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Original Article

Prevalence, Perceptions, and Patterns of Cannabis Use Among Cardiac Inpatients at a Tertiary-Care Hospital: A Cross-Sectional Survey

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ABSTRACT

Background: Cannabis use may adversely affect cardiovascular health. Patterns of use by cardiac patients are unknown. We evaluated the prevalence, perceptions, and patterns of cannabis use among cardiac inpatients.

Methods: A consecutive cross-section of cardiac inpatients, hospitalized between November 2019 and May 2020, were surveyed in-person or via telephone. Descriptive statistics and logistic regression were used to examine the characteristics of cannabis use.

Results: The prevalence of past-12-month cannabis use was 13.8% (95% confidence interval [CI]: 11.8%-16.0%). Characteristics independently associated with cannabis use were as follows: age < 64

RÉSUMÉ

Contexte : L'utilisation du cannabis peut nuire à la santé cardiovasculaire, mais les habitudes d'utilisation des patients atteints de troubles cardiaques ne sont pas connues. Nous avons évalué la prévalence, les perceptions et les habitudes d'utilisation du cannabis chez des patients hospitalisés présentant des troubles cardiaques.

Méthodologie : Une analyse transversale a été réalisée en interrogeant en personne ou au téléphone des patients hospitalisés consécutivement entre novembre 2019 et mai 2020 et présentant des troubles cardiaques. Des statistiques descriptives et une régression logistique ont été utilisées pour examiner les caractéristiques liées à l'utilisation du cannabis.

Evidence suggests that cannabis use is associated with cardiovascular harm. A recent systematic review found that nonmedical cannabis use was associated with an increased likelihood of myocardial infarction and stroke.¹ Other investigators have identified an associated increased risk of an acute coronary syndrome,^{2,3} dysrhythmias,⁴ and chronic cardiovascular disease.^{5,6} Smoking cannabis may be associated with many of the same cardiovascular risks as smoking tobacco, given its effects on blood pressure, inflammation, and cardiac rhythm.⁷⁻⁹ Cannabis may also interact adversely with certain cardiovascular drugs.¹⁰

Cardiovascular risks notwithstanding, studies have supported the therapeutic benefits of cannabis in managing certain disorders and symptoms, including the following: neuropathic pain and posttraumatic stress disorder; improved appetite in patients with cancer or human immunodeficiency virus (HIV); decreased spasticity from multiple sclerosis; and reduced frequency of certain forms of epileptic seizures.¹¹⁻¹³

Recreational cannabis was legalized in Canada between October 2018 and October 2019.¹⁴ Canada has published its Lower Risk Cannabis Use Guidelines (LRCUGs) designed to provide the public and clinicians with evidence-based recommendations to reduce the risks associated with cannabis use.^{15,16} These guidelines provide little information for individuals with cardiovascular disease (CVD). Current knowledge is limited regarding the prevalence and patterns of cannabis use among adults with medical conditions,¹⁷ particularly those with CVD.¹⁸ Given the potential risks that cannabis use may pose to cardiovascular patients, understanding the nature and dimension of its use within this population is important.

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Ethics Statement: This project was reviewed by the Ottawa Health Science Network Research Ethics Board and approved as a quality-improvement evaluation.

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years (< 44 years, odds ratio [OR] = 3.96 [95% CI: 1.65-9.53]; age 45-64 years, OR = 2.72 [95% CI: 1.65-4.47]); tobacco use in the previous 6 months (OR = 1.91 [95% CI: 1.18-3.07]); having a cannabis smoker in one's primary social group (OR = 4.17 [95% CI: 2.73-6.38]); and a history of a mental health diagnosis (OR = 1.82 [95% CI: 1.19-2.79]). Among those using cannabis, 70.5% reported smoking or vaping it; 47.2% reported daily use. Most did not know the tetrahydrocannabinol (THC; 71.6%) or cannabidiol (CBD; 83.3%) content of their cannabis, or the dose of cannabis in their edibles (66.7%). As defined by Canada's Lower Risk Cannabis Use Guidelines, 96.7% of cannabis users reported ≥ 1 higher-risk use behaviour (mean = 2.3, standard deviation = 1.2). Over 60% of patients expressed no intention to quit or reduce cannabis use in the next 6 months.

Conclusions: Cannabis use appears prevalent among cardiac patients. Most users demonstrated higher-risk use behaviours and low intentions to quit. Further work is needed to understand the impacts of cannabis use on the cardiovascular system and to develop guidelines and educational tools relating to lower-risk use, for cardiac patients and providers.

The purpose of this evaluation was to examine the prevalence, perceptions, and patterns of cannabis use among a consecutive series of inpatients at a tertiary-care cardiac hospital in Ontario, Canada, to gather insights that could lead to the improvement of patient care.

Methods

Design and setting

We conducted a cross-sectional survey of a consecutive series of patients admitted to inpatient cardiology and cardiac surgery units at the University of Ottawa Heart Institute between November 2019 and May 2020.

Participants

Patients were eligible for the survey if they met the following criteria: (i) they were admitted to 1 of 3 cardiac inpatient units at the institute between November 11, 2019, and May 14, 2020; (ii) they could speak and comprehend English or French; (iii) they were not severely cognitively or hearing impaired; and (iv) they were healthy enough to participate in the survey. The survey was administered to participants in-person during their hospitalization, or by telephone posthospitalization. Participants provided consent to participate in the survey.

Résultats : La prévalence de l'utilisation du cannabis au cours des 12 mois précédents était de 13,8 % (intervalle de confiance [IC] à 95 % : 11,8 % à 16,0 %). Les caractéristiques indépendamment associées à l'utilisation du cannabis étaient les suivantes : âge < 64 ans (< 44 ans, rapport de cotes [RC] = 3,96 [IC à 95 % : 1,65 à 9,53]; âge de 45 à 64 ans, RC = 2,72 [IC à 95 % : 1,65 à 4,47]); tabagisme dans les six mois précédents (RC = 1,91 [IC à 95 % : 1,18 à 3,07]); présence d'un consommateur de cannabis au sein du cercle social principal (RC = 4,17 [IC à 95 % : 2,73 à 6,38]); et diagnostic antérieur lié à la santé mentale (RC = 1,82 [IC à 95 % : 1,19 à 2,79]). Parmi les utilisateurs de cannabis, 70,5 % d'entre eux ont rapporté qu'ils fumaient ou vapotaient et 47,2 % ont déclaré en consommer quotidiennement. La plupart ne connaissaient pas le contenu en tétrahydrocannabinol (THC; 71,6 %) ou en cannabidiol (CBD; 83,3 %) du cannabis consommé, ou la dose contenue dans les aliments à base de cannabis consommés (66,7 %). Au total, 96,7 % des utilisateurs de cannabis ont rapporté ≥ 1 comportement(s) à risque élevé (moyenne = 2,3, écart-type = 1,2) selon les Recommandations canadiennes pour l'usage du cannabis à moindre risque. Par ailleurs, plus de 60 % des patients n'ont exprimé aucune intention d'interrompre ou de diminuer leur consommation de cannabis au cours des six prochains mois.

Conclusions : L'utilisation du cannabis semble courante chez les patients qui présentent des troubles cardiaques. La plupart des utilisateurs ont démontré des comportements à risque élevé, et une faible intention de mettre fin à leur consommation. D'autres études sont requises pour caractériser les répercussions de l'utilisation du cannabis sur l'appareil cardiovasculaire et élaborer des lignes directrices et des outils éducatifs à l'intention des patients atteints de troubles cardiaques et des professionnels de la santé en vue de favoriser un usage à moindre risque.

Data sources

Four of the authors (K.W., K.M., S.N., S.M.) developed a survey using questions adapted from the following existing, validated surveys: National Cannabis Survey 2018 & 2019¹⁹; Canadian Cannabis Survey (CCS) 2018²⁰ & 2019²¹; Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU)²²; and the Canadian Alcohol Tobacco and Drugs Survey 2017.²³ The survey was piloted and revised prior to the start of the evaluation. The primary variable of interest was self-reported cannabis use in the past year. A 12-month recall period was selected, as this permits measurement of current or recent cannabis use and enables comparisons with other national surveys (CCS and Canadian Alcohol Tobacco and Drugs Survey). Previous year cannabis use was measured by asking patients "Have you ever used cannabis?" with the following response options read to them: "No, I have never used cannabis; Yes, I have only tried cannabis once in my life but not in the past year; Yes, I have used it more than once but not within the past year; Yes, I have used it within the past year." Those who reported cannabis use in the previous year were asked the following further questions about their use: patterns of use; history of use; methods of administration; source of the cannabis; knowledge of tetrahydrocannabinol (THC) and cannabidiol (CBD) content; reasons for use; and co-use with other substances. All participants were asked about the following: their

perceptions and feelings toward cannabis use; their use of tobacco, e-cigarettes, and alcohol; reason for their hospital admission; their history of mental health diagnosis; their other substance use; and their sociodemographic characteristics (age, sex, ethnic background, employment status, level of education). Participants had the option to have the survey administered in English or French. A copy of the survey questions used in this analysis is available in the [Supplemental Methods S1](#).

Reduction of bias

To reduce potential biases, we attempted to survey a consecutive series of patients by approaching patients in chronological order based on admission date and time. Evaluation staff received training in survey administration and followed a standard operating procedure to ensure consistency in the delivery of the survey.

Sample size

The primary objective was to measure prevalence of cannabis use, and we aimed to survey at least 150 participants who had used cannabis over the past year. A target sample size of 1012 was calculated based on an expected prevalence of cannabis use in the past 12 months of 15%,²⁴ an alpha of 0.05, and an absolute error (measure of precision) of $\pm 2.2\%$.

Statistical analysis

Descriptive statistics were used to summarize cannabis prevalence, perceptions, and sociodemographic characteristics. Response categories with cell sizes less than 10 were merged with other categories to protect respondent identity.

Three quantitative variables (number of standard drinks per week, length of hospital stay in days, and age) were converted to categorical variables for data analysis. The Canadian guidelines for low-risk alcohol consumption²⁵ were used to group “number of standard drinks per week” into the following binary variable: “Consumes more than guidelines of alcohol per week (higher risk) or consumes within guidelines per week (lower risk).”

Cannabis use characteristics of this cardiac inpatient sample were compared post hoc to the LRCUGs¹⁵ to examine how many patients were reporting higher-risk cannabis use. Five of the LRCUGs’ 10 higher-risk behaviours were assessed in our survey (initiating cannabis use before age 25 years, driving within 2 hours of consuming cannabis, smoking cannabis, frequency of cannabis use > once per week, co-use of cannabis and tobacco in the previous 6 months). The responses were converted into binary (yes/no) variables; the “yes” responses were summed for each patient who used cannabis, to determine the number of higher-risk behaviours per patient.

Logistic regression was used to examine the associations between cannabis use and sociodemographic characteristics. Unadjusted odds ratios (ORs) were calculated for each independent variable, with cannabis use in the past 12 months as the dependent variable. The independent variables examined were sex, age group, education, employment status, tobacco use, alcohol use, opioid use, exposure to cannabis smoke in the home, cannabis use in primary social group, and history of a mental health diagnosis. These variables were selected based

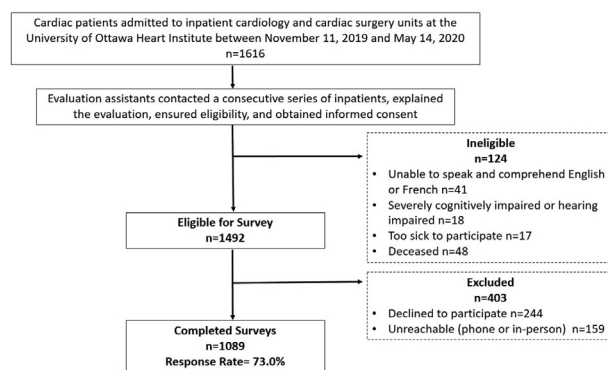


Figure 1. Selection of participants for survey.

on clinical experience and prior literature suggesting that they have a potential association with cannabis use. Following the univariate analyses, 2 multivariable models were built. The first model included all variables. The second model included all variables with a significant univariate association with cannabis use, in addition to age and biological sex. The following tests were used to compare the 2 multivariable models and select the model with the best fit: Nagelkerke R value (a larger number suggests better model fit); $-2 \log$ likelihood (smaller number suggests better fit); and Block 1 (reduced model) vs Block 2 (full model) comparison and examination of the likelihood ratio χ^2 test for the additional terms added in the second block. All assumptions of logistic regression were tested and found to have been met. SPSS Statistics for Windows (version 28.0; IBM, Armonk, NY) was used to conduct all statistical analyses.

The full dataset was used to calculate descriptive statistics. In preparation for logistic-regression analysis, missing data were addressed as follows: Any cases missing more than 33% of responses for the variables included in the logistic regression were removed from the dataset ($n = 12$). The pattern of “missingness” of the data in the trimmed dataset was then examined using SPSS Statistics missing-data analysis. Multiple imputations (5 iterations), using SPSS Statistics (automatic imputation) were performed to impute the missing data. A pooled estimate of the 5 dataset iterations was used to conduct the logistic-regression analysis.

Ethics approval

This project was reviewed by the Ottawa Health Science Network Research Ethics Board and approved as a quality-improvement evaluation.

Results

A total of 1616 cardiac patients were admitted and discharged from participating inpatient units during the evaluation period. Prior to the COVID-19 pandemic lockdown in March 2020, patients were approached consecutively while they were in the hospital. If patients were not reached while they were in the hospital or during the pandemic lockdown, they were contacted by phone in order of discharge, to ask them to complete the survey. Of those approached, 124 patients (7.7%) were not eligible for the survey, and 403 patients (24.9%) declined or were

Table 1. Prevalence of cannabis use in cardiac inpatients, by sociodemographic, health, and social/environmental characteristics

Variable	Cannabis use, in past 12 months			Prevalence of cannabis use, in past 12 months % (95% CI)
	No n (%)	Yes n (%)	Total n	
Total	939	150	1089	13.8 (11.8–16.0)
Sociodemographic				
Sex				
Male	647 (68.9)	110 (73.3)	757	14.5 (12.2–17.2)
Female	292 (31.1)	40 (26.7)	332	12.0 (8.9–15.9)
Missing	0	0	0	
Age group, y				
≤ 44	31 (3.3)	18 (12.0)*	49	36.7 (24.3–50.7)
45–64	338 (36.0)	86 (57.3)*	424	20.3 (16.7–24.3)
≥ 65	570 (60.7)	46 (30.7)	616	7.5 (5.6–9.7)
Missing	0	0	0	
Some postsecondary education				
No	366 (39.6)	56 (38.1)	422	13.3 (10.3–16.8)
Yes	559 (60.4)	91 (61.9)	650	14.0 (11.5–16.8)
Missing	14	3	17	
Ethnicity				
European/non-Indigenous North American	815 (88.6)	135 (91.2)	950	14.2 (12.1–16.5)
Other	105 (11.4)	13 (8.8)	118	11.0 (6.3–17.6)
Missing	19	2	21	
Employment status				
Employed	275 (29.8)	51 (34.7)	326	15.6 (12.0–19.9)
Retired	552 (59.9)	65 (44.2)*	617	10.5 (8.3–13.1)
Unemployed/receiving disability income support	95 (10.3)	31 (21.1)*	126	24.6 (17.7–32.6)
Missing	17	3	20	
Health services utilization				
Admission diagnosis				
Coronary artery disease	576 (61.3)	89 (59.3)	665	13.4 (11.0–16.1)
Valvular disease	141 (15.0)	28 (18.7)	169	16.6 (11.6–22.7)
Heart failure	72 (7.7)	10 (6.7)	82	12.2 (6.4–20.6)
Other	150 (16.0)	23 (15.3)	173	13.3 (8.9–18.9)
Missing	0	0	0	
Length of UOHI stay in days				
≤ 5	289 (30.8)	46 (30.7)	335	13.7 (10.4–17.7)
6–8	237 (25.2)	38 (25.3)	275	13.8 (10.1–18.3)
9–13	185 (19.7)	33 (22.0)	218	15.1 (10.9–20.3)
≥ 14	228 (24.3)	33 (22.0)	261	12.6 (9.0–17.1)
Missing	0	0	0	
Readmitted to UOHI within 30 days				
No	894 (95.2)	139 (92.7)	1033	13.5 (11.5–15.6)
Yes	45 (4.8)	11 (7.3)	56	19.6 (10.9–31.4)
Missing	0	0	0	
Substance use and mental health				
Tobacco use, in previous 6 months				
No	831 (89.0)	102 (68.5)	933	10.9 (9.1–13.1)
Yes	103 (11.0)	47 (31.5)*	150	31.3 (24.3–39.1)
Missing	5	1	6	
Ever used e-cigarettes				
No	857 (92.0)	113 (75.8)	970	11.6 (9.7–13.8)
Yes	75 (8.0)	36 (24.2)*	111	32.4 (24.3–41.5)
Missing	7	1	8	
Current alcohol use				
Within guidelines	882 (95.1)	134 (91.2)	1016	13.2 (11.2–15.4)
Above guidelines	45 (4.9)	13 (8.8)†	58	22.4 (13.2–34.3)
Missing	12	3	15	
Opioid use, in previous 6 months				
No	791 (90.0)	119 (82.6)	910	13.1 (11.0–15.4)
Yes	88 (10.0)	25 (17.4)†	113	22.1 (15.2–30.4)
Missing	60	6	66	
History of mental health diagnosis				
No	724 (79.6)	91 (61.9)	815	11.2 (9.1–13.5)
Yes	186 (20.4)	56 (38.1)*	242	23.1 (18.2–28.8)
Missing	29	3	32	
History of depression diagnosis				
No	795 (87.4)	106 (72.1)	901	11.8 (9.8–14.0)
Yes	115 (12.6)	41 (27.9)*	156	26.3 (19.9–33.6)
Missing	29	3	32	
History of anxiety diagnosis				
No	812 (89.2)	109 (74.1)	921	11.8 (9.9–14.0)
Yes	98 (10.8)	38 (25.9)*	136	27.9 (20.9–35.9)
Missing	29	3	32	
Social/environmental				
Someone smokes cannabis in the home				
No	907 (97.8)	132 (89.8)	1039	12.7 (10.8–14.8)
Yes	20 (2.2)	15 (10.2)*	35	42.9 (27.6–59.3)
Missing	12	3	15	
Someone in primary social group smokes cannabis				
No	826 (89.1)	82 (55.8)	908	9.0 (7.3–11.0)
Yes	101 (10.9)	65 (44.2)*	166	39.2 (32.0–46.7)
Missing	12	3	15	

CI, confidence interval; UOHI, University of Ottawa Heart Institute.

* $\chi^2 P < 0.001$.† $\chi^2 P < 0.05$.

Table 2. Associations between participant characteristics and cannabis use

Variables	Cannabis use in the past 12 months, odds ratio (95% confidence interval)		
	Univariable	Model 1	Model 2
		Multivariable	Multivariable
Sex			
Male	1.20 (0.81–1.77)	1.25 (0.80–1.94)	1.26 (0.81–1.96)
Female	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Age, y			
≤ 44	7.24 (3.76–13.94)*	3.96 (1.65–9.53)†	3.91 (1.63–9.36)†
45–64	3.14 (2.14–4.63)*	2.72 (1.65–4.47)*	2.74 (1.68–4.49)*
≥ 65	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Some postsecondary education			
Yes	1.0 (Ref)	1.0 (Ref)	NA
No	0.93 (0.65–1.33)	0.95 (0.63–1.43)	NA
Employment status			
Employed	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Retired	0.64 (0.43–0.95)†	1.60 (0.95–2.69)	1.60 (0.95–2.68)
Unemployed or receiving disability income support	1.75 (1.06–2.91)†	1.33 (0.73–2.40)	1.28 (0.71–2.30)
Tobacco use previous 6 months			
Yes	3.64 (2.43–5.46)*	1.91 (1.18–3.07)†	1.93 (1.20–3.09)†
No	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Current alcohol use			
Above guidelines	1.88 (0.99–3.58)	1.82 (0.88–3.78)	NA
Within guidelines	1.0 (Ref)	1.0 (Ref)	NA
Opioid use past 6 months			
Yes	1.89 (1.16–3.07)†	1.28 (0.73–2.23)	1.28 (0.74–2.23)
No	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Someone smokes cannabis in the home			
Yes	5.08 (2.54–10.16)*	2.31 (0.99–5.42)	2.26 (0.98–5.20)
No	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
Someone in primary social group smokes cannabis			
Yes	6.43 (4.37–9.45)*	4.17 (2.73–6.38)*	4.22 (2.76–6.44)*
No	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)
History of mental health diagnosis			
Yes	2.42 (1.67–3.49)*	1.82 (1.19–2.79)†	1.82 (1.19–2.78)†
No	1.0 (Ref)	1.0 (Ref)	1.0 (Ref)

Bold font indicates statistical significance.

NA, not applicable; Ref, reference category.

* $P < 0.001$.

† $P < 0.05$.

unreachable. Of the eligible patients, 1089 (73.0%) completed the survey (Fig. 1).

Prevalence

The overall prevalence of cannabis use in the past year for our sample was 13.8% (95% confidence interval [CI], 11.8%–16.0%; $n = 150$; Table 1), and the prevalence of ever using cannabis in one's life was 42.1% (95% CI, 39.2%–45.1%). Cardiac inpatients who reported cannabis use in the previous year were, on average, 9 years younger than those who had not used cannabis in the previous year (mean age 58.3 ± 13.1 vs 67.5 ± 11.9 years; $P < 0.001$).

Factors associated with cannabis consumption

Table 2 summarizes the observed associations between cannabis use and other variables. In the univariable logistic-regression models, factors associated with cannabis use in the previous 12 months were as follows: age < 65 years; being unemployed or receiving disability benefits; having used tobacco in the previous 6 months; having used opioids in the previous 6 months; having someone in the home who smokes cannabis; having someone in one's primary social group who

smokes cannabis; and history of a mental health diagnosis. Two adjusted models were created, and model #1 fit the data best. In the multivariable model #1, factors independently associated with cannabis use in the previous 12 months were the following: age < 64 years (age < 44 years OR = 3.96 [95% CI:1.65–9.53]; age 45–64 years OR = 2.72 [95% CI:1.65–4.47]); tobacco use in the previous 6 months (OR = 1.91 [95% CI: 1.18–3.07]); having someone in one's primary social group who smokes cannabis (OR = 4.17 [95% CI:2.73–6.38]); and history of a mental health diagnosis (OR = 1.82 [95% CI: 1.19–2.79]).

Perceptions of cannabis use

Compared to non-users, those who had used cannabis in the past 12 months were more likely to perceive cannabis as being safe to use, including for those with heart disease (Mann-Whitney $U = 52252.50$; $n_1 = 936$; $n_2 = 148$; $P < 0.001$, two-tailed). Cannabis users were also more likely to support the legalization of cannabis (Mann-Whitney $U = 36398.50$; $n_1 = 933$; $n_2 = 150$; $P < 0.001$, two-tailed) and to report that they intended to increase their cannabis use now that it had been legalized ($X^2 = 35.22$; $P < 0.001$).

Table 3. Patterns of use among participants who had used cannabis in the past 12 months (n = 150)

	Variable	n (%), unless otherwise stated
Sex	Male	110 (73.3)
	Female	40 (26.7)
Age group, y	≤ 44	18 (12.0)
	45–64	86 (57.3)
	≥ 65	46 (30.7)
Age first tried cannabis, y, mean (SD)		31.0 (57.1)
Primary form of cannabis used	Missing	7
	Smoking or vaping	84 (59.6)
	Edibles	41 (29.1)
	Concentrates or topicals or pills or other	16 (11.3)
Smoked cannabis in the past 12 mo (vaping not included)	Missing	9
	Yes	99 (67.8)
	No	47 (32.2)
Consumed edible cannabis in the past 12 mo	Missing	4
	Yes	65 (44.5)
	No	81 (55.5)
Frequency of cannabis use	Missing	4
	Everyday	68 (47.2)
	Every 2–3 days	10 (6.9)
	Once a week	16 (11.1)
	Once or twice a month	15 (10.4)
	Less than once a month	35 (24.3)
Main reason for cannabis use	Missing	6
	Nonmedical use (recreational)	67 (46.5)
	Medical use without a prescription	41 (28.5)
	Both medical and nonmedical use	23 (16.0)
	Medical use with a prescription	13 (9.0)
Specific reasons for using cannabis	Missing	6
	For enjoyment/fun or social reasons	76 (53.9)
	To alleviate pain	48 (34.0)
	For relaxation or to manage anxiety or to relieve stress	48 (34.0)
	To help sleep	37 (26.2)
Driven a motor vehicle within 2 h of using cannabis, in past 12 mo	Missing	9
	Yes	20 (14.0)
	No	123 (86.0)
Ever used cannabis and tobacco together	Missing	7
	Yes	45 (31.5)
	No	98 (68.5)
Tobacco use previous 6 mo	Missing	7
	Yes	47 (31.5)
	No	102 (68.5)
Has a healthcare provider ever asked about your cannabis use?	Missing	1
	Yes	68 (49.6)
	No	69 (50.4)
Should a healthcare provider ask about your cannabis use?	Missing	13
	Yes	102 (70.8)
	No	24 (16.7)
	I don't know	18 (12.5)
Intention to quit or reduce cannabis in the next 6 mo	Missing	6
	Yes, planning to quit or reduce	21 (14.7)
	Recently quit	34 (23.8)
	No plans to quit or reduce	88 (61.5)
Increased personal cannabis use since legalized in Canada	Missing	7
	Yes	39 (27.5)
	No	103 (72.5)
Knowledge of THC content in one's cannabis	Missing	8
	Knows dose	40 (28.4)
	Does NOT know dose	101 (71.6)
Knowledge of CBD content in one's cannabis	Missing	9
	Knows dose	24 (16.7)
	Does NOT know dose	120 (83.3)
Knowledge of cannabis dose in one's edibles	Missing	6
	Knows dose	23 (33.3)
	Does NOT know dose	46 (66.7)
Knowledge of strain(s) of cannabis used	Missing	12
	Does not use edibles	69
	Knows strain used	61 (44.2)
Number of reported higher-risk cannabis-use behaviours per LRCUG, mean (SD)	Does NOT know strain used	77 (55.8)
	Missing	12
		2.3 (1.2)

CBD, cannabidiol; LRCUG, lower-risk cannabis-use guidelines; SD, standard deviation; THC, tetrahydrocannabinol.

Patterns of cannabis use

Table 3 presents the characteristics of cannabis users. Among all cannabis users, nearly half reported using cannabis daily. Over two-thirds reported smoking cannabis, and nearly half reported using edibles. Smoking and vaping were the primary means of cannabis delivery. Although half reported using cannabis principally for recreational purposes, almost 30% reported using it for medical reasons without a prescription, and 9.0% reported having a prescription. For pain relief, to relax or to relieve stress and anxiety, and to aid sleep were the most reported reasons for cannabis use. Over 44% (n = 63) reported a history of tobacco and cannabis co-use (ever use and past 6-month use).

Over one-quarter of cannabis users (n = 39) reported that they had increased their consumption since cannabis became legalized. Nearly all cannabis users (96.7%) reported at least one higher-risk behaviour as per the LRCUGs.

Over 71% (n = 101) of patients did not know the dose of THC in their cannabis, and 83.3% did not know the dose of CBD, and > 55% did not know what strain(s) of cannabis they used (Indica, Sativa, Hybridized) or whether it was synthetic.

Most cannabis users (61.5%) indicated that they did not want to quit or reduce cannabis use in the next 6 months. When intentions to quit were stratified by patients' main reason for using cannabis, 76.9% of patients (10 of 13) who use cannabis for medical reasons with a prescription had no intentions to quit in the next 6 months, vs 60.0% of recreational users (26 of 65), 60.0% of those using cannabis for medical reasons without a prescription (24 of 40), and 60.9% of those using cannabis for both recreational and medical purposes (14 of 23).

Discussion

To our knowledge, this evaluation provides the first description of patterns of cannabis use among Canadian cardiac inpatients. The prevalence of cannabis use in the previous 12 months among our sample was approximately 14%, with nearly half using cannabis daily. Cardiac patients who used cannabis were most likely to smoke or vape their cannabis and were, on average, 9 years younger than patients who did not use cannabis. Compared to Canada's LRCUGs, 96.7% of cannabis users reported ≥ 1 higher-risk use behaviour (mean = 2.3, standard deviation = 1.2). Over 60% of cannabis users expressed no intention to quit or reduce cannabis use in the next 6 months. The majority (70.8%) felt that healthcare providers should be discussing cannabis use with patients, despite only half of patients reporting ever being asked if they use cannabis.

Cannabis use rates in cardiac patients may be up to 10% higher than rates reported by Canadians of the same age group in the general population.²⁴ In the third quarter of 2019, the Canadian National Cannabis Survey found that 24.8% (95% CI 22.7%-27.1%) of Canadians aged 25-44 years, and 10.3% (95% CI 9.1%-11.5%) of Canadians aged 45-64 years were current cannabis users (past-3-month use), compared to 36.7% (95% CI 24.3%-50.7%) and 20.3% (95% CI 16.7%-24.3%) in our corresponding age groups, respectively.²⁶ Given the small sample size, different period prevalence

(3 vs 12 months), and the larger confidence intervals in our cardiac sample, no definitive conclusions can be drawn.

Factors independently associated with cannabis use in our sample were as follows: being younger than 65 years; having used tobacco in the previous 6 months; having someone in one's primary social group that smokes cannabis; and having a history of a mental health diagnosis. These findings are consistent with the CCS, which has repeatedly found that Canadians who use cannabis tend to be younger.²⁷⁻³¹ Many studies also have found an association between tobacco use and cannabis use.³²⁻³⁴ The influence of social environments was observed in the 2020 Canadian National Cannabis Survey, which found that 72% of Canadians who reported using cannabis in the past 12 months had someone in their household who also used cannabis, compared to only 10% of Canadians who had not used cannabis.²⁷ The association between cannabis use and certain mental health diagnoses has been well-documented; a recent Canadian study found that over half of those who used cannabis reported doing so to manage symptoms of mental health issues, particularly those with bipolar disorder (90.8%) and posttraumatic stress disorder (90.7%).³⁵

When the cannabis use characteristics reported among our cardiac inpatient sample were compared to Canada's LRCUGs,¹⁵ nearly all patients had at least one higher-risk use behaviour. This finding is similar to findings of Goodman et al.,³⁶ who examined adherence to LRCUGs in the general population and found that 88.8% of cannabis users reported one or more higher-risk use behaviours. In our sample, over 54% of users consumed cannabis more than once per week, and nearly half were daily users. Any use level above once per week is considered high-risk use, per the LRCUGs.^{15,16} In comparison, according to the 2019 and the 2020 CCS, only 18% of Canadian cannabis users in the general population reported using cannabis daily.^{27,31} The most hazardous method of consumption is to smoke cannabis,^{9,37} the primary form of consumption in over two-thirds of our sample. We also noted that certain misperceptions and knowledge gaps regarding cannabis were present in our patient population and may pose additional risks and challenges. The safety of cannabis use, including for those with heart disease, was perceived as significantly greater by patients who had used cannabis in the previous 12 months compared to non-users. This finding is in contrast with the mounting evidence of the cardiac risks associated with cannabis use.^{1,2,4} Users demonstrated little knowledge of the dose or proportion of THC and CBD in their cannabis products, or of the strain of cannabis being consumed. Overall, our survey findings suggest that cardiac inpatients are engaging in a variety of higher-risk cannabis-use behaviours, which suggest a potential need for patient education around lower-risk use of cannabis. The 2020 Scientific Statement from the American Heart Association¹⁰ also supports these conclusions and recommends increased education about cannabis for patients and clinicians.

It is unclear what would constitute safe or lower-risk cannabis use for an individual with CVD. A 2022 update to the LRCUGs³⁸ has added a recommendation (#11) specifying that those with CVD may be at risk of acute harm from cannabis use, should avoid inhaling high-potency cannabis, and potentially should avoid using cannabis altogether. The

type of cannabinoid ingested, be it THC or CBD, may also affect risk for patients with cardiovascular issues. THC, especially high-potency THC, appears to have negative effects on the cardiovascular system.³⁸⁻⁴⁰ Yet very preliminary findings (case-report, observational studies, anecdotal evidence) suggest that CBD could have positive cardiovascular effects.⁴⁰ When determining what level of cannabis use is safe or lower risk for patients with CVD, one also must determine how cannabis interacts with cardiovascular drugs. Preliminary evidence suggests that cannabis may interact with a variety of cardiovascular medications.¹⁰ Overall, further research is needed to develop comprehensive guidance relating to the safe use of cannabis for cardiac patients.

The prevalence of cigarette and cannabis co-use among our sample of cardiac inpatients, was slightly lower than the co-use prevalence among a sample of cannabis users from the general population in Ontario (31.5% vs 41.7%),⁴¹ yet the prevalence of mixing tobacco with cannabis was nearly identical (31.1% [95% CI 24.3%-39.4%] vs 31.1% [95% CI 27.0%-35.9%]). The lower percentage of co-use in our sample may be due to the lower prevalence of tobacco use in the Ottawa area (14.6%), compared to that in the rest of Ontario (16.9%).⁴² The rate of tobacco use among cannabis users was much higher than that among non-users of cannabis in our cardiac inpatient population (31.3% vs 10.9%). A recent observational cohort study of > 35,000 patients seeking tobacco-cessation treatment in Ontario, Canada found that cannabis users were 15% less likely to quit tobacco smoking than were cigarette smokers who did not co-use cannabis (OR 0.85, 95% CI 0.77-0.93).⁴³ Our group found similar results in a recent tobacco-cessation evaluation among hospital inpatients: cannabis use was the strongest predictor of not being able to quit tobacco smoking.⁴⁴ A recent meta-analysis and narrative review of 20 studies (12 randomized controlled trials and 8 uncontrolled trials) showed weak evidence for the effectiveness of single- or multi-substance interventions for tobacco and/or cannabis cessation.⁴⁵ Given that tobacco smoking remains the most important modifiable risk factor for primary and secondary prevention of cardiovascular events, more high-quality evidence is needed to determine what interventions may be most effective at helping co-users with smoking cessation. Furthermore, cannabis use may impact other CVD risk factors (ie, physical activity, alcohol use, mental health, healthy eating). More research is needed to understand the relationships between cannabis use and these modifiable risk factors.

Over half of our patients (50.4%) reported that no healthcare provider had ever asked them about their cannabis use; 70.8% of our patients felt that healthcare providers should do so. However, over 60% indicated that they had no intention to quit or reduce cannabis use in the next 6 months. These findings suggest a window of opportunity for healthcare providers to have discussions about cannabis use and provide patients with education and support or referral to cessation services.

Limitations

A cross-sectional survey design was used, as this design is ideal for measuring prevalence, although no causal conclusions can be derived. Attempts were made to minimize interviewer bias by providing training to interviewers and developing a

standardized protocol for survey administration. To reduce sampling bias, a patient census was used to contact a consecutive series of patients, and eligibility criteria were made as broad as possible. Future surveys should consider the use of interpreters to capture responses from patients who do not speak English or French. A possible limitation is that non-responders were significantly and systematically different than responders. Nonresponse bias was minimized by attempting to reach patients when they were in the hospital and at least 5 times via telephone, postdischarge, and by clearly explaining the purpose of the evaluation survey. A high response rate of 73.0% was achieved.

Most responses were self-reported. Studies that have examined the sensitivity and specificity of self-reported cannabis use have found that the sensitivity of self-report of cannabis use, compared to biochemical verification, ranges from 33.9% (prenatal cannabis use)⁴⁶ to 85.7%⁴⁷ and that specificity ranges from 84%⁴⁸ to 99%.⁴⁹ Overall, the literature supports self-report measures of cannabis use in epidemiologic studies. Patients may not have admitted to using cannabis; thus, the survey results may underestimate the prevalence and characteristics of cannabis use. However, “misreporting” rates likely have improved post-legalization.

This evaluation was conducted at one highly specialized tertiary-care cardiac hospital, in Eastern Ontario, Canada, among cardiac inpatients. Due to the single-site design and small sample size, application of these results to other patient populations in other geographic locations should be done with caution.

Conclusion

Cannabis use is prevalent among cardiac patients. Cardiac inpatients who use cannabis are significantly younger than patients who do not use cannabis, and the prevalence among cardiac patients may be higher than that among age-matched people in the general population. Many patients are not following lower-risk-use guidelines, have significant knowledge gaps related to cannabis, and have a low level of intention to quit. Given the known cardiovascular effects of cannabis use, an important approach for health providers is to systematically ask patients about their cannabis use and, when possible, provide education about lower-risk use. Further work is necessary to better understand the combined effects of THC and CBD on the cardiovascular system, and to develop better guidelines, educational tools, and, potentially, interventions for cardiac patients who use cannabis.

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Supplementary Material

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