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Abstract

Background: The Canadian federal government has committed to legalize, regulate, and restrict non-medical cannabis use by adults in 2018. To prepare for monitoring the health, social and economic impacts of this policy change, a greater understanding of the long-term trends in the prevalence of cannabis use in Canada is needed.

Data and methods: Nine national surveys of the household population collected information about cannabis use during the period from 1985 through 2015. These surveys are examined for comparability. The data are used to estimate past-year (current) cannabis use (total, and by sex and age). Based on the most comparable data, trends in use from 2004 through 2015 are estimated.

Results: From 1985 through 2015, past-year cannabis use increased overall. Analysis of comparable data from the Canadian Tobacco Use Monitoring Survey and the Canadian Tobacco, Alcohol and Drugs Survey for the 2004-to-2015 period suggests that use was stable among 15- to 17-year-old males, decreased among 15- to 17-year-old females and among 18- to 24-year-olds (both sexes), and increased among people aged 25 or older.

Interpretation: According to data from national population surveys, since 2004, cannabis use was stable or decreased among youth, and rose among adults. Results highlight the importance of consistent monitoring of use in the pre-and post-legalization periods.

Keywords: Cochran-Armitage test, controlled and illegal drugs, marijuana, risk behaviour, substance use, trend analysis

The Canadian federal government has committed to legalize, regulate, and restrict the non-medical use of cannabis in 2018. This policy change has increased the need for an understanding of trends in the prevalence of use before and after legalization.

Since 1985, nine national surveys have collected information about cannabis use, the results of which can be combined to estimate the evolution of cannabis consumption. However, the surveys were designed to address different data and policy needs and are not perfectly comparable. An evaluation of these data is needed prior to trend analysis to determine how differences in survey design and methodology may affect comparability, and ultimately, results.

Examination of the consistency of survey data is particularly important because non-survey sources of information about cannabis are often not suitable for monitoring or for research. Data based on arrests or drug seizures are affected by differential enforcement over time and by fluctuations in volumes seized.[1-3] Relationships between legal supplies for medical purposes, the number of clients registered with Licensed Producers, and the total cannabis market are difficult to establish.[4] Recent American studies have examined effects of non-medical cannabis decriminalization[5] and medical cannabis laws on consumption,[6-8] rates of dependence/cannabis use disorder,[9,10] and impacts on the health care system.[11] However, the American experience may not reflect the situation in Canada.

The main objective of this study is to examine trends in the 12-month (current) prevalence of cannabis consumption, overall and by age and sex. To accomplish this, it is necessary to assess surveys in terms of design, methodology, sources of bias, and how these factors may affect the comparability of estimates. The nine national surveys that included drug use questions can be classified into three types: 1) health or social—Health Promotion Survey (HPS), General Social Survey (GSS), and Canadian Community Health Survey–Mental Health and Well-being (CCHS-MH); 2) addiction—National Alcohol and Drug Survey (NADS), Canada's Alcohol and Other Drugs Survey (CADS), and Canadian Addiction Survey (CAS); and 3) alcohol, drug and/or tobacco monitoring—Canadian Tobacco Use Monitoring Survey (CTUMS), Canadian Drug Use Monitoring Survey (CADUMS), and Canadian Tobacco, Alcohol and Drugs Survey (CTADS).

Each survey asked about past-year cannabis use and had target populations that included youth and adults in the 10 provinces (Text table 1). For each survey, there are multiple sources of sampling and non-sampling error, which differ across surveys and through time. Variations in factors known to affect the accuracy of estimates are particularly important in assessing the comparability of surveys.[12,13] The factors considered in this analysis were selected from the literature, depending on the information available in the survey user guides and questionnaires: survey context, target population, sample size, response rate, questions, questionnaire design, collection mode, transition to cellphones, weighting, and collectors and sponsors.

Survey context

The context of a survey can have a bi-directional effect on participation—encouraging some potential respondents and dissuading others.[12] Health and social surveys that cover diverse subject matter may be less susceptible to this type of bias because of their broader scope and/or because drug-use questions are embedded among other less sensitive questions.[12,13] Addiction and substance use monitoring surveys may be more prone to this bias; respondents may agree or refuse to participate because they have a strong position on the subject.[12-15]

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Text table 1
Survey design information, by survey, 1985 through 2015

Survey name	Year	Survey context	Target population	Exclusions	Managed or sponsored by	Collected by	Sample design	Collection mode	Collection period	Sample size	Response rate %
Health Promotion Survey (HPS)	1985	Health	Household population aged 15 or older in provinces and Yukon (1985)	Territories (1990), Northwest Territories (1985) people without telephones, residents of institutions, homeless, unable to converse in English or French	Health and Welfare Canada	Statistics Canada	Random Digit Dialling (RDD), Waksberg, and/or Elimination of Non-Working Banks (ENWB)	Telephone and paper	June 3 through 21, 1985	11,181	81.0
	1990								June 1 through 30, 1990	13,792	78.0
National Alcohol and Drug Survey (NADS)	1989	Addiction	Household population aged 15 or older in provinces	Territories, people without telephones, residents of institutions, homeless, unable to converse in English or French	Health and Welfare Canada	Statistics Canada	RDD/ Waksberg/ ENWB	Telephone and paper	March 1 through 25, 1989	11,364	78.7
General Social Survey (GSS)	1993	Social	Household population aged 15 or older in provinces	Territories, people without telephones, residents of institutions, homeless, unable to converse in English or French	Health and Welfare Canada	Statistics Canada	ENWB/RDD	Computer-assisted telephone interview (CATI)	February through December, 1993	10,385	81.6
Canada's Alcohol and Other Drugs Survey (CADS)	1994	Addiction	Household population aged 15 or older in provinces	Territories, people without telephones, residents of institutions, homeless, unable to converse in English or French	Health Canada	Statistics Canada	ENWB/RDD	CATI	September 7 through November 5, 1994	12,155	75.6
Canadian Community Health Survey–Mental Health and Well-being (CCHS-MH)	2002	Health	Household population aged 15 or older in provinces	Territories, residents of institutions, homeless, residents of Indian Reserves or Crown lands, full-time members of Canadian Forces	Statistics Canada, Health Canada, Public Health Agency of Canada	Statistics Canada	Labour Force Survey area frame with multi-stage design	CATI and computer-assisted personal interview (CAPI)	May 1 through December 31, 2002	36,984	77.0
	2012							CATI and CAPI	January 2 through December 31, 2012	25,113	68.9
Canadian Addiction Survey (CAS)	2004	Addiction	Household population aged 15 or older in provinces	Territories, people without telephones, residents of institutions, homeless, unable to converse in English or French	Health Canada†	Jolicoeur and Associates	Stratified 2-stage sample with RDD	CATI	December 16 through 23, 2003 and January 9 through April 19, 2004	13,909	47.0
Canadian Tobacco Use Monitoring Survey (CTUMS)	2004	Tobacco and/or drug use monitoring	Household population aged 15 or older in provinces	Territories, people without telephones, residents of institutions, homeless, unable to converse in English or French	Health Canada	Statistics Canada	2-stage with ENWB/RDD	CATI	February through December of each survey year	20,275	83.0
	2005									20,840	79.2
	2006									21,976	80.8
	2007									20,921	74.9
	2008									20,541	78.8
	2009									20,121	75.2
	2010									19,822	73.8
	2011									20,703	78.9
	2012									19,286	83.5

Text table 1
Survey design information, by survey, 1985 through 2015

Survey name	Year	Survey context	Target population	Exclusions	Managed or sponsored by	Collected by	Sample design	Collection mode	Collection period	Sample size	Response rate %
Canadian Drug Use Monitoring Survey (CADUMS)	2008	Tobacco and/or drug use monitoring	Household population aged 15 or older in provinces	Territories, people without telephones or in cellphone-only households, residents of institutions, homeless, unable to converse in English or French	Health Canada	Jolicoeur and Associates	2-stage RDD	CATI	April 23, 2008 through December, 2009	16,674	43.5
	2009								January 27 through November, 2009	13,082	44.7
	2010								February 15 through December, 2010	13,615	50.5
	2011								February through December, 2011	10,076	45.4
	2012								February through December, 2012	11,090	39.8
Canadian Tobacco Alcohol and Drugs Survey (CTADS)	2013	Tobacco and/or drug use monitoring	Household population aged 15 or older in provinces	Territories, people without telephones or in cellphone-only households (CTADS 2013; CTADS 2015 adopted survey frame that includes cellphone numbers), residents of institutions, homeless, unable to converse in English or French	Health Canada	Statistics Canada	2-stage with ENWB/RDD	CATI	February 1 through December 31 of each survey year	14,565	63.1
	2015									15,154	48.3

† Canadian Executive Council on Addictions and selected provinces (Nova Scotia, New Brunswick and British Columbia)
Sources: 1985 and 1990 Health Promotion Survey (HPS); 1989 National Alcohol and Drug Survey (NADS); 1993 General Social Survey (GSS); 1994 Canadian Alcohol and Other Drugs Survey (CADS); 2004 Canadian Addiction Survey (CAS); 2004 through 2012 Canadian Tobacco Use Monitoring Survey (CTUMS); 2008 through 2012 Canadian Alcohol and Drug Use Monitoring Survey (CADUMS); 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS); 2002 and 2012 Canadian Community Health Survey–Mental Health and Well-being (CCHS-MH).

Target population

The nine surveys had the same basic target population—household residents aged 15 or older in the 10 provinces (Text table 1). Exclusions were similar, driven primarily by logistical and budgetary considerations, and include: individuals unable to converse in English or French, residents of the territories or institutions (for example, incarcerated), full-time members of the Canadian Forces, people living on Indian reserves/settlements, the homeless, and residents of households without a landline telephone or only a cellphone.

Of all of the surveys, the 2002 and 2012 CCHS–MH were the least sensitive to population exclusions. They relied primarily on an area frame, and most (85%) interviews were conducted in person. As well, interviews were offered in multiple languages, not only English and French.

Sample sizes, collection periods and response rates

In general, larger sample sizes and longer collection periods are preferable, as are higher response rates (50% is adequate; 60% is good; 70% is very good).

Sample sizes for the in-person 2002 (n = 36,984) and 2012 (n = 25,113) CCHS–MH were larger than those for the telephone-based surveys. The surveys conducted between 1985 and 1994 (HPS, NADS, CADS, and GSS) had samples that ranged from 10,385 to 13,792; CAS and CADUMS samples ranged from 10,076 to 16,674; CTUMS, from 19,822 to 21,976; and CTADS, 14,565 and 15,154.

Most surveys collected data over a continuous 10-month period. Several earlier surveys were conducted over one or two months, and CAS had two collection periods covering about three months.

Non-response is an indicator of data quality and a potential source of non-sampling error, depending on the degree to which respondents and non-respondents differ. Non-response weighting adjustments helped to ensure that samples approximated the age and sex distributions of the target population, but sometimes at the expense of other characteristics. For example, CAS and CADUMS weighted files compare favourably with Census of Population totals for age and sex, but tend to overestimate the number of married people

and/or degree-holders, and underestimate the numbers who never married, who had less than high school (CADUMS), or who had some postsecondary education.[16-18]

In all surveys, participation was voluntary. Responses rates for the Statistics Canada and Jolicoeur and Associates surveys were calculated similarly, taking account of eligibility (telephone number determined to be residential or out-of-scope—business), non-response at the household level (Statistics Canada surveys required completion of household roster), and completion/refusal of the survey by the selected person. Response rates to the Statistics Canada surveys averaged 75.6% and ranged from 48.4% to 83.0%, compared with an average of 45.2% (from 39.8% to 47.0%) for the surveys conducted by Jolicoeur and Associates (Text table 1). The 2015 CTADS response rate (lowest of the Statistics Canada surveys) may not be comparable to the other rates, owing to inclusion of cellphone numbers, the challenges of contacting respondents via cellphones, and broader coverage.

Cannabis question and questionnaire design

Across the surveys, the degree of comparability of the question about cannabis consumption was high (Appendix Table A). Past-year cannabis use was self-reported based on responses to essentially: "During the past 12 months have you used marijuana?" All questions referenced the past 12 months; some referred to marijuana by more than one name such as hash or hashish.

Questionnaire design was less consistent. Questions that use different terminology or more detailed instructions can affect the comparability of prevalence estimates from different surveys. For example, CADUMS and CTADS contained a preface to the cannabis question module with a list of cannabis terminology and added instructions to interviewers (not read) to include medical use as part of the (regular) cannabis estimates.

Collection method

Mode of data collection can influence response rates, data quality, and non-sampling errors. Except for the 2002 and 2012 CCHS–MH, which were conducted largely through computer-assisted personal interviews (CAPI), the surveys were telephone-based, with paper or electronic (computer-assisted telephone interview—CATI) questionnaires.

Some studies have found higher rates of "stigmatized or sensitive behaviours" using CAPI rather than CATI. This suggests that trained interviewers, expert at establishing rapport with respondents, make the difference.[19,20] Other studies are less conclusive or find results to be similar regardless of mode.[21-24]

Transition to cellphones

Except for the 2015 CTADS, cellphone-only households were out-of-scope for the telephone-based surveys. The 2015 CTADS adopted a household survey frame comprised of one to three telephone numbers associated with the same address, which includes landline and cellular telephone numbers.[25] Before 2000, the vast majority of households had a landline.[15,26] However, cellphone use has become an important source of coverage error, especially given differences in health behaviours, socio-demographics and risk factor profiles between households with landlines and those relying exclusively on cellphones.[26-28] Inclusion of respondents in cellphone-only households improves survey coverage, particularly among young adults; not sampling residents of cellphone-only households would likely decrease estimates of cannabis use. The effect of this source of bias is potentially stronger for CTUMS, CTADS (2013), CAS and CADUMS, which were conducted during the landline-to-cellphone transition. The CCHS-MH, which relied mostly on in-person interviews of respondents selected using area-based frames is the least affected, because the target population was generally not required to have a landline.

What is already known on this subject?

- Cannabis consumption differs by age, sex, and region.
- The prevalence of past-year cannabis use tends to be highest at ages 18 to 24 and higher among males than among females.
- Differences in survey methodology and design can affect estimates.

What does this study add?

- From 1985 through 2015, nine national surveys collected information about cannabis use in Canada.
- Trends in cannabis use for the 2004-to-2015 period can be examined with data from the Canadian Tobacco Use Monitoring Survey and the Canadian Tobacco, Alcohol and Drugs Survey.
- Since 2004, the prevalence of cannabis use remained stable or decreased among 15- to 24-year-olds, but increased among people aged 25 or older.

Collection and sponsors

Statistics Canada conducted seven of the nine surveys; Jolicoeur and Associates, the remainder. All surveys were sponsored by Health Canada or its predecessor, Health and Welfare Canada, exclusively, or in cooperation with other government agencies and/or departments. Who collects and/or sponsors the data has been shown to affect survey participation;[12,29] potential respondents may suspect that the sponsor (in this case, the government) has a "position" on the survey topic,[12] which changed over the period.

Analytical techniques

The surveys can be divided into four fairly distinct groups, based on differences in purpose and/or design, collection mode, question wording, or a combination of several minor differences on multiple dimensions: CTUMS/CTADS; CCHS–MH; CAS/CADUMS; and the surveys conducted during the 1985-to-1994 period.

Analyses were performed using SAS 9.3 and SAS-callable SUDAAN v.11.0.1.[30] Survey sampling weights were applied so that the analyses would be representative of the Canadian household population.

Because variance estimation practices changed since 1985, 95% confidence intervals associated with the point estimates could not be estimated the same way. CTADS,[25] CTUMS,[25] and CCHS–MH[25] used Balanced Repeated Replication with either 500 bootstrap weights (CTADS 2015 and CCHS–MH) or 250 mean bootstrap weights with Fay adjustment (CTUMS and CTADS 2013). CAS[16,17] and CADUMS[18] used Taylor linearization. Surveys conducted during the 1985-to-1994 period relied on approximate sampling variability tables.[25,31]

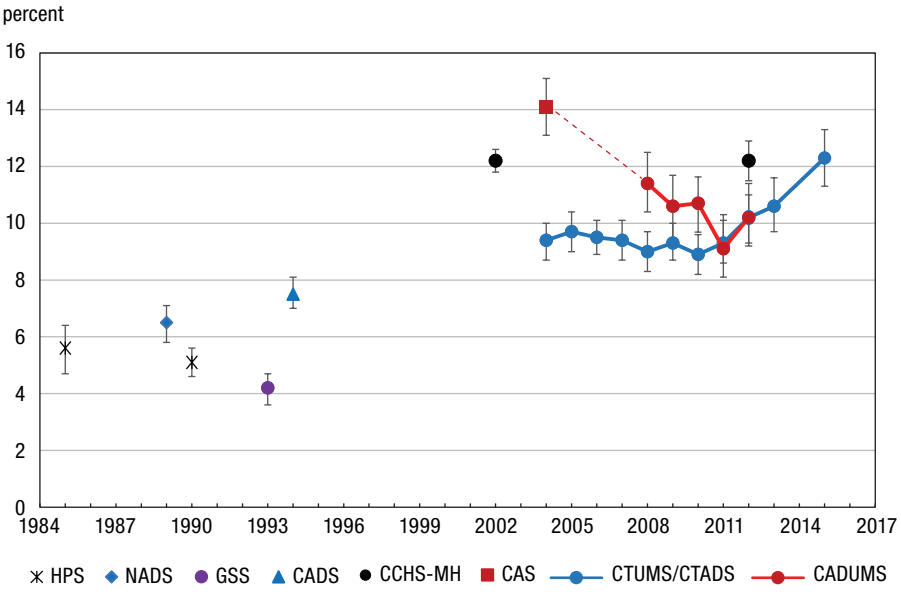
To establish whether cannabis consumption differs by age and sex, cross-tabulations using weighted CTADS 2015 data were calculated. Results at the $p < 0.05$ level were considered statistically significant.

Trend analysis

Analysis of changes in the prevalence of cannabis use during the 2004-to-2015 period was based on cross-sectional data from CTUMS/CTADS. CTUMS and CTADS are essentially the same survey—CTUMS was renamed CTADS when more drug-related content was added. The surveys have consistently worded cannabis questions, methodologies, and collection features.[25,32] The 11 cycles provide the longest, unbroken national series and are also the most recent data available.

The type of variance estimation was not consistent over the period. Therefore, it was necessary to reformat and then normalize the sampling weights to enable the linear trend test using a two-tailed (non-directional) Cochran-Armitage.[33,34] Because several surveys oversampled youth, survey weights were normalized using three age groups (15 to 24, 25 to 44, and 45 or older). Design-based variance estimation is preferable, but is not an option for the complete series because of differences in surveys and incompatibility of the data files. Before testing

Figure 1
Prevalence of past-year cannabis use, by survey, household population aged 15 or older, Canada excluding territories, 1985 through 2015



Sources: 1985 and 1990 Health Promotion Survey (HPS); 1989 National Alcohol and Drug Survey (NADS); 1993 General Social Survey (GSS); 1994 Canadian Alcohol and Other Drugs Survey (CADS); 2004 Canadian Addiction Survey (CAS); 2004 through 2012 Canadian Tobacco Use Monitoring Survey (CTUMS); 2008 through 2012 Canadian Alcohol and Drug Use Monitoring Survey (CADUMS); 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS); 2002 and 2012 Canadian Community Health Survey–Mental Health and Well-being (CCHS-MH).

Table 1
Prevalence of past-year cannabis use, by age group and sex, household populaton aged 15 or older, Canada excluding territories, 2015

	Total			Male			Female		
		95% confidence interval			95% confidence interval			95% confidence interval	
	%	from	to	%	from	to	%	from	to
Total	12.3	11.3	13.3	14.9	13.5	16.5	9.7*	8.6	11.0
Age group									
15 to 17	17.5†	14.0	21.5	18.9†	14.0	25.1	15.8E†	11.3	21.6
18 to 24†	28.4	25.7	31.2	31.8	28.0	35.8	25.0*	21.5	28.8
25 to 44	17.7†	15.5	20.2	21.2†	17.7	25.2	14.3*†	11.6	17.4
45 to 64	7.0†	5.7	8.4	9.3†	7.3	11.8	4.6*†	3.3	6.4
65 or older	1.6E†	1.0	2.5	2.1E†	1.3	3.6	F	...	...

... not applicable
E use with caution
F too unreliable to be published
* significantly different from male ($p < 0.05$)
† significantly different from 18- to 24-year-olds ($p < 0.05$)
Source: 2015 Canadian Tobacco, Alcohol, and Drugs Survey (CTADS).

the linear trends using the normalized weights, files pertaining to the 2004-to-2013 period with compatible variance approaches were run using design-based variance estimation to determine if design-based variance would appreciably change the final analysis results. It did not; therefore, the final trend analyses were conducted using the normalized weighted files.

Long-term trend (1985 through 2015)

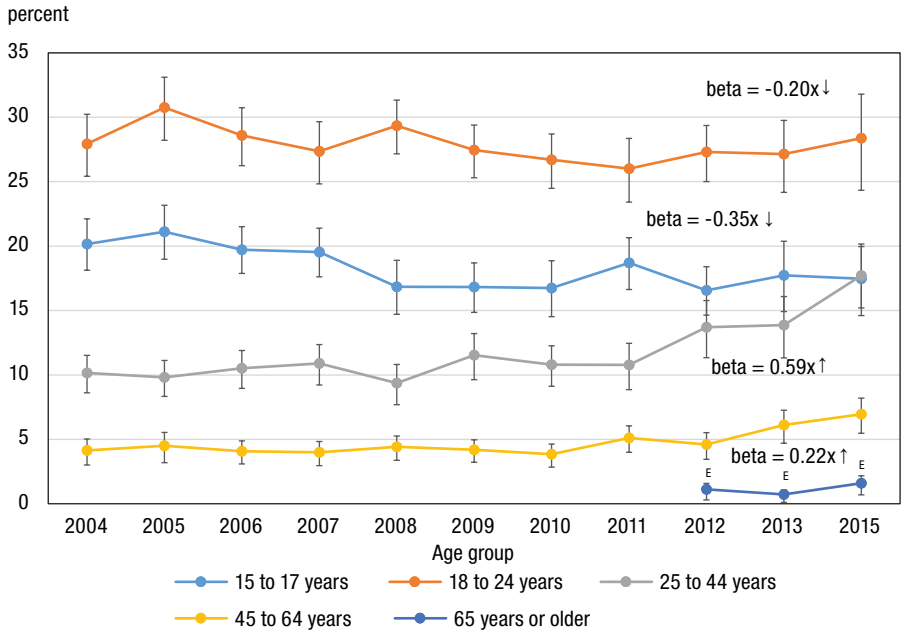
The estimated prevalence of self-reported current (past 12-month) cannabis consumption among the Canadian household population aged 15 or older increased between 1985 and 2015 (Figure 1). The most recent estimate from CTADS 2015—12.3%—was more than double the 1985 HPS estimate of 5.6%. However, use during this period was marked by intervals of stability and decrease.

Last decade (2004 through 2015)

According to CTADS 2015, the prevalence of past-year cannabis consumption was 28.4% among 18-to 24-year-olds, higher than among other age groups (17.5% at ages 15 to 17; 17.7% at ages 25 to 44; 7.0% at ages 45 to 64; and 1.6% at age 65 or older) (Table 1). In all age groups except 15 to 17 and 65 or older (estimate for women too unreliable to publish), males were more likely than females to report cannabis use. These age differences generally persisted when estimates were calculated separately for each sex (Table 1) and for other cycles (data not shown).

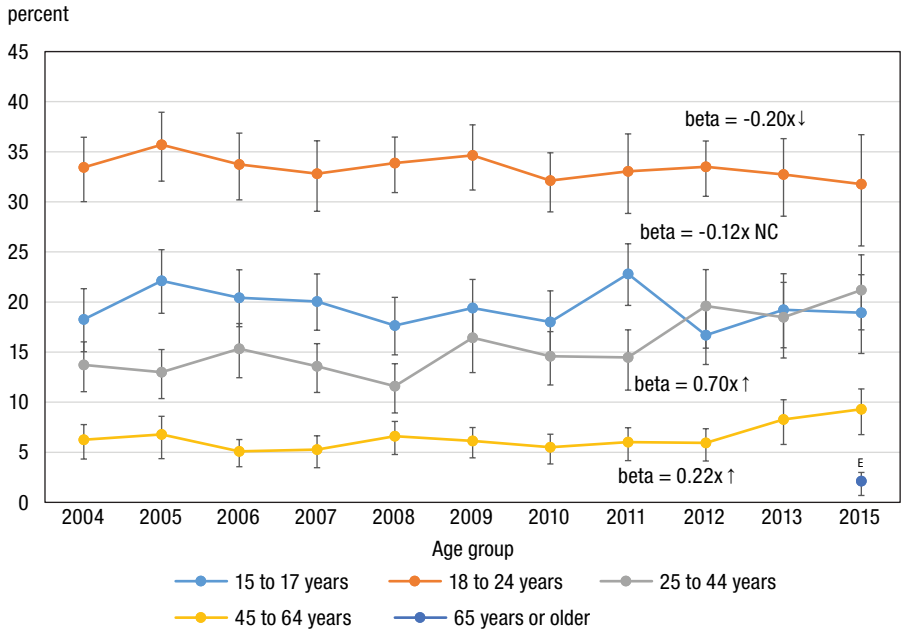
Based on comparable CTUMS/CTADS data for 2004 through 2015, trends in current cannabis consumption differed by age group (Figures 2, 3 and 4). For example, current use declined among females aged 15 to 17 and among 18- to 24-year-olds of both sexes, but was stable among males aged 15 to 17. Conversely, regardless of sex, the prevalence of consumption increased among adults aged 25 to 44 or 45 to 64. For people aged 65 or older, trend analysis before 2012 was not possible—estimates for seniors required suppression due to

Figure 2
Prevalence of cannabis use, by age group, household population aged 15 or older, Canada excluding territories, 2004 through 2015



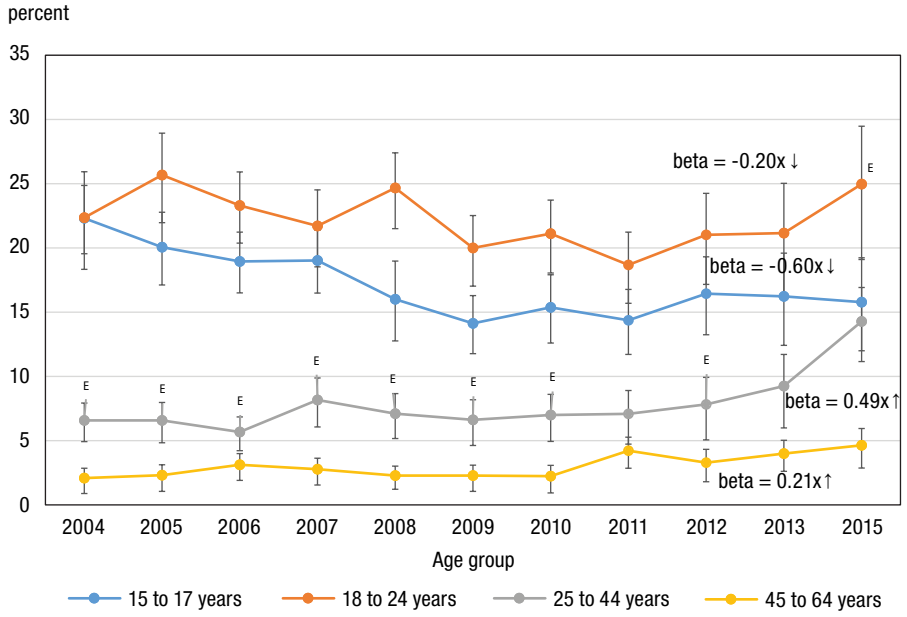
[E] use with caution
I = 95% confidence interval
↑statistically significant increase in trend ($p < 0.05$)
↓statistically significant decrease in trend ($p < 0.05$)
Notes: Betas indicate direction and strength of association; absolute values closer to 0 indicate a weaker association, values closer to 1.00, a stronger association. Because at least five data points are needed to test for a trend, the line pertaining to 65 or older was not tested.
Sources: 2004 to 2012 Canadian Tobacco Use Monitoring Survey (CTUMS) and 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS).

Figure 3
Prevalence of cannabis use, by age group, male household population aged 15 or older, Canada excluding territories, 2004 through 2015



[E] use with caution
I = 95% confidence interval
↑statistically significant increase in trend ($p < 0.05$)
↓statistically significant decrease in trend ($p < 0.05$)
NC = not statistcially signficant
Notes: Betas indicate direction and strength of association; absolute values indicate a weaker association, values closer to 1.00, a stronger association. Because at least five data points are needed to test for a trend, the line pertaining to 65 or older was not tested.
Sources: 2004 to 2012 Canadian Tobacco Use Monitoring Survey (CTUMS) and 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS).

Figure 4
Prevalence of cannabis use, by age group, female household population aged 15 or older, Canada excluding territories, 2004 through 2015



[E] use with caution
I = 95% confidence interval
↑statistically significant increase in trend ($p < 0.05$)
↓statistically significant decrease in trend ($p < 0.05$)
Notes: Betas indicate direction and strength of association; absolute values closer to 0 indicate a weaker association, values closer to 1.00, a stronger association. Because of insufficient cell counts, prevalence estimates suppressed for women aged 65 or older.
Sources: 2004 to 2012 Canadian Tobacco Use Monitoring Survey (CTUMS) and 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS).

the small number of records. The recent availability of releasable data points suggests that use by people aged 65 or older (both sexes combined) has increased.

Discussion

National surveys that collected information about drug use date back to the mid-1980s; in fact, for some periods, several surveys/data points are available. This necessitates evaluation of sometimes-competing data sources prior to estimating prevalence rates and testing for linear trends. The surveys were evaluated on several dimensions of design/methodology that affect the comparability of estimates from one year to the next.

The stable and/or decreasing cannabis consumption among youth since the mid-2000s evident in CTUMS/CTADS data is consistent with research based on school and/or household surveys of young Canadians[35-37] and of youth in other countries.[38] Similarly, the increase among adults is familiar,[35,38,39] although not universally found.[36]

A strength of the trend analysis from 2004 to 2015 is that CTADS and CTUMS used similar survey methodology. For the most part, sampling method, collection mode, and sample sizes remained relatively stable; therefore, differences in the estimates should not be influenced by these factors. CTADS, like CTUMS, was conducted by Statistics Canada interviewers, and data were collected by telephone. However, CTADS 2015 used the new household frame that includes cellphone numbers. This change may affect the comparability of 2015 data, the impact of which is difficult to quantify.

The 2002 and 2012 CCHS–MH yielded some of the highest estimates of cannabis use for the period. Unique design features of this survey likely contributed to the higher prevalence estimates, but also limited direct comparisons with other surveys. A large majority (85%) of CCHS–MH interviews were in-person/at respondents' homes, whereas the other surveys were conducted over the telephone. This is not necessarily a shortcoming, and could be advantageous. Higher estimates from surveys focusing on sensitive subjects may be more accurate reflections of the true extent of a behaviour. Although this cannot be proven, the CCHS–MH made considerable efforts to encourage participation and accurate reporting, which included interviewer training about mental illness.[40] The value of the CCHS–MH is not in examining changes in cannabis consumption over time, but rather, in assessing the extent of under-reporting in telephone surveys.

While the methodology and survey design features of CAS and CADUMS remained largely consistent with each other (by design), differences in the questionnaires, survey collectors, response rates, and non-response weighting adjustments affect their comparability with CTUMS/CTADS data.

A review of the CAS methodology and questionnaire[16,17] did not identify a single factor that accounts for the unusually high prevalence of cannabis use, but instead, minor differences on several dimensions. For these reasons, CAS/CADUMS data were not included in the 2004-to-2015 trend analysis.

The data collected during the 1985-to-1994 period are important for establishing a longer national trend in cannabis consumption and for providing evidence from multiple sources that the prevalence of use was lower than it is today. The present study demonstrated considerable similarities between these and the more recent surveys: sponsor and collector, context, response rates, question wording, and collection mode. These similarities are not surprising, given that NADS/CADS are among the original addiction surveys and that the HPS is a precursor of the CCHS. However, older data pose analytical challenges such as missing/deleted variables and approximate variance estimation that result in wider confidence intervals and difficulties interpreting tests of statistical significance. Moreover, the analytical potential of the earlier surveys is restricted by the irregularity of their

timing and the sparseness of their cannabis-related content. Therefore, these data were not included in the analysis of annual trends.

Limitations

This study has a number of strengths including a detailed evaluation of all national data sources which provided the foundation for Statistics Canada's experimental estimates of cannabis consumption[41]. Nevertheless, results of this study should be interpreted in light of several limitations. 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, laws, enforcement and attitudes have evolved.[2,5,42] Legal access to medical cannabis since 2001[43] may have influenced perceptions and willingness to report use.[5,7,13,44] These factors could be particularly relevant for older adults, as increases may reflect not so much a change in behaviour, but rather, a new willingness to report.

Data for the trend analysis were selected on the basis of comparability, continuity and recency, but this does not discount the value of the other data sources. Given the complexity of the subject, the dynamism of drug use behaviour, and consequences of consumption,[6,10,45-50] the availability of multiple datasets is advantageous.

Information from all the surveys was self-reported and has not been verified. The few studies comparing self-reported drug use with direct measures from urine or blood samples found some underreporting. However, these studies tended to be small, focused on people involved in the criminal justice system or treatment, and/or pertained to drugs other than cannabis. Consequently, the results may not be generalizable to cannabis users in the household population.[51-53] Studies that have been able to assess the logical consistency between lifetime and recent drug use tend to find few inconsistencies.[54,55]

The data are cross-sectional, and cannabis consumption was examined by age and sex only. Socioeconomic status, marital status, region, and use of other drugs or tobacco were not considered. As well, the trend analysis was limited to current consumption; the results and the comparability of data might be different for other measures (for example, daily use, age of initiation, previous use).

For much of the period it was not possible to separate medical from non-medical use and therefore the results do not distinguish between the two.

Conclusion

Since 1985, national data on cannabis use have been collected. Analysis of the results demonstrates considerable consistency over time and across sources in many estimates, despite sometimes fairly substantial differences in survey context, methodology, terminology and response rates. With the proposed changes to cannabis legislation to take effect in 2018, trends in use will evolve, further underscoring the importance of monitoring and evaluating the health, social and economic impacts. Consequently, the availability of high-quality, relevant and timely survey and non-survey data will continue to be important. ■

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Appendix

Table A
Survey questions related to cannabis/marijuana, by survey, 1985 through 2015

Survey name	Year	Cannabis (marijuana) question preface	Cannabis (marijuana) ever use	Cannabis (marijuana) use during:		Frequency of cannabis (marijuana) use:						Age of initiation	Medicinal use
				Past 12 months	Past 3 months	Past 12 months	Daily use	Near daily use	Past 3 months	Daily use	Near daily use		
Health Promotion Survey (HPS)	1985	...	...	In the past 12 months have you used marijuana or hashish?	...	...	...	...	...	...	...	...	...
	1990	...	Have you ever used: marijuana or hashish?	Have you used it in the past 12 months?	...	...	...	...	...	...	...	...	...
National Alcohol and Drug Survey (NADS)	1989	...	Have you ever used any of the following? Marijuana or hash (response categories distinguish between use during last 12 months and not during last 12 months)	Have you ever used any of the following? Marijuana or hash	...	How often have you used marijuana or hash in the past 12 months?	...	More than once a week	...	...	...	...	...
General Social Survey (GSS)	1993	...	...	In the past 12 months, did you use marijuana/ hash?	...	In the past 12 months, how often marijuana/ hash used?	...	More than once a week	...	...	...	...	...
Canada's Alcohol and Other Drugs Survey (CADS)	1994	...	Have you ever tried or used marijuana or hash?	Have you used it in the past 12 months?	...	How often did you use marijuana or hash in the past 12 months?	...	More than once a week	...	...	...	...	...
Canadian Community Health Survey -Mental Health and Well-being (CCHS-MH)	2002	...	Have you ever used or tried marijuana or hashish?	Have you used it in the past 12 months?	...	How often (did you use marijuana or hashish in the past 12 months?)	Every day	. . .	...	...	...	...	...
	2012	...	Have you ever used or tried marijuana or hashish?	Have you used it in the past 12 months?	...	How often (did you use marijuana or hashish in the past 12 months?)	Every day	. . .	...	...	...	...	...

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Survey questions related to cannabis/marijuana, by survey, 1985 through 2015

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				Past 12 months	Past 3 months	Past 12 months	Daily use	Near daily use	Past 3 months	Daily use	Near daily use		
Canadian Addiction Survey (CAS)	2004	...	Have you ever used or tried marijuana, cannabis or hashish?	Have you used it in the past 12 months?	And how about the past 3 months? How often did you use marijuana, cannabis or hashish (in the past 3 months)?)	...	...	...	And how about the past 3 months? How often did you use marijuana, cannabis or hashish (in the past 3 months)?	...	Daily or almost daily	How old were you when you started using marijuana, cannabis or hashish?	In the past 12 months have you intentionally used marijuana, cannabis, hashish to treat pain, nausea, glaucoma, multiple sclerosis, depression or any other medical condition?
Canadian Tobacco Use Monitoring Survey (CTUMS)	2004 through 2012	...	Have you ever used or tried marijuana, cannabis or hashish?	Have you used it in the past 12 months?	...	How often did you use marijuana, cannabis or hashish in the past 12 months?	Every day	. . .	...	...	...	How old were you when you first did this?	...
Canadian Drug Use Monitoring Survey (CADUMS)	2008 through 2010, 2012	In this series of questions when we use the term marijuana, we refer to the use of marijuana, hashish, hash oil or other cannabis derivates.	In your lifetime, have you ever used or tried marijuana, cannabis or hashish… *Interviewer note not read*: Including medical use	Have you used it in the past 12 months?	And how about the past 3 months? How often did you use marijuana?	...	...	...	And how about the past 3 months? How often did you use marijuana?	...	Daily or almost daily	How old were you when you started using marijuana?	...
	2011												In the past 12 months, have you used or tried marijuana (hashish, hash oil or other cannabis derivatives) for medical purposes?
Canadian Tobacco Alcohol and Drugs Survey (CTADS)	2013	In this series of questions when we use the term marijuana, we refer to the use of marijuana, hashish, hash oil or: other cannabis derivatives (2013); any other preparation of the cannabis plant (2015).	During your lifetime, have you ever used or tried marijuana? *Interviewer note not read* -- This includes the: medical use of marijuana, cannabis or hashish (2013); use of marijuana (hashish, hash oil or other cannabis derivatives for medical purposes) (2015).	During the past 12 months have you used marijuana?	During the past three months have you used marijuana?	...	...	...	During the past three months how often did you use marijuana?	...	Daily or almost daily	How old were you when you tried or started using marijuana?	...
	2015												In the past 12 months, have you used or tried marijuana (hashish, hash oil or other cannabis derivatives) for medical purposes?

... not applicable

Sources: 1985 and 1990 Health Promotion Survey (HPS); 1989 National Alcohol and Drug Survey (NADS); 1993 General Social Survey (GSS); 1994 Canadian Alcohol and Other Drugs Survey (CADS); 2004 Canadian Addiction Survey (CAS); 2004 through 2012 Canadian Tobacco Use Monitoring Survey (CTUMS); 2008 through 2012 Canadian Alcohol and Drug Use Monitoring Survey (CADUMS); 2013 and 2015 Canadian Tobacco, Alcohol and Drugs Survey (CTADS); 2002 and 2012 Canadian Community Health Survey–Mental Health and Well-being (CCHS-MH).