Cannabis Use During the COVID-19 Pandemic in Canada: A Repeated Cross-sectional Study

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**Objectives:** In the context of the ongoing coronavirus disease pandemic in Canada, we aimed to (1) characterize trends in cannabis use in the overall population; and (2) characterize patterns of and identify risk characteristics associated with an increase in cannabis use among those who used cannabis.

**Methods:** Data were obtained from three waves of an online, repeated cross-sectional survey of adults residing in Canada (May 08–June 23, 2020; N = 3012). Trends were assessed using Cochran-Armitage and chi-square tests, and risk characteristics were identified using logistic regression analyses.

**Results:** Cannabis use in the overall population remained stable during the months of May and June. Among those who used cannabis, about half increased their cannabis use compared to before the start of the pandemic. This proportion of an increase in cannabis use among those who used cannabis remained consistent across the survey waves. Risk characteristics associated with higher odds of an increase in cannabis use included residence in the central region (Odds ratio, 95% confidence intervals: 1.93, 1.03–3.62), being 18 to 29 years old (2.61, 1.32–5.17) or 30 to 49 years old (1.85, 1.07–3.19), having less than college or university education (1.86, 1.13–3.06) and being somewhat worried about the pandemic’s impact on personal finances (1.73, 1.00–3.00).

**Conclusions:** A large proportion of those who used cannabis have increased cannabis use during the pandemic, suggesting a need for interventions to limit increased cannabis use, policy measures to address cannabis-attributable harms, and continued monitoring of cannabis use during and after the pandemic.

**Key Words:** Canada, cannabis, COVID-19, marijuana, SARS-CoV-2

The severe acute respiratory syndrome coronavirus (SARS-CoV-2) is a zoonotic coronavirus, the causative agent responsible for the novel coronavirus disease (COVID-19) that is spreading rapidly across the globe. It has been declared a pandemic by the World Health Organization, given the severity of the outbreaks in several jurisdictions. More than 43 million confirmed cases and 1 million deaths have occurred as of October 27, 2020. The brunt of the burden of disease has been borne by the Region of Americas, and more specifically the United States, where 25,825 confirmed cases and 676 deaths per million people have been observed. In comparison to its southern neighbor, Canada has fared relatively better, with approximately 5726 confirmed cases and 264 deaths per million people.

Given the absence of pharmaceutical interventions, public health authorities across the globe have prioritized nonpharmaceutical interventions in response to the rising...
burden of disease. Prominent among such interventions are physical distancing restrictions, which reduce the contact rate by minimizing opportunities of person-to-person transmission, often involving closures of educational institutions, work from home, and cancellation of public gatherings and events. Despite their utility in reducing the contact rate, these restrictions are associated with substantial social and economic impacts, including increased time spent isolated and reduction or loss of employment. Such restrictions were enacted in March 2020 in Canada. However, as the incident cases decreased between May and June 2020 (11,200–2300 cases per week), several of these restrictions were eased, including permitting on-site work, opening of daycares and schools, allowing organized sport activities, opening of retail stores and dine-in restaurants and resumption of public gatherings (with restrictions on numbers).

As a consequence of the pandemic and these physical distancing restrictions, cannabis use may have increased due to additional stress and anxiety about the future, social isolation and loneliness, and changes in daily routines due to closures of nonessential workplaces. Indeed, cannabis use increased among those who used cannabis during the implementation of physical distancing restrictions in the European Union. There are indications that similar changes have occurred in Canada as well. An online survey conducted between March and April 2020 in Canada found that cannabis use increased among the overall population by 7%, with this increase most prominent in the younger age groups. Data on cannabis retail sales are consistent with these findings, as average monthly retail sales climbed from $151 million between December 2019 and February 2020 to $187 million between March and June 2020 in Canada. Despite these observations noted at the outset of the pandemic, patterns and risk characteristics associated with cannabis use, especially increase in cannabis use, during the pandemic are unclear. Understanding cannabis use during the pandemic is imperative for clinical practitioners and public health authorities in Canada.

In light of these critical knowledge gaps, we examined cannabis use during the ongoing pandemic between May and June 2020 in Canada. We aimed to: (1) characterize trends in cannabis use in the overall population, and; (2) characterize patterns of and identify risk characteristics associated with an increase in cannabis use among those who used cannabis.

METHODS

Data Source and Sample
Data were obtained from 3 waves of an online, repeated cross-sectional survey of adults (≥18 years) residing in Canada, which was conducted by the Centre for Addiction and Mental Health in collaboration with the market research firm Delvinia. The first survey wave was conducted between May 8 and May 12, 2020 (N = 1005), the second survey wave between May 29 and June 1, 2020 (N = 1002), and the third survey wave between June 19 and June 23, 2020 (N = 1005). The sampling frame was comprised of a million-plus members of an existing web panel called AskingCanadians, who were recruited on the basis of loyalty partnerships with major corporations such as departmental stores, retailers, and airlines. Further information regarding the web panel is available elsewhere (http://corporate.askingcanadians.com/). Importantly, quota sampling by age, sex, and region (proportional to the English-speaking population) was operationalized (see Table S1 in the Supplementary Appendix, http://links.lww.com/JAM/A239 for a comparison of the samples with the general population). The sampling strategy ensured that participants were not selected more than once by the survey (ie, 1-time selection in either of the 3 survey waves). All survey waves were conducted in English. The response rates for the survey waves ranged from 15.93% to 17.19%. The age, sex, and regional compositions of the samples did not change between the survey waves (P > 0.05).

Measures

Cannabis Use and Number of Days of Cannabis Use
Cannabis use (yes versus no) and number of days of cannabis use were determined based on responses to the item, “During the past 7 days, on how many days did you use cannabis (also known as marijuana, hash, “pot”)?”

Increase in Cannabis Use
Changes in cannabis use were determined based on responses to the item, “In the past 7 days, did you use cannabis more often, about the same, or less often overall than you did before the COVID-19 pandemic started?” Responses to this item included much less, slightly less, no change, slightly more, and much more. However, these responses were dichotomized to reflect an increase in cannabis use (slightly more, much more) versus no increase in cannabis use (much less, slightly less, no change).

Risk Characteristics

Socio-demographics. Socio-demographics included sex (male versus female or other), region (Western [British Columbia, Northwest Territories, and Yukon Territory] versus Prairies [Alberta, Manitoba, Saskatchewan] versus Central [Ontario] versus Atlantic [Quebec, Nova Scotia, New Brunswick, Prince Edward Island, Newfoundland, and Labrador]), age (18–29 years versus 30–49 years versus ≥50 years), urbanicity (urban versus suburban or rural), marital status (married or living with a partner versus never married, widowed, divorced or separated), ethno-racial identity (White versus non-White), education (less than university or college completion versus at least university or college completion) and household income (<$60,000 versus $60,000–$99,999 versus ≥ $100,000).

Substance Use Patterns. Substance use patterns included heavy episodic drinking (yes versus no), which was defined as the consumption on 1 occasion of at least 4 drinks for females and at least 5 drinks for males during the past week.
Mental Health Indicators. Mental health indicators included depressive symptomatology, which was determined by responses to 3 items from the Center for Epidemiologic Studies Depression Scale (CES-D). These 3 items included “How often have you felt depressed,” “How often have you felt lonely” and “How often have you felt hopeful about the future,” with all of them referring to experiences during the past week. However, due to the inadequate internal consistency (Cronbach Alpha of 0.56), these 3 items were not summed together into a summary scale. The responses to all 3 of these items were categorized as <1 day versus 1 to 2 days versus 3 to 4 days versus 5 to 7 days.

Impacts of the Pandemic. Concerns about personal finances were determined by responses to the item, “How worried are you about the impact of COVID-19 on your personal financial situation?” In a similar manner, concerns about contracting the virus were determined by responses to the item, “How worried are you that you or someone close to you (close relative or friend) will get ill from COVID-19?” Responses to both of these items were categorized as not at all worried or not very worried versus somewhat worried versus very worried. Furthermore, employment impacts due to physical distancing restrictions (working from home at some point during the pandemic versus loss of employment at some point during the pandemic versus none or other) were determined based on responses to the item, “How have physical distancing measures due to the COVID-19 pandemic affected your employment situation?”

Analytical Strategy
Descritive frequencies of cannabis use were generated by survey waves. Although the Cochran-Armitage test is used to detect linear trends, its ability to detect nonlinear changes is limited. As such, both chi-square and Cochran-Armitage tests were used to compare the distributions over the survey waves. The median number of days of cannabis use among those who used cannabis was subsequently compared over the survey waves using the Kruskal-Wallis test.

Increase in cannabis use among those who used cannabis was characterized next by survey waves, with chi-square and Cochran-Armitage tests used to compare the distributions. Risk characteristics associated with an increase in cannabis use among those who used cannabis were then identified using cross-tabulations and the distributions were compared using chi-square tests. Risk characteristics significantly associated with an increase in cannabis use (P < 0.05) were subsequently selected for inclusion in multivariable logistic regression analyses. Variance inflation factors were computed to test multicollinearity between the risk characteristics, and the Hosmer-Lemeshow test was conducted to test the model fit. As the rates of data missingness in the analyses of the risk characteristics were low (<9%), a complete case analysis approach was operationalized.

All analyses were conducted using SAS Software Version 9.4.

Ethics Approval
Research protocols were approved by the Research Ethics Board at the Centre for Addiction and Mental Health. All participants provided informed consent before the administration of the surveys.

RESULTS

Cannabis Use During the Months of May and June of the Pandemic

Cannabis use remained stable during the months of May and June of the pandemic (Table 1): 11.45% at Wave 1, 13.01% at Wave 2, and 12.38% at Wave 3 (P > 0.05 for both chi-square and Cochran-Armitage tests). The median number of days of cannabis use among those who used cannabis also remained stable during this time period: 4.00 days (Interquartile Range [IQR]: 5.00) at Wave 1, 4.00 days (5.00) at Wave 2, and 3.00 days (5.00) at Wave 3 (N = 369; P = 0.8658).

Increase in Cannabis Use During the Months of May and June of the Pandemic Compared to Before

In comparison with before the start of the pandemic, cannabis use increased among about half of those who used cannabis at each of the three survey waves (55.65% at Wave 1, 51.94% at Wave 2, and 47.58% at Wave 3) (Table 1). However, the increase in cannabis use among those who used cannabis remained stable (P > 0.05 for both chi-square and Cochran-Armitage tests). Chi-square tests indicated that region, age, ethnicity, education, feelings of depression, feelings of loneliness and concerns about personal finances were associated with an increase in cannabis use (Table 2). As such, these risk characteristics were included in the logistic regression analyses. An adequate model fit was achieved (Hosmer-

### TABLE 1. Cannabis Use and Increase in Cannabis Use at Wave 1 (May 8 to May 12, 2020), Wave 2 (May 29 and June 1, 2020), and Wave 3 (June 19 and June 23, 2020) in Canada

| Total | Wave 1 | Wave 2 | Wave 3 | Chi-Square Test | Cochran-Armitage Test |
|-------|--------|--------|--------|-----------------|---------------------|
| N %   | N %    | N %    | N %    | Statistic       | P                   |
| Cannabis use (in the overall population) | | | | | |
| Those who used cannabis | 369 | 12.28 | 115 | 11.45 | 130 | 13.01 | 124 | 12.38 | 1.14 | 0.5648 | 0.63 | 0.5406 |
| Those who did not use cannabis | 2636 | 87.72 | 889 | 88.55 | 869 | 86.99 | 878 | 87.62 | | |
| Increase in cannabis use (among those who used cannabis) | | | | | |
| Increase | 190 | 51.63 | 64 | 55.65 | 67 | 51.94 | 59 | 47.58 | 1.56 | 0.4575 | 1.25 | 0.2196 |
| No change or decrease | 178 | 48.37 | 51 | 44.35 | 62 | 48.06 | 65 | 52.42 | | | | | |
TABLE 2. Cross-tabulations Between Risk Characteristics and Increase in Cannabis Use Among Those Who Used Cannabis in Canada (May 8 to June 23, 2020)

|                      | Increase in Cannabis Use |                |                |                |                  |     |     |
|----------------------|--------------------------|----------------|----------------|----------------|------------------|-----|-----|
|                      | Total                    | No             | Yes            |                | Chi-Square Test  | Statistic | P   |
|                      | N                        | %              | N              | %              |                  |       |     |
| Sex                  |                          |                |                |                |                  |     |     |
| Male                 | 196                      | 53.12          | 92             | 46.84          | 104              | 53.06 | 0.34| 0.5577|
| Female or Other      | 173                      | 46.88          | 86             | 50.00          | 86               | 50.00 | 0.19| 0.6629|
| Region               |                          |                |                |                |                  |       |     |
| Western              | 57                       | 15.45          | 26             | 45.61          | 31               | 54.39 | 8.50| 0.0367|
| Prairies             | 101                      | 27.37          | 57             | 57.00          | 43               | 43.00 | 0.92| 0.3389|
| Central              | 134                      | 36.31          | 53             | 39.55          | 81               | 60.45 |     |      |
| Atlantic             | 77                       | 20.87          | 42             | 54.55          | 35               | 45.45 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Age                  |                          |                |                |                |                  |       |     |
| 18–29 Years          | 80                       | 21.68          | 30             | 37.97          | 49               | 62.03 | 10.54| 0.0051|
| 30–49 yrs            | 182                      | 49.32          | 83             | 45.60          | 99               | 54.40 |     |      |
| ≥ 50 yrs             | 107                      | 29.00          | 65             | 60.75          | 42               | 39.25 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Urbanicity           |                          |                |                |                |                  |       |     |
| Urban                | 170                      | 46.07          | 82             | 48.24          | 88               | 51.76 | 0.002| 0.9619|
| Suburban or Rural    | 199                      | 53.93          | 96             | 48.48          | 102              | 51.52 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Marital status       |                          |                |                |                |                  |       |     |
| Married or living with a partner | 201 | 55.22 | 95 | 47.26 | 106 | 52.74 | 0.12 | 0.7302 |
| Never married, widowed, divorced or separated | 163 | 44.78 | 80 | 49.08 | 83 | 50.92 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Ethno-Racial identity|                          |                |                |                |                  |       |     |
| Non-White            | 113                      | 31.13          | 42             | 37.17          | 71               | 62.83 | 8.41| 0.0037|
| White                | 250                      | 68.67          | 134            | 53.60          | 116              | 46.40 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Education            |                          |                |                |                |                  |       |     |
| Less than university or college completion | 115 | 31.25 | 46 | 40.00 | 69 | 60.00 | 4.69 | 0.0303 |
| At least university or college completion | 253 | 68.75 | 152 | 52.17 | 121 | 47.83 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Household income     |                          |                |                |                |                  |       |     |
| <$60,000             | 103                      | 30.65          | 49             | 47.57          | 54               | 52.43 | 0.51| 0.7755|
| $60,000–$99,999      | 111                      | 33.04          | 49             | 44.55          | 61               | 55.45 |     |      |
| ≥ $100,000           | 122                      | 36.31          | 60             | 49.18          | 62               | 50.82 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Heavy episodic drinking |                      |                |                |                |                  |       |     |
| Yes                  | 194                      | 52.72          | 84             | 43.52          | 109              | 56.48 | 3.61| 0.0574|
| No                   | 174                      | 47.28          | 93             | 53.45          | 81               | 46.55 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Feelings of depression|                          |                |                |                |                  |       |     |
| 5–7 d                | 44                       | 11.92          | 16             | 36.36          | 28               | 63.64 | 17.65| 0.0005|
| 3–4 d                | 73                       | 19.78          | 26             | 35.62          | 47               | 64.38 |     |      |
| 1–2 days             | 131                      | 35.50          | 60             | 46.15          | 70               | 53.85 |     |      |
| <1 d                 | 121                      | 32.79          | 76             | 62.81          | 45               | 37.19 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Feelings of loneliness|                          |                |                |                |                  |       |     |
| 5–7 d                | 55                       | 14.91          | 17             | 30.91          | 38               | 69.09 | 22.05| <0.0001|
| 3–4 d                | 85                       | 23.04          | 35             | 41.18          | 50               | 58.82 |     |      |
| 1–2 d                | 90                       | 24.39          | 38             | 42.70          | 51               | 57.30 |     |      |
| <1 d                 | 139                      | 37.67          | 88             | 63.31          | 51               | 36.69 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Feelings of hopefulness about the future |                      |                |                |                |                  |       |     |
| 5–7 d                | 60                       | 16.26          | 32             | 53.33          | 28               | 46.67 | 3.04| 0.3850|
| 3–4 d                | 93                       | 25.20          | 46             | 49.46          | 47               | 50.54 |     |      |
| 1–2 d                | 122                      | 33.06          | 51             | 42.15          | 70               | 57.85 |     |      |
| <1 d                 | 94                       | 25.47          | 49             | 52.13          | 45               | 47.87 |     |      |
|                      |                          |                |                |                |                  |     |     |
| Employment impacts   |                          |                |                |                |                  |       |     |
| Working from home    | 109                      | 29.54          | 43             | 39.81          | 65               | 60.19 | 5.68| 0.0585|
| Loss of employment   | 85                       | 23.04          | 40             | 47.06          | 45               | 52.94 |     |      |
| None or other        | 175                      | 47.43          | 95             | 54.29          | 80               | 45.71 |     |      |

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Lemeshow P-value >0.05) and multicollinearity was not detected (variance inflation factors <10 for all risk characteristics). In the multivariable model, residence in the central region (Odds ratio [OR], 95% confidence interval [CI]; 1.93, 1.03–3.62), being 18 to 29 years old (2.61, 1.32–5.17) or 30 to 49 years old (1.85, 1.07–3.19), having less than college or university education (1.86, 1.13–3.06) and being somewhat worried about personal finances (1.73, 1.00–3.00) were associated with higher odds of increasing cannabis use among those who used cannabis (Table 3).

**DISCUSSION**

We characterized cannabis use during the ongoing pandemic based on multiple waves of an online, repeated cross-sectional survey conducted in Canada. Our findings indicated that cannabis use in the overall population remained stable during the months of May and June of the pandemic. In addition, cannabis use increased among a large proportion of those who used cannabis during this time period, with about half of them indicating increased cannabis use compared to before the start of the pandemic at each of the 3 survey waves.
However, the increase in cannabis use among those who used cannabis remained stable. Cannabis use in the overall population during the months of May and June of the pandemic remained unchanged. It is difficult to gauge the impacts of the pandemic on cannabis use in the overall population, given the present surveys were not representative and the potential confounding due to recent legalization of recreational cannabis use in Canada. About half of those who used cannabis increased cannabis use compared to before the start of the pandemic. This finding is consistent with the assessment of the number of days of cannabis use among those who used cannabis. According to an annual, representative survey of those 16 years and older across all provinces and territories in Canada, 32% of those who used cannabis during the past month reported daily or near daily use between April and June 2019. The analogous estimate amounted to 43% of those who used cannabis during the past week from all of the three survey waves combined, even though the present measurement timeframe was comparatively smaller in duration. Indeed, cannabis use among the overall population increased by 7%, as measured by a representative, online survey of those 15 years and older across provinces in Canada that was conducted between March 29 and April 03, 2020. Similar findings have also been observed elsewhere among those who used cannabis. About one third of those who used cannabis increased cannabis use during the physical distancing restrictions in France, as determined by a nonrepresentative, online survey of those 16 years and older that was conducted between March 25 and March 30, 2020. In a similar manner, based on assessments of those who used cannabis in an online, nonrepresentative survey conducted between April 08 and May 25, 2020 in the European Union, 23% increased frequency of cannabis use and 10% increased quantity of cannabis use during the physical distancing restrictions. Importantly, the increases in frequency of cannabis use and quantity of cannabis use were more pronounced among those who used cannabis regularly rather than occasionally in the European Union. Unfortunately, the present measurements did not allow for such distinctions. However, cannabis use should be explored further in detail, including comprehensive assessments of motivations of consumption, consumption patterns and behaviors (history of use, frequency per day, quantity per occasion, modes of administration, types of products, poly substance use), health outcomes and consequences (cannabis use disorder, attributable health problems, impaired driving) and treatment-seeking behaviors.

In terms of risk characteristics associated with an increase in cannabis use among those who used cannabis, region, age, education, and concerns about personal finances were all relevant. Younger age and lower educational attainment have been previously shown to be associated with an increase in cannabis use among the overall population and among those who used cannabis in Canada and France. These specific findings may be reflective of young people in post-secondary educational institutions, who may experience increased feelings of boredom and availability of leisure time due to closures of educational institutions, thereby leading to an increase in cannabis use. Furthermore, those who use cannabis may be self-medicating to cope with the heightened worries and anxieties about the impacts on the personal financial situation due to the pandemic. Indeed, boredom and anxiety due to COVID-19 were the most frequently cited reasons for the increase in drug use in the European Web Survey on Drugs.

The cannabis-attributable burden of disease in Canada is substantial, although it is comparatively smaller than the alcohol- or tobacco-attributable burden of disease. The increase in cannabis use among those who used cannabis is concerning, as most of the cannabis-attributable adverse health outcomes stem from frequent or intensive use. As such, it is essential for clinical practitioners and public health authorities to encourage moderation in cannabis use and prevent sustained frequent cannabis use, especially among younger adults. The evidence-based lower-risk cannabis use guidelines can be drawn upon to this end. These guidelines suggest avoidance of cannabis products with high concentrations of tetrahydrocannabinol, modes of administration involving smoking combusted material, smoking techniques to facilitate psychoactive ingredient absorption, and frequent or intensive patterns of use. In particular, the guidelines recommend occasional cannabis use, not to exceed once per week or weekend use. In addition, public health authorities should also consider policy measures to address the consequences of the increase in cannabis use, both in terms of cannabis-attributable adverse health outcomes and harm to others. Furthermore, a clear need for continued monitoring of cannabis use during and after the pandemic is evident, especially as stay at home measures are gradually relaxed.

There are some limitations that should be considered in the interpretation of the findings. First, due to the self-reported nature of the data, recall and social desirability biases cannot be ruled out. Cannabis use and increase in cannabis use may have been consequently underreported. However, self-reports of alcohol and drug use have been previously shown to be valid. Second, inferences of causality in relation to the risk characteristics associated with an increase in cannabis use cannot be made, given the potential exposure-outcome temporality violations due to the cross-sectional design. Third, as participants in the three survey waves were recruited through quota sampling, the absence of random selection procedures may limit the generalizability of the findings. On that same note, selection of participants from an existing web panel may further limit the generalizability of the findings, especially to those without internet access. However, quota sampling in online surveys has been shown to be an effective strategy to rapidly collect valid data, especially regarding sensitive topics. Importantly, a small fraction (6%) of the population reports lack of home internet access in Canada. In a similar manner, certain geographic regions (especially Quebec) may have been underrepresented, as the survey was limited to the English-speaking population. Fourth, the small cell sizes necessitated categories of some risk characteristics to be combined together, including female and other for sex and non-Whites for ethno-racial identity (see Table S2 in the Supplementary Appendix, http://links.lww.com/JAM/A239 for the frequency distributions).
CONCLUSIONS

Cannabis use in the overall population remained stable during the months of May and June of the pandemic. Compared to before the start of the pandemic, cannabis use increased among a large proportion of those who used cannabis, which was consistent across each of the 3 survey waves (ie, no change in trend). Region, age, education, and concerns about personal finances were identified as important risk characteristics associated with an increase in cannabis use among those who used cannabis. These findings underscore a need for guidance regarding moderation of cannabis use and prevention of sustained frequent use, policy measures to address cannabis-attributable harms, and continued monitoring of cannabis use during and after the pandemic in Canada.

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