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Study Design

Cannabis Use: A New Risk Behaviour Among Adults With Congenital Heart Disease

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ABSTRACT

Background: Cannabis use has increased in Canada and can be associated with adverse cardiovascular events. Given increased use and accessibility to cannabis, there is a need among clinicians to

RÉSUMÉ

Contexte : La consommation de cannabis, en hausse au Canada, a été associée à des manifestations cardiovasculaires indésirables. Puisque l'usage et la disponibilité du cannabis ont augmenté, il est

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Cannabis use has been on the rise in Canada with reports that 377,024 Canadians were registered to purchase medical cannabis as of September 2020, an increase of 24% from June 2020. During the COVID-19 pandemic, there has been a decrease in active client registrations to 247,548 in March

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better understand cannabis use in adults with congenital heart disease.

Methods: A cross-sectional survey (May to September 2018) was used to investigate cannabis use among 252 patients with adult congenital heart disease in a quaternary care centre.

Results: Of the 252 patients, 53 (21%) reported using cannabis. The majority of cannabis users were men (62%), between the ages of 25 and 39 years (mean age = 32 ± 16 years), and more likely to use tobacco (n = 9, 17%; *P* = 0.001) and alcohol (n = 37, 60%; *P* = 0.001). Significant differences (*P* = 0.011) were found between the age of onset for tobacco use among cannabis users (mean age: 16 ± 8 years) and non-cannabis users (mean age: 20 ± 3 years). Users reported consuming cannabis for recreational purposes (n = 29, 55%), anxiety (n = 22, 42%), depression (n = 15, 28%), and pain management (n = 4, 8%).

Conclusions: This study supports our clinical experience that a high proportion of patients with adult congenital heart disease use cannabis. Cannabis users represent a patient population who may demonstrate less optimal health behaviours, including tobacco and alcohol use. Assessment of cannabis use should be an integral part of risk behaviour and cardiovascular risk profile at each clinic visit. Given the current legalization of cannabis in Canada and the growing increase of cannabis use, educational support should be provided to patients and caregivers.

nécessaire pour les cliniciens de mieux comprendre cet usage chez les adultes qui présentent une cardiopathie congénitale.

Méthodologie : Nous avons mené une enquête transversale (mai à septembre 2018) sur l'usage du cannabis auprès de 252 adultes atteints d'une cardiopathie congénitale dans un centre de soins quaternaires.

Résultats : Cinquante-trois patients sur 252 (21 %) ont indiqué consommer du cannabis. Les utilisateurs de cannabis étaient en majorité des hommes (62 %), ils étaient âgés de 25 à 39 ans (âge moyen de 32 ans ± 16), et ils étaient plus susceptibles de consommer du tabac (n = 9; 17 %; *p* = 0,001) et de l'alcool (n = 37; 60 %; *p* = 0,001). Une différence significative a été notée entre l'âge au moment de commencer l'usage de tabac chez les utilisateurs de cannabis (âge moyen de 16 ± 8 ans) et chez les non-utilisateurs (âge moyen de 20 ± 3 ans). Les personnes consommaient du cannabis pour un usage récréatif (n = 29; 55 %), ou pour la prise en charge de l'anxiété (n = 22; 42 %), de la dépression (n = 15; 28 %) ou de la douleur (n = 4; 8 %).

Conclusion : Notre étude corrobore notre expérience clinique, selon laquelle une proportion importante des adultes atteints d'une cardiopathie congénitale consomment du cannabis. Les patients qui font usage de cannabis constituent une population qui pourrait adopter des comportements moins favorables pour la santé, comme la consommation d'alcool et de produits de tabac. Une évaluation de l'usage de cannabis devrait faire partie intégrante du profil de comportements à risque et du risque cardiovasculaire réalisé à chacune des visites des patients. Étant donné la légalisation du cannabis au Canada et l'augmentation constante de son usage, un soutien éducatif devrait être offert aux patients et à leurs proches.

2022.[1] In the first quarter of 2019 when cannabis became legal, 646,000 Canadians reported trying cannabis for the first time; this number has doubled from 327,000 in 2018.[2] Not only have these numbers risen in the general Canadian population but they have also been reported among adults with congenital heart disease (CHD). The APPROACH-IS explored health behaviours among 4028 adults with CHD across 15 countries that included substance use such as cannabis, amphetamine, and cocaine.[3,4] It also described the prevalence of cigarette smoking and cannabis consumption and co-use in adults with CHD along with quantifying their differential effect. Substance use is not uncommonly seen in individuals with CHD, and cannabis use has been identified as the most prevalent in North America.[4] Interestingly, Canada was the leading country with 11.9% of the adults with CHD who used cannabis, and Canada had the highest prevalence for cannabis use (19% of men and 4% of women).[3,4]

Although it is rising in use, cannabis is known to cause negative side effects such as emotional or sexual dysfunction, vision problems, and fatigue.[5] One study on cannabis use in adolescents documented impaired performance in adulthood and long-lasting deficits in both visual and spatial short-term working memories,[6] whereas others have noted that cannabis use has been beneficial in some chronic pain and cancer management cases.[7-11] There are various forms of cannabis: dry cannabis—any part of a cannabis plant that has been subjected to a drying process, other than seeds; cannabis oil—extracted from the cannabis plant and made into an oil that is usually not psychoactive; ingestible cannabis—cannabis ingested by eating or drinking; and vapour cannabis—ingestion of cannabis by gases and airborne particulates by using an inhalation device.

Importantly, cannabis use is associated with serious adverse cardiovascular side effects including elevated blood pressure, increased sympathetic stimulation, arrhythmias, increase in oxygen demand of the myocardium, and increased risk of a myocardial infarction.[12,13] The hazard of death among cannabis users was twice among patients presenting with first myocardial infarction even after adjusting for tobacco use.[14] In addition, Khanji et al.[15] found that regular use of cannabis was associated with adverse changes in left ventricular size and subclinical dysfunction compared with those who rarely or never used cannabis.

Adults with CHD are a vulnerable patient population who are at increased risk for cardiovascular events. Guidelines suggest that CHD clinicians provide education on health behaviours including unsafe substance use, cigarette smoking, heavy alcohol consumption, and recreational drug use including cannabis.[16,17] There are limited data about the use of cannabis among the population with adult CHD (ACHD) although there is growing interest.

The purpose of this study was to determine the prevalence of cannabis use and understand the characteristics and knowledge of cannabis in adults with CHD followed at a large Canadian tertiary care centre.

Methods

Participant information and recruitment

Participants were English-speaking adults with CHD and routine outpatient follow-up at the Toronto ACHD Program. During this 5-month recruitment period from May to

Table 1. Demographic and clinical characteristics of the study population

Variable	Study population (N =252)	Non-cannabis users (n = 199) (79%)	Cannabis users (n = 53) (21%)	*P* value
Age (y)				
Mean	37 ± 16	39 ± 16	32 ± 14	0.097
Sex, n (%)				0.640
Men	139 (55)	106 (53)	33 (62)	
Women	108 (43)	89 (45)	19 (36)	
Type of heart defect, n (%)				0.962
Simple	16 (6)	12 (6)	4 (8)	
Moderate	82 (33)	64 (32)	18 (34)	
Great	48 (19)	38 (19)	10 (19)	
Nonclassified	106 (42)	85 (43)	21 (40)	
Education, n (%)				0.190
High school or less	81 (32)	56 (28)	24 (45)	
University	139 (55)	111 (56)	28 (53)	
College	31 (12)	30 (15)	1 (2)	
Graduate degree or greater	—	—	—	
Marital status, n (%)				0.745
Single	121 (48)	97 (49)	24 (45)	
Married/partner	121 (48)	93 (47)	28 (53)	
Divorced	9 (4)	8 (4)	1 (2)	
Tobacco use, n (%)	20 (8)	11 (6)	9 (17)	0.001
Alcohol use, n (%)	137 (54)	100 (50)	37 (60)	0.011
Illicit drug use, n (%)	2 (1)	1 (0.5)	1 (2)	0.167

The table includes missing values and answers were not provided; types of heart defects include defects of simple, moderate, and great complexity; other heart defects include congenital heart defects that could not be classified based on information provided by participants. The *P* value describes the statistical difference between the cannabis and non-cannabis users.

September 2018, patients attending the clinic were randomly asked to participate in a research study. A convenience sampling method was completed to enhance feasibility. Eligible patients who volunteered to participate were recruited until the desired sample size of 252 was achieved. A sample size was chosen to ensure that our data reflected a representative sample and based on the study by Chong et al.,[8] who used a similar approach to better understand cannabis use among a chronic disease population in young adults with multiple sclerosis. If interested, patients completed the one-time survey on their own time in the clinic while waiting for their appointment. All surveys were anonymous to preserve privacy and to achieve a higher response rate; they were collected by the research assistant in a secure envelope at the end of their visit.

Types of heart defect (a response on the demographic portion of the questionnaire) were classified into 3 categories: simple, moderate, and great complexity.[18] The participants were divided into groups based on age: age 18-24 years, age 25-39 years, age 40-54 years, age 55-69 years, and age ≥70 years.

Questionnaire development

Participants were asked to complete demographic questions consisting of sex, type of heart defect, education, marital status, tobacco use, alcohol use (including number of drinks a day), drug use, cannabis use, and age. Review of the literature had found that the focus for most questionnaires regarding cannabis use was on the aspect of cannabis use disorders. Questionnaires presently available such as the Cannabis Abuse Screening Test and the Cannabis Use Disorders Identification Test-Revised were reviewed.[19,20] The questionnaire was developed by reviewing surveys that have been used in the literature to explore patterns of cannabis use, as well as input and feedback from our clinical staff and researchers. This questionnaire was created for the purpose of the study using content experts and congenital clinic staff who reviewed the survey. It was piloted on nonenrolled patients for ease of use, comprehension, and content. The questionnaire contained a total of 38 questions (Supplemental Appendix S1) and took approximately 5 minutes to complete.

Statistical analysis

Before the data were analysed, they were screened for missing and implausible data using frequencies. Visual inspection confirmed that there were no cases of missing data. Skewness and kurtosis values were calculated to check for indicators of deviations from the assumption of normality, and all fell within the acceptable range of +3 to −3. For the Pearson χ^2 tests, categories were examined to determine if there was an appropriate sampling distribution. In cases where less than 5% of the data still existed within these categories for 2 × 2 contingency tables, a Fisher's exact test was used to

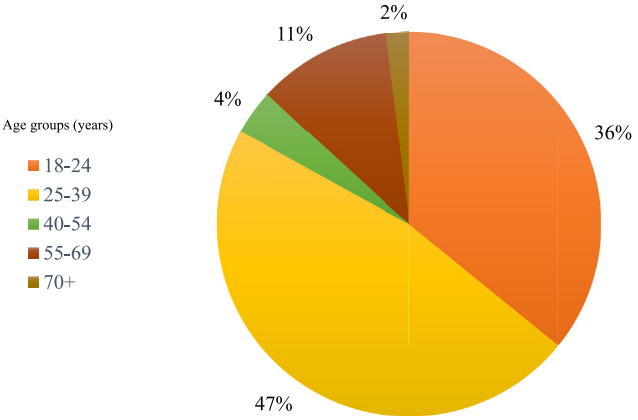

Figure 1. Cannabis use by age group.

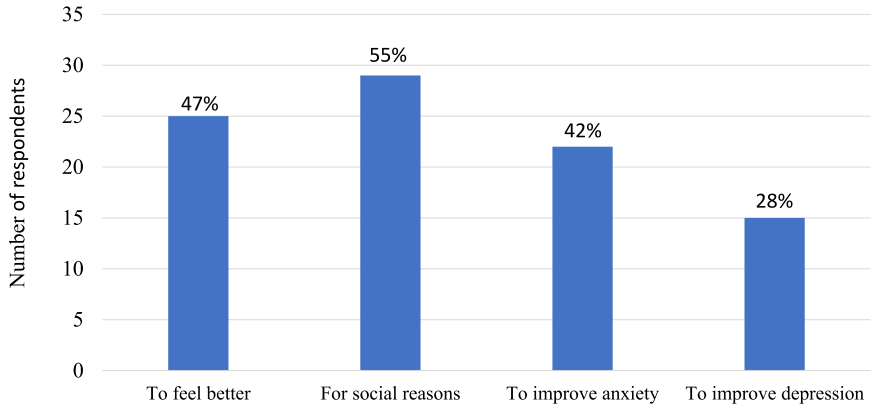

Figure 2. Reasons for consumption of cannabis in the cannabis users (n = 53).

report the significance statistic. A *P* value of ≤0.05 was used to determine significance.

Means and standard deviations were calculated to provide descriptive information for continuous variables. A series of Pearson χ^2 tests were conducted on categorical data. If less than 5% of the data existed (in contingency tables of 2 × 2), a Fisher's exact test was used, whereby in contingency tables greater than 2 × 2, a Fisher-Freeman-Halton test was used. A series of 7 χ^2 tests were used to examine the categorical data for cannabis use, tobacco use, and age. Treatment of missing data was screened visually by reviewing frequency tables for any implausible data.

Results

A total of 280 adults with CHD were approached in the outpatient clinic of the Toronto ACHD Program; 252 (90%) of them agreed to participate and were prospectively recruited for this cross-sectional study. Table 1 describes demographic and clinical characteristics of the entire study population and non-cannabis users and cannabis users, respectively.

The prevalence of cannabis use was 21% (n = 53) and that of alcohol use was 54% (n = 137). Participants consisted of men (n = 139, 55%) and women (n = 108, 23%). The majority of patients had a CHD of at least moderate complexity (moderate: n = 83, 33%; great: n = 48, 19%). In 106 patients (42%), the CHD could not be categorized because of inaccurate information provided on the questionnaire (Table 1).

The majority of participants who identified themselves as cannabis users were men (n = 33, 62%) and had obtained the university/college level of education (n = 29, 55%; Table 1). In the entire study population, there was no significant difference between cannabis users and non-cannabis users regarding age, sex, complexity of heart defect, education, and marital status (Table 1). Cannabis users (n = 25, 47%) were 25-39 years of age, compared with 18-24 (n = 19, 36%), 40-54 (n = 2, 4%), 55-69 (n = 6, 11%), and ≥70 (n = 1, 2%) years of age (Fig. 1).

Among cannabis users (n = 53, 21%), the participants used dry cannabis (n = 45, 85%), compared with oil (n = 17, 32%), ingestible (n = 22, 42%), and vapour (n = 17, 32%).

Participants reported using cannabis occasionally (n = 19, 36%) and after 1 hour of waking (n = 24, 46%). In addition, they reported using cannabis to feel better (n = 25, 47%), for social reasons (n = 29, 55%), to reduce pain (n = 20, 38%), improve anxiety (n = 22, 42%), and improve depression (n = 15, 28%) (Fig. 2). Four (7.5%) participants reported using cannabis on hospital premises, whereas 17 (32%) reported seeking early discharge to go home and use cannabis.

Cannabis users started drinking alcohol and smoking tobacco at a younger age compared with non-cannabis users (*P* = 0.05) (Table 2). Cannabis users are consuming significantly more alcoholic drinks per day than non-cannabis users (*P* = 0.001) and are significantly younger than non-cannabis users (Table 3).

Various participant perspectives were found regarding cannabis availability and knowledge, including visiting a licensed cannabis provider, seeking cannabis from unlicensed providers, being aware of types of cannabis/tetrahydrocannabinol, and being educated about cannabis before consumption (Table 4).

Table 2. Age of onset for cannabis use and tobacco use

	df	N	χ^2	*P* value	OR
Cannabis use					
Tobacco use	1	252	8	0.011	4.0
Alcohol use	1	252	6	0.01	3.0
Tobacco use					
Alcohol use	1	252	4	0.05	3.0
Age (y)					
Heart defect type	12	252	25	0.015	–
Alcohol use	4	252	7	0.142	–
Drug use	12	252	19	0.102	–
Cannabis use	4	252	15	0.005	–

The table presents χ^2 tests comparing cannabis use, tobacco use, and age with other categories. Age is grouped into cohorts of 18-24, 25-39, 40-54, 55-69, and ≥70 years of age.

df, degree of freedom; OR, odds ratio.

Table 3. Age and alcohol consumption for cannabis and non-cannabis users

Variable	Cannabis users	Non-cannabis users	*P* value
Age, mean (y)	32 ± 14	39 ± 17	0.05
Mean number of alcoholic drinks a day	3.0	1.00	0.001

Table 4. Study participants' perspectives regarding cannabis availability, source of cannabis, and knowledge of the specific strain/THC level

Variable	df	N	χ^2	*P* value	OR
Do you think health insurance should cover cannabis costs in Ontario	1	226	4	0.054	2.0
Do you visit a licensed cannabis producer	1	74	6	0.012	6.0
Have you ever sought cannabis from an unlicensed producer	1	132	52	0.000	21.0
Are you aware of the strain or THC levels in the type of cannabis you use	1	64	4	0.035	4.0
Did you research/educate yourself on the different strains/THC levels of cannabis, or the cannabis sold by a licensed producer before consumption	1	66	8	0.006	6.0

df, degree of freedom; OR, odds ratio; THC, tetrahydrocannabinol.

Discussion

Given the increased availability and acceptability of cannabis use, improved comprehension of the "why" for use may help clinicians to better care for their patients with ACHD. Our study identified that cannabis use among patients with ACHD followed at a quaternary care centre is quite common (21% of the study population). Patients with ACHD reported using cannabis for a variety of reasons, such as to feel better and for social reasons. Contrary to our assumption, we found that fewer patients with ACHD identified using cannabis to help with anxiety or depression than for social or overall well-being reasons. Cannabis users were younger than those who did not use cannabis. Furthermore, cannabis users started using tobacco 4 years earlier than non-cannabis users. This finding is consistent with 2 recent studies, which reported a relationship between cannabis and tobacco use.[3,4] Cannabis use was most prevalent (19% of men, 4% of women patients) in Canada, whereas the frequency of co-use of cannabis and tobacco was highest in Switzerland, France, and Canada among this large multicentre study from across 15 countries.[4] Co-use of cannabis and tobacco is known to be associated with increased dependence on tobacco and cannabis, mental health challenges, higher cancer risk, and decreased cessation outcomes.[4] Importantly, Moons et al.[4] found that the effect of co-use had a moderate negative effect on mental health in a population known to have a higher prevalence of anxiety and depression.[21] This study emphasizes the importance of risk assessment behaviour during routine ACHD follow-up visits because the use of cannabis or co-use of drugs may have a harmful effect on mental health in a vulnerable patient population who is already often at higher risk for underlying mental health issues such as anxiety or depression. It also highlights the importance of increased awareness of common cannabis use in patients with ACHD and the need to provide education about cannabis to health care providers and their patients. This study emphasizes the importance of specifically providing education to patients about any potential harm of cannabis use.

Future studies should seek to explore the impact of cannabis use not only among patients but also among family, friends, and caregivers. Educational tools about cannabis use should be available for patients and health care providers to highlight the impact of cannabis use on mental and physical health and co-use of other harmful substances.

Limitations

Results from this study are only generalizable to adults with CHD followed at a Canadian specialized ACHD centre who represent our population of interest. In addition, 252 respondents may not reflect the true prevalence of cannabis use in the population with ACHD given the total volume of patients followed in our centre, and all biases may have not been addressed (eg, ethnicity and socioeconomic status). Cannabis users might have been more interested in completing the survey that may introduce a selection bias.

Individuals tend to under-report health risk behaviours, meaning those who participated in our study may have under-reported their cannabis use.[22] The survey was available only in English. Because our congenital population tends to be a younger population, even though for some of our patients English may not be their primary language, the vast majority communicates in English, and the need for a translator is the exception so that a negligible number of patients are excluded from participation in the study.

At times, participants seemed unclear how to respond to "type of heart problem" or were not able to name their CHD in our questionnaire, which made it difficult to categorize the complexity of CHD. This highlights gaps in patient education about their chronic CHD. A more defined list of heart defects could have been provided to participants to indicate their type of heart problem.

Conclusions

This study supports our clinical experience that a high proportion of patients with ACHD use cannabis with potential impact on physical and mental health. Cannabis users represent a vulnerable patient population who at times demonstrate less optimal health behaviours, such as tobacco and alcohol use. Most patients use cannabis for recreational purposes and co-use it with tobacco. Assessment of cannabis use should be an integral part of risk behaviour and cardiovascular risk profile at each clinic visit. Given the current legalization of cannabis in Canada and the growing increase of cannabis use, educational support should be provided to patients and caregivers.

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Ethics Statement

Research ethics approval was obtained by the University Health Network Research Ethics Board for the study (REB CAPCR ID: 17-6143).

Patient Consent

Informed consent was obtained by a trained research assistant who was not a part of the patient's standard of care in order to minimize any undue influence to participate.

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Disclosures

The authors have no conflicts of interest to disclose.

References

1. Government of Canada. Data on cannabis for medical purposes. Available at: https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/research-data/medical-purpose.html. Accessed December 22, 2022.
2. Statistics Canada. National Cannabis Survey, first quarter; 2019. Available at: https://www150.statcan.gc.ca/n1/daily-quotidien/190502/dq190502a-eng.htm. Accessed December 22, 2022.
3. Holbein CE, Peugh J, Veldtman GR, et al. Health behaviours reported by adults with congenital heart disease across 15 countries. *Eur J Prev Cardiol*. 2020;27:1077–1087.
4. Moons P, Luyckx K, Kovacs AH, et al. Prevalence and effects of cigarette smoking, cannabis consumption, and co-use in adults from 15 countries with congenital heart disease. *Can J Cardiol*. 2019;35:1842–1850.
5. Ware MA, Adams H, Guy GW. The medicinal use of cannabis in the UK: results of a nationwide survey. *Int J Clin Pract*. 2005;59:291–295.
6. Renard J, Vitalis T, Rame M, et al. Chronic cannabinoid exposure during adolescence leads to long-term structural and functional changes in the prefrontal cortex. *Eur Neuropsychopharmacol*. 2016;26:55–64.
7. Savage SR, Romero-Sandoval A, Schatman M, et al. Cannabis in pain treatment: clinical and research considerations. *J Pain*. 2016;17:654–668.
8. Chong MS, Wolff K, Wise K, et al. Cannabis use in patients with multiple sclerosis. *Mult Scler*. 2006;12:646–651.
9. Manchikanti L, Cash KA, Damron KS, et al. Controlled substance abuse and illicit drug use in chronic pain patients: an evaluation of multiple variables. *Pain Physician*. 2006;9:215–225.
10. Clark AJ, Ware MA, Yazer E, Murray TJ, Lynch ME. Patterns of cannabis use among patients with multiple sclerosis. *Neurology*. 2004;62:2098–2100.
11. Ware MA, Doyle CR, Woods R, Lynch ME, Clark AJ. Cannabis use for chronic non-cancer pain: results of a prospective survey. *Pain*. 2003;102:211–216.
12. Mittleman MA, Lewis RA, Maclure M, Sherwood JB, Muller JE. Triggering myocardial infarction by marijuana. *Circulation*. 2001;103:2805–2809.
13. DeFilippis EM, Bajaj NS, Singh A, et al. Marijuana use in patients with cardiovascular disease: JACC review topic of the week. *J Am Coll Cardiol*. 2020;75:320–332.
14. DeFilippis EM, Singh A, Divakaran S, et al. Cocaine and marijuana use among young adults with myocardial infarction. *J Am Coll Cardiol*. 2018;71:2540–2551.
15. Khanji MY, Jensen MT, Kenawy AA, et al. Association between recreational cannabis use and cardiac structure and function. *JACC Cardiovasc Imaging*. 2020;13:886–888.
16. Baumgartner H, De Backer J, Babu-Narayan SV, et al. 2020 ESC Guidelines for the management of adult congenital heart disease. *Eur Heart J*. 2021;42:563–645.
17. Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2019;73:e81–e192.
18. Warnes CA, Liberthson R, Danielson GK, et al. Task force 1: the changing profile of congenital heart disease in adult life. *J Am Coll Cardiol*. 2001;37:1170–1175.
19. 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.
20. Legleye S, Karila L, Beck F, Reynaud M. Validation of the CAST, a general population Cannabis Abuse Screening Test. *J Subst Use*. 2007;12:233–242.
21. Kovacs AH, Saidi AS, Kuhl EA, et al. Depression and anxiety in adult congenital heart disease: predictors and prevalence. *Int J Cardiol*. 2009;137:158–164.
22. Gerritsen M, Berndt N, Lechner L, et al. Self-reporting of smoking cessation in cardiac patients: how reliable is it and is reliability associated with patient characteristics? *J Addict Med*. 2015;9:308–316.

Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Pediatric and Congenital Heart Disease* at https://www.cjcpc.ca// and at https://doi.org/10.1016/j.cjcpc.2023.09.001.