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Analysis of trends in the prevalence of cannabis use and related metrics in Canada

by Michelle Rotermann

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Analysis of trends in the prevalence of cannabis use and related metrics in Canada

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Abstract

Background: The Canadian federal government legalized non-medical cannabis use by adults in October 2018. Ongoing monitoring of the effects of the change is needed because uncertainty remains about the impact of the legislation on cannabis use behaviours and whether the impact will affect some more than others.

Data and methods: Data from the Canadian Tobacco, Alcohol and Drugs Survey and the Canadian Tobacco Use Monitoring Survey were used to examine longer-term (historical) rates of use during 2004 to 2017. Five iterations of the National Cannabis Surveys (NCS) (2018-2019) were used to examine current use (overall, daily or almost daily (DAD), quantities, and types of products) in the months before and after legalization.

Results: From 2004 through 2017 cannabis use decreased among 15 to 17 year olds, remained stable for 18 to 24 year olds, and increased among adults aged 25 to 64. During 2018 and into 2019, rates of cannabis use increased overall from 14% to 18%; with statistically significant increases also for males generally (16% to 22%) and males aged 18 to 64. Rates of cannabis use remained largely stable for females (13%) and seniors (4%). In 2019, about 60% of consumers reported using one cannabis product; use of dried cannabis (flower/leaf) was the most common (84.2%). The average user consumed 27.5 grams of dried cannabis (flower/leaf) over three months; amounts consumed varied depending on use frequency (e.g. occasional users: 2.6 grams/3 months versus DAD users: 62.6 grams/3 months).

Interpretation: Results highlight the importance of understanding pre-legalization behaviours as changes in use after legalization may have begun prior to the legislation. NCS allows for the early impacts of legalisation to be examined and provides a picture of not only changes in who is using but also what and how much.

Keywords: Trend analysis, legalization, *Cannabis Act*, C-45, controlled and illegal drugs, marijuana, substance use

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Cannabis is one of the most widely used substance in Canada with close to half of all Canadians aged 15 or older reporting having tried it.¹

While cannabis can be used for a variety of medical purposes,^{2,3} its use, particularly regular or heavy use, use started young, or during adolescence is related to a variety of harms to both users⁴⁻⁷ and others.⁸⁻¹⁰

As of October 17, 2018 Canada became the second country in the world to legalize the non-medical use of cannabis for adults.¹¹ In addition, policies legalizing non-medical and/or medical cannabis use are increasingly common elsewhere, including in several US states.¹²

Impacts of legalization on the use of cannabis in Canada remain uncertain because the *Cannabis Act* has been in place for less than a year, and because Canada's framework for legalization¹¹ makes comparisons to other jurisdictions difficult¹³ (due to varying regional access, different provincial/territorial retail sales models, restrictions on potency, and product types).

Data on cannabis use have always been important for monitoring trends and identifying sub-populations at risk. The *Cannabis Act* has broadened interest in cannabis-related information.

It is increasingly recognized that information about overall cannabis use prevalence while necessary is not sufficient for monitoring the full scope of legalization's impacts.¹⁴⁻¹⁶ Emergent literature suggests quantity may be a better predictor of cannabis-related harms than frequency¹⁴⁻¹⁵ and not much is known about the actual cannabis products being consumed.

Legalization also affects product availability,¹⁷ how cannabis is used, and/or product preferences, which in turn could have implications for health, health care service use, revenues, and crime.^{14,18-19}

Fortunately, Canada has considerable data sources for tracking potential cannabis-use behaviour changes, including established surveys like Canadian Tobacco, Alcohol and Drugs Survey (CTADS)²⁰ and the newest survey—National Cannabis Survey (NCS).²¹

There are two main objectives of this study. First, to update previously established longer-term (historical) trends in the 12-month prevalence of cannabis consumption, overall and by selected covariates for the 2004-2017 period. Second, to examine cannabis consumption and related behaviours (three-month prevalence, daily and almost daily (DAD) use, numbers and types of cannabis products, and quantities of dried (flower/leaf)) using NCS data collected every three months from early 2018-into-2019.

Data sources

Cannabis use prevalence (12-month)

The data are from the annual cross-sectional 2004-2012 Canadian Tobacco Use Monitoring Survey (CTUMS) and CTADS 2013, 2015, and 2017, which provides estimates on tobacco, cannabis, alcohol (CTADS only), and other drugs (CTADS only).²⁰ The surveys were conducted by computer-assisted telephone inter-

What is already known on this subject?

- Cannabis remains one of the most widely used drugs in Canada.
- Cannabis use, particularly daily (regular) has been associated with adverse effects, including dependency.
- The prevalence of past-year cannabis use tends to be highest at ages 18 to 24 and higher among males than among females.
- Legalization of non-medical cannabis use by adults was preceded by the legalized use for medical purposes nearly two decades earlier; the *Cannabis Act* is scheduled for amendments by October 2019 to allow for the legal sale of additional cannabis products, including edibles, concentrates and topicals.

What does this study add?

- National Cannabis Survey 2018-2019 can be used to examine not only overall and daily/almost daily (DAD) use in the months immediately before and after legalization but also used to address some data gaps, including: more detailed information about cannabis product types, and quantities consumed (dried flower/leaf).
- Monitoring of historical trends (2004 through 2017) can be examined with data from the Canadian Tobacco Use Monitoring Survey and the Canadian Tobacco, Alcohol and Drugs Survey.
- During 2004-2017, the prevalence of cannabis use increased overall, but remained stable or decreasing among 15-to-24 year olds, and increased among people aged 25 to 64.
- By Quarter 1 2019, about 5.3 million or 18% of Canadians aged 15 years and older reported using cannabis in the past three months. This was higher than the 14% who reported using just one year earlier, before legalization. The increase in cannabis use between the first quarters of 2018 and 2019 can be partly explained by greater use among males (rates rose from 16% to 22%) and people aged 45 to 64 (9% to 14%). Levels of consumption remained stable for females, at 13%, and seniors (4%).
- The percentages of Canadians reporting DAD use also remained unchanged at 6.1% from Q1 2018 through Q1 2019.

view (CATI) by Statistics Canada and sponsored by Health Canada.

The target populations of the CTUMS/CTADS was the household population aged 15 and older in each province. These surveys are voluntary and collected over eleven months. CTUMS sample sizes: 19,822-21,976 and correspond to response rates: 73.8%-83.5%. CTADS sample sizes: 14,565-16,349 and had response rates: of 35.7%-63.1%. Both excluded residents of the territories, full-time residents of institutions, the homeless, and persons unable to converse in English or French.

Prior research established the compatibility of CTUMS and CTADS for trend analysis and noted the two surveys are essentially one and share many questions and concepts, methodologies, and collection features.²²

Cannabis use prevalence (three-month), daily or almost daily use, and other

The cross-sectional, voluntary NCS is collected every three months (quarterly) since February 2018.²¹ The main objective is to monitor changes in cannabis-related behaviours during the periods immediately preceding and following legalization of non-medical cannabis.

The survey features an internet-based electronic questionnaire (EQ). The majority of respondents (61%) completed the survey unassisted, using the secure access code sent by mail. Respondents who had not completed the survey by the third week of collection are contacted by telephone and asked to participate with the aid of a trained-interviewer who reads the questions and records the responses into the EQ-application.

The target population of the NCS is the same as that of CTUMS/CTADS. Except Quarter 2 (Q2) where respondents from the territorial capitals were included. NCS samples averaged 5,811 respondents (excluding Q2 1,217 territorial residents) and has response rates of 51% (which exceeds the 2017 (35.7%) and 2015 (48.3%) CTADS' response rates.

Definitions

Cannabis use prevalence, daily or almost daily use, products, and dried cannabis (flower/leaf) quantities

Past-year cannabis (marijuana) use was based on responses to the following yes/no CTUMS/CTADS questions: "Have you used it in the past 12 months?" and "During the past 12 months have you used marijuana?"

Past-three month cannabis and DAD use was based on responses to one NCS question: "During the past three months, how often did you use cannabis?" Respondents who indicated some (e.g. once/twice, monthly, weekly, or daily or almost daily) were considered to have used; persons indicating "not in the past three months", not.

Past-three month (NCS) users were further classified according to how frequently they used: DAD or not DAD.

Use of 8 different cannabis products: dried (flower/leaf), oil cartridges/vape pens, hashish/kief, liquid concentrates, solid concentrates, edibles, other liquids, other (not specified) was based on selecting either a quantity or unit associated with each product. All respondents reporting cannabis use in the past three months were asked if they had used each product and to report the amount(s)—using a combination of units (e.g. grams) and numbers of units (e.g. 1).

Cannabis consumers were considered to have used a product so long as either a valid quantity or valid unit was selected. Choosing this definition ensured that virtually all respondents who reported using cannabis had selected at least one product. The one-hundred respondents who neither selected at least one unit nor one unit of measure, were dropped. The number of cannabis products, (coded: 1, 2 or 3 or more) was then calculated for each respondent.

The number of records missing a unit or quantity was 8% (unweighted) for dried (flower/leaf) cannabis and on average 44% for other products (Appendix A). As a result, only the quan-

tivities of dried (flower/leaf) cannabis were estimated.

In order to estimate the total and average amounts of dried (flower/leaf) per cannabis user, reported quantities were first standardized by converting to grams (when reported in another metric (e.g. ounces) (Appendix B). A value of 1 was assigned to 244 dried (flower/leaf) records where the quantity was missing. The value of 0.32 grams (weight of a joint)²³ was given to the 8 records without a unit.

Average quantities of dried (flower/leaf) were calculated for all dried (flower/leaf) cannabis consumers (regardless if they reported another product), as well as separately: for those reporting dried (flower/leaf) only versus dried (flower/leaf) with other products.

Analytical techniques

Analyses were performed using SAS/SUDAAN v.11.0.3. Survey sampling weights were applied so that the analyses

would be representative of the Canadian population.

While CTUMS, CTADS and NCS all used bootstrap variance estimation to account for its complex sampling design the use of Balanced Repeated Replication (BRR) was not exactly the same. CTUMS and CTADS 2013 used 250 mean bootstrap weights with Fay adjustment,²⁰ CTADS 2015 and 2017 used 500 bootstrap weights,²⁰ and the NCS, 1000.²¹

Historical cannabis use (2004-2017)

Analysis of changes in the prevalence of cannabis use (12-month) during the 2004-2017 period were based on combined and weighted CTUMS/CTADS data.

Because the type of variance estimation was inconsistent across CTUMS/CTADS cycles it was necessary to normalize the sampling weights to enable the linear trend tests, conducted using logistic regressions each containing

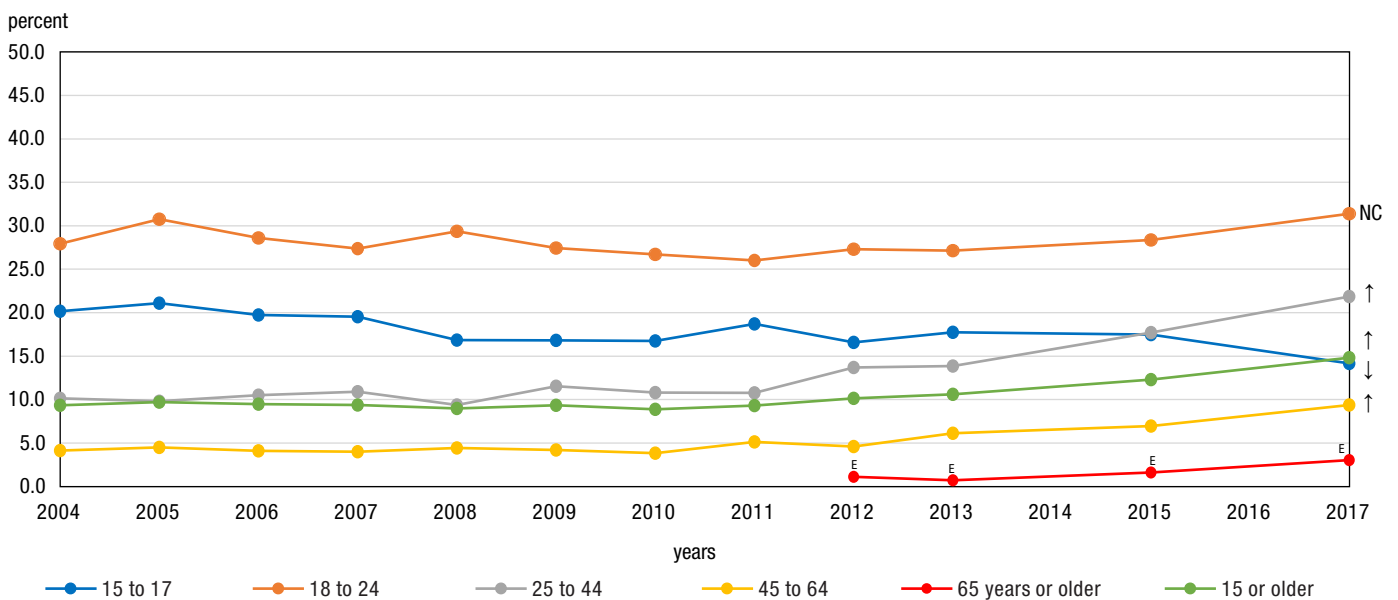
the linear time variable (year) and the outcome variable (e.g. cannabis use in past 12- months: yes/no). Each age (sexes combined), province and sex + age specific trends over time were tested separately. CTUMS and CTADS ask about the respondent’s sex.

Current cannabis consumption (2018-2019)

The overview of prevalence and correlates of cannabis use (past three-months) in 2019 used mostly weighted NCS 2019 Quarter 1 data—the most recent. For context, corresponding NCS 2018 Q1, CTUMS 2004, and CTADS 2017 estimates are provided. Variance estimation (95% confidence intervals) and significance testing (t-test statistics) were done using bootstrap replicate weights to account for each survey’s complex sampling design.

Analysis of changes in cannabis consumption (3-month) and related indicators (types and numbers of cannabis products, and quantities of dried, were

Figure 1
Prevalence of cannabis use in the past 12 months, by age group, household population aged 15 or older, Canada excluding territories, 2004 through 2017



^E use with caution
 ↑ statistically significant increase in linear trend (p < 0.05)
 ↓ statistically significant decrease in linear trend (p < 0.05)
 NC = linear trend not statistically significant (p ≥ 0.05)

Notes: Because at least five data points are needed to test for a trend, the line pertaining to 65 or older was not tested.
Source: 2004 to 2012 Canadian Tobacco Use Monitoring Survey (CTUMS) and 2013, 2015 and 2017 Canadian Tobacco, Alcohol and Drugs Survey (CTADS).

examined by age, sex (gender), province (selected outcomes only) and frequency of use (where applicable) using weighted NCS data from all (5) quarters.

Unlike the CTUMS/CTADS analysis the NCS analysis used the design-based variance approach typical of data with a complex sampling strategy. Linear changes in cannabis use trends used 5 quarters of 2018-2019 data and were assessed using logistic (dichotomous) and linear regressions for continuous outcomes (e.g. quantities of dried). Each age (genders combined), and gender + age specific trends were tested separately. NCS asks about the respondent's gender.

Results at the $p < 0.05$ level were considered statistically significant.

Results

Historical trends

Past-year cannabis use (2004-2017)

Based on comparable data from 2004-2017 (12 data points), the estimated prevalence of (past-year) cannabis consumption among the Canadian household population aged 15 or older increased from 2004 through 2017 (Figure 1). The most recent estimate from this series: CTADS 2017 –14.8%—was about 60% higher than the 2004 CTUMS estimate of 9.4% (Table 1). According to CTADS 2017, 23.4% of British Columbians reported using cannabis in the past year, significantly above

the estimates for the rest of Canada (all other provinces combined). Residents of Quebec (11.0%) had lower-than-average use (Table 1). Analysis of trends at the provincial level also showed that rates increased in all provinces, except Quebec (data not shown).

The longer-term trends in past-year consumption differed by age group (Figure 1). For example, cannabis use prevalence decreased among 15- to 17-year-olds, remained stable for 18- to 24-year-olds, and increased among adults aged 25 to 64. Trend analysis was not possible for people aged 65 years or older. Average age of cannabis users also significantly rose from 29.4 years old in 2004 to 35.5 years old in

Table 1
Percentage of people reporting cannabis use (past year or three months) by gender, age group and province, household population aged 15 years or older, Canada, excluding territories, 2004, 2017, 2018 Quarter 1, and 2019 Quarter 1

	Canadian Tobacco Use Monitoring Survey			Canadian Tobacco, Alcohol and Drugs Survey			National Cannabis Survey					
	2004			2017			2018 Quarter 1			2019 Quarter 1		
	95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval		
	%	lower	upper	%	lower	upper	%	lower	upper	%	lower	upper
Canada	9.4	8.7	10.0	14.8 ^y	13.5	16.2	14.0	12.7	15.4	17.5 ^z	16.1	19.0
Gender												
Male	12.2*	11.1	13.3	18.7**y	16.6	20.9	15.8*	13.9	17.9	22.3**z	20.0	24.8
Female [†]	6.6	6.0	7.3	11.1 ^y	9.7	12.7	12.2	10.6	14.1	12.7	11.0	14.5
Age group												
15 to 24 [†]	25.6	24.0	27.2	26.9	25.0	28.8	23.2	17.0	30.8	29.5	23.5	36.2
25 or older	6.1*	5.5	6.9	12.7**y	11.3	14.3	12.8*	11.6	14.1	15.9**z	14.5	17.4
Age group												
15 to 17	20.2*	17.9	22.7	14.2**y	12.2	16.3	F	...	...	F	...	...
18 to 24 [†]	27.9	26.0	30.0	31.4 ^y	29.0	33.9	28.1	20.7	37.0	34.8	27.4	43.1
25 to 44	10.2*	8.8	11.7	21.8**y	18.6	25.4	21.4	19.0	24.1	24.2*	21.5	27.1
45 to 64	4.1*	3.3	5.3	9.4**y	7.8	11.3	8.8*	7.4	10.6	14.0**z	11.9	16.3
65 or older	F	...	...	3.0**y	1.8	5.2	4.0*	2.9	5.5	4.4*	3.3	6.0
Average	29.4	28.6	30.3	35.5 ^y	34.2	36.8	...	...	...	38.0	36.8	39.2
Province												
Newfoundland and Labrador	8.1	6.8	9.6	11.9 ^y	8.7	15.9	16.4	12.6	21.1	18.5	14.6	23.2
Prince Edward Island	8.7	7.4	10.3	14.6 ^y	11.3	18.7	14.1	10.3	18.9	15.4	11.7	19.9
Nova Scotia	11.3*	9.7	13.0	18.8 ^y	15.1	23.1	20.0*	15.5	25.5	18.2	13.9	23.4
New Brunswick	8.8	7.4	10.6	13.2 ^y	9.8	17.5	14.3	10.3	19.5	18.2	14.2	23.1
Quebec	11.4*	9.9	13.1	11.0*	8.5	14.1	10.4*	8.2	13.0	11.0*	8.8	13.8
Ontario	7.7*	6.6	9.0	14.0 ^y	12.1	16.3	13.5	11.2	16.3	20.0**z	17.2	23.2
Manitoba	7.6*	6.5	8.8	15.7 ^y	12.1	20.1	16.6	13.0	21.0	13.0*	9.7	17.2
Saskatchewan	8.2	7.1	9.4	12.5 ^y	9.4	16.3	15.1	11.8	19.2	15.7	12.5	19.4
Alberta	9.6	8.2	11.1	15.0 ^y	11.9	18.9	16.6	13.2	20.6	21.5*	17.6	26.0
British Columbia	10.8	9.3	12.4	23.4**y	18.5	29.1	17.1	13.9	20.9	19.1	15.6	23.1

... not applicable

^z use with caution

F too unreliable to publish

* Significantly different from reference category ($p < 0.05$); for provincial comparisons significantly different from Rest of Canada ($p < 0.05$)

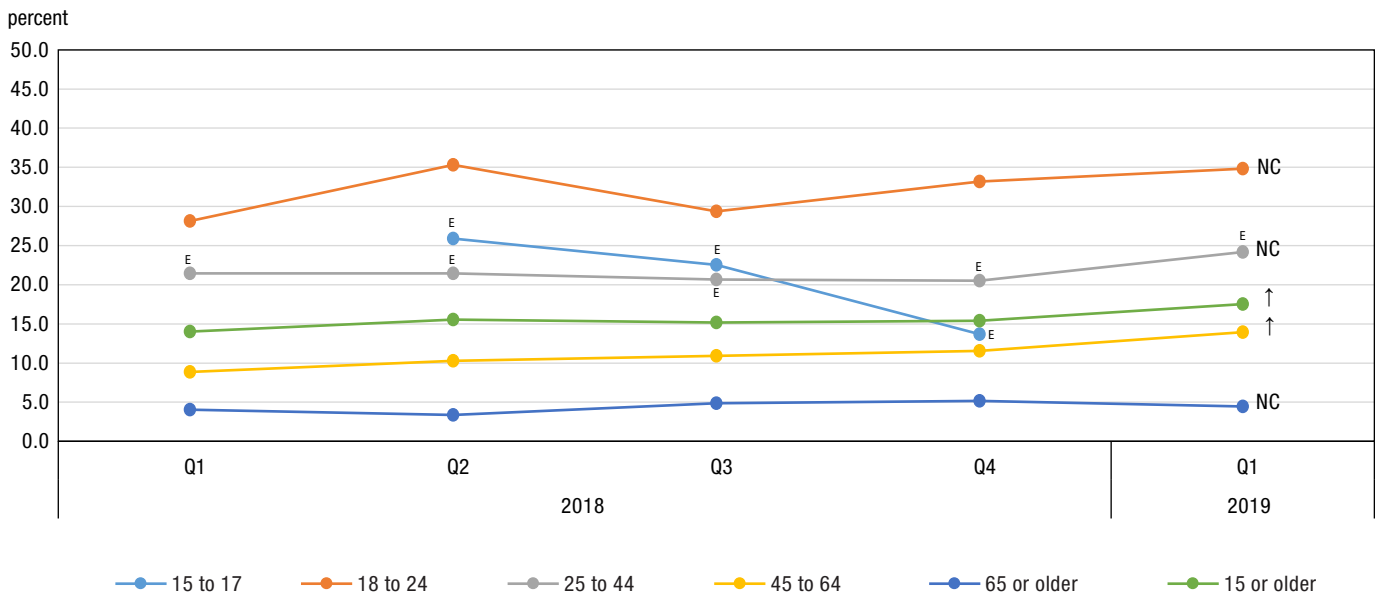
^y Significantly different from corresponding 2004 estimate ($p < 0.05$)

^z Significantly different from corresponding 2018 Q1 estimate ($p < 0.05$)

[†] Reference category

Sources: Canadian Tobacco Use Monitoring Survey 2004, Canadian Tobacco, Alcohol, and Drugs Survey 2017, and National Cannabis Survey 2018, Quarter 1 and 2019, Quarter 1.

Figure 2
Prevalence of cannabis use during previous 3 months, household population aged 15 or older, Canada excluding territories, 2018 Quarter 1 to 2019 Quarter 1



^E use with caution

↑ statistically significant increase in linear trend ($p < 0.05$)

NC = linear trend not statistically significant ($p \geq 0.05$)

Note: Because at least 5 data points are needed to test for a trend, the line pertaining to 15 to 17 year olds was not tested.

Source: National Cannabis Survey 2018 Quarters 1-4 and 2019 Quarter 1.

2017 (Table 1). These patterns also held when the estimates were calculated separately by sex (data not shown).

Cannabis use – Quarter 1, 2019 (Post legalization)

According to the most recent NCS (Q1 2019), about 18% (5.3 million) of Canadians aged 15 or older reported using cannabis in the past three months (Figure 2 and Table 1) and consumers, on average, were 38 years old unchanged from Q3 2018 (the first time this could be calculated) (data not shown).

The prevalence of cannabis use over the past three-months was higher among 18-to 24-year-olds (34.8%) than in other age groups (4% to 24%) (Figure 2 and Table 1). In all age groups except 15 to 17, males were also more likely than females to report using in the past three months (Figures 3 and 4).

In 2019, 21.5% of Albertans and 20.0% of Ontarians reported using cannabis in the past three months, significantly above the estimates for the rest of Canada (other provinces combined).

At 11% and 13%, Quebec and Manitoba residents had lower-than-average use (Table 1).

Higher frequency of cannabis use, defined in the NCS as daily or almost daily (DAD), identifies individuals at heightened risk for dependency and other cannabis-related harms. In 2019, 6.1% of Canadians aged 15 or older reported using cannabis DAD (Figure 5). DAD use was also more common among males (7.6%) than females (4.5%), and in 18-to 24-year-olds (12.5%) as compared to 45 to 64 year olds, or persons aged 65 or older (4.8%, 2.1%, respectively) (Figure 5).

2018 to 2019 trends of past three-month use (5 quarters)

During 2018 and 2019, past three-month prevalence (of any cannabis use) increased (i.e. the linear trend was significant) and several Q5 estimates were higher than comparable Q1 estimates, e.g.: nationally (14.0% to 17.5%), among males overall (15.8% to 22.3%), persons aged 45 to 64 (8.8% to 14.0%), and in

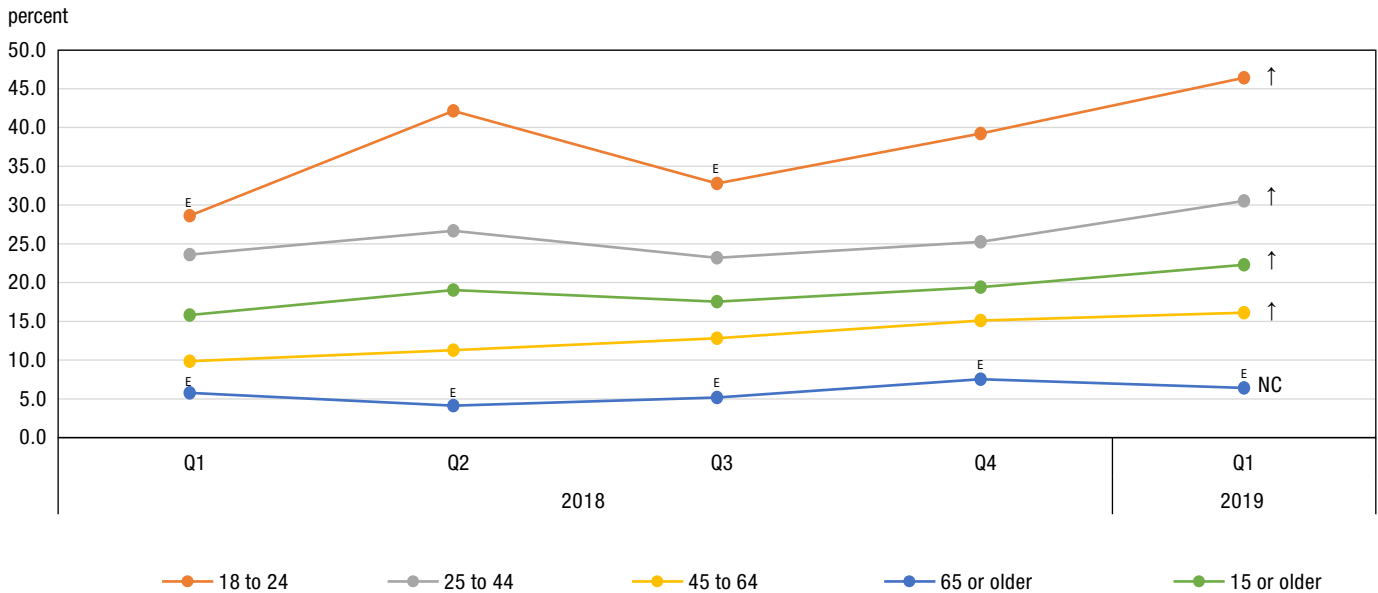
Ontario (13.5% to 20%) (Figure 2-4, Table 1). Statistically significant increases also occurred among males aged 18 to 24 (28.6% to 46.4%), 25 to 44 (23.6% to 30.5%), and 45 to 64 (9.9% to 16.1%); changes not experienced by similarly-aged females, with the exception of 45 to 64 year old females (7.9% to 11.7%) (Figure 3-4).

Conversely, the percentage of Canadians reporting DAD use at each Quarter remained stable between 2018 and 2019, regardless of gender, age (Figure 5) or province, with the exception of British Columbia, where DAD use increased from 5.4% to 8.4% (Data not shown).

Numbers and types of cannabis products used during the past three months

Canadians who reported using cannabis in the past three months were asked about the numbers and types of cannabis products used. According to NCS Q1 2019, nearly 59% of cannabis consumers

Figure 3
Prevalence of cannabis use during previous 3 months, males only, household population aged 15 or older, Canada excluding territories, 2018 Quarter 1 to 2019 Quarter 1



^E use with caution

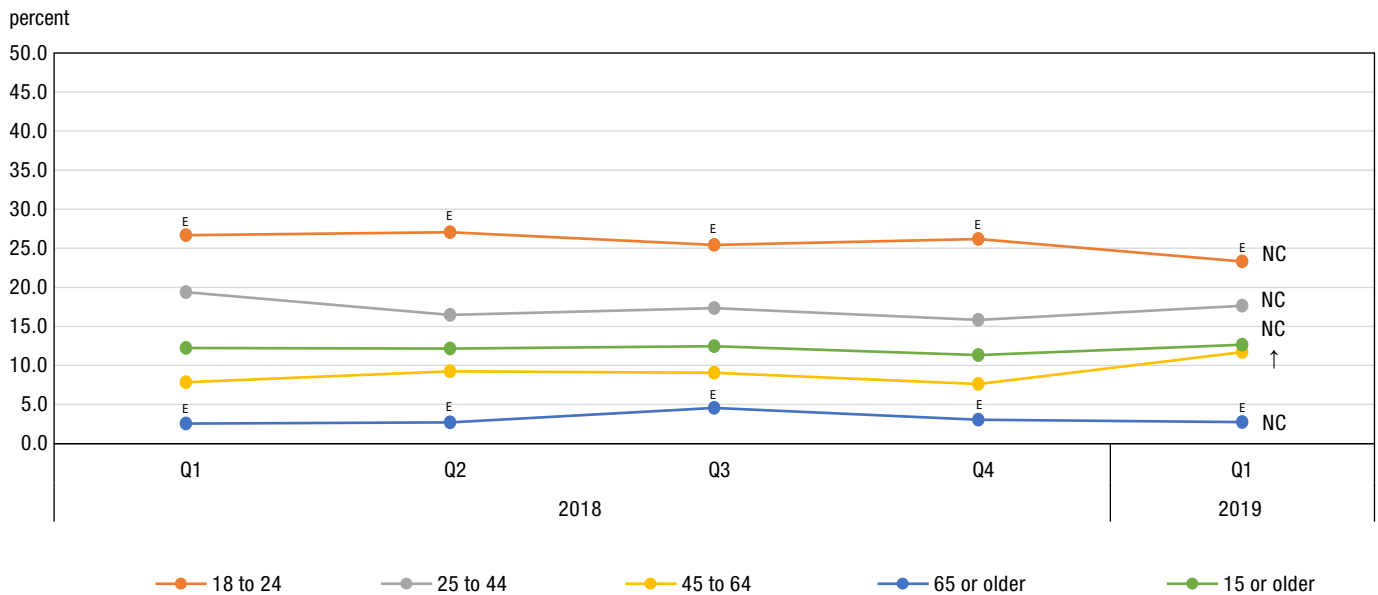
[↑] statistically significant increase in linear trend ($p < 0.05$)

NC = linear trend not statistically significant ($p \geq 0.05$)

Note: Estimates for 15 to 17 year olds were too unreliable to publish or test.

Source: National Cannabis Survey 2018 Quarters 1-4 and 2019 Quarter 1.

Figure 4
Prevalence of cannabis use during previous 3 months, household population aged 15 or older, Females, Canada excluding territories, 2018 Quarter 1 to 2019 Quarter 1



^E use with caution

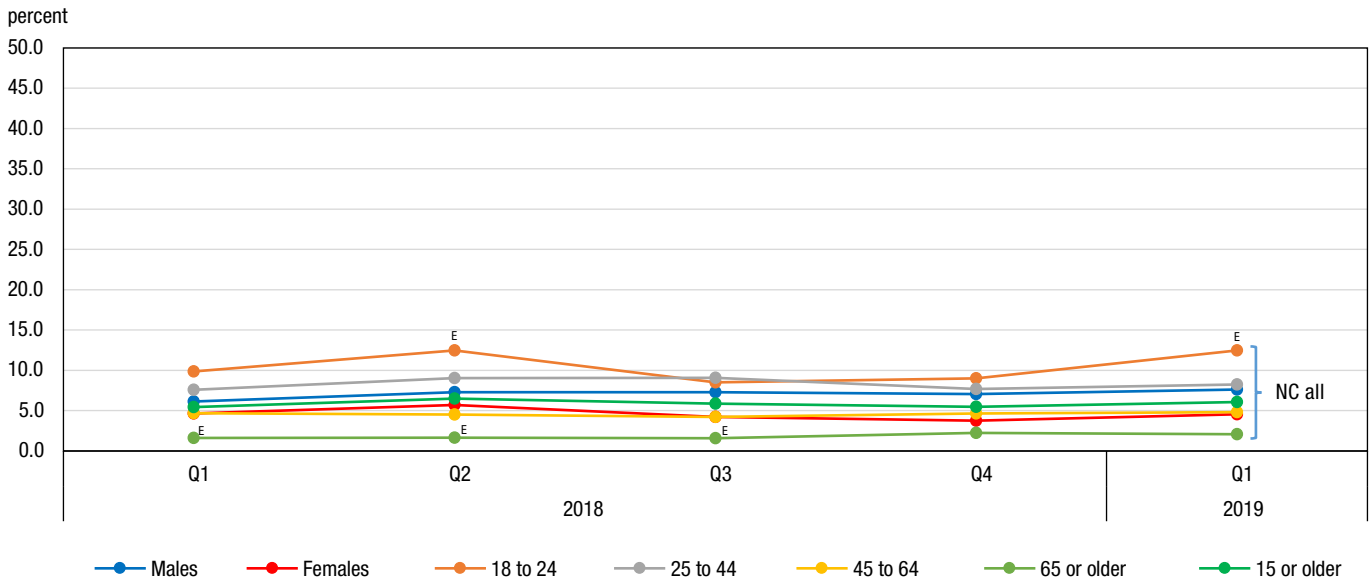
[↑] statistically significant increase in linear trend ($p < 0.05$)

NC = linear trend not statistically significant ($p \geq 0.05$)

Note: Estimates for 15 to 17 year olds were too unreliable to publish or test.

Source: National Cannabis Survey 2018 Quarters 1-4 and 2019 Quarter 1.

Figure 5
Prevalence of daily or almost daily use in the past 3 months, by gender and age, household population aged 15 or older, Canada excluding territories, 2018 Quarter 1 to 2019 Quarter 1



^E use with caution

NC = linear trend not statistically significant ($p \geq 0.05$)

Note: Estimates for 15 to 17 year olds were too unreliable to publish or test.

Source: National Cannabis Survey 2018 Quarters 1-4 and 2019 Quarter 1.

reported using one product, another 20% two, and the remaining 21% three or more (Table 2).

Dried (flower/leaf) cannabis was the most popular—used by more than 8 in 10 consumers (84.2%). For about 45%, it was the only product used, for another

39% dried (flower/leaf) was reported with at least one other product; the remainder (15.8%) reported using products other than dried (flower/leaf), e.g. edibles.

Product variety and whether dried (flower/leaf) cannabis was the only

product used, did not differ by gender or, for the most part, by age.

Frequency of cannabis use, however, was related not only to the use of more products but also with product types. For example, use of three or more products was about 2.5 times as common among DAD users (34.8%) compared to those using less often (13.8%). DAD users were also more likely to use dried cannabis (flower/leaf) in addition to other products and less likely to use other (non-dried) cannabis products exclusively (53.6% versus 31% and 11% versus 18.4%).

Between 2018 and 2019 none of the trend lines for number or types or products were statistically significant (data not shown). Because results changed little across quarters only the most recent 2019 Q1 estimates are shown.

Amount of dried (flower/leaf) cannabis consumed

According to NCS 2019 Q1, the typical dried cannabis (flower/leaf) consumer used 27.5 grams over 3 months (Table 3). Although quantities used did not differ by gender they were higher for

Table 2
Percentage of cannabis users reporting number of cannabis products and type of products used in the past three months, by frequency of use, household population aged 15 years or older, Canada, excluding territories, 2019 Quarter 1

	Total			Daily or almost daily			Not daily or almost daily		
	95% confidence interval			95% confidence interval			95% confidence interval		
	%	lower limit	upper limit	%	lower limit	upper limit	%	lower limit	upper limit
Number of cannabis products									
1	58.6	53.4	63.6	44.6	36.8	52.8	66.2*	59.8	72.1
2	20.2	16.4	24.5	20.5	14.8	27.7	20.0	15.3	25.7
3 or more	21.2	17.2	25.9	34.8	26.8	43.8	13.8*	10.0	18.9
Cannabis product types									
Dried (flower/leaf) only	45.2	40.3	50.3	35.4	28.3	43.2	50.6*	44.2	57.0
Dried (flower/leaf) + other	39.0	34.0	44.2	53.6	45.5	61.5	31.0*	25.2	37.4
Only other	15.8	12.8	19.3	11.0 ^E	7.5	16.0	18.4*	14.4	23.3

^E use with caution

* Significantly different from daily or almost daily ($p < 0.05$)

Note: Other cannabis products include: oil cartridges/vape pens, hashish/kief, liquid concentrates, solid concentrates, edibles, other liquids, other (not specified)

Source: National Cannabis Survey 2019, Quarter 1.

Table 3
Average(mean) quantities of dried (flower/leaf) cannabis used in the past three months, by selected covariates, household population aged 15 or older, Canada excluding territories, 2019 Quarter 1

	Quantities of dried cannabis (flower/leaf)		
	Mean	95% confidence interval	
		lower limit	upper limit
Total grams			
Average	27.5	22.7	32.3
Gender			
Males [†]	27.6	21.3	33.9
Females	27.6	20.6	34.6
Age group			
15 to 24 [†]	18.9 [‡]	10.7	27.0
25 or older	30.0 [*]	24.5	35.6
Cannabis product type			
Dried (flower/leaf) only [†]	22.1	15.9	28.4
Dried (flower/leaf) + other	33.7 [*]	26.5	41.0
Frequency of use			
Daily or almost daily (DAD) [†]	62.6	52.3	72.9
Weekly	12.0 [*]	8.9	15.1
Monthly	8.3 ^{*‡}	3.7	12.8
Once or twice	2.6 ^{*‡}	1.5	3.7

[‡] Use with caution

^{*} Significantly different from reference category ($p < 0.05$)

[†] Reference category

Note: 1 outlier record was dropped from analysis with total dried cannabis quantity exceeding 5,000 grams.

Source: National Cannabis Survey 2019, Quarter 1.

persons reporting use of other cannabis products in addition to dried (flower/leaf) (33.7 grams vs. 22.1 grams) and for more frequent users. Most notably, DAD users averaged 62.6 grams over 3 months, significantly more than persons who used less often: (2.6 grams for persons reporting using once or twice over a three-month period to 12.0 grams for weekly users). No trends between Q1 2018 and Q1 2019 were statistically significant (data not shown).

Discussion

This study presents an analysis of cannabis use prevalence and related metrics using representative, national Canadian data collected over fifteen years, including data collected immediately before and after the enactment of the *Cannabis Act*. The combination

of historical and recent data provides important context and shows that much of the change observed in 2018/2019, including increasing prevalence overall, the aging of cannabis users generally, and significant rate increases for select older age groups, is part of a longer-term trend started many years ago and not only in Canada.^{14,22,24-29}

The identification and monitoring of regular users of cannabis is of particular relevance to public health as this group is at higher risk of dependency and cannabis-related harms^{5,15} and poor mental health.⁶⁻⁷ By 2019, 6.1% of Canadians aged 15 and older (1.8 million) reported using cannabis on a DAD basis which was unchanged from one year earlier (when non-medical cannabis consumption was not yet legal). Complete and comparable Canadian national DAD trend data for the 2004 to 2017 are unavailable and research from other countries is inconsistent. For example, data from the European Union and Norway suggests daily use rates are stable³⁰ whereas DAD use in the United States has been increasing.^{14,28}

Given that non-medical cannabis has been legal for less than one-year and that amendments³¹ regulating potentially more harmful and potent products are planned, monitoring of this metric will be important.

The increasing use of cannabis (overall but not DAD) in older populations, aged 25 and older, requires surveillance and additional research to better understand motivations, preferences and potential harms. Consistent with several other studies, this study also found more aged cannabis users today than in the past.^{14,22,24-26} It might be that at least some of the rate increases observed at older ages are due to more accurate reporting by a population more sensitive to the disclosure of formerly illegal drug use.²⁶ Increased reporting of cannabis use at older ages may also be related to the use of cannabis as medication or as an effort to manage or alleviate symptoms increasingly common at older ages, like insomnia and pain.³² Another NCS-based study has found that medical users (par-

ticularly those with a medical document) are older than non-medical users.³³

Not much is known about the actual cannabis products used and emergent literature suggests that quantity may be a better predictor of cannabis-related harms than frequency of use.¹⁴⁻¹⁵ Several of the NCS-based findings such as the popularity of dried cannabis (flower/leaf) and associations between quantities consumed and frequency of use have been found elsewhere.^{14,34-35} Comparisons between average quantities consumed over three months using NCS data and estimates from other sources were less comparable.^{14,34-35} Differences in survey methodology and reference periods, but also potential issues related to recall, might contribute to these differences. Generally, the NCS-based quantity estimates are lower than those reported elsewhere. On the other hand, some research has found that cannabis users tend to over-estimate joint size^{23,36} and therefore it might be that the NCS estimates are more accurate. Alternatively, it may also be that other research has been able to estimate total exposure to all cannabis products whereas the average quantities of dried (flower/leaf) cannabis presented here underestimate total exposure for persons using multiple product types.

Strengths and Limitations

This study has a number of strengths including the use of a broader range of established and emerging indicators of cannabis use and inclusion of both shorter (recent) and longer-term (historical) indicators. Nevertheless, results of this study should be interpreted in light of several limitations.

Information from the surveys was self-reported and has not been verified. Studies that have been able to assess the logical consistency between lifetime and recent drug use tend to find few inconsistencies.^{30,38} Cannabis use tends to be more accurately reported than other drugs.³⁰

Changes over time in respondents' willingness to admit drug use, in their definition of what constitutes drug use,

and in the perceived or real risk of legal consequences could neither be controlled nor detected, but could affect trends. In Canada, as in many other countries, legal access to medical and most recently non-medical cannabis may have influenced willingness to report use. These changes may be particularly relevant for older adults, and as such, some of the observed increases may reflect not so much a change in behaviour, but rather, a new willingness to report.

Being able to accurately estimate the quantity of total cannabis consumed is of interest to government, industry and the medical communities. Different products are associated with different risks, typically related to modes of consumption or potency^{19,37} and therefore important for public health monitoring but also because product preferences can be influenced by legalization.¹⁸

Despite consumers being asked to provide detailed information about the products they used, respondents struggled to provide information about the details of cannabis products they are using, particularly for non-dried products versus dried.¹⁶ Dried (flower/leaf) cannabis is easier to report, although infrequent or varying use, and sharing, can limit reporting-capacity. Other (non-dried) cannabis products are more challenging, due to: non-standard packaging, limited (absent) labels, and confusion between amounts of active ingredients as compared to product weights, or issues related to lack of familiarity with metrics or conversions. Although missing information will bias estimates for quantities consumed, the better reporting of dried (flower/leaf) cannabis and its popularity limit the impact.

For each survey, there are multiple sources of sampling and non-sampling error. Variations in factors known to affect the accuracy of estimates can also affect their comparability.³⁸⁻⁴⁰ A detailed review of how CTUMS compares to

CTADS is available elsewhere.²² There are other differences between NCS and CTUMS/CTADS which have not been presented before and worth noting.

The NCS was designed to monitor changes in cannabis use behaviours preceding and following the *Cannabis Act*. It focuses exclusively on cannabis and not multiple substances.²¹

While the question about cannabis-use frequency appears similar across surveys the corresponding response categories were not. In particular, the NCS includes the “not in the past three months” category. CTUMS and CTADS ask separate questions. This may also affect comparability.¹⁹

The NCS is collected more regularly (every three-month/quarterly) than the annual CTUMS or biennial CTADS and uses shorter collection periods (1 versus 11 months).

Unlike CTUMS/CTADS which tends to use a 12-month reference period nearly all of the NCS cannabis questions refer to behaviours in the past 3-months. Having more time for a behaviour to occur can increase the estimate. This is particularly well documented for drug, alcohol and tobacco use¹ and why comparisons of estimates, in terms of magnitude (level), based on reference periods of differing lengths should be avoided; on the other hand, comparisons of behaviours, irrespective of reference-period length, by socio-demographic characteristics are often valid.

Mode of data collection can influence response rates, data quality, and non-sampling errors.³⁹ Unlike CTUMS/CTADS which used CATI exclusively the NCS is internet-based with most respondents completing the survey unaided. The anonymity this mode of collection offers may have affected NCS respondent’s willingness to participate and/or disclose their cannabis use. Indeed, some studies have found that self-administered surveys can result in

higher reporting of drug use³⁹; of course, others show that trained interviewers, expert at establishing rapport can also make a difference.⁴¹

No trend data are available for the territories. Analyses are limited to household respondents and therefore some groups, known to be a high risk for drug use (e.g. the homeless) are excluded.

The primary purpose of CTUMS/CTADS and NCS is monitoring of cannabis and/or other substances. As such, the sample sizes are sometimes small thereby requiring more general variable definitions. While power was generally sufficient to identify trends and associations nationally, sub-national examinations were limited and small sample sizes in some parts of the analysis may also have reduced the ability to reach statistical significance. For much of the period studied it was also not possible to distinguish medical from non-medical use and therefore the results presented do not differentiate.

Conclusions

This study brings together the highest quality, comparable national cannabis use data collected among the general population in the decade (or so) prior to the enactment of the *Cannabis Act* with the most recent data collected first within months of legalization and then afterwards. Inclusion of data from before and after legalization provides important historical context to the recent changes (or stability) in current cannabis use behaviours.

Ongoing policy changes related to legalization, regulation and restrictions of non-medical cannabis and shifting social acceptance of its use will continue to affect use patterns thereby necessitating ongoing monitoring. ■

Appendix A

Numbers of unweighted records with missing units or quantities by type of cannabis product, Canada excluding territories, 2018 Quarter 1 to 2019 Quarter 1 (combined)

	Type of cannabis product							
	Dried cannabis (flower /leaf)	Oil cartridges/vape pens	Hashish/Kief	Liquid concentrates	Solid concentrates	Edibles	Other liquids	Other (not specified)
No unit e.g. grams	8	5	6	6	3	7	3	8
No quantity e.g. 1	244	240	240	269	216	180	214	217
Total missing	252	245	285	275	219	187	217	225
Total records	3246	643	616	708	496	1078	290	486
% missing	8	38	46	39	44	17	75	46

Source: National Cannabis Survey 2018 (Q1-Q4) and 2019 (Q1) combined.

Appendix B

Gram equivalents used to standardize reported dried cannabis (flower/leaf) quantities

Unit reported	Gram equivalent
Pounds	454.00
Ounce	28.00
1/2 Ounce	14.00
1/4 Ounce	7.00
1/8 Ounce	3.50
Grams	1.00
Joints	0.32

Note: In order to estimate the quantity of dried cannabis used during the past three months it was necessary to first standardize (convert) all reported units to grams and then multiply by the number of units. For example, for persons reporting in grams no change was required; for others, it was necessary to convert the reported unit by its gram equivalent, e.g. ounces became 28g. Then each gram equivalent was multiplied by the number of units reported. Total quantity of dried cannabis = (grams) x (number of reported units).

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