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Pre-Legalization Patterns and Trends of Cannabis Use Among Canadian Youth: Results from the COMPASS Prospective Cohort Study

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Pre-Legalization Patterns and Trends of Cannabis Use Among
Canadian Youth: Results from the COMPASS Prospective
Cohort Study

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ABSTRACT

Objective: Canada will federally legalize recreational cannabis use among adults in October 2018. The impact this will have on Canadian youth is cause for concern. The current study examined changes in youth cannabis use over the time prior to legalisation to explore the impact of the beginning federal discourse around legalization during the 2016/2017 school year.

Design: COMPASS, a prospective cohort study based on annual self-administered questionnaires.

Setting: Ontario and Alberta during the first 6 years of the COMPASS study (2012/2013 – 2017/2018).

Participants: Canadian grade 9 to 12 students attending secondary schools participating in COMPASS. In total, 230,404 questionnaires were included in the analysis. (Y1:2012/13 n=24,173, Y2:2013/14 n=45,298, Y3:2014/15 n=42,355, Y4:2015/16 n=40,436, Y5:2016/17 n=43,245, Y6:2017/18 n=34,897).

Primary and secondary outcome measures: Lifetime cannabis use, past-year cannabis use, weekly cannabis use, ease of access to cannabis, and age at first cannabis use.

Results: Cannabis never-use increased from Y1 to Y4 then decreased between Y5 and Y6. Annual changes in age at first cannabis use mirrored this trend. Lifetime and past-year cannabis use were lowest in Y4 then increased in Y5 and Y6. Following a decrease from Y1 to Y3, the proportion of students who believed cannabis was easy to access started to increase from Y4 to Y6.

Conclusion: After a steady decrease in patterns of cannabis among youth over several years, it appears that there has been a gradual increase in cannabis use among youth following the start of discourse around cannabis legalization, with some populations of youth being at greater risk.

Strengths and limitations of this study

- This study describes cannabis use patterns and trends prior to legalization.
- It benefits from prospective design, validated measures, and large sample size.
- Data are drawn from a convenience sample and therefore not generalizable.

- Recall and social desirability biases may have influenced self-report data.

Keywords: Public Health, Youth, Cannabis

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INTRODUCTION

In 2018, Canada will be the second country to federally legalize recreational cannabis use, and the first to do so with the primary emphasis on public health and education.[1] Following almost 80 years of complete prohibition, individual use of medicinal cannabis was legalized in Canada in 2001, albeit with the requirement for special approval of a medical exemption by Health Canada, which formed a significant access barrier for most.[2–4] In 2014, new regulations abolished this approval process and shifted gate-keeping duties to physicians, leading to a rise in prescriptions.[1] Court decisions in 2015 and 2016 precipitated a further loosening of restrictions on the permitted range of cannabis sources and products.[2,5,6] Concurrently, the Canadian government formed a Cannabis Legalization Task Force, which delivered its final report in December 2016.[7] The resulting Cannabis Act (Bill C-45) was introduced to Parliament in April 2017 and passed in June the following year.[8] It will come into force in October 2018.[9]

Evidence on the effects of medical or recreational legalization of cannabis on youth, for whom it remains illegal given age restrictions, is mixed. Some studies have shown that more permissive cannabis laws increase rates of cannabis use among adolescents,[10–13] while others have reported that they do not.[14–18] There is evidence that legalization can lead to gradual increases in use, more high-frequency use, a drop in the average age at first use, and increased use of more potent forms of cannabis.[19–26] As Canadian youth already use cannabis at a higher rate than Canadian adults or youth globally, any increase in use prevalence or frequency due to legalization is cause for concern.[7,27,28]

COMPASS, a large prospective cohort study of youth in Canada (2012–2021) serves as a research platform for evaluating the consequences of policy change on youth health behaviours.[29] With data reaching back to the 2012/2013 school year, evidence from COMPASS will be used by researchers and decision makers to evaluate the impact of cannabis legalization on Canadian youth. This paper relied on the first six years of COMPASS data to characterise the changes in youth cannabis use over time in terms of lifetime and past-year use, use frequency, age at first use, and ease of access to cannabis, to provide insight into pre-legalization cannabis use among Canadian youth.

METHODS

Study Design

COMPASS, a prospective cohort study, annually collects hierarchical data from grade 9-12 students and the schools they attend. This report uses student data from COMPASS years 1 to 6 (2012/2013 to 2017/2018) collected in Ontario and Alberta. The COMPASS questionnaire (Cq) was administered during class time, with items based on national guidelines or surveillance tools as previously described.[29,30] A full description of COMPASS study methods and data collection tools is also available online (www.compass.uwaterloo.ca). Students could decline to participate at any time. The COMPASS study was approved by the University of Waterloo Office of Research Ethics (OR file 17264) and appropriate school boards.

COMPASS data presented in this report are from 24,173 students (43 schools) in Year 1 (Y1 2012/2013), 45,298 students (89 schools) in Year 2 (Y2 2013/2014), 42,355 students (87 schools) in Year 3 (Y3 2014/2015), 40,436 students (81 schools) in Year 4 (Y4 2015/2016), 43,245 students (88 schools) in Year 5 (Y5 2016/2017), and 34,897 students (69 schools) in Year 6 (Y6 2017/2018). Students with missing values for demographic or cannabis use measures were excluded from this study. The start of formal federal discourse around cannabis legalization occurred in March 2016, near the end of the Y4 data collection cycle.

Measures

Sample characteristics

Students provided demographic information on grade, sex/gender, and race/ethnicity, as well as answering three questions on past-year cannabis use frequency, age at first use, and ease of access to cannabis consistent with national surveillance measures on cannabis use and as previously described.[30,31]

Cannabis lifetime/past-year use and use frequency

Students were asked, “In the last 12 months, how often did you use marijuana or cannabis?” and responded with one of 9 options: “I have never used marijuana”, “I have used marijuana but not in the last 12 months”, “Less than once a month”, “Once a month”, “2 or 3 times a month”, “Once a week”, “2 or 3 times a week”, “4 to 6 times a week”, and “Every day”.

Individuals were classified as lifetime users if they indicated any marijuana use and past-year users if they indicated use of “at least once a month” or more frequent. Among past-year users, students were classified as weekly users if they indicated use of “once a week” or more often and as occasional users if they indicated less frequent use.

Age at first cannabis use and ease of access to cannabis

Students were asked, “How old were you when you first used marijuana or cannabis?” and responded with one of 13 options: “I have never used marijuana”, “I do not know”, “8 years or younger”, one option for each age from 9 to 17, and “18 years or older”. Age of first use was measured on the subsample of grade 12 students who had indicated past marijuana use. Students who answered, “I do not know” to the age of initiation question were excluded from the analyses. Students also responded to the question “Do you think it would be difficult or easy for you to get marijuana if you wanted some?” with “Difficult”, “Easy”, or “I do not know”.

School median income and urbanicity

School data were extracted from Statistics Canada 2016 census data. School median income was determined using the median income for the forward sortation area (first three letters of postal code). Urbanicity was measured based on total population and population density for the population centre in which the school resides.

Statistical Analysis

Statistical analyses were conducted in SAS 9.4. Four logistic regression models and one linear regression model were used to estimate the relationship between the five cannabis-related outcomes and COMPASS study year, gender, and race/ethnicity. Models were adjusted for grade, median income, and urbanicity.

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2
3 **RESULTS**
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5 The proportion of cannabis never-users increased from 68.5% to 71.2% from Y1 to Y4,
6 decreased to 70.5% in Y5 and then dropped to 68% in Y6 (Table 1). Annual changes in age at
7 first cannabis use mirrored this trend, with the number of students starting at 12 or younger
8 increasing from 12.1% in Y1 to 14.7% in Y4 and then decreasing to 11.9% in Y6. In both cases,
9 the level of change observed between Y4 and Y6 exceeded that between Y1 and Y4. The
10 proportion of students who thought cannabis difficult to access changed most rapidly, halving
11 from 13.8% in Y3 to 7.4% in Y4 and then further decreasing to 6.5% in Y6.
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18 **Lifetime and Past-Year Use**
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20 Rates of lifetime and past-year cannabis use were highest among male and aboriginal
21 students, and lowest among Asian students (Figure 1). Both rates reached their lowest points in
22 Y4 at 28.8% and 24.1% respectively but have been increasing since, with the changes appearing
23 to be accelerating. Lifetime use similarly increased by a relative 2.4% in Y5 and 7.8% in Y6.
24 Interestingly, both lifetime and past-year use by male students remained steady between Y4 and
25 Y5, rising sharply in Y6, while use rates among female students rose in both Y5 and Y6. Changes
26 in lifetime and past-year use among students grouped by races/ethnicity were mixed, though Y4
27 marked a turning point for most youth. In Y5, lifetime use rates among black and Hispanic
28 students decreased, while increasing among white, Asian, and Aboriginal students. These trends
29 were similar for past-year use, though past-year rates were markedly lower than life-time use
30 only for Aboriginal students.
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Table 1 – Demographic characteristics of and cannabis use indicators among COMPASS youth (Canada).

n (%)	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Total	21931	41601	38875	37012	43334	63653
Grade						
9	5693 (26.0)	10848 (26.1)	10123 (26.0)	9695 (26.2)	8991 (26.4)	8806 (26.4)
10	5624 (25.6)	10862 (26.1)	10651 (27.4)	9804 (26.5)	9324 (27.4)	9037 (27.1)
11	5385 (24.6)	10389 (25.0)	9726 (25.0)	9400 (25.4)	8467 (24.9)	8426 (25.3)
12	5229 (23.8)	9502 (22.8)	8375 (21.5)	8113 (21.9)	7222 (21.2)	7038 (21.1)
Gender						
Female	11092 (50.6)	20973 (50.4)	19506 (50.2)	18245 (49.3)	16958 (49.9)	16659 (50.0)
Male	10839 (49.4)	20628 (49.6)	19369 (49.8)	18767 (50.7)	17046 (50.1)	16648 (50.0)
Race/Ethnicity						
White	17199 (78.4)	33651 (80.9)	31045 (79.9)	29034 (78.4)	26532 (78)	25364 (76.2)
Black	1065 (4.9)	1776 (4.3)	1881 (4.8)	1923 (5.2)	1620 (4.8)	1720 (5.2)
Asian	1392 (6.3)	2288 (5.5)	2276 (5.9)	2434 (6.6)	2231 (6.6)	2483 (7.5)
Aboriginal	640 (2.9)	1465 (3.5)	1319 (3.4)	1181 (3.2)	1276 (3.8)	1246 (3.7)
Hispanic	520 (2.4)	821 (2.0)	826 (2.1)	882 (2.4)	920 (2.7)	1010 (3.0)
Other/Mixed	1115 (5.1)	1600 (3.8)	1528 (3.9)	1558 (4.2)	1425 (4.2)	1484 (4.5)
Province						
Ontario	21931 (100)	38285 (92.0)	35747 (92.0)	33938 (91.7)	31245 (91.9)	30195 (90.7)
Alberta	n/a	3316 (8.0)	3128 (8.0)	3074 (8.3)	2759 (8.1)	3112 (9.3)
Cannabis Use Frequency						
Never	15028 (68.5)	28993 (69.7)	27226 (70)	26367 (71.2)	23978 (70.5)	22649 (68.0)
Not in past year	1261 (5.7)	2299 (5.5)	2041 (5.3)	1735 (4.7)	1532 (4.5)	1500 (4.5)
Less than once a month	1974 (9.0)	3689 (8.9)	3474 (8.9)	3199 (8.6)	3133 (9.2)	3502 (10.5)
Once a month	607 (2.8)	1097 (2.6)	1055 (2.7)	958 (2.6)	898 (2.6)	1028 (3.1)
2-3 times a month	853 (3.9)	1458 (3.5)	1318 (3.4)	1308 (3.5)	1242 (3.7)	1341 (4.0)
Once a week	362 (1.7)	636 (1.5)	587 (1.5)	559 (1.5)	560 (1.6)	556 (1.7)
2-3 times a week	559 (2.5)	879 (2.1)	795 (2.0)	695 (1.9)	716 (2.1)	793 (2.4)
4-6 times a week	428 (2.0)	774 (1.9)	706 (1.8)	607 (1.6)	593 (1.7)	609 (1.8)
Every day	859 (3.9)	1776 (4.3)	1673 (4.3)	1584 (4.3)	1352 (4.0)	1329 (4.0)
Age at First Cannabis Use						
12 or younger	840 (12.1)	1805 (14.4)	1689 (14.6)	1571 (14.7)	1319 (13.2)	1266 (11.9)
13	911 (13.2)	1715 (13.6)	1519 (13)	1292 (12.1)	1119 (11.2)	1103 (10.3)
14	1855 (26.9)	3161 (25.1)	3003 (25.8)	2603 (24.5)	2433 (24.3)	2512 (23.6)
15	1646 (23.8)	2969 (23.5)	2686 (23.1)	2538 (23.8)	2519 (25.1)	2787 (26.1)
16	1076 (15.6)	1838 (14.6)	1711 (14.7)	1555 (14.6)	1633 (16.3)	1952 (18.3)
17	334 (4.8)	593 (4.7)	520 (4.5)	519 (4.9)	533 (5.3)	609 (5.7)
18 or older	44 (0.6)	78 (0.6)	61 (0.5)	75 (0.7)	62 (0.6)	64 (0.6)
Don't Know	197 (2.9)	449 (3.6)	460 (3.9)	492 (4.6)	408 (4.1)	365 (3.4)
Ease of Access to Cannabis						
Difficult	2861 (13.0)	5650 (13.6)	5362 (13.8)	2754 (7.4)	2488 (7.3)	2157 (6.5)
Easy	11664 (53.2)	21835 (52.5)	20212 (52)	20524 (55.5)	19048 (56)	19583 (58.8)
Don't Know	7406 (33.8)	14116 (33.9)	13301 (34.2)	13734 (37.1)	12468 (36.7)	11567 (34.7)

Age at First Use and Ease of Access

The average age at first cannabis use reported by grade 12 students was 14.8 years in Y1 and Y2, 14.7 years from Y3 to Y5, and 15.0 years in Y6 (Figure 2). Male students consistently started using at younger ages than females, though averages for both increased in Y5 and Y6. Among black students, average age at first use dropped from 14.3 to 12.8 years between Y1 and Y3, then steadily recovered to reach 13.8 years in Y6, surpassing Aboriginal students (13.7 years), whose average remained low. White, Hispanic, and Asian students reported their youngest average age in Y4, with values on the rise since.

After decreasing from Y1 to Y3, the proportion of students who thought cannabis easy to access increased from Y4 to Y6, with a sharp rise among female students in Y4 and Y5, and a subsequent rise among male students in Y6. The lowest, though steadily rising, rates of easy access were recorded among Asian students, the highest among black and Aboriginal students. This was the case until Y6, when rates among Hispanic and white students, which started increasing in Y4 after three years of decline, peaked at the highest values observed over the six years studied.

Frequency of Use

Between 9.3% and 10.1% of students reported high-risk weekly use (Figure 3). However, both weekly and occasional use have been increasing since reaching their lowest point in Y4, the latter rising especially fast. Rates of occasional use among male students, generally lower than those among female students, rose by a relative 14.5% between Y5 and Y6, compared to a relative 10.2% increase among female students over the same period. Of note, rates of occasional use were 2.4-fold higher than weekly use rates among females, compared to an average 1.2-fold difference for males.

Students identifying with different racial or ethnic groups varied less in terms of occasional than of weekly use. Occasional use rates fluctuated between Y1 and Y4 for most groups, then subsequently rose in Y5 for Aboriginal, white, and Hispanic students and in Y6 for black and Asian students. Only black and aboriginal students reported more weekly than occasional use for all years, though with mirroring trajectories. Rates of weekly use among black students increased from 16.2% in Y1 to 21.4% in Y4, then decreased to 16.3% in Y6, while those among aboriginal students dropped from 27.2% in Y1 to 21.8% in Y5 and then rose sharply to

25% in Y6. Weekly use among Hispanic and Asian students increased from Y1 to Y4 and decreased in Y5 and Y6, while the opposite trend was observed for white students.

Regression Analyses

Inflection points were observed in the trend curves for all five cannabis use indicators over the six COMPASS study years shown here, though at different times (Table 2). For instance, compared to Y1, students had significantly lower odds of reporting past-year cannabis use from Y2 to Y4, but significantly higher odds in Y6. Similar patterns were observed for lifetime use, weekly use, age at first use, and ease of access, with odds of easy access continually increasing starting in Y4. Meanwhile, demographic differences remained mostly consistent across all indicators of cannabis use. Male students were more likely than female students to report any use, easy access, or a lower age at first use. Compared to white students, aboriginal students had the highest odds of reporting lifetime (OR 2.88) and past-year use (OR 2.39), weekly use (OR 3.22), and easy access (OR 1.15). Asian students had lower odds of reporting easy access or any category of use, while white students were more likely to start using cannabis later than any other group.

Table 2 – Regression analyses[†] of the relationship between COMPASS year, student gender, student race or ethnicity and five cannabis use outcomes.

OR (95% CI)	Lifetime use	Past-year use	Weekly use	Ease of access	Age at first use
Year					
2012/2013 (<i>ref</i>)					
2013/2014	0.91 (0.88, 0.94) *	0.92 (0.89, 0.96) *	0.93 (0.88, 0.98) *	0.97 (0.94, 1.00)	1.00 (0.91, 1.11)
2014/2015	0.91 (0.88, 0.95) *	0.93 (0.90, 0.97) *	0.93 (0.88, 0.98) *	0.96 (0.93, 0.99) *	0.88 (0.79, 0.98) *
2015/2016	0.86 (0.83, 0.90) *	0.90 (0.87, 0.94) *	0.89 (0.84, 0.94) *	1.12 (1.08, 1.16) *	0.89 (0.80, 0.98) *
2016/2017	0.90 (0.86, 0.93) *	0.96 (0.92, 1.00)	0.90 (0.85, 0.95) *	1.16 (1.12, 1.21) *	0.96 (0.86, 1.07)
2017/2018	1.03 (0.99, 1.07)	1.11 (1.06, 1.15) *	0.95 (0.89, 1.00)	1.32 (1.27, 1.37) *	1.23 (1.11, 1.37) *
Gender					
Female (<i>ref</i>)					
Male	1.14 (1.12, 1.17) *	1.16 (1.14, 1.19) *	1.80 (1.74, 1.86) *	1.24 (1.22, 1.26) *	0.63 (0.60, 0.67) *
Race/Ethnicity					
White (<i>ref</i>)					
Black	1.48 (1.41, 1.55) *	1.54 (1.47, 1.61) *	2.62 (2.48, 2.77) *	1.12 (1.08, 1.17) *	0.22 (0.19, 0.25) *
Asian	0.43 (0.41, 0.45) *	0.45 (0.42, 0.47) *	0.59 (0.54, 0.64) *	0.38 (0.37, 0.40) *	0.66 (0.57, 0.76) *
Aboriginal	2.88 (2.74, 3.03) *	2.39 (2.28, 2.52) *	3.22 (3.04, 3.42) *	1.15 (1.09, 1.21) *	0.29 (0.25, 0.33) *
Hispanic	1.16 (1.09, 1.23) *	1.08 (1.01, 1.16) *	1.30 (1.18, 1.42) *	1.00 (0.94, 1.06)	0.64 (0.55, 0.76) *

[†]Models were adjusted for grade, school median income, and school urbanicity. * indicates significance at $p < 0.05$

DISCUSSION

Cannabis use has been highly prevalent among COMPASS youth since 2012/2013, as it is among their peers across Canada.[7,27,28] Our data generally suggest that, following a steady decrease over several years, there has been a gradual increase in youth cannabis use since the beginning of the federal discourse around legalization. During this time, public perception of cannabis use shifted to include a type of “sensible” use, which is intermittent and socially acceptable.[32–35] For youth, these more accommodating social norms and pro-cannabis messaging are associated with increased cannabis use.[36–38] Here, most of the increase we observed was due to an upswing of occasional, or “sensible”, use. When placed in the context of growing access after 2014/2015 and the slow rise in average age at first use, these data may represent the emergence of a large group of casual cannabis users who start later and use infrequently. Future, post-legalization evaluations must therefore explore the impact on various patterns of use.

We may characterise our results further by relying on the normalization theory framework, which posits that the interplay between six factors – access, trying and usage rates, attitudes, cultural accommodation, and governmental response – can normalise drug use.[39,40] Other factors have recently been suggested, e.g. seeing drugs as a means of achieving normal goals, such as cannabis use by athletes to enhance performance.[41–43] Indicators for the normalisation of cannabis use have been prevalent in Canada for some time.[34,44–46] Subsequent to reduced restriction of medical cannabis in 2014, rates of students who thought cannabis easy to access significantly increased in 2015/2016 (Y4) and rose in tandem with further deregulation.[1,2] The increased availability of cannabis is likely to have normalized and facilitated access for youth, who most commonly obtain drugs through their social network.[40,47] Perceived access drives use [48] and we identified that rates of cannabis use in our sample increased the following year (2016/2017). This is true especially among female students, for whom the effects of normalization may be greater as their cannabis use has historically been more stigmatized than that of their male peers.[49] Female students are also more likely to use alternative cannabis products, which were then becoming more accessible.[2,50,51] As normalization and access to diverse cannabis products is liable to increase in Canada after legalization,[19,22] special attention should be paid to subsequent impacts on female youth.

The evidence presented here demonstrate that the focus on demographic differences among youth who use cannabis is warranted. For instance, lifetime and past-year use rates were particularly high among aboriginal students, who also reported the most weekly use. This is in line with existing evidence reporting similar results for both American and Canadian aboriginal youth, who are more likely to start younger and use cannabis more regularly than white adolescents, especially if male.[52–57] Following a steady decrease over several years, weekly use by aboriginal youth increased significantly in 2017/2018 (Y6). This is a concerning development that may warrant close future monitoring, and interventions to mitigate the effects of cannabis legalization for these adolescents are likely to be needed.

The evidence also suggests that studies on the impact of cannabis legalization on Canadian youth should consider data from several years prior to the passage of the Cannabis Act. Relying on 2017/2018 as a solitary baseline is liable to miss key developments in the years before, and therefore likely to underestimate subsequent effect, e.g. the increase in youth lifetime and past-year use. In 2016/2017, Health Canada funded the expansion of COMPASS to include high school students in Québec, British Columbia, and Nunavut, increasing the relevance of its future investigations of youth cannabis use. As cannabis legalization is likely to disproportionately affect youth, these data will be essential to understanding and mitigating its impact.

Limitations

The COMPASS study has several strengths, including prospective design, validated measures, and large sample size.[29] However, recall and social desirability biases may influence data from self-report questionnaires, leading to underreporting of cannabis use, especially among subpopulations (e.g. females) where use is more stigmatised.[49] High school students who use cannabis at a high frequency are more likely to drop out,[58] also resulting in underestimations, especially of weekly use rates. As the schools studied were from a convenience sample, results are not generalizable. However, use of a passive-consent protocol resulted in high participation rates and reduced selection bias within schools, and the large sample size suggests that conclusions drawn will apply to a substantial proportion of Canadian high school students.

Conclusions

Our data suggest that there has been a gradual rise in youth cannabis use due to the federal discourse around cannabis legalization prior to actual changes in law. This negative trend appears

amplified among some sub-populations of youth. Future research examining the impact of cannabis legalization should consider the ramifications of these pre-implementation changes when drawing conclusions about its overall effect on Canadian youth.

Contributors: AZ designed the work, interpreted the data, wrote the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. KB designed the work, managed and analysed the data, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. MdG substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. YJ substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. SL is the principal investigator of the COMPASS study, designed the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work.

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Competing interests: None declared.

Data sharing statement: COMPASS data are available for researchers upon successful completion and approval of the COMPASS data usage application (<https://uwaterloo.ca/compass-system/information-researchers>). Technical reports detailing COMPASS study methods are available online (<https://uwaterloo.ca/compass-system/publications#technical>).

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Figure Legends

Figure 1 – Rates of lifetime and past-year cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting lifetime and past-year cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) lifetime and (D) past-year cannabis use.

Figure 2 – Average age at first cannabis use and rates of easy access to cannabis among youth participating in the COMPASS study (ON and AB, Canada). Grade 12 COMPASS students reporting (A, B) average age at first cannabis use (A) overall and by gender and (B) by ethnicity each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of grade 9-12 COMPASS students who think cannabis is easy to access (C) overall and by gender and (D) by ethnicity.

Figure 3 – Rates of weekly and occasional cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting weekly (1-6 times a week or daily) and occasional (2-3 times a month or less) cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) weekly and (D) occasional cannabis use.

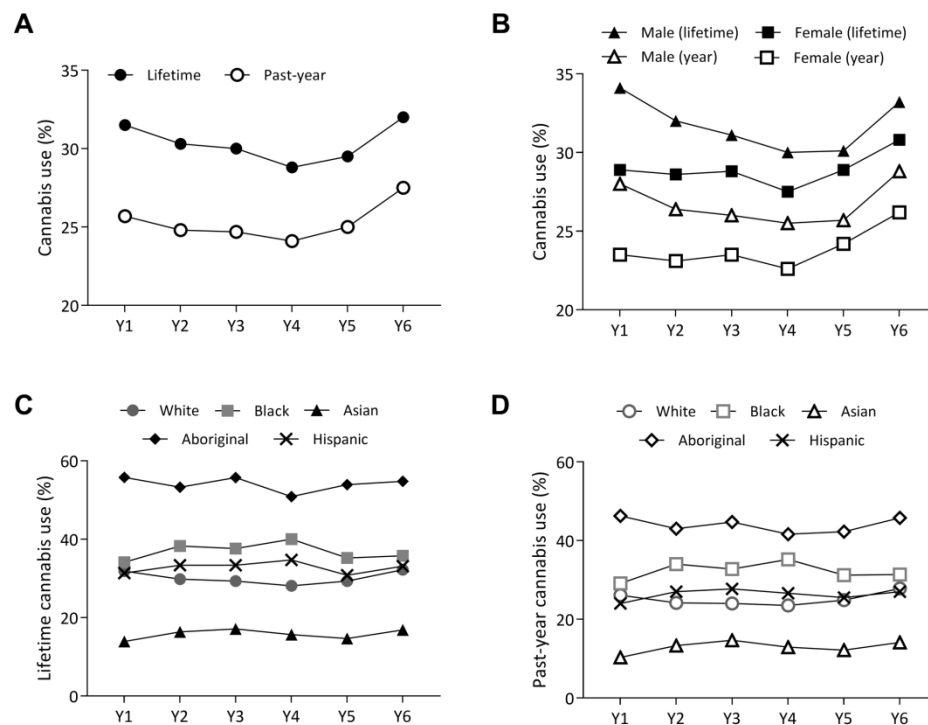


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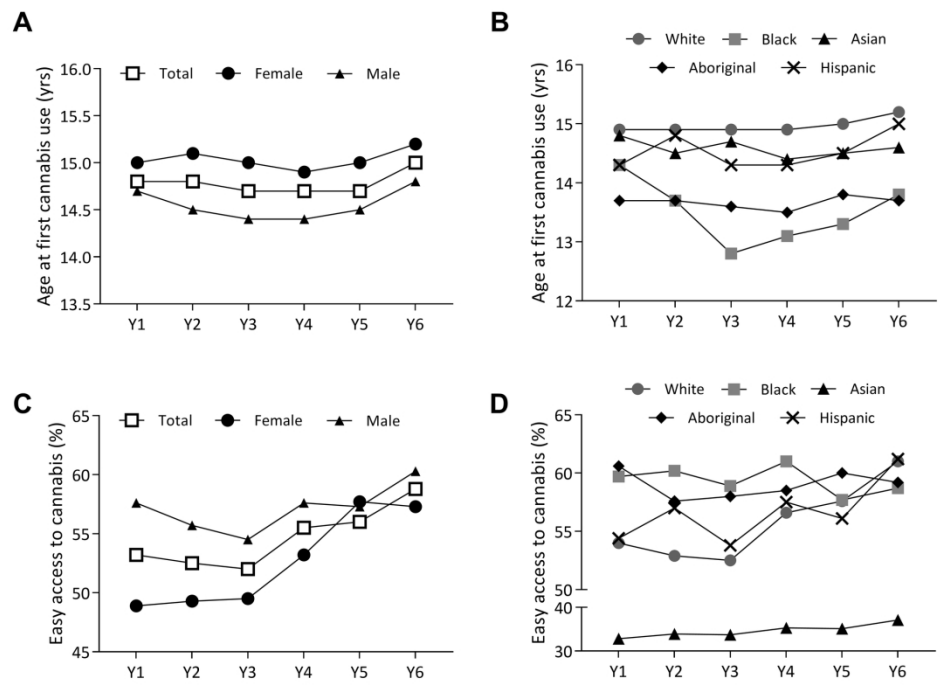


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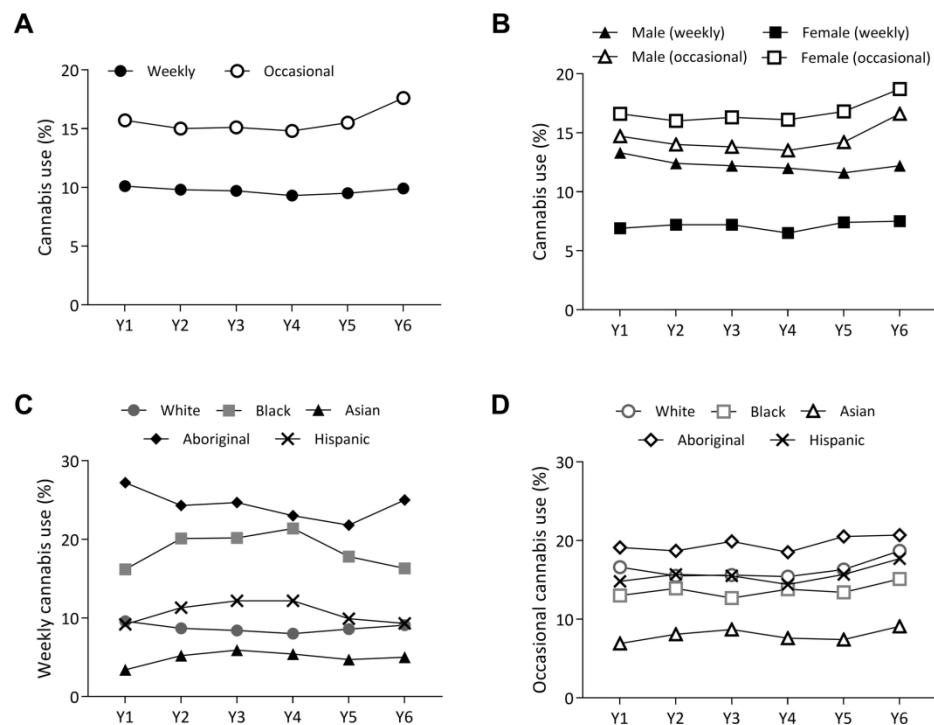


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STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4, 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4, 5
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4, 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4, 5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	4, 7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	Report numbers of outcome events or summary measures over time	7

1	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-9
2			(b) Report category boundaries when continuous variables were categorized	
3			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
4	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
5				
6	Discussion			
7	Key results	18	Summarise key results with reference to study objectives	10, 11
8	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
9	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 11
10	Generalisability	21	Discuss the generalisability (external validity) of the study results	11
11	Other information			
12	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

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Pre-Legalization Patterns and Trends of Cannabis Use Among Canadian Youth: Results from the COMPASS Prospective Cohort Study

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ABSTRACT

Objective: Canada will federally legalize recreational cannabis use among adults in October 2018. The impact this will have on Canadian youth is cause for concern. The current study examined changes in youth cannabis use over the time prior to legalisation to explore the impact of the beginning federal discourse around legalization during the 2016/2017 school year.

Design: COMPASS, a prospective cohort study based on annual self-administered questionnaires.

Setting: Ontario and Alberta during the first 6 years of the COMPASS study (2012/2013 – 2017/2018).

Participants: Canadian grade 9 to 12 students attending secondary schools participating in COMPASS. In total, 230,404 questionnaires were included in the analysis. (Y1:2012/13 n=24,173, Y2:2013/14 n=45,298, Y3:2014/15 n=42,355, Y4:2015/16 n=40,436, Y5:2016/17 n=37,060, Y6:2017/18 n=34,897).

Primary and secondary outcome measures: Lifetime cannabis use, past-year cannabis use, weekly cannabis use, ease of access to cannabis, and age at first cannabis use.

Results: After first increasing, cannabis never-use decreased between Y5 and Y6. Annual changes in age at first cannabis use mirrored this trend. Lifetime and past-year use rates were lowest in Y4 then increased in Y5 and Y6, mostly due to rising occasional use. Male and non-white students were more likely to report using cannabis. The proportion of students who believed cannabis was easy to access started to increase in Y4.

Conclusion: After a steady decrease in patterns of cannabis among youth over several years, it appears that there has been a gradual increase in cannabis use among youth following the start of discourse around cannabis legalization, with some populations of youth being at greater risk.

Strengths and limitations of this study

- This study describes cannabis use patterns and trends prior to legalization.
- It benefits from prospective design, validated measures, and large sample size.
- Data are drawn from a convenience sample and therefore not generalizable.
- Recall and social desirability biases may have influenced self-report data.

Keywords: Public Health, Youth, Cannabis

INTRODUCTION

In 2018, Canada will be the second country to federally legalize recreational cannabis use, and the first to do so with the primary emphasis on public health and education.[1] Following almost 80 years of complete prohibition, individual use of medicinal cannabis was legalized in Canada in 2001, albeit with the requirement for special approval of a medical exemption by Health Canada, which formed a significant access barrier for most.[2–4] In 2014, new regulations abolished this approval process and shifted gate-keeping duties to physicians, leading to a rise in prescriptions.[1] Court decisions in 2015 and 2016 precipitated a further loosening of restrictions on the permitted range of cannabis sources and products.[2,5,6] Concurrently, the Canadian government formed a Cannabis Legalization Task Force, which delivered its final report in December 2016.[7] The resulting Cannabis Act (Bill C-45) was introduced to Parliament in April 2017 and passed in June the following year.[8] It will come into force in October 2018.[9]

Evidence on the effects of medical or recreational legalization of cannabis on youth, for whom it remains illegal given age restrictions, is mixed. Some studies have shown that more permissive cannabis laws increase rates of cannabis use among adolescents,[10–13] while others have reported that they do not.[14–18] There is evidence that legalization can lead to gradual increases in use, more high-frequency use, a drop in the average age at first use, and increased use of more potent forms of cannabis.[19–26] As Canadian youth already use cannabis at a higher rate than Canadian adults or youth globally, any increase in use prevalence or frequency due to legalization is cause for concern.[7,27,28]

COMPASS, a large prospective cohort study of youth in Canada (2012–2021) serves as a research platform for evaluating the consequences of policy change on youth health behaviours.[29] With data reaching back to the 2012/2013 school year, evidence from COMPASS will be used by researchers and decision makers to evaluate the impact of cannabis legalization on Canadian youth. This paper relied on the first six years of COMPASS data to characterise the changes in youth cannabis use over time in terms of lifetime and past-year use, use frequency, age at first use, and ease of access to cannabis, to provide insight into pre-legalization cannabis use among Canadian youth.

METHODS

Study Design

COMPASS, a prospective cohort study, annually collects hierarchical data from grade 9-12 students and the schools they attend. This report uses student data from COMPASS years 1 to 6 (2012/2013 to 2017/2018) collected in Ontario and Alberta. The COMPASS student questionnaire (Cq) is an anonymous, self-administered questionnaire completed by students during class time, with items based on national guidelines or surveillance tools as previously described.[29,30] Students could decline to participate at any time. Response rates range from 76% to 80% (Year 1: 79.0%, Year 2: 79.2%, Year 3: 78.7%, Year 4: 79.9%, Year 5: 76.0%, Year 6: 78.7%). The primary reason for non-response was absenteeism or scheduled spare on the data collection date. Parental permission rates are greater than 99%. A full description of COMPASS study methods and data collection tools is also available online (www.compass.uwaterloo.ca). The COMPASS study was approved by the University of Waterloo Office of Research Ethics (OR file 17264) and appropriate school boards.

COMPASS data presented in this report are from 24,173 students (43 schools) in Year 1 (Y1 2012/2013), 45,298 students (89 schools) in Year 2 (Y2 2013/2014), 42,355 students (87 schools) in Year 3 (Y3 2014/2015), 40,436 students (81 schools) in Year 4 (Y4 2015/2016), 37,060 students (88 schools) in Year 5 (Y5 2016/2017), and 34,897 students (69 schools) in Year 6 (Y6 2017/2018). Schools that dropped out of the COMPASS study reported cannabis ever-use rates of 31.9%, while schools that remained reported rates of 30.1%. Students with missing values for demographic or cannabis use measures were excluded from this study. The start of formal federal discourse around cannabis legalization occurred in March 2016, near the end of the Y4 data collection cycle.

Measures

Sample characteristics

Students provided demographic information on grade, sex/gender, and race/ethnicity, as well as answering three questions on past-year cannabis use frequency, age at first use, and ease of access to cannabis consistent with national surveillance measures on cannabis use and as previously described.[30,31]

Cannabis lifetime/past-year use and use frequency

Students were asked, “In the last 12 months, how often did you use marijuana or cannabis?” and responded with one of 9 options: “I have never used marijuana”, “I have used marijuana but not in the last 12 months”, “Less than once a month”, “Once a month”, “2 or 3 times a month”, “Once a week”, “2 or 3 times a week”, “4 to 6 times a week”, and “Every day”. Individuals were classified as lifetime users if they indicated any marijuana use and past-year users if they indicated use of “at least once a month” or more frequent. Among past-year users, students were classified as weekly users if they indicated use of “once a week” or more often and as occasional users if they indicated less frequent use.

Age at first cannabis use and ease of access to cannabis

Students were asked, “How old were you when you first used marijuana or cannabis?” and responded with one of 13 options: “I have never used marijuana”, “I do not know”, “8 years or younger”, one option for each age from 9 to 17, and “18 years or older”. Age of first use was measured on the subsample of grade 12 students who had indicated past marijuana use. Students who answered, “I do not know” to the age of initiation question were excluded from the analyses. Students also responded to the question “Do you think it would be difficult or easy for you to get marijuana if you wanted some?” with “Difficult”, “Easy”, or “I do not know”.

School median income and urbanicity

School data were extracted from Statistics Canada 2016 census data. School median income was determined using the median income for the forward sortation area (first three letters of postal code). Urbanicity was measured based on total population and population density for the population centre in which the school resides.

Patient and Public Involvement

Students were not involved in study design, research question design, or recruitment and conduct of the study, beyond self-administration of the student questionnaire. Some items were based on previously validated measures which may have involved students or patients in their design. School-specific results were annually provided in terms of overall health measures to each

participating school in the form of a school feedback report, which school administrators were encouraged to disseminate to staff, students, and parents or guardians.

Statistical Analysis

Statistical analyses were conducted in SAS 9.4. Generalized estimating equations (GEE) with alternating logistic regression (ALR) were used to estimate the relationship between lifetime, past year, and weekly marijuana use and ease of access outcomes and COMPASS study year, gender and race/ethnicity. Among grade 12 students only, a linear mixed model was used to examine the relationship between age of initiation and COMPASS study year, gender and race/ethnicity. All models were adjusted for grade, school median income, urbanicity, and clustering by school. The PROC GENMOD procedure was used to fit GEE models with an exchangeable logOR. The PROC MIXED procedure was used to fit the linear mixed model with random intercept.

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3 **RESULTS**
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5 The proportion of cannabis never-users increased from Y1 to Y4 but then decreased in Y5
6 and Y6 (Table 1). Annual changes in age at first cannabis use mirrored this trend, with the number
7 of students starting at 12 or younger first increasing to 14.7% in Y4 and then decreasing to 11.9%
8 in Y6. In both cases, the level of change observed between Y4 and Y6 exceeded that between Y1
9 and Y4. The proportion of students who thought cannabis difficult to access changed most rapidly,
10 halving from 13.8% in Y3 to 7.4% in Y4 and then further decreasing to 6.5% in Y6.
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16 **Lifetime and Past-Year Use**
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18 Rates of lifetime and past-year cannabis use were highest among male and aboriginal
19 students, and lowest among Asian students (Figure 1). Both rates reached their lowest points in Y4
20 at 28.8% and 24.1% respectively but have been increasing since, with the changes appearing to be
21 accelerating. Lifetime use similarly increased in Y5 and Y6. Interestingly, both lifetime and past-
22 year use by male students remained steady between Y4 and Y5, rising sharply in Y6, while use
23 rates among female students rose in both Y5 and Y6. Changes in lifetime and past-year use among
24 students grouped by races/ethnicity were mixed, though Y4 marked a turning point for most youth.
25 In Y5, lifetime use rates among black and Hispanic students decreased, while increasing among
26 white, Asian, and Aboriginal students. These trends were similar for past-year use, though past-
27 year rates were markedly lower than life-time use only for Aboriginal students.
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Table 1 – Demographic characteristics of and cannabis use indicators among COMPASS youth (Canada).

n (%)	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Total	21931	41601	38875	37012	43004	33307
Grade						
9	5693 (26.0)	10848 (26.1)	10123 (26.0)	9695 (26.2)	8991 (26.4)	8806 (26.4)
10	5624 (25.6)	10862 (26.1)	10651 (27.4)	9804 (26.5)	9324 (27.4)	9037 (27.1)
11	5385 (24.6)	10389 (25.0)	9726 (25.0)	9400 (25.4)	8467 (24.9)	8426 (25.3)
12	5229 (23.8)	9502 (22.8)	8375 (21.5)	8113 (21.9)	7222 (21.2)	7038 (21.1)
Gender						
Female	11092 (50.6)	20973 (50.4)	19506 (50.2)	18245 (49.3)	16958 (49.9)	16659 (50.0)
Male	10839 (49.4)	20628 (49.6)	19369 (49.8)	18767 (50.7)	17046 (50.1)	16648 (50.0)
Race/Ethnicity						
White	17199 (78.4)	33651 (80.9)	31045 (79.9)	29034 (78.4)	26532 (78)	25364 (76.2)
Black	1065 (4.9)	1776 (4.3)	1881 (4.8)	1923 (5.2)	1620 (4.8)	1720 (5.2)
Asian	1392 (6.3)	2288 (5.5)	2276 (5.9)	2434 (6.6)	2231 (6.6)	2483 (7.5)
Aboriginal	640 (2.9)	1465 (3.5)	1319 (3.4)	1181 (3.2)	1276 (3.8)	1246 (3.7)
Hispanic	520 (2.4)	821 (2.0)	826 (2.1)	882 (2.4)	920 (2.7)	1010 (3.0)
Other/Mixed	1115 (5.1)	1600 (3.8)	1528 (3.9)	1558 (4.2)	1425 (4.2)	1484 (4.5)
Province						
Ontario	21931 (100)	38285 (92.0)	35747 (92.0)	33938 (91.7)	31245 (91.9)	30195 (90.7)
Alberta	n/a	3316 (8.0)	3128 (8.0)	3074 (8.3)	2759 (8.1)	3112 (9.3)
Cannabis Use Frequency						
Never	15028 (68.5)	28993 (69.7)	27226 (70)	26367 (71.2)	23978 (70.5)	22649 (68.0)
Not in past year	1261 (5.7)	2299 (5.5)	2041 (5.3)	1735 (4.7)	1532 (4.5)	1500 (4.5)
Less than once a month	1974 (9.0)	3689 (8.9)	3474 (8.9)	3199 (8.6)	3133 (9.2)	3502 (10.5)
Once a month	607 (2.8)	1097 (2.6)	1055 (2.7)	958 (2.6)	898 (2.6)	1028 (3.1)
2-3 times a month	853 (3.9)	1458 (3.5)	1318 (3.4)	1308 (3.5)	1242 (3.7)	1341 (4.0)
Once a week	362 (1.7)	636 (1.5)	587 (1.5)	559 (1.5)	560 (1.6)	556 (1.7)
2-3 times a week	559 (2.5)	879 (2.1)	795 (2.0)	695 (1.9)	716 (2.1)	793 (2.4)
4-6 times a week	428 (2.0)	774 (1.9)	706 (1.8)	607 (1.6)	593 (1.7)	609 (1.8)
Every day	859 (3.9)	1776 (4.3)	1673 (4.3)	1584 (4.3)	1352 (4.0)	1329 (4.0)
Age at First Cannabis Use						
12 or younger	840 (12.1)	1805 (14.4)	1689 (14.6)	1571 (14.7)	1319 (13.2)	1266 (11.9)
13	911 (13.2)	1715 (13.6)	1519 (13)	1292 (12.1)	1119 (11.2)	1103 (10.3)
14	1855 (26.9)	3161 (25.1)	3003 (25.8)	2603 (24.5)	2433 (24.3)	2512 (23.6)
15	1646 (23.8)	2969 (23.5)	2686 (23.1)	2538 (23.8)	2519 (25.1)	2787 (26.1)
16	1076 (15.6)	1838 (14.6)	1711 (14.7)	1555 (14.6)	1633 (16.3)	1952 (18.3)
17	334 (4.8)	593 (4.7)	520 (4.5)	519 (4.9)	533 (5.3)	609 (5.7)
18 or older	44 (0.6)	78 (0.6)	61 (0.5)	75 (0.7)	62 (0.6)	64 (0.6)
Don't Know	197 (2.9)	449 (3.6)	460 (3.9)	492 (4.6)	408 (4.1)	365 (3.4)
Ease of Access to Cannabis						
Difficult	2861 (13.0)	5650 (13.6)	5362 (13.8)	2754 (7.4)	2488 (7.3)	2157 (6.5)
Easy	11664 (53.2)	21835 (52.5)	20212 (52)	20524 (55.5)	19048 (56)	19583 (58.8)
Don't Know	7406 (33.8)	14116 (33.9)	13301 (34.2)	13734 (37.1)	12468 (36.7)	11567 (34.7)

Age at First Use and Ease of Access

The average age at first cannabis use reported by grade 12 students was highest in Y6 (Figure 2). Male students consistently started using at younger ages than females, though averages for both increased in Y5 and Y6. Among black students, average age at first use dropped from 14.3 to 12.8 years between Y1 and Y3, then steadily recovered to reach 13.8 years in Y6, surpassing Aboriginal students (13.7 years), whose average remained low. White, Hispanic, and Asian students reported their youngest average age in Y4, with values on the rise since.

After decreasing from Y1 to Y3, the proportion of students who thought cannabis easy to access increased from Y4 to Y6, with a sharp rise among female students in Y4 and Y5, and a subsequent rise among male students in Y6. The lowest, though steadily rising, rates of easy access were recorded among Asian students, the highest among black and Aboriginal students. This was the case until Y6, when rates among Hispanic and white students, which started increasing in Y4 after three years of decline, peaked at the highest values observed over the six years studied.

Frequency of Use

Between 9.3% and 10.1% of students reported weekly use (Figure 3). Both weekly and occasional use have been increasing since reaching their lowest point in Y4, the latter rising especially fast. Rates of occasional use among male students, generally lower than those among female students, rose 1.4-fold faster between Y5 and Y6. Of note, rates of occasional use were 2.4-fold higher than weekly use rates among females, compared to an average 1.2-fold difference for males.

Rates of occasional use rates varied less between different racial or ethnic groups than rates of weekly use. Over time, occasional use rates fluctuated between Y1 and Y4 for most groups, then subsequently rose in Y5 for Aboriginal, white, and Hispanic students and in Y6 for black and Asian students. Only black and aboriginal students reported more weekly than occasional use for all years, though with mirroring trajectories. Rates of weekly use among black students increased from Y1 to Y4, then decreased in Y6, while those among aboriginal students dropped from 27.2% in Y1 to 21.8% in Y5 and then rose sharply to 25% in Y6.

Regression Analyses

Inflection points were observed in the trend curves for all five cannabis use indicators over the six COMPASS study years shown here, though at different times (Table 2). For instance, compared to Y1, students had significantly lower odds of reporting past-year cannabis use from Y2 to Y4, but significantly higher odds in Y6. Similar patterns were observed for lifetime use, weekly use, age at first use, and ease of access, with odds of easy access continually increasing starting in Y4. Meanwhile, demographic differences remained mostly consistent across all indicators of cannabis use. Male students were more likely than female students to report any use, easy access, or a lower age at first use. Compared to white students, aboriginal students had the highest odds of reporting lifetime (OR 2.66), past-year (OR 2.24) and weekly use (OR 3.04). Asian students had lower odds of reporting easy access or any category of use, while white students were more likely to start using cannabis later than any other group.

Table 2 – Regression analyses[†] of the relationship between COMPASS year, student gender, student race or ethnicity and five cannabis use outcomes.

OR (95% CI)	Lifetime use	Past-year use	Weekly use	Ease of access	Age at first use
Year					
2012/2013 (<i>ref</i>)					
2013/2014	0.92 (0.87, 0.97) *	0.92 (0.87, 0.98) *	0.94 (0.87, 1.02)	0.98 (0.93, 1.03)	1.00 (0.90, 1.11)
2014/2015	0.92 (0.87, 0.97) *	0.94 (0.88, 0.99) *	0.94 (0.86, 1.02)	0.97 (0.91, 1.03)	0.87 (0.79, 0.97) *
2015/2016	0.88 (0.84, 0.92) *	0.92 (0.87, 0.97) *	0.91 (0.84, 0.98) *	1.15 (1.08, 1.22) *	0.87 (0.79, 0.97) *
2016/2017	0.89 (0.83, 0.94) *	0.94 (0.89, 1.00)	0.90 (0.82, 0.97) *	1.16 (1.10, 1.23) *	0.95 (0.85, 1.06)
2017/2018	1.04 (0.97, 1.10)	1.11 (1.04, 1.18) *	0.96 (0.88, 1.04)	1.34 (1.26, 1.43) *	1.21 (1.08, 1.35) *
Gender					
Female (<i>ref</i>)					
Male	1.14 (1.10, 1.18) *	1.16 (1.12, 1.20) *	1.80 (1.70, 1.90) *	1.23 (1.19, 1.28) *	0.63 (0.59, 0.66) *
Race/Ethnicity					
White (<i>ref</i>)					
Black	1.50 (1.31, 1.72) *	1.57 (1.35, 1.82) *	2.77 (2.30, 3.34) *	1.11 (1.01, 1.22) *	0.21 (0.19, 0.24) *
Asian	0.45 (0.39, 0.52) *	0.47 (0.41, 0.55) *	0.66 (0.56, 0.79) *	0.39 (0.34, 0.44) *	0.62 (0.53, 0.72) *
Aboriginal	2.66 (2.38, 2.97) *	2.24 (2.02, 2.48) *	3.04 (2.71, 3.42) *	1.10 (0.99, 1.22)	0.30 (0.26, 0.35) *
Hispanic	1.18 (1.09, 1.27) *	1.11 (1.01, 1.21) *	1.34 (1.16, 1.56) *	1.00 (0.93, 1.07)	0.63 (0.53, 0.74) *

[†] Models were adjusted for grade, school median income, school urbanicity, and school-level clustering. * indicates significance at $p < 0.05$

DISCUSSION

Cannabis use has been highly prevalent among COMPASS youth since 2012/2013, as it is among their peers across Canada.[7,27,28] Our data generally suggest that, following a steady decrease over several years, there has been a gradual increase in youth cannabis use since the beginning of the federal discourse around legalization. During this time, public perception of cannabis use shifted to include a type of “sensible” use, which is intermittent and socially acceptable.[32–35] For youth, these more accommodating social norms and pro-cannabis messaging are associated with increased cannabis use.[36–38] Here, most of the increase we observed was due to an upswing of occasional, or “sensible”, use. When placed in the context of growing access after 2014/2015 and the slow rise in average age at first use, these data may represent the emergence of a large group of casual cannabis users who start later and use infrequently. Future, post-legalization evaluations must therefore explore the impact on various patterns of use.

We may characterise our results further by relying on the normalization theory framework, which posits that the interplay between six factors – access, trying and usage rates, attitudes, cultural accommodation, and governmental response – can normalise drug use.[39,40] Other factors have recently been suggested, e.g. seeing drugs as a means of achieving normal goals, such as cannabis use by athletes to enhance performance.[41–43] Indicators for the normalisation of cannabis use have been prevalent in Canada for some time.[34,44–46] Subsequent to reduced restriction of medical cannabis in 2014, rates of students who thought cannabis easy to access significantly increased in 2015/2016 (Y4) and rose in tandem with further deregulation.[1,2] The increased availability of cannabis is likely to have normalized and facilitated access for youth, who most commonly obtain drugs through their social network.[40,47] Perceived access drives use [48] and we identified that rates of cannabis use in our sample increased the following year (2016/2017). This is true especially among female students, for whom the effects of normalization may be greater as their cannabis use has historically been more stigmatized than that of their male peers.[49] Female students are also more likely to use alternative cannabis products, which were then becoming more accessible.[2,50,51] As normalization and access to diverse cannabis products is liable to increase in Canada after legalization,[19,22] special attention should be paid to subsequent impacts on female youth.

The evidence presented here demonstrate that the focus on demographic differences among youth who use cannabis is warranted. For instance, lifetime and past-year use rates were particularly high among aboriginal students, who also reported the most weekly use. This is in line with existing evidence reporting similar results for both American and Canadian aboriginal youth, who are more likely to start younger and use cannabis more regularly than white adolescents, especially if male.[52–57] Following a steady decrease over several years, weekly use by aboriginal youth increased significantly in 2017/2018 (Y6). This is a concerning development that may warrant close future monitoring, and interventions to mitigate the effects of cannabis legalization for these adolescents are likely to be needed.

The evidence also suggests that studies on the impact of cannabis legalization on Canadian youth should consider data from several years prior to the passage of the Cannabis Act. Relying on 2017/2018 as a solitary baseline is liable to miss key developments in the years before, and therefore likely to underestimate subsequent effect, e.g. the increase in youth lifetime and past-year use. In 2016/2017, Health Canada funded the expansion of COMPASS to include high school students in Québec, British Columbia, and Nunavut, increasing the relevance of its future investigations of youth cannabis use. As cannabis legalization is likely to disproportionately affect youth, these data will be essential to understanding and mitigating its impact.

Limitations

The COMPASS study has several strengths, including prospective design, validated measures, and large sample size.[29] However, recall and social desirability biases may influence data from self-report questionnaires, leading to underreporting of cannabis use, especially among subpopulations (e.g. females) where use is more stigmatised.[49] High school students who use cannabis at a high frequency are more likely to drop out,[58] also resulting in underestimations, especially of weekly use rates. As the schools studied were from a convenience sample, results are not generalizable. However, use of a passive-consent protocol resulted in high participation rates and reduced selection bias within schools, and the large sample size suggests that conclusions drawn will apply to a substantial proportion of Canadian high school students.

Conclusions

Our data suggest that there has been a gradual rise in youth cannabis use due to the federal discourse around cannabis legalization prior to actual changes in law. This negative trend appears

amplified among some sub-populations of youth. Future research examining the impact of cannabis legalization should consider the ramifications of these pre-implementation changes when drawing conclusions about its overall effect on Canadian youth.

Contributors: AZ designed the work, interpreted the data, wrote and revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. KB designed the work, managed and analysed the data, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. MdG substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. YJ substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. SL is the principal investigator of the COMPASS study, designed the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work.

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Data sharing statement: COMPASS data are available for researchers upon successful completion and approval of the COMPASS data usage application (<https://uwaterloo.ca/compass-system/information-researchers>). Technical reports detailing COMPASS study methods are available online (<https://uwaterloo.ca/compass-system/publications#technical>).

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Figure Legends

Figure 1 – Rates of lifetime and past-year cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting lifetime and past-year cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) lifetime and (D) past-year cannabis use.

Figure 2 – Average age at first cannabis use and rates of easy access to cannabis among youth participating in the COMPASS study (ON and AB, Canada). Grade 12 COMPASS students reporting (A, B) average age at first cannabis use (A) overall and by gender and (B) by ethnicity each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of grade 9-12 COMPASS students who think cannabis is easy to access (C) overall and by gender and (D) by ethnicity.

Figure 3 – Rates of weekly and occasional cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting weekly (1-6 times a week or daily) and occasional (2-3 times a month or less) cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) weekly and (D) occasional cannabis use.

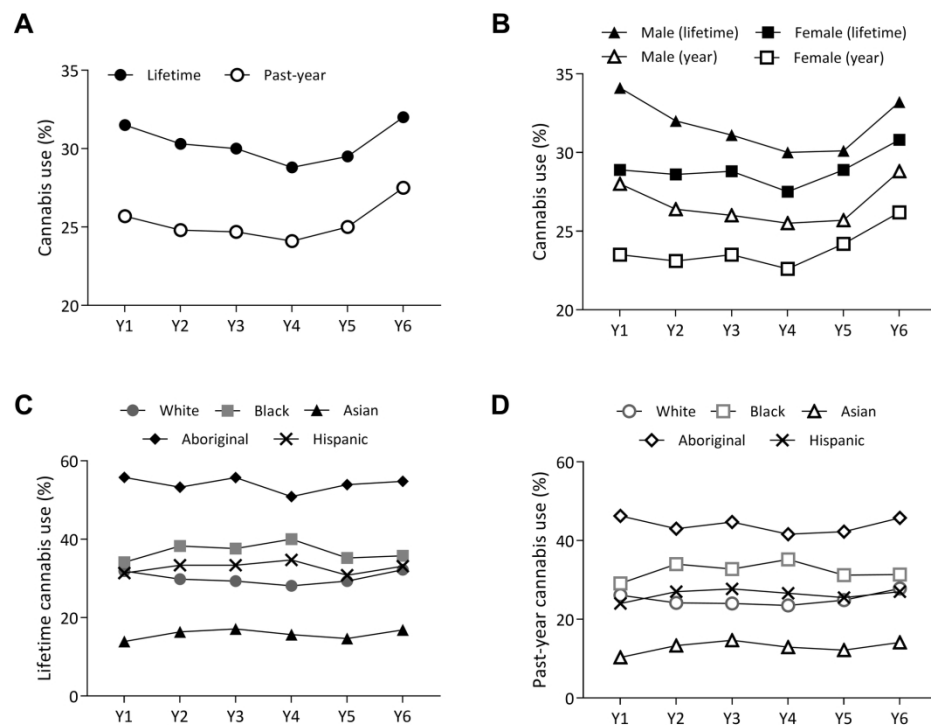


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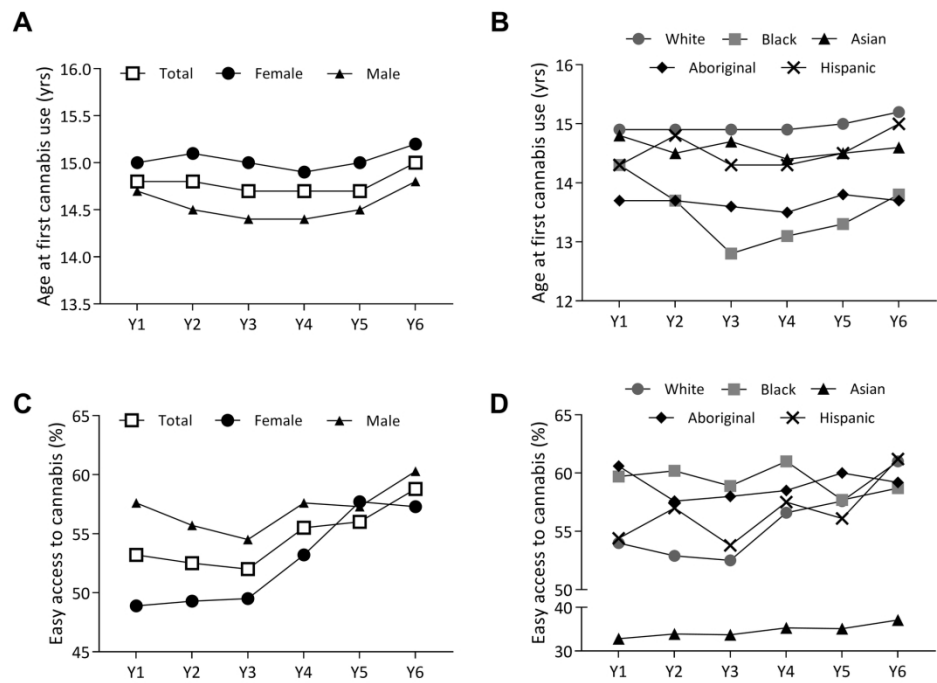


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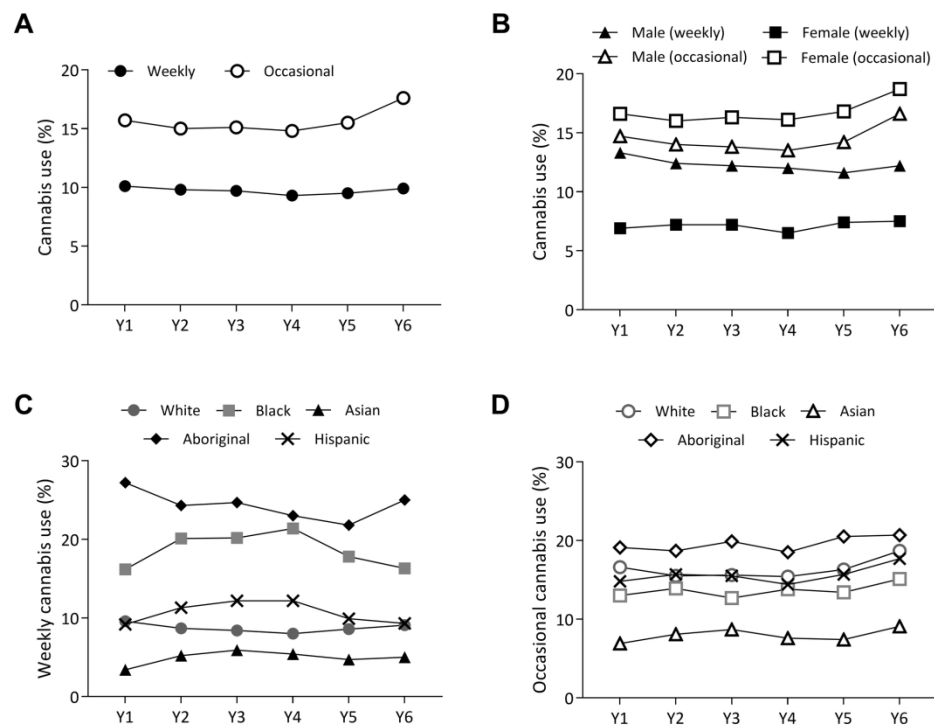


Figure 3 – Rates of weekly and occasional cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting weekly (1-6 times a week or daily) and occasional (2-3 times a month or less) cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) weekly and (D) occasional cannabis use.

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STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4, 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4, 5
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4, 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4, 5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	4, 7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	Report numbers of outcome events or summary measures over time	7

1	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-9
2			(b) Report category boundaries when continuous variables were categorized	
3			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
4	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
5				
6	Discussion			
7	Key results	18	Summarise key results with reference to study objectives	10, 11
8	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
9	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 11
10	Generalisability	21	Discuss the generalisability (external validity) of the study results	11
11	Other information			
12	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.

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Pre-Legalization Patterns and Trends of Cannabis Use Among Canadian Youth: Results from the COMPASS Prospective Cohort Study

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Pre-Legalization Patterns and Trends of Cannabis Use Among Canadian Youth: Results from the COMPASS Prospective Cohort Study

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ABSTRACT

Objective: Canada federally legalized recreational cannabis use among adults in October 2018. The impact this will have on Canadian youth is cause for concern. The current study examined changes in youth cannabis use over the time prior to legalisation to explore the impact of the beginning federal discourse around legalization during the 2016/2017 school year.

Design: COMPASS, a prospective cohort study based on annual self-administered questionnaires.

Setting: Ontario and Alberta during the first 6 years of the COMPASS study (2012/2013 – 2017/2018).

Participants: Canadian grade 9 to 12 students attending secondary schools participating in COMPASS. In total, 230,404 questionnaires were included in the analysis. (Y1:2012/13 n=24,173, Y2:2013/14 n=45,298, Y3:2014/15 n=42,355, Y4:2015/16 n=40,436, Y5:2016/17 n=37,060, Y6:2017/18 n=34,897).

Primary and secondary outcome measures: Lifetime cannabis use, past-year cannabis use, weekly cannabis use, ease of access to cannabis, and age at first cannabis use.

Results: Cannabis never-use decreased between Y5 and Y6. Changes in age at first cannabis use mirrored this trend, with male students consistently starting younger. Cannabis access rates increased from Y4, mainly led by female students. Lifetime and past-year use rates were lowest in Y4 then increased in Y5 and Y6 due to a rise in the occasional use more common among female students, who reported use increases first. Non-white students were more likely use cannabis, with black and Aboriginal students the only two groups consistently reporting more weekly than occasional use, though with opposing trajectories. Overall, aboriginal students had the highest odds of reporting lifetime, past-year, and weekly use among the demographic groups examined.

Conclusion: After a steady decrease in patterns of cannabis among youth over several years, it appears that there has been a gradual increase in cannabis use among youth following the start of discourse around cannabis legalization, with some populations of youth being at greater risk.

Strengths and limitations of this study

- This study describes cannabis use patterns and trends prior to legalization.
- It benefits from prospective design, validated measures, and large sample size.
- Data are drawn from a convenience sample and therefore not generalizable.
- Recall and social desirability biases may have influenced self-report data.

Keywords: Public Health, Youth, Cannabis

INTRODUCTION

In 2018, Canada was the second country to federally legalize recreational cannabis use, and the first to do so with the primary emphasis on public health and education.[1] Following almost 80 years of complete prohibition, individual use of medicinal cannabis was legalized in Canada in 2001, albeit with the requirement for special approval of a medical exemption by Health Canada, which formed a significant access barrier for most.[2–4] In 2014, new regulations abolished this approval process and shifted gate-keeping duties to physicians, leading to a rise in prescriptions.[1] Court decisions in 2015 and 2016 precipitated a further loosening of restrictions on the permitted range of cannabis sources and products.[2,5,6] Concurrently, the Canadian government formed a Cannabis Legalization Task Force, which delivered its final report in December 2016.[7] The resulting Cannabis Act (Bill C-45) was introduced to Parliament in April 2017 and passed in June the following year.[8] It came into force in October 2018.[9]

Evidence on the effects of medical or recreational legalization of cannabis on youth, for whom it remains illegal given age restrictions, is mixed. Some studies have shown that more permissive cannabis laws increase rates of cannabis use among adolescents,[10–13] while others have reported that they do not.[14–18] There is evidence that legalization can lead to gradual increases in use, more high-frequency use, a drop in the average age at first use, and increased use of more potent forms of cannabis.[19–26] As Canadian youth already use cannabis at a higher rate than Canadian adults or youth globally, any increase in use prevalence or frequency due to legalization is cause for concern.[7,27,28]

COMPASS, a large prospective cohort study of youth in Canada (2012–2021) serves as a research platform for evaluating the consequences of policy change on youth health behaviours.[29] With data reaching back to the 2012/2013 school year, evidence from COMPASS will be used by researchers and decision makers to evaluate the impact of cannabis legalization on Canadian youth. This paper relied on the first six years of COMPASS data to characterise the changes in youth cannabis use over time in terms of lifetime and past-year use, use frequency, age at first use, and ease of access to cannabis, to provide insight into pre-legalization cannabis use among Canadian youth.

METHODS

Study Design

COMPASS, a prospective cohort study, annually collects hierarchical data from grade 9-12 students and the schools they attend. This report uses student data from COMPASS years 1 to 6 (2012/2013 to 2017/2018) collected in Ontario and Alberta. The COMPASS student questionnaire (Cq) is an anonymous, self-administered questionnaire completed by students during class time, with items based on national guidelines or surveillance tools as previously described.[29,30] Students could decline to participate at any time. Response rates range from 76% to 80% (Year 1: 79.0%, Year 2: 79.2%, Year 3: 78.7%, Year 4: 79.9%, Year 5: 76.0%, Year 6: 78.7%). The primary reason for non-response was absenteeism or scheduled spare on the data collection date. Parental permission rates are greater than 99%. A full description of COMPASS study methods and data collection tools is also available online (www.compass.uwaterloo.ca). The COMPASS study was approved by the University of Waterloo Office of Research Ethics (OR file 17264) and appropriate school boards.

COMPASS data presented in this report are from 24,173 students (43 schools) in Year 1 (Y1 2012/2013), 45,298 students (89 schools) in Year 2 (Y2 2013/2014), 42,355 students (87 schools) in Year 3 (Y3 2014/2015), 40,436 students (81 schools) in Year 4 (Y4 2015/2016), 37,060 students (88 schools) in Year 5 (Y5 2016/2017), and 34,897 students (69 schools) in Year 6 (Y6 2017/2018). Schools that dropped out of the COMPASS study reported cannabis ever-use rates of 31.9%, while schools that remained reported rates of 30.1%. Students with missing values for demographic or cannabis use measures were excluded from this study. The start of formal federal discourse around cannabis legalization occurred in March 2016, near the end of the Y4 data collection cycle.

Measures

Sample characteristics

Students provided demographic information on grade, sex/gender, and race/ethnicity, as well as answering three questions on past-year cannabis use frequency, age at first use, and ease of access to cannabis consistent with national surveillance measures on cannabis use and as previously described.[30,31]

Cannabis lifetime/past-year use and use frequency

Students were asked, "In the last 12 months, how often did you use marijuana or cannabis?" and responded with one of 9 options: "I have never used marijuana", "I have used marijuana but not in the last 12 months", "Less than once a month", "Once a month", "2 or 3 times a month", "Once a week", "2 or 3 times a week", "4 to 6 times a week", and "Every day". Individuals were classified as lifetime users if they indicated any marijuana use and past-year users if they indicated use of "at least once a month" or more frequent. Among past-year users, students were classified as weekly users if they indicated use of "once a week" or more often and as occasional users if they indicated less frequent use.

Age at first cannabis use and ease of access to cannabis

Students were asked, "How old were you when you first used marijuana or cannabis?" and responded with one of 13 options: "I have never used marijuana", "I do not know", "8 years or younger", one option for each age from 9 to 17, and "18 years or older". Age of first use was measured on the subsample of grade 12 students who had indicated past marijuana use. Students who answered, "I do not know" to the age of initiation question were excluded from the analyses. Students also responded to the question "Do you think it would be difficult or easy for you to get marijuana if you wanted some?" with "Difficult", "Easy", or "I do not know".

School median income and urbanicity

School data were extracted from Statistics Canada 2016 census data. School median income was determined using the median income for the forward sortation area (first three letters of postal code). Urbanicity was measured based on total population and population density for the population centre in which the school resides.

Patient and Public Involvement

Students were not involved in study design, research question design, or recruitment and conduct of the study, beyond self-administration of the student questionnaire. Some items were based on previously validated measures which may have involved students or patients in their design. School-specific results were annually provided in terms of overall health measures to each

participating school in the form of a school feedback report, which school administrators were encouraged to disseminate to staff, students, and parents or guardians.

Statistical Analysis

Statistical analyses were conducted in SAS 9.4. Generalized estimating equations (GEE) with alternating logistic regression (ALR) were used to estimate the relationship between lifetime, past year, and weekly marijuana use and ease of access outcomes and COMPASS study year, gender and race/ethnicity. Among grade 12 students only, a linear mixed model was used to examine the relationship between age of initiation and COMPASS study year, gender and race/ethnicity. All models were adjusted for grade, school median income, urbanicity, and clustering by school. The PROC GENMOD procedure was used to fit GEE models with an exchangeable logOR. The PROC MIXED procedure was used to fit the linear mixed model with random intercept.

RESULTS

The proportion of cannabis never-users increased from Y1 to Y4 but then decreased in Y5 and Y6 (Table 1). Annual changes in age at first cannabis use mirrored this trend, with the number of students starting at 12 or younger first increasing to 14.7% in Y4 and then decreasing to 11.9% in Y6. In both cases, the level of change observed between Y4 and Y6 exceeded that between Y1 and Y4. The proportion of students who thought cannabis difficult to access changed most rapidly, halving from 13.8% in Y3 to 7.4% in Y4 and then further decreasing to 6.5% in Y6.

Lifetime and Past-Year Use

Rates of lifetime and past-year cannabis use were highest among male and aboriginal students, and lowest among Asian students (Figure 1). Both rates reached their lowest points in Y4 at 28.8% and 24.1% respectively but have been increasing since, with the changes appearing to be accelerating. Lifetime use similarly increased in Y5 and Y6. Interestingly, both lifetime and past-year use by male students remained steady between Y4 and Y5, rising sharply in Y6, while use rates among female students rose in both Y5 and Y6. Changes in lifetime and past-year use among students grouped by races/ethnicity were mixed, though Y4 marked a turning point for most youth. In Y5, lifetime use rates among black and Hispanic students decreased, while increasing among white, Asian, and Aboriginal students. These trends were similar for past-year use, though past-year rates were markedly lower than life-time use only for Aboriginal students.

Table 1 – Demographic characteristics of and cannabis use indicators among COMPASS youth (Canada).

n (%)	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Total	21931	41601	38875	37012	43004	33307
Grade						
9	5693 (26.0)	10848 (26.1)	10123 (26.0)	9695 (26.2)	8991 (26.4)	8806 (26.4)
10	5624 (25.6)	10862 (26.1)	10651 (27.4)	9804 (26.5)	9324 (27.4)	9037 (27.1)
11	5385 (24.6)	10389 (25.0)	9726 (25.0)	9400 (25.4)	8467 (24.9)	8426 (25.3)
12	5229 (23.8)	9502 (22.8)	8375 (21.5)	8113 (21.9)	7222 (21.2)	7038 (21.1)
Gender						
Female	11092 (50.6)	20973 (50.4)	19506 (50.2)	18245 (49.3)	16958 (49.9)	16659 (50.0)
Male	10839 (49.4)	20628 (49.6)	19369 (49.8)	18767 (50.7)	17046 (50.1)	16648 (50.0)
Race/Ethnicity						
White	17199 (78.4)	33651 (80.9)	31045 (79.9)	29034 (78.4)	26532 (78)	25364 (76.2)
Black	1065 (4.9)	1776 (4.3)	1881 (4.8)	1923 (5.2)	1620 (4.8)	1720 (5.2)
Asian	1392 (6.3)	2288 (5.5)	2276 (5.9)	2434 (6.6)	2231 (6.6)	2483 (7.5)
Aboriginal	640 (2.9)	1465 (3.5)	1319 (3.4)	1181 (3.2)	1276 (3.8)	1246 (3.7)
Hispanic	520 (2.4)	821 (2.0)	826 (2.1)	882 (2.4)	920 (2.7)	1010 (3.0)
Other/Mixed	1115 (5.1)	1600 (3.8)	1528 (3.9)	1558 (4.2)	1425 (4.2)	1484 (4.5)
Province						
Ontario	21931 (100)	38285 (92.0)	35747 (92.0)	33938 (91.7)	31245 (91.9)	30195 (90.7)
Alberta	n/a	3316 (8.0)	3128 (8.0)	3074 (8.3)	2759 (8.1)	3112 (9.3)
Cannabis Use Frequency						
Never	15028 (68.5)	28993 (69.7)	27226 (70)	26367 (71.2)	23978 (70.5)	22649 (68.0)
Not in past year	1261 (5.7)	2299 (5.5)	2041 (5.3)	1735 (4.7)	1532 (4.5)	1500 (4.5)
Less than once a month	1974 (9.0)	3689 (8.9)	3474 (8.9)	3199 (8.6)	3133 (9.2)	3502 (10.5)
Once a month	607 (2.8)	1097 (2.6)	1055 (2.7)	958 (2.6)	898 (2.6)	1028 (3.1)
2-3 times a month	853 (3.9)	1458 (3.5)	1318 (3.4)	1308 (3.5)	1242 (3.7)	1341 (4.0)
Once a week	362 (1.7)	636 (1.5)	587 (1.5)	559 (1.5)	560 (1.6)	556 (1.7)
2-3 times a week	559 (2.5)	879 (2.1)	795 (2.0)	695 (1.9)	716 (2.1)	793 (2.4)
4-6 times a week	428 (2.0)	774 (1.9)	706 (1.8)	607 (1.6)	593 (1.7)	609 (1.8)
Every day	859 (3.9)	1776 (4.3)	1673 (4.3)	1584 (4.3)	1352 (4.0)	1329 (4.0)
Age at First Cannabis Use						
12 or younger	840 (12.1)	1805 (14.4)	1689 (14.6)	1571 (14.7)	1319 (13.2)	1266 (11.9)
13	911 (13.2)	1715 (13.6)	1519 (13)	1292 (12.1)	1119 (11.2)	1103 (10.3)
14	1855 (26.9)	3161 (25.1)	3003 (25.8)	2603 (24.5)	2433 (24.3)	2512 (23.6)
15	1646 (23.8)	2969 (23.5)	2686 (23.1)	2538 (23.8)	2519 (25.1)	2787 (26.1)
16	1076 (15.6)	1838 (14.6)	1711 (14.7)	1555 (14.6)	1633 (16.3)	1952 (18.3)
17	334 (4.8)	593 (4.7)	520 (4.5)	519 (4.9)	533 (5.3)	609 (5.7)
18 or older	44 (0.6)	78 (0.6)	61 (0.5)	75 (0.7)	62 (0.6)	64 (0.6)
Don't Know	197 (2.9)	449 (3.6)	460 (3.9)	492 (4.6)	408 (4.1)	365 (3.4)
Ease of Access to Cannabis						
Difficult	2861 (13.0)	5650 (13.6)	5362 (13.8)	2754 (7.4)	2488 (7.3)	2157 (6.5)
Easy	11664 (53.2)	21835 (52.5)	20212 (52)	20524 (55.5)	19048 (56)	19583 (58.8)
Don't Know	7406 (33.8)	14116 (33.9)	13301 (34.2)	13734 (37.1)	12468 (36.7)	11567 (34.7)

Age at First Use and Ease of Access

The average age at first cannabis use reported by grade 12 students was highest in Y6 (Figure 2). Male students consistently started using at younger ages than females, though averages for both increased in Y5 and Y6. Among black students, average age at first use dropped from 14.3 to 12.8 years between Y1 and Y3, then steadily recovered to reach 13.8 years in Y6, surpassing Aboriginal students (13.7 years), whose average remained low. White, Hispanic, and Asian students reported their youngest average age in Y4, with values on the rise since.

After decreasing from Y1 to Y3, the proportion of students who thought cannabis easy to access increased from Y4 to Y6, with a sharp rise among female students in Y4 and Y5, and a subsequent rise among male students in Y6. The lowest, though steadily rising, rates of easy access were recorded among Asian students, the highest among black and Aboriginal students. This was the case until Y6, when rates among Hispanic and white students, which started increasing in Y4 after three years of decline, peaked at the highest values observed over the six years studied.

Frequency of Use

Between 9.3% and 10.1% of students reported weekly use (Figure 3). Both weekly and occasional use have been increasing since reaching their lowest point in Y4, the latter rising especially fast. Rates of occasional use among male students, generally lower than those among female students, rose 1.4-fold faster between Y5 and Y6. Of note, rates of occasional use were 2.4-fold higher than weekly use rates among females, compared to an average 1.2-fold difference for males.

Rates of occasional use rates varied less between different racial or ethnic groups than rates of weekly use. Over time, occasional use rates fluctuated between Y1 and Y4 for most groups, then subsequently rose in Y5 for Aboriginal, white, and Hispanic students and in Y6 for black and Asian students. Only black and aboriginal students reported more weekly than occasional use for all years, though with mirroring trajectories. Rates of weekly use among black students increased from Y1 to Y4, then decreased in Y6, while those among aboriginal students dropped from 27.2% in Y1 to 21.8% in Y5 and then rose sharply to 25% in Y6.

Regression Analyses

Inflection points were observed in the trend curves for all five cannabis use indicators over the six COMPASS study years shown here, though at different times (Table 2). For instance, compared to Y1, students had significantly lower odds of reporting past-year cannabis use from Y2 to Y4, but significantly higher odds in Y6. Similar patterns were observed for lifetime use, weekly use, age at first use, and ease of access, with odds of easy access continually increasing starting in Y4. Meanwhile, demographic differences remained mostly consistent across all indicators of cannabis use. Male students were more likely than female students to report any use, easy access, or a lower age at first use. Compared to white students, aboriginal students had the highest odds of reporting lifetime (OR 2.66), past-year (OR 2.24) and weekly use (OR 3.04). Asian students had lower odds of reporting easy access or any category of use, while white students were more likely to start using cannabis later than any other group.

Table 2 – Regression analyses[†] of the relationship between COMPASS year, student gender, student race or ethnicity and five cannabis use outcomes.

OR (95% CI)	Lifetime use	Past-year use	Weekly use	Ease of access	Age at first use
Year					
2012/2013 (<i>ref</i>)					
2013/2014	0.92 (0.87, 0.97) *	0.92 (0.87, 0.98) *	0.94 (0.87, 1.02)	0.98 (0.93, 1.03)	1.00 (0.90, 1.11)
2014/2015	0.92 (0.87, 0.97) *	0.94 (0.88, 0.99) *	0.94 (0.86, 1.02)	0.97 (0.91, 1.03)	0.87 (0.79, 0.97) *
2015/2016	0.88 (0.84, 0.92) *	0.92 (0.87, 0.97) *	0.91 (0.84, 0.98) *	1.15 (1.08, 1.22) *	0.87 (0.79, 0.97) *
2016/2017	0.89 (0.83, 0.94) *	0.94 (0.89, 1.00)	0.90 (0.82, 0.97) *	1.16 (1.10, 1.23) *	0.95 (0.85, 1.06)
2017/2018	1.04 (0.97, 1.10)	1.11 (1.04, 1.18) *	0.96 (0.88, 1.04)	1.34 (1.26, 1.43) *	1.21 (1.08, 1.35) *
Gender					
Female (<i>ref</i>)					
Male	1.14 (1.10, 1.18) *	1.16 (1.12, 1.20) *	1.80 (1.70, 1.90) *	1.23 (1.19, 1.28) *	0.63 (0.59, 0.66) *
Race/Ethnicity					
White (<i>ref</i>)					
Black	1.50 (1.31, 1.72) *	1.57 (1.35, 1.82) *	2.77 (2.30, 3.34) *	1.11 (1.01, 1.22) *	0.21 (0.19, 0.24) *
Asian	0.45 (0.39, 0.52) *	0.47 (0.41, 0.55) *	0.66 (0.56, 0.79) *	0.39 (0.34, 0.44) *	0.62 (0.53, 0.72) *
Aboriginal	2.66 (2.38, 2.97) *	2.24 (2.02, 2.48) *	3.04 (2.71, 3.42) *	1.10 (0.99, 1.22)	0.30 (0.26, 0.35) *
Hispanic	1.18 (1.09, 1.27) *	1.11 (1.01, 1.21) *	1.34 (1.16, 1.56) *	1.00 (0.93, 1.07)	0.63 (0.53, 0.74) *

[†] Models were adjusted for grade, school median income, school urbanicity, and school-level clustering. * indicates significance at p < 0.05

DISCUSSION

Cannabis use has been highly prevalent among COMPASS youth since 2012/2013, as it is among their peers across Canada.[7,27,28] Our data generally suggest that, following a steady decrease over several years, there has been a gradual increase in youth cannabis use since the beginning of the federal discourse around legalization. During this time, public perception of cannabis use shifted to include a type of “sensible” use, which is intermittent and socially acceptable.[32–35] For youth, these more accommodating social norms and pro-cannabis messaging are associated with increased cannabis use.[36–38] Here, most of the increase we observed was due to an upswing of occasional, or “sensible”, use. When placed in the context of growing access after 2014/2015 and the slow rise in average age at first use, these data may represent the emergence of a large group of casual cannabis users who start later and use infrequently. Future, post-legalization evaluations must therefore explore the impact on various patterns of use.

We may characterise our results further by relying on the normalization theory framework, which posits that the interplay between six factors – access, trying and usage rates, attitudes, cultural accommodation, and governmental response – can normalise drug use.[39,40] Other factors have recently been suggested, e.g. seeing drugs as a means of achieving normal goals, such as cannabis use by athletes to enhance performance.[41–43] Indicators for the normalisation of cannabis use have been prevalent in Canada for some time.[34,44–46] Subsequent to reduced restriction of medical cannabis in 2014, rates of students who thought cannabis easy to access significantly increased in 2015/2016 (Y4) and rose in tandem with further deregulation.[1,2] The increased availability of cannabis is likely to have normalized and facilitated access for youth, who most commonly obtain drugs through their social network.[40,47] Perceived access drives use [48] and we identified that rates of cannabis use in our sample increased the following year (2016/2017). This is true especially among female students, for whom the effects of normalization may be greater as their cannabis use has historically been more stigmatized than that of their male peers.[49] Female students are also more likely to use alternative cannabis products, which were then becoming more accessible.[2,50,51] As normalization and access to diverse cannabis products is liable to increase in Canada after legalization,[19,22] special attention should be paid to subsequent impacts on female youth.

The evidence presented here demonstrate that the focus on demographic differences among youth who use cannabis is warranted. For instance, lifetime and past-year use rates were particularly high among aboriginal students, who also reported the most weekly use. This is in line with existing evidence reporting similar results for both American and Canadian aboriginal youth, who are more likely to start younger and use cannabis more regularly than white adolescents, especially if male.[52–57] Following a steady decrease over several years, weekly use by aboriginal youth increased significantly in 2017/2018 (Y6). This is a concerning development that may warrant close future monitoring, and interventions to mitigate the effects of cannabis legalization for these adolescents are likely to be needed.

The evidence also suggests that studies on the impact of cannabis legalization on Canadian youth should consider data from several years prior to the passage of the Cannabis Act. Relying on 2017/2018 as a solitary baseline is liable to miss key developments in the years before, and therefore likely to underestimate subsequent effect, e.g. the increase in youth lifetime and past-year use. In 2016/2017, Health Canada funded the expansion of COMPASS to include high school students in Québec, British Columbia, and Nunavut, increasing the relevance of its future investigations of youth cannabis use. As cannabis legalization is likely to disproportionately affect youth, these data will be essential to understanding and mitigating its impact.

Limitations

The COMPASS study has several strengths, including prospective design, validated measures, and large sample size.[29] However, recall and social desirability biases may influence data from self-report questionnaires, leading to underreporting of cannabis use, especially among subpopulations (e.g. females) where use is more stigmatised.[49] High school students who use cannabis at a high frequency are more likely to drop out,[58] also resulting in underestimations, especially of weekly use rates. As the schools studied were from a convenience sample, results are not generalizable. However, use of a passive-consent protocol resulted in high participation rates and reduced selection bias within schools, and the large sample size suggests that conclusions drawn will apply to a substantial proportion of Canadian high school students.

Conclusions

Our data suggest that there has been a gradual rise in youth cannabis use due to the federal discourse around cannabis legalization prior to actual changes in law. This negative trend appears

amplified among some sub-populations of youth. Future research examining the impact of cannabis legalization should consider the ramifications of these pre-implementation changes when drawing conclusions about its overall effect on Canadian youth.

Contributors: AZ designed the work, interpreted the data, wrote and revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. KB designed the work, managed and analysed the data, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. MdG substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. YJ substantially contributed to the design of the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work. SL is the principal investigator of the COMPASS study, designed the work, revised the manuscript, approved the version to be published and agreed to be accountable for all aspects of the work.

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Competing interests: None declared.

Data sharing statement: COMPASS data are available for researchers upon successful completion and approval of the COMPASS data usage application (<https://uwaterloo.ca/compass-system/information-researchers>). Technical reports detailing COMPASS study methods are available online (<https://uwaterloo.ca/compass-system/publications#technical>).

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Figure Legends

Figure 1 – Rates of lifetime and past-year cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting lifetime and past-year cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) lifetime and (D) past-year cannabis use.

Figure 2 – Average age at first cannabis use and rates of easy access to cannabis among youth participating in the COMPASS study (ON and AB, Canada). Grade 12 COMPASS students reporting (A, B) average age at first cannabis use (A) overall and by gender and (B) by ethnicity each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of grade 9-12 COMPASS students who think cannabis is easy to access (C) overall and by gender and (D) by ethnicity.

Figure 3 – Rates of weekly and occasional cannabis use among youth participating in the COMPASS study (ON and AB, Canada). Total proportion of COMPASS students reporting weekly (1-6 times a week or daily) and occasional (2-3 times a month or less) cannabis use (A) in total and (B) by gender each school year from Y1 (2012/2013) to Y6 (2017/2018). (C, D) Total proportion of COMPASS students grouped by race/ethnicity reporting (C) weekly and (D) occasional cannabis use.

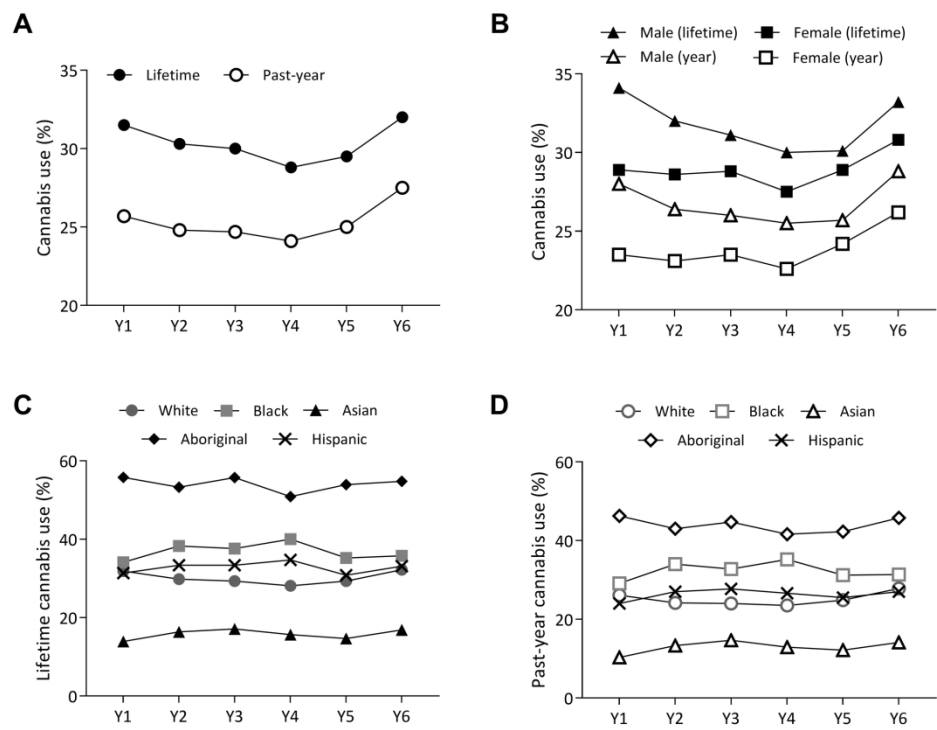


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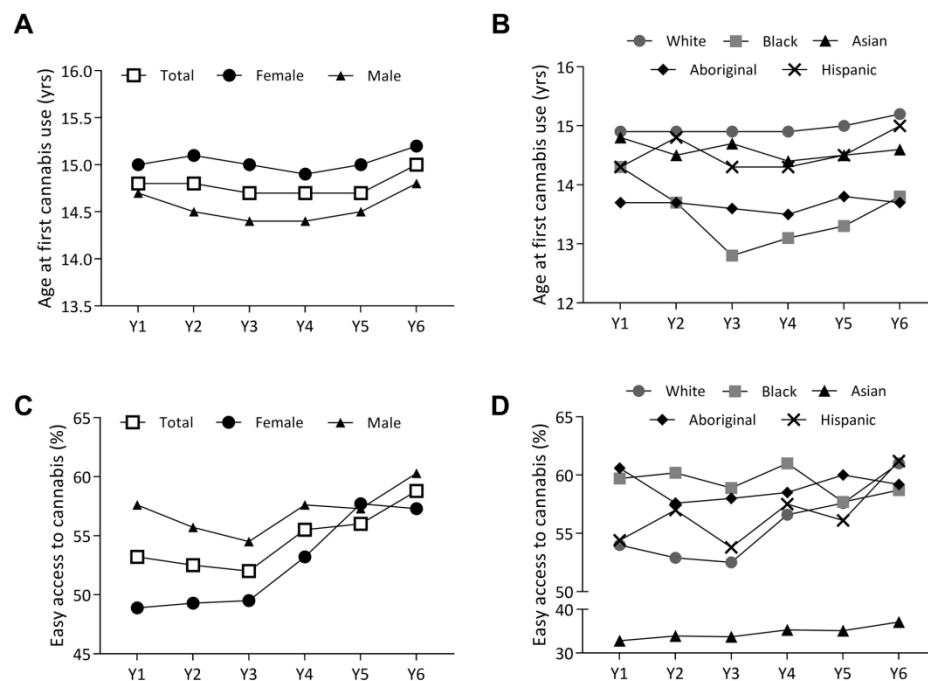


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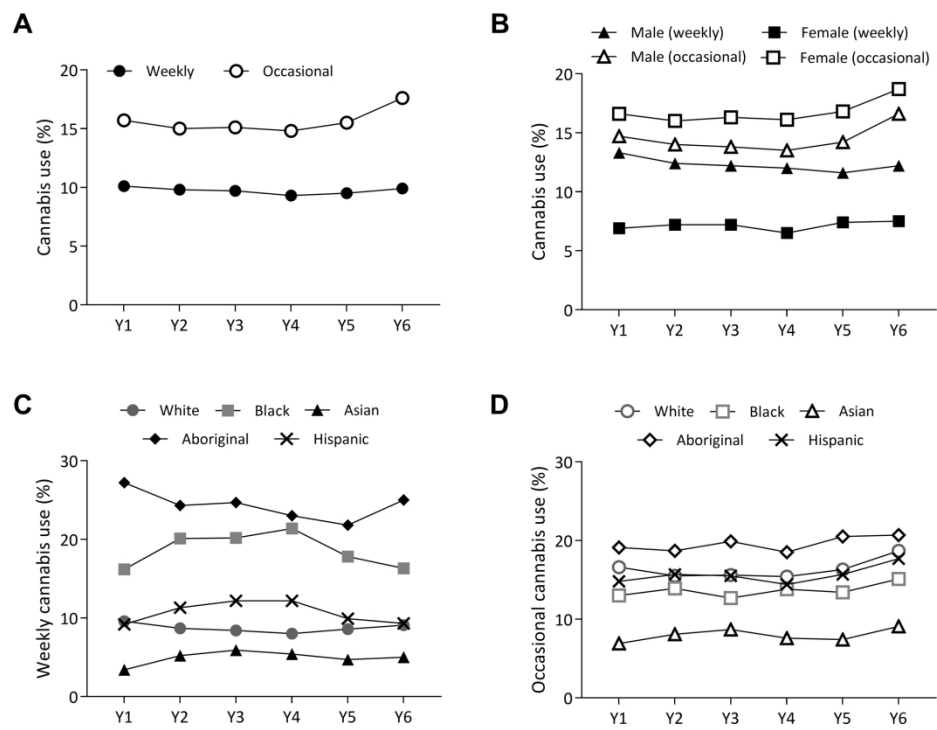


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STROBE Statement—Checklist of items that should be included in reports of *cohort studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	1 2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up (b) For matched studies, give matching criteria and number of exposed and unexposed	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4, 5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4, 5
Bias	9	Describe any efforts to address potential sources of bias	4
Study size	10	Explain how the study size was arrived at	4, 5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4, 5
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, explain how loss to follow-up was addressed (e) Describe any sensitivity analyses	5
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	4, 7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	Report numbers of outcome events or summary measures over time	7

1	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	6-9
2			(b) Report category boundaries when continuous variables were categorized	
3			(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
4				
5				
6				
7				
8	Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
9				
10	Discussion			
11	Key results	18	Summarise key results with reference to study objectives	10, 11
12				
13	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
14				
15	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10, 11
16				
17	Generalisability	21	Discuss the generalisability (external validity) of the study results	11
18				
19	Other information			
20	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12
21				
22				
23				

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at <http://www.strobe-statement.org>.