	Route of Administration (usage several times per week or more)	Smoke	132 (37.1)	71 (53.8)	34 (47.9)
		Edibles	131 (36.8)	75 (57.3)	34 (45.3)
		Vape	107 (30.1)	55 (51.4)	30 (54.5)
		Oil, Capsules, Spray	185 (52.0)	101 (54.6)	46 (45.5)
		Cream, Ointment, Oil on Skin	137 (38.5)	79 (57.7)	39 (49.4)
		Inhaled/Ingested Concentrates	81 (22.8)	41 (50.6)	19 (46.3)
Recommendation #5: PWUC should refrain from frequent (e.g., daily or near-daily) or intensive (e.g., binging) cannabis use	Frequency of use (highest frequency of use across multiple types of cannabis products)	Rarely/never	1 (0.3)	—	—
		Several times per month	18 (5.1)	11 (61.1)	5 (45.5)
		Several times per week	26 (7.3)	15 (57.7)	9 (60.0)
		Once per day	64 (18.0)	42 (65.6)	18 (42.9)
		Several times per day	238 (66.9)	129 (54.2)	58 (45.0)
Recommendation #6: Where circumstances allow, PWUC should use legal and quality-controlled cannabis products and devices.	Cannabis source	Medical Supplier	250 (70.2)	141 (56.4)	65 (46.1)
		Store/Dispensary	112 (31.5)	57 (51.0)	25 (43.9)
		Grown by participant	43 (12.1)	24 (55.8)	13 (54.2)
		Family or friends	18 (5.1)	10 (55.6)	7 (70.0)
		Unlicensed seller/dealer	20 (5.6)	11 (55.0)	6 (54.5)
Recommendation #7: PWUC who experience impaired cognitive performance should consider temporarily suspending or substantially reducing the intensity (e.g., frequency/potency) of their cannabis use.	Impairments to concentration, memory, and/or attention	Yes	95 (26.7)	52 (54.7)	24 (46.2)
		No	241 (67.7)	138 (57.3)	62 (44.9)
Recommendation #11: Some specific groups of people are at elevated risk for cannabis use-related health problems because of biological predispositions or comorbidities. They should accordingly (and possibly on medical advice as required) avoid or adjust their cannabis use.	Co-morbid mental health concerns	No identified mental health concerns	17 (4.8)	11 (64.7)	6 (54.5)
		One concern: Mild depression and/or anxiety	71 (19.9)	42 (59.2)	19 (4.52)
		One concern: Moderate to severe anxiety or depression, or PTSD	69 (19.4)	33 (47.8)	14 (42.4)
		Two or more concerns: Moderate to severe anxiety and/or depression, and/or PTSD	199 (55.9)	114 (57.3)	51 (44.7)
	Co-morbid mental health concerns and not using cannabis for depression, anxiety, or PTSD	One concern: Mild depression and/or anxiety	34 (9.5)	21 (61.8)	7 (33.3)
		One concern: Moderate to severe anxiety or depression, or PTSD	13 (3.6)	6 (46.2)	1 (16.7)
		Two or more concerns: Moderate to severe anxiety and/or depression, and/or PTSD	19 (5.3)	15 (78.9)	8 (53.3)

Table 5 (continued)

LRCUG Recommendation	Survey Variable Aligned with LRCUG Recommendation		A All cannabis users, n (%)	B Proportion of A unaware of LRCUG, n (%)	C Proportion of B interested in receiving LRCUG, n (%)
Recommendation #12: The combination of risk-factors for adverse health outcomes from cannabis use further amplifies the likelihood of experiencing severe harms and should be avoided.	Combination of potential risk-factors, including: (1) high THC, (2) smoking (several times per week or more), (3) daily use, (4) obtaining cannabis from unlicensed seller/dealer, (5) impairments to cognitive functioning, (6) one or more mental health concerns (not using cannabis for these concerns; excludes solely mild depression/anxiety)	Zero risk factors	32 (9.0)	16 (50.0)	6 (37.5)
		One risk factors	110 (30.9)	68 (61.8)	30 (44.1)
		Two to three risk factors	177 (49.7)	92 (52.0)	45 (48.9)
		Four to six risk factors	37 (10.4)	24 (64.9)	9 (37.5)

Notes: PWUC = people who use cannabis. The sum of Column A may not equal the sub-sample of current users (*n* = 356) if there were missing responses (e.g., THC to CBD ratio) or multiple options selected (e.g., cannabis source)

Table 6 Sources of cannabis knowledge

	All Veterans				Veterans Unaware of LRCUG, Interested in Receiving Guidelines			
	Cannabis Use Status n (%)			Total sample n (%)	Cannabis Use Status n (%)			Total sub-sample n (%)
Source of Cannabis Knowledge	Never Used	Past User	Current User		Never Used	Past User	Current User	
Healthcare Provider	31 (11.4)	24 (8.8)	217 (79.8)	272 (46.7)	8 (12.5)	4 (6.3)	52 (81.3)	64 (40.3)
Internet	55 (21.9)	36 (14.3)	160 (63.7)	251 (43.1)	18 (25.7)	13 (18.6)	39 (55.7)	70 (44.0)
Family or Friends	48 (27.0)	34 (19.1)	96 (53.9)	178 (30.6)	17 (32.1)	13 (24.5)	23 (43.4)	53 (33.3)
Cannabis Retailer	8 (6.8)	30 (34.1)	131 (37.0)	169 (29.0)	2 (3.9)	16 (31.4)	33 (64.7)	51 (32.1)
Public Health Officials	22 (18.8)	25 (28.4)	96 (27.1)	143 (24.6)	5 (14.2)	6 (17.1)	24 (68.6)	35 (22.0)
Street Supplier	1 (0.9)	4 (4.5)	10 (2.8)	15 (2.6)	0 (0.0)	2 (66.7)	1 (33.3)	3 (1.9)
Other Sources	10 (8.5)	3 (3.4)	36 (10.2)	11 (1.9)	2 (15.4)	2 (15.4)	9 (69.2)	13 (8.2)
	Cannabis Use Status M ± SD			Total Sample M ± SD	Cannabis Use Status M ± SD			Total sub-sample M ± SD
	Never Used	Past User	Current User		Never Used	Past User	Current User	
Number of Endorsed Sources of Cannabis Information	1.50 ± 0.82	1.77 ± 1.04	2.12 ± 1.14	1.93 ± 1.09	1.44 ± 0.65	1.70 ± 1.05	2.01 ± 1.05	1.82 ± 1.00

when broken into specific categories (e.g., participants who use cannabis daily, are unaware of the LRCUG, but are interested in receiving the LRCUG), suggesting that results may not be reliably replicated among such categories. Third, participants' Veteran status and presence of chronic pain was self-reported and not cross-validated against military and medical records, respectively. Finally, socially desirable responding was not measured, and may impact the accuracy of participant responses. Despite these limitations, this research provides an important basis for future researchers to build on. While the LRCUG address recreational cannabis use, our study suggests the importance of having safer use guidelines tailored for MC use. This is particularly important for populations with higher rates of MC use and co-morbid mental health concerns (e.g., Canadian Veterans living with CP). Development of lower-risk MC use guidelines could help promote safer and better-informed use tailored to patients' needs and circumstances. Further, increased collaboration among researchers, practitioners, and Veterans could allow for tailored lower-risk MC use guidelines that consider the unique needs of Canadian Veterans.

Abbreviations

CAF	Canadian Armed Forces
CBD	Cannabidiol
CP	Chronic pain
GAD-7	General Anxiety Disorder-7 Questionnaire
LRCUG	Lower Risk Cannabis Use Guidelines
MC	Medical cannabis
PCL-5	PTSD Checklist for DSM-5
PHQ-9	Patient Health Questionnaire
PTSD	Posttraumatic stress disorder
THC	Delta-9-tetrahydrocannabinol
VAC	Veterans Affairs Canada

Author contributions
DS, JR, VP, GT, and NH contributed to the conceptualization and design of this work, as well as data acquisition. LHL, MS, CL, JR, DS, and NH contributed to data analysis. All authors contributed to data interpretation. LHL, MS, and CL drafted the manuscript, with significant intellectual content revisions from DS, JR, VP, GT, and NH. All authors approved the final version for publication and agreed to be accountable for all aspects of the work.

Data availability
Data are not publicly available for participant privacy purposes, but can be made available upon reasonable request to the corresponding author (NH).

Declarations

Ethics approval and consent to participate
Ethical approval was sought and received from the Hamilton Integrated Research Ethics Board (project #15279). Participants provided informed consent before participating in the associated research.

Consent for publication
Not applicable.

Competing interests
Mitchell R. Sheehy and David P. Storey are Veterans of the Canadian Armed Forces and receive financial benefits through Veterans Affairs Canada (VAC). However, these Veteran benefits are in no way contingent upon or tied to any research output. Neither MS or DS have previously, nor are currently receiving reimbursement for medical cannabis through VAC.

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