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Cannabis Consumption in People Living with HIV: Reasons for Use, Secondary Effects, and Opportunities for Health Education

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Abstract

Introduction: Rates of cannabis consumption range from 40% to 74% among people living with HIV (PLWH). Little is known about the reasons for cannabis use, related modes of administration, effectiveness for symptom relief, or undesirable effects in the modern antiretroviral therapy (ART) era. Our aim was to conduct an exploratory study to identify potential areas for further evaluation and intervention.

Materials and Methods: From January to June 2018, health care providers at the Chronic Viral Illness Service in Montreal, Canada, asked their patients about cannabis use during routine visits. Patients reporting cannabis use were invited to complete a 20-min coordinator-administered questionnaire. Questions related to patterns of use, modes of administration, reasons for use, secondary effects, and HIV health-related factors (e.g., adherence to ART).

Results: One hundred and four PLWH reporting cannabis use participated. Median age was 54 years (interquartile range [IQR] 46–59), 13% were female, and 42% were HIV-Hepatitis C co-infected. Median CD4 count was 590 cells/mm^3 (IQR 390–821), 95% of participants were on ART, and 88% had suppressed viral loads. Reported cannabis use was more than once daily (32%); daily (25%); weekly (22%); monthly (17%); and rarely (twice to thrice per year; 6%). The majority of participants (97%) smoked dry plant cannabis. Other modes included vaping (12%), capsules (2%), edibles (21%), and oils (12%). Common reasons for cannabis use were for pleasure (68%) and to reduce anxiety (57%), stress (55%), and pain (57%). Many participants found cannabis "quite effective" or "extremely effective" (45%) for symptom relief. Secondary effects included feeling high (74%), increased cough (45%), paranoia (22%), palpitations (20%), and increased anxiety (21%). Over two-thirds of participants indicated that secondary effects were not bothersome at all. Most participants (68%) rarely missed doses of their ART, while 27% missed occasionally (once to twice per month). The most commonly accessed sources of information about cannabis were friends (77%) and the internet (55%).

Conclusion: The most common reasons for cannabis use in our population were for pleasure, followed by reduction of stress/anxiety and symptoms associated with a medical condition. Most smoke cannabis and rate cannabis as quite effective for symptom relief. While many participants experience secondary effects, most are not bothered by these symptoms. Amid widespread changes in the regulatory landscape of recreational cannabis, health care providers should be prepared to answer questions about cannabis.

Keywords: cannabis; marijuana; HIV; AIDS

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Introduction

Since the beginning of the HIV epidemic, patients have turned to cannabis for symptom relief.[1] Initially used to stimulate appetite and treat wasting syndrome in persons with AIDS,[1,2] cannabis was also used to counteract the adverse effects associated with antiretroviral therapy (ART).[3] While wasting syndrome is typically no longer a problem and current ART is very well tolerated, people living with HIV (PLWH) and Hepatitis C virus (HCV)-co-infected PLWH continue to display high levels of cannabis use. However, the reasons for use have changed over time. Studies in diverse settings in the modern antiviral era indicate levels of lifetime cannabis use ranging from 40% to 74%.[4,5] In a study conducted between 1999 and 2001 involving 104 individuals in the HIV Ontario Observational Database, the prevalence of PLWH endorsing cannabis use was 43%, while 29% reported medicinal use.[6] This study demonstrated that there is significant overlap between the use of medical and recreational cannabis.[6] In the Canadian HIV-HCV, Co-Infection Cohort, 53% of participants endorsed recreational cannabis use within the past 6 months.[7] When long-term trends were examined with data from the Multicenter AIDS Cohort Study (MACS) from 2742 HIV seropositive from 1984 to 2013, the annual prevalence of current cannabis (within the past 6 months) declined, but the daily use increased in both early (enrolled before 2001) and late (enrolled after 2001) cohorts.[8]

In Canada, medicinal cannabis has been approved for therapeutic purposes since 2001. The Canadian government recently legalized cannabis to regulate the production, distribution, sale, and consumption of cannabis for recreational purposes, with roll-out of distinct provincial and territorial regulatory systems on October 17, 2018. The new laws governing recreational cannabis enable persons to obtain cannabis legally without a medical prescription, but simply with proof of age, in a manner similar to alcohol. The new laws may make both patients and health care providers more comfortable in discussing cannabis use. However, there may also be potential risks associated with cannabis use about which health care providers must be aware, such as reduced ART adherence or secondary effects of cannabis use. Our aim was to gain a better understanding of the current reasons for cannabis use among our clinical population of PLWH. Understanding the reasons PLWH currently use cannabis, preferred dosage forms, concomitant substance use, and adverse effects is important for informing health care provider and patient education strategies.

Material and Methods

Study design, setting, and population

A cross-sectional clinic-based study was performed using a convenience sample of PLWH.

Setting

The Chronic Viral Illness Service (CVIS) is a multidisciplinary care clinic for adults with chronic viral illnesses such as HIV and HCV. It regularly follows ~1600 PLWH and is located within the McGill University Health Centre, a large, publicly funded tertiary care hospital in Montreal, Canada. PLWH who reported cannabis use during routine clinical care appointments at the CVIS from January to June 2018 were invited to participate.

Participant recruitment

Physicians and health care providers were encouraged to ask their patients about cannabis use during routine clinic and research visits. Posters advertising the study were also placed in patient examination rooms and the waiting room to enable patient self-referral. Inclusion criteria were as follows: (1) HIV infection; (2) self-reported cannabis or cannabinoid use in the past 12 months; (3) appointment at the CVIS for clinical care, research, or both; and (4) the ability to read and understand French or English. A $25 honorarium was provided for completing the survey.

Data collection and analysis

A questionnaire to assess broad characteristics of cannabis use was administered by Z.S. This questionnaire was developed by S.J.A. and D.J and inspired by a survey designed several years ago by Ware et al.[9] The current questionnaire included questions to evaluate adherence to HIV and HCV treatment. The questionnaire captured the following: (1) background sociodemographic and economic and certain health information (medical conditions and health complaints); (2) cannabis use (duration, dosage form, frequency, reasons for use, and efficacy for symptom relief); (3) cannabis secondary effects; (4) cannabis use for medicinal reasons; (5) future anticipated cannabis use once legalized; and (6) level of comfort with general cannabis knowledge. Data collected from the patients' electronic medical records and the CVIS clinical database included demographic information (age and sex), HIV

Table 1. Sociodemographic, Economic and Clinical Characteristics of the Study Population

Characteristic	*n* = 104
Age (years), median (95% CI)	54 (46–59)
Sex, *n* (%)	
Female	13 (13)
Male	90 (87)
Transgender	1 (1)
Infection type, *n* (%)	
HIV monoinfected	60 (58)
HIV/HCV co-infected[a]	44 (42)
Born in Canada, *n* (%)	82 (79)
Ethnicity, *n* (%)	
Caucasian	84 (81)
Black Caribbean	6 (6)
Hispanic	6 (6)
Others	8 (6)
Labs	
CD4 count, median (95% CI)	590 (390–821)
CD4/CD8 ratio, median (95% CI)	0.7 (0.5–1.1)
Detectable VL (>50 copies/mL), *n* (%)	12 (12)
On antiretroviral therapy, *n* (%)	101 (97)
Do you ever miss doses of your HIV or Hepatitis C medications?, *n* (%)	
Never/rarely (<1–2 times/year)	71 (68)
Occasionally (1–2 times per month)	28 (27)
Often (1–2 times per week)	1 (1)
Very often (3 or more times per week)	4 (4)
Years of school attended, median (IQR)	12 (10–14)
Highest level of education completed, *n* (%)	
Grade school	26 (25)
Secondary school	28 (27)
College degree or professional certificate	32 (31)
University—bachelor's degree	12 (12)
University—graduate degree	5 (5)
University—professional degree	1 (1)
Currently employed, *n* (%)	42 (40)
Household yearly income, *n* (%)	
Under $15,000	58 (56)
$15,000–$34,999	22 (21)
$35,000–$49,999	12 (12)
Greater than $50,000	8 (8)
Prefer not to answer	4 (4)
Marital status, *n* (%)	
Single	87 (84)
Married	5 (5)
Common law	10 (10)
Widowed	1 (1)
Separated	1 (1)
Self-reported medical condition, *n* (% of individuals out of 104 endorsing the condition)	
Asthma	28 (27)
Hypertension/high blood pressure	16 (15)
Diabetes	7 (7)
Cardiovascular disease	10 (10)
Congestive heart failure	3 (3)
Anxiety	40 (39)
Depression	34 (33)
Health complaints reported, *n* (% of individuals out of 104 endorsing the complaint)	
Respiratory	
Shortness of breath at rest	16 (15)
Shortness of breath during activity	58 (56)
Shortness of breath during sleep	11 (11)
Cough	34 (33)
Sputum	39 (38)
Psychological	
Anxiety	54 (52)
Depression	33 (32)
Stress	52 (50)
General/other	
Fatigue	50 (48)
Pain	52 (50)
Leg/muscle discomfort	55 (53)
Loss of appetite	26 (25)
Weight loss	24 (23)

[a]At any time.

HCV, hepatitis C virus; CI, confidence interval; IQR, interquartile range; VL, viral load.

monoinfection versus HIV-HCV co-infection status, country of birth, ethnicity, CD4 count, and CD4/CD8 ratio. For questions where more than one response could apply (e.g., methods of obtaining cannabis and methods of using cannabis), individuals could check all responses that applied. Unless otherwise indicated, responses are expressed as the percentage of participants checking off a box, taken over the denominator of all participants. Descriptive statistics were performed using Stata, version 13 (StataCorp, CollegeStation, TX).

Ethics

This study was approved by the Research Institute of the McGill University Health Centre Research Ethics Board (MUHC 2018-3835). Written informed consent was obtained before enrolment. The research was conducted in accordance with the Helsinki Declaration.

Results

A total of 104 PLWH completed the survey. During the study period, 1549 individual patients, HIV monoinfected or HIV co-infected patients, were seen, accounting for 2964 visits during that period. It was not possible to capture the total number of participants who were approached and who declined use as physicians did not record this information. Participant characteristics are summarized in Table 1. The majority of participants were Canadian-born, Caucasian men. Self-reported adherence was very good, with 95% of individuals never or rarely missing doses (less than once to twice per year) or only occasionally missing doses (once to twice per month) of ART (Table 1). There were nearly equal numbers of individuals with HIV monoinfection and HIV-HCV co-infection. Greater than half of the sample population was unemployed and declared an annual household income $<$ $15,000. Nearly half reported being diagnosed with

Table 2. Cannabis Use

Cannabis use parameter	$n = 104$
Duration of cannabis use (years), median (IQR)	26 (15–37)
Age at which person starting to use cannabis (years), median (IQR)	18 (15–25)
Time of last cannabis use, *n* (%)	
Within the last 24 h	62 (60)
More than 24 h ago, but within the last 7 days	23 (22)
More than 7 days ago, but within the last 4 weeks	7 (7)
More than 4 weeks ago, but within the last year	12 (12)
Time of day at which person is most likely to use cannabis[a], *n* (%)	
Early morning	20 (19)
Before noon	21 (20)
Afternoon	48 (46)
Evening	88 (85)
Night	37 (36)
Method of obtaining cannabis[a], *n* (%)	
From a friend/family member	54 (52)
From a specific cannabis source (e.g., dealer)	55 (53)
From a health care provider with a prescription	14 (14)
Self-grown	7 (7)
Prefer not to answer	4 (4)
Method of cannabis use[a], *n* (%)	
Smoked dried plant	101 (97)
Vaporized	6 (6)
Oil	12 (12)
Pills	2 (2)
Added to baked goods or other foods	21 (20)
If smoked, methods for smoking cannabis[a], *n* (%)	
As a joint	68 (65)
As a joint mixed with tobacco	47 (45)
Using a pipe	36 (35)
Using a water pipe (bong)	16 (15)
Inhaled using a vaporizer	9 (9)
Eaten (e.g., as brownies, cakes, and cookies)	25 (34)
Form of cannabis used[a], *n* (%)	
Hashish	25 (24)
Herbal (leaf and stems)	26 (25)
Herbal (buds, sinsemilla, and hydroponic)	98 (94)
Hash oil	15 (14)
Frequency of cannabis use, *n* (%)	
Rarely (2–3 times per year)	5 (5)
Monthly	18 (17)
Weekly	22 (21)
Daily	26 (25)
More than once daily	33 (32)
Quantity of cannabis used at any one time, *n* (%)	
If smoked	
One or two puffs	12 (12)
Half a joint	39 (38)
A whole joint	33 (32)
More than one joint	17 (16)
I do not know	3 (3)
If eaten/drunk	
Less than 1 g	14 (14)
More than 1 g	6 (6)
I don't know	12 (12)
Using oils	
Less than 1 g	13 (13)
More than 1 g	1 (1)
I do not know	6 (6)
Grams per week of cannabis consumed, *n* (%)	
Less than 1 g	37 (36)
1–5 g	25 (24)
6–9 g	15 (14)
10 g or more	14 (14)
Unknown	13 (13)

[a]Individuals could choose more than one response (*n* divided by 104 total participants).

anxiety and one-third reported receiving a diagnosis of depression. Compared to the general CVIS clinic cohort of 1614 patients followed for HIV or HIV alone, in addition to another chronic viral co-infection, this study has a greater proportion of men (87% vs. 69%) and persons of Caucasian ethnicity (81% vs. 39%), who were Canadian born (79% vs. 44%) and co-infected HCV (42% vs. 10%). Similar proportions of participants in this study were currently on an ART regimen as in the overall CVIS cohort (97% vs. 92%) and median CD4 cell counts were also similar in this study at 590 (390–821) versus 573 (390–783) cells/mm^3.

The median age at which participants started to use cannabis was 18 years (interquartile range [IQR] 15–25) and the median duration of cannabis use was 26 years (IQR 15–37). Nearly two-thirds reported use within the last 24 h. Cannabis was used at all times of day by our study sample, with one-fifth endorsing early morning use and close to all participants (97%) smoking the cannabis in dried plant format. Only two participants take cannabinoids in capsule format, while only 12 (12%) use oils (Table 2).

The most common reason for cannabis use included pleasure (68%) followed by self-management of symptoms of anxiety (58%), depression (31%), and stress (66%) (Table 3). Pain relief was a reason for cannabis consumption in half of participants, while greater than one-third reported cannabis use for loss of appetite and leg/muscle discomfort. Effectiveness for symptom relief varied between individuals and ranged from being not effective (6%) to quite or extremely effective (45%). For stress and anxiety, nearly one-fifth of respondents indicated that it provided complete symptom relief. With regard to overall effectiveness of cannabis for the symptom relief sought, two-thirds of individuals reported it as quite effective (39%) or somewhat effective (34%). The most common secondary effects experienced by participants included feeling relaxed (92%), feeling high (74%), dry mouth (64%), and increased cough (45%). Over two-thirds of

Table 3. Reasons for Cannabis Use and Symptom Relief

Reason/degree of symptom relief	*n* = 104 *n* (%)
Reasons for cannabis consumption[a]	
To reduce stress	62 (60)
To reduce anxiety	62 (60)
For symptoms associated with a medical condition	53 (51)
Social reasons	42 (40)
Weight gain/appetite stimulation	40 (39)
Pleasure	71 (68)
To enhance creativity during certain activities	19 (18)[b]
Other	18 (17)[c]
Whether cannabis is used for one of the following reasons/whether one experiences strong or complete symptom relief after use[a]	
Respiratory	
Shortness of breath at rest	15 (14)/2 (2)
Shortness of breath during activity	18 (17)/4 (4)
Shortness of breath during sleep	4 (4)/1 (1)
Cough	11 (11)/2 (2)
Sputum	14 (14)/2 (4)
Psychological	
Anxiety	60 (58)/39 (38)
Depression	32 (31)/23 (22)
Stress	66 (64)/44 (42)
General/other	
Fatigue	33 (32)/15 (15)
Pain	53 (51)/32 (31)
Leg/muscle discomfort	38 (37)/24 (23)
Loss of appetite	38 (37)/19 (18)
Weight loss	13 (13)/7 (7)
Difficulty performing daily activities	14 (14)/6 (6)
Best description of the overall effectiveness of cannabis for the symptom relief sought, *n* (%)	
Not effective	6 (6)
Slightly or somewhat effective	51 (49)
Quite or extremely effective	47 (45)

[a]Individuals could choose more than one response.
[b]Examples included work, hobbies, sex, and relaxation.
[c]Examples included to improve mood/calm oneself when dealing with people and to concentrate better at work and while watching movies.

Table 4. Cannabis Secondary Effects

Secondary effect	*n* = 104 *n* (%)
Respiratory	
Increased cough	47 (45)
Decreased cough	9 (9)
Increased shortness of breath	28 (27)
Decreased shortness of breath	11 (11)
Psychological	
Feeling high	77 (74)
Paranoia	23 (22)
Feeling relaxed	96 (92)
Increased anxiety	22 (21)
Other	
Fast heart rate/palpitations	21 (20)
Dry mouth	67 (64)
Best description of person's experience of secondary effects from using cannabis	
Very mild or mild	73 (70)
Moderate	27 (26)
Severe or very severe	4 (4)
Intensity of secondary effect	
Not intense at all	32 (31)
Very mild or mild intensity	43 (41)
Moderate intensity	26 (25)
Severe or very severe intensity	3 (3)
Degree of bothersomeness of secondary effect	
Not bothersome at all	71 (68)
Very mild or mild	20 (19)
Moderate	10 (10)
Severe or very severe	3 (3)

participants indicated that secondary effects were not bothersome at all, while only 3% indicated that these secondary effects were severely bothersome (Table 4). Fourteen participants were previously prescribed dronabinol/synthetic cannabinoids by a physician. Of those individuals, 13 preferred natural cannabis over dronabinol/synthetic cannabinoids, whereas one person did not have a preference between synthetic cannabinoids or natural cannabis. With regard to other substance use, two-thirds of participants were current tobacco smokers (Table 5). The majority of participants consumed alcohol either monthly or less, or two to four times per month, and very few participants reported heavy alcohol consumption. Ninety-five percent of respondents reported some illicit drug use (other than cannabis) within the past 6 months (Table 5). In terms of cannabis information, most participants reported obtaining information from friends (77%) followed by the internet (55%).

Most participants who used cannabis to treat symptoms associated with a medical condition did so because it relieved symptoms when used recreationally (58%). Furthermore, 81% of participants indicated that smoking cannabis as a joint would be their preferred method of administration for medicinal cannabis, followed by smoking it in a pipe (14%) or vaporized (12%). The majority of participants (90%) indicated that they will probably or definitely continue to use cannabis in the future (Supplementary Table S1). Scenarios that would make over 50% of individuals increase their cannabis include cannabis being legalized for recreational use in Canada, confirmed by researchers to relieve specific symptoms, and easy to obtain/more accessible (Supplementary Table S1).

Participants perceived their general cannabis knowledge as good (median score 7 out of 10). The most popular sources of information about cannabis included friends (77%) and the internet (55%), while health care providers were used less frequently to obtain information about cannabis (37%, 19%, and 11% for

Table 5. Tobacco, Alcohol, and Illicit Drug Consumption

Substance	*n* = 104
Tobacco	
Current tobacco smokers, *n* (%)	69 (66)
If yes, age started, median (IQR)	15 (12–17)
If yes, no. of cigarettes per day, median (IQR)	18 (10–25)
Currently smoke e-cigarettes (vapes), *n* (%)	11 (11)
If yes, do e-cigarettes contain nicotine, *n* (%)	5 (5)
If yes, do e-cigarettes contain cannabis, *n* (%)	1 (1)
No. of e-cigarettes per day, median (IQR)	1 (1–1)
No. of e-cigarettes per month, median (IQR)	4 (1–7)
Alcohol[a], *n* (%)	
Frequency of having a drink containing alcohol	
Never	18 (17)
Monthly or less	22 (21)
2–4 times per month	28 (27)
2–3 times a week	18 (17)
4 or more times per week	18 (17)
No. of standard drinks containing alcohol consumed in a typical day	
None	19 (18)
1 or 2 drinks	49 (47)
3 or 4 drinks	24 (23)
5 or 6 drinks	11 (11)
7 to 9 drinks	1 (1)
10 or more drinks	0 (0)
How often having six or more drinks on one occasion	
Never	54 (52)
Less than monthly	28 (27)
Monthly	5 (5)
Weekly	14 (14)
Daily or almost daily	3 (3)
Illicit drugs[b], *n* (%)	
Frequency of drugs[a] other than alcohol	
Never	5 (5)
Once a month or less often	16 (15)
2 to 4 times a month	17 (16)
2 to 3 times a week	14 (14)
4 times a month or more often	52 (50)
Use of more than one type of drug[a] on the same occasion	
Never	69 (66)
Once a month or less often	16 (15)
2 to 4 times a month	10 (10)
2 to 3 times a week	3 (3)
4 times a month or more often	6 (6)
How many times do you take drugs[a] on a typical day when you use drugs	
None	6 (6)
1–2 times	56 (54)
3–4 times	27 (26)
5–6 times	4 (4)
7 or more times	11 (11)
How often are you influenced heavily by drugs[a]?	
Never	50 (48)
Less than once a month	17 (16)
Every month	11 (11)
Every week	13 (13)
Daily or almost every day	13 (13)

[a]Individuals could choose more than one response.
[b]Drugs not prescribed by a physician or bought in a pharmacy; a comprehensive list of illicit substances was provided to participants as examples and included substances such as crack, cocaine, methamphetamines, and ecstasy.

doctors, nurses, and pharmacists, respectively). Participants in this survey indicated a high degree of comfort asking their physician about cannabis and greater than two-thirds (70%) did not anticipate that cannabis legalization would change their current cannabis use. Three-quarters of participants also indicated a high degree of interest to participate in studies on cannabis.

Discussion

Herein, we conducted a comprehensive survey on the reasons for cannabis use and secondary effects in PLWH to better understand our clinic population's experiences with cannabis and identify needs for future study. The most common reasons for cannabis use in our population were for pleasure, followed by reduction of stress/anxiety and symptoms associated with a medical condition. When used to reduce stress and anxiety, close to half of individuals rated the degree of relief as strong or complete relief. Furthermore, when used for a medical condition, nearly half of respondents rated the overall effectiveness of cannabis as quite or extremely effective. Although physicians will often report anecdotal evidence that many of their patients find cannabis therapeutic for many medical conditions (depression, anxiety, chronic pain, and anorexia), many physicians would like to see randomized controlled clinical trials of safety and efficacy for various conditions before endorsing its use. Some participants also endorsed using cannabis to treat shortness of breath, cough, and sputum, although participants did not find cannabis effective for respiratory complaints. The lungs are known to express cannabinoid receptors[10] and it has been shown that smoked cannabis ($\sim$500 mg of 1–2% THC) in healthy adults and adults with asthma was comparable in magnitude and duration of effect to the beta-2 adrenergic receptor agonist isoproterenol.[11,12] In a randomized trial of 16 adults with advanced chronic obstructive pulmonary disease (COPD), who inhaled 35 mg of vaporized cannabis (18.2% THC, <0.1% cannabidiol) versus 35 mg of a placebo control cannabis (0.33% THC, <0.99% cannabidiol), no differences in exertional breathlessness, exercise endurance, or airway function were observed between groups.[13] A previous Ontario-based study performed in PLWH from 1999 to 2001 showed that the most common reason for overall cannabis use was appetite stimulation and weight gain.[6] Reasons for medical cannabis use were similar between males and

females, although a significant number of women used cannabis for pain management.[6] This study also demonstrated that male gender and history of intravenous drug use were predictive of both recreational and medicinal cannabis use. However, only household income under $20,000 Canadian dollars was predictive of medical cannabis use.[6]

A major concern about the use of cannabis in PLWH relates to potential effects on ART adherence. In our study, 88% of cannabis users had an undetectable viral load. However, 95% adherence is associated with viral suppression, reduced rate of hospitalization, and reduced risk of HIV transmition.[14,15] Our study was not designed to test whether there is an association with ART adherence. Using data from the AIDS Care Cohort to evaluate Exposure to Survival Services (ACCESS study), a prospective cohort study of PLWH who use illicit drugs, Slawson et al. examined data from 523 persons from 2005 through 2012 followed longitudinally, of whom 23% of participants reported at least daily cannabis consumption at baseline.[16] They found that high intensity cannabis use was not associated with compromised adherence to ART in 523 PLWH.[16] To date, the study by Slawson et al. is the only one that has examined high cannabis consumption in a population of PLWH who use illicit drugs followed longitudinally and with free access to health care and HIV ART.[16]

Close to all participants in our study (97%) reported smoking cannabis as a joint. Approximately half of our participants reported increased cough with cannabis use and nearly one-third reported increased shortness of breath with cannabis use compared to periods when they are not using cannabis. Smoking cannabis results in combustion and generation of pyrolytic compounds, which can be harmful to the lungs.[17] Increased respiratory symptoms (predominantly increase in cough and phlegm) are known effects of cannabis smoking.[18,19] The high percentage (27%) of self-reported asthma likely reflects the burden of respiratory symptoms. Alternative modes of cannabis administration, such as vaping, can reduce the respiratory symptoms such as cough associated with cannabis administration.[20] Cannabis smoking alone is not associated with increased risk of COPD, lung function decline, or lung cancer.[18,20–25] Health care providers need to be aware of the potentially detrimental respiratory effects of smoking cannabis as joints and be ready to suggest alternative methods of drug delivery such as vaping. Consumption of cannabis as oils or edibles, particularly if PLWH are also current or ex-cigarette smokers, is an alternative method of administration although one must be cognizant of the different pharmacokinetics of inhaled versus ingested cannabis, which may make such substitution of delivery methods not preferable for the patient.[20] Another important area for health education pertains to the risk of paranoia and paradoxical increase in anxiety experienced by approximately one-fifth of our participants. There is evidence that persons with a family history of schizophrenia and who have cannabis-induced psychosis should be strongly discouraged from using cannabis with high levels of psychoactive cannabinoids, most notably THC.[26] Tools such as the "The Cannabis Use Disorder Identification Test–Revised (CUDIT-R)" are designed to assist health care providers in identifying potentially hazardous cannabis use or a possible cannabis use disorder, for which further intervention may be required.[27] Health care providers may also wish to familiarize themselves with the "Lower-risk cannabis use guidelines," which is an evidence-based tool designed to reduce the risk of adverse public health outcomes from cannabis users in legalization contexts.[28]

Relatively few participants (11%) listed pharmacists as a source of information about cannabis, even though pharmacists are the most accessible of all health care professionals, possess in depth-knowledge of pharmacology, and already have experience in dealing with substances such as herbal products that contain medicinal agents, in addition to numerous other compounds. Since legalization of recreational cannabis in Canada, cannabis is dispensed within pharmacies in some provinces. Therefore, we expect that the reliance on pharmacists to assist in understanding cannabis' complex psychophysiological and therapeutic effects is likely to increase substantially following legalization and patients should be encouraged to seek out information from their pharmacist on the this topic. The Canadian Pharmacists Association prepared a series of learning modules to assist pharmacists in increasing their knowledge about cannabis in preparation for legalization on their website. Health care providers who are not comfortable in their knowledge of cannabis can also refer their patients to clinics that specialize in cannabis, such as the Canadian Cannabis Clinic and Santé Cannabis. Furthermore, now that recreational cannabis use is legalized in Canada, we anticipate that individuals will have access to more reliable information through governmental websites geared for the public.

A secondary finding of our study was that cannabis users had very high rates of concurrent tobacco use, coupled with symptoms of anxiety and depression (as measured by self-report). In our study, 66% of participants smoked tobacco, which is near the high end of the range of smoking rates for populations with HIV (36–70%).[8,29,30] Among the general population, tobacco smoking is a leading cause of morbidity and mortality[31] and 19% of the general Canadian population are tobacco smokers.[32] In our participants of PLWH, 39% reported anxiety, while 33% reported depression, which is in line with the prevalence of these conditions in other populations of PLWH.[30,33–35] Furthermore, the prevalence of these conditions is two to three times more common in PLWH compared to the general population.[30,33–35] Many participants in our study also reported alcohol use, suggesting that education regarding cannabis could be done in conjunction with counseling on tobacco and alcohol reduction/cessation strategies.

Even in the modern ART era, chronic pain is a major health issue for PLWH, with prevalence estimates between ~40–85%.[36–39] In the ambulatory setting, pain is the second most common complaint, with neuropathic pain accounting for ~50% of pain.[36,39,40] Chronic pain management is the most common reason for use of cannabinoid-based medicines.[41] The co-occurrence of chronic pain and substance use disorders has been explained by individuals self-medicating to manage their chronic pain.[42] In an exploratory analysis, Sohler et al. examined patterns of cigarette, alcohol, and illicit drug use in PLWH with chronic pain, who were prescribed opioid analgesics.[43] In that study, almost half of the participants reported being prescribed opioid analgesics. In multivariate analyses, only cannabis use was significantly associated with lower odds of being prescribed opioid analgesics (adjusted odds ratio: 0.57; 95% confidence interval: 0.38–0.87), suggesting that new cannabis legislation might reduce the need for opioid analgesics for pain management in PLWH.[43] Furthermore, the "substitution hypothesis" has been proposed, whereby cannabis use may serve as a substitute for opioids, tobacco, and alcohol. In a study by Socias et al., intentional cannabis use was shown to reduce the amount of crack-cocaine use.[44] Such findings are relevant given the rates of mortality stemming from the opioid crisis in Canada.[45]

Our study has several limitations. We used a cross-sectional design with descriptive analyses. We did not make any attempt to test associations between variables as doing so would go beyond the exploratory and descriptive nature of the study. The specific compositions of the products used by patients are not known (i.e., ratios of THC vs. cannabidiol). We relied heavily on health care provider referral of patients. The large number of illicit drug users likely reflects sampling bias as many of the participants are referred by the outreach nurse and certain physicians who have practices with many HIV-HCV co-infected patients who use illicit drugs. We did not collect information on health care provider attitudes and/or practices. It is possible that the majority of participants in this study have health care providers with more open attitudes toward cannabis, which may have biased the survey responses. The questionnaires were also administered by a study coordinator to ensure participants would answer the majority of questions. Thus, it is possible that participants underreported their use of cannabis and other substances for social desirability reasons. Moreover, half of the participants in this survey were HIV-HCV co-infected, whereas these patients only make up about 10% of our overall clinic population. Therefore, important selection bias may limit generalizability of results to patients within our clinic and other settings, and sets the stage for work that might make use of the clinical database to select a random list of patients, to better understand cannabis use experiences and related aspects. Similarly, most of the participants were Canadian-born, Caucasian men with low education and income levels, also limiting generalizability of the findings. Gender is an especially important factor in future cannabis research as there are differences in cannabinoid receptor densities in the male versus female brain.[46,47] A study on prevalence of cannabis use among PLWH in maritime Canada was conducted by Harris et al., who reported that 92% of PLWH with cannabis use were male and 71% were Caucasian.[48] Furthermore, data from the Canadian Observational Cohort (CANOC) collaboration, a multisite cohort study of greater than 24,000 PLWH who began ART after January 1, 2000,[49,50] demonstrate that the majority of PLWH in Canada are men.[49,50] Our relatively modest sample size of 104 PLWH prohibited us from examining responses to questions based on subpopulations within our clinic. Finally, we did not collect data on sexual risk behaviour or cannabis dependence.

Conclusion

Most of the PLWH in this study use cannabis for pleasure and to reduce feelings of anxiety and depression. Cannabis is well tolerated by majority of our PLWH and most of them find it effective for symptom relief,

while secondary effects were not very bothersome. Health care providers can educate patients about the potential health risks of smoked cannabis and suggest measures to reduce these risks. This is especially important as Canada has recently legalized the use of recreational cannabis and patients are likely to turn to health care providers more openly to request information pertaining to cannabis.

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Supplementary Material

Supplementary Table S1

References

1. Ware MA, Rueda S, Singer K, et al. Cannabis use by persons living with HIV/AIDS: patterns and prevalence of use. J Cannabis Ther. 2003;3:3–15.
2. Aggarwal SK, Carter GT, Sullivan MD, et al. Medicinal use of cannabis in the United States: historical perspectives, current trends, and future directions. J Opioid Manag. 2009;5:153–168.
3. Kosel BW, Aweeka FT, Benowitz NL, et al. The effects of cannabinoids on the pharmacokinetics of indinavir and nelfinavir. AIDS. 2002;16:543–550.
4. Patel SM, Thames AD, Arbid N, et al. The aggregate effects of multiple comorbid risk factors on cognition among HIV-infected individuals. J Clin Exp Neuropsychol. 2013;35:421–434.
5. Lorkiewicz SA, Ventura AS, Heeren TC, et al. Lifetime marijuana and alcohol use, and cognitive dysfunction in people with human immunodeficiency virus infection. Subst Abus. 2018;39:116–123.
6. Furler MD, Einarson TR, Millson M, et al. Medicinal and recreational marijuana use by patients infected with HIV. AIDS Patient Care STDS. 2004;18:215–228.
7. Costiniuk CT, Brunet L, Rollet-Kurhajec KC, et al. Tobacco smoking is not associated with accelerated liver disease in human immunodeficiency virus-hepatitis C coinfection: a longitudinal cohort analysis. Open Forum Infect Dis. 2016;3:ofw050.
8. Okafor CN, Cook RL, Chen X, et al. Prevalence and correlates of marijuana use among HIV-seropositive and seronegative men in the Multicenter AIDS Cohort Study (MACS), 1984–2013. Am J Drug Alcohol Abuse. 2017;43:556–566.
9. Ware MA, Doyle CR, Woods R, et al. Cannabis use for chronic non-cancer pain: results of a prospective survey. Pain. 2003;102:211–216.
10. Galiegue S, Mary S, Marchand J, et al. Expression of central and peripheral cannabinoid receptors in human immune tissues and leukocyte subpopulations. Eur J Biochem. 1995;232:54–61.
11. Tashkin DP, Shapiro BJ, Lee YE, et al. Effects of smoked marijuana in experimentally induced asthma. Am Rev Respir Dis. 1975;112:377–386.
12. Tashkin DP, Shapiro BJ, Frank IM. Acute effects of smoked marijuana and oral delta9-tetrahydrocannabinol on specific airway conductance in asthmatic subjects. Am Rev Respir Dis. 1974;109:420–428.
13. Abdallah SJ, Smith BM, Ware MA, et al. Effect of vaporized cannabis on exertional breathlessness and exercise endurance in advanced chronic obstructive pulmonary disease. A randomized controlled trial. Ann Am Thorac Soc. 2018;15:1146–1158.
14. Bonn-Miller MO, Oser ML, Bucossi MM, et al. Cannabis use and HIV antiretroviral therapy adherence and HIV-related symptoms. J Behav Med. 2014;37:1–10.
15. Wood E, Hogg RS, Yip B, et al. The impact of adherence on CD4 cell count responses among HIV-infected patients. J Acquir Immune Defic Syndr. 2004;35:261–268.
16. Slawson G, Milloy MJ, Balneaves L, et al. High-intensity cannabis use and adherence to antiretroviral therapy among people who use illicit drugs in a Canadian setting. AIDS Behav. 2015;19:120–127.
17. Sparacino CM, Hyldburg PA, Hughes TJ. Chemical and biological analysis of marijuana smoke condensate. NIDA Res Monogr. 1990;99:121–140.
18. Morris MA, Jacobson SR, Kinney GL, et al. Marijuana Use associations with pulmonary symptoms and function in tobacco smokers enrolled in the subpopulations and intermediate outcome measures in COPD study (SPIROMICS). Chronic Obstr Pulm Dis. 2018;5:46–56.
19. Ghasemiesfe M, Ravi D, Vali M, et al. Marijuana use, respiratory symptoms, and pulmonary function: a systematic review and meta-analysis. Ann Intern Med. 2018;169:106–115.
20. Earleywine M, Barnwell SS. Decreased respiratory symptoms in cannabis users who vaporize. Harm Reduct J. 2007;4:11.
21. Tetrault JM, Crothers K, Moore BA, et al. Effects of marijuana smoking on pulmonary function and respiratory complications: a systematic review. Arch Intern Med. 2007;167:221–228.
22. Hancox RJ, Poulton R, Ely M, et al. Effects of cannabis on lung function: a population-based cohort study. Eur Respir J. 2010;35:42–47.
23. Tashkin DP, Coulson AH, Clark VA, et al. Respiratory symptoms and lung function in habitual heavy smokers of marijuana alone, smokers of marijuana and tobacco, smokers of tobacco alone, and nonsmokers. Am Rev Respir Dis. 1987;135:209–216.
24. Pletcher MJ, Vittinghoff E, Kalhan R, et al. Association between marijuana exposure and pulmonary function over 20 years. JAMA. 2012;307:173–181.
25. Kempker JA, Honig EG, Martin GS. The effects of marijuana exposure on expiratory airflow. A study of adults who participated in the U.S. National Health and Nutrition Examination Study. Ann Am Thorac Soc. 2015;12:135–141.
26. Wilkinson ST, Radhakrishnan R, D'Souza DC. Impact of cannabis use on the development of psychotic disorders. Curr Addict Rep. 2014;1:115–128.
27. Adamson SJ, Kay-Lambkin FJ, Baker AL, et al. An improved brief measure of cannabis misuse: the Cannabis Use Disorders Identification Test-Revised (CUDIT-R). Drug Alcohol Depend. 2010;110:137–143.

28. Fischer B, Russell C, Sabioni P, et al. Lower-risk cannabis use guidelines: a comprehensive update of evidence and recommendations. Am J Public Health. 2017;107:e1–e12.
29. Helleberg M, Gerstoft J, Afzal S, et al. Risk of cancer among HIV-infected individuals compared to the background population: impact of smoking and HIV. AIDS. 2014;28:1499–1508.
30. Cook JA, Burke-Miller JK, Steigman PJ, et al. Prevalence, comorbidity, and correlates of psychiatric and substance use disorders and associations with HIV risk behaviors in a multisite cohort of women living with HIV. AIDS Behav. 2018;22:3141–3154.
31. Ezzati M, Lopez AD. Regional, disease specific patterns of smoking-attributable mortality in 2000. Tob Control. 2004;13:388–395.
32. Statistics_Canada. Health Trends 2014. Statistics Canada Catalogue No. 82-213-XWE. http://www12.statcan.gc.ca/health-sante/82-213/index.cfm?Lang=ENG (last accessed July 7, 2018).
33. Bing EG, Burnam MA, Longshore D, et al. Psychiatric disorders and drug use among human immunodeficiency virus-infected adults in the United States. Arch Gen Psychiatry. 2001;58:721–728.
34. Orlando M, Burnam MA, Beckman R, et al. Re-estimating the prevalence of psychiatric disorders in a nationally representative sample of persons receiving care for HIV: results from the HIV Cost and Services Utilization Study. Int J Methods Psychiatr Res. 2002;11:75–82.
35. Do AN, Rosenberg ES, Sullivan PS, et al. Excess burden of depression among HIV-infected persons receiving medical care in the united states: data from the medical monitoring project and the behavioral risk factor surveillance system. PLoS One. 2014;9:e92842.
36. Merlin JS, Westfall AO, Raper JL, et al. Pain, mood, and substance abuse in HIV: implications for clinic visit utilization, antiretroviral therapy adherence, and virologic failure. J Acquir Immune Defic Syndr. 2012;61:164–170.
37. Miaskowski C, Penko JM, Guzman D, et al. Occurrence and characteristics of chronic pain in a community-based cohort of indigent adults living with HIV infection. J Pain. 2011;12:1004–1016.
38. Newshan G, Bennett J, Holman S. Pain and other symptoms in ambulatory HIV patients in the age of highly active antiretroviral therapy. J Assoc Nurses AIDS Care. 2002;13:78–83.
39. Bruce RD, Merlin J, Lum PJ, et al. 2017 HIVMA of IDSA clinical practice guideline for the management of chronic pain in patients living with HIV. Clin Infect Dis. 2017;65:e1–e37.
40. Aouizerat BE, Miaskowski CA, Gay C, et al. Risk factors and symptoms associated with pain in HIV-infected adults. J Assoc Nurses AIDS Care. 2010;21:125–133.
41. Belle-Isle L, Hathaway A. Barriers to access to medical cannabis for Canadians living with HIV/AIDS. AIDS Care. 2007;19:500–506.
42. Ilgen MA, Perron B, Czyz EK, et al. The timing of onset of pain and substance use disorders. Am J Addict. 2010;19:409–415.
43. Sohler NL, Starrels JL, Khalid L, et al. Cannabis use is associated with lower odds of prescription opioid analgesic use among HIV-infected individuals with chronic pain. Subst Use Misuse. 2018;53:1602–1607.
44. Socias ME, Kerr T, Wood E, et al. Intentional cannabis use to reduce crack cocaine use in a Canadian setting: a longitudinal analysis. Addict Behav. 2017;72:138–143.
45. Fischer B, Pang M, Tyndall M. The opioid death crisis in Canada: crucial lessons for public health. Lancet Public Health. 2019;4:e81–e82.
46. Skalski LM, Towe SL, Sikkema KJ, et al. The impact of marijuana use on memory in HIV-infected patients: a comprehensive review of the HIV and marijuana literatures. Curr Drug Abuse Rev. 2016;9:126–141.
47. Crane NA, Schuster RM, Fusar-Poli P, et al. Effects of cannabis on neurocognitive functioning: recent advances, neurodevelopmental influences, and sex differences. Neuropsychol Rev. 2013;23:117–137.
48. Harris GE, Dupuis L, Mugford GJ, et al. Patterns and correlates of cannabis use among individuals with HIV/AIDS in Maritime Canada. Can J Infect Dis Med Microbiol. Spring 2014;25:e1–e7.
49. Palmer AK, Klein MB, Raboud J, et al. Cohort profile: the Canadian observational cohort collaboration. Int J Epidemiol. 2011;40:25–32.
50. Cescon A, Patterson S, Chan K, et al. Gender differences in clinical outcomes among HIV-positive individuals on antiretroviral therapy in Canada: a multisite cohort study. PLoS One. 2013;8:e83649.

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Abbreviations Used

ART = antiretroviral therapy
COPD = chronic obstructive pulmonary disease
CVIS = Chronic Viral Illness Service
HCV = hepatitis C virus
IQR = interquartile range
PLWH = people living with HIV
THC = Δ9-tetrahydrocannabinol