**Title:** Associations of perceived risk of regular cannabis use with cannabis-related driving and passenger behaviours among Canadian high school students: a cross-sectional study.

**Authors' names:** Melissa Carpino MSc[1], Donald Langille MD MHSc[1], Gabriela Ilie PhD[1,2], Mark Asbridge PhD[1,3]

[1]Department of Community Health and Epidemiology, Dalhousie University
[2]Department of Urology, Dalhousie University
[3]Department of Emergency Medicine, Dalhousie University

**Correspondence to:** Melissa Carpino, melissa.carpino@dal.ca

**Funding statement:** No funding to declare.

**Competing interests:** None declared.

## Abstract

**Background:** Rates of driving under the influence of cannabis (DUIC) among youth have now surpassed rates of drinking and driving across Canada. Many Canadian youth also report riding with a cannabis-impaired driver (RWCD), and many perceive cannabis as safe, with limited impairing effects. Youth's lack of awareness of the potential driving risks posed by cannabis may make them more likely to engage in cannabis-related driving behaviours. The present study examined associations of perceived risk associated with regular cannabis use with DUIC and RWCD.

**Methods:** Our study examined cross-sectional data from 33,915 high school students who took part in a national survey in 2016-2017. Multinomial logistic regression techniques were used to generate adjusted and unadjusted models for DUIC and RWCD.

**Results:** Greater perceived risk of regular cannabis use was associated with reduced risk of DUIC and RWCD in a dose-response manner. Students who perceived that regular cannabis use posed great risk had 0.06 (95% CI: 0.04, 0.10) times the risk of past 30-day DUIC compared to students who perceived that regular use posed no risk. Students who perceived that regular cannabis use posed great risk had 0.08 (95% CI: 0.07, 0.10) times the risk of past 30-day RWCD compared to students who perceived that regular use posed no risk. Associations were consistent for both sexes and for urban and rural students.

**Interpretation:** Given the importance of youth perceptions in shaping cannabis-related driving and passenger behaviours, efforts must be made to disseminate appropriate information regarding cannabis-related driving risks to high school students.


WORD COUNT: 250

## Introduction

Considering Canada's recent legalization of recreational cannabis, driving under the influence of cannabis (DUIC) is increasingly relevant to public health and safety. Evidence from legalization experiences in the United States[1,2] has raised concern that legalization may increase cannabis use and DUIC in Canada, particularly among youth.

After alcohol, cannabis is the most used psychoactive substance in Canada (used by 15% of Canadians in 2017 for medical and recreational purposes)[3]. An approximate two-fold increase in the risk of a motor vehicle collision with recent cannabis use has been demonstrated[4,5], and risk of crash increases with increasing tetrahydrocannabinol (THC) levels[5]. However, recent case-control studies do not support increased crash risk with THC exposure after adjusting for appropriate variables[6,7,8]. Despite mixed findings, cannabis is the second most frequently detected drug in injured and fatally injured Canadian drivers[9,10,11,12,13].

Over 2% of Canadian drivers report DUIC in the past 30 days[14]. In 2012, DUIC was most prevalent among Canadians aged 18-19 (8.3%), followed by those aged 15-17 (6.4%)[15,16]. Many Canadian youth also report riding with a cannabis-impaired driver (RWCD). National data indicates that 20% of high school students report ever RWCD[17]. While males and rural students are more likely to report DUIC compared to females and urban students, respectively[17,18,19,20,21], there is little data related to cannabis-related passenger behaviour among students.

Many youth perceive that cannabis has limited effects on driving[22,23]. Psychological models theorize that demographic characteristics (e.g., age, sex, race, etc.), sociopsychological factors (e.g., autonomy), and structural variables (e.g., prior exposure to a condition) influence risk perception[24,25,26]. Youth perceptions of risks associated with cannabis use and DUIC may also be due to cognitive factors, including comparative optimism bias[27] – a cognition that leads individuals to estimate their own risk of a negative event as lower than that of others[28]. Few studies have explored the role of risk perception in shaping behaviours such as DUIC and RWCD among youth[29,30,31].

Our primary objective was to examine associations of perceived risk of regular cannabis use with DUIC and RWCD among Canadian high school students. We aimed to determine: 1) whether these associations were dose-related, such that greater perceived risk was associated with reduced risk of DUIC and RWCD, and 2) whether these associations differed between males and females, and urban and rural students.

## Methods

*Setting*

The Canadian Student Tobacco, Alcohol and Drugs Survey (CSTADS) was administered between October 2016 and June 2017 in private, public, and Catholic schools attended by students in grades 7-12 (secondary I-V in Québec) across nine Canadian provinces. Schools in New Brunswick (which declined participation) and the three territories were excluded.

*Participants*

The present study includes 33,915 high school students in grades 9-12 who took part in the 2016-2017 survey cycle. In total, 117 school boards, 699 schools, and 52,103 students in grades 7-12 participated. Both active and passive permission protocols were used to obtain parental permission for participation. Overall, the response rate was 76%.

As Canadian adolescents can operate motor vehicles between ages 16 and 17, the sample included only students in grades 11 and 12 (14,520 students) for analyses of DUIC. Analyses of RWCD were based on all 33,915 students in grades 9-12.

*Study Design*

The survey used a stratified single-stage cluster design. Strata were based on two classifications: health region cigarette smoking rate and school type. To ensure a generalizable sample within each province, schools were selected from strata at random, and then all eligible students within selected schools were surveyed. This sampling design was used in all provinces except Québec since the 2016-2017 CSTADS was conducted in partnership with the Québec Health Survey of High School Students. Detailed information on the sampling strategy used in Québec can be found in the CSTADS' publicly available microdata file. A cross-sectional study design was used to address the research questions.

*Outcome Variables*

DUIC was derived from responses to the question: "Have you driven a vehicle (e.g., car, snowmobile, motor boat, or all-terrain vehicle (ATV)) within 2 hours of using marijuana or cannabis?". Response options were: "No, never", "Yes, in the last 30 days", and "Yes, more than 30 days ago". DUIC was coded 0 for "No, never"; 1 for "Yes, in the last 30 days"; and 2 for

"Yes, more than 30 days ago". RWCD was derived from responses to the question: "Have you ever been a passenger in a vehicle (e.g., car, snowmobile, motor boat, or ATV) driven by someone who had been using marijuana or cannabis in the last 2 hours?". Response options were: "No, never", "Yes, in the last 30 days", "Yes, more than 30 days ago", and "I do not know". To avoid having more than three categories for this outcome, RWCD was coded 0 for "No, never" and "I do not know"; 1 for "Yes, in the last 30 days"; and 2 for "Yes, more than 30 days ago".

*Independent Variable*

Perceived risk of regular cannabis use was assessed by asking: "How much do you think people risk harming themselves when they smoke marijuana or cannabis on a regular basis?". Response options were: "No risk", "Slight risk", "Moderate risk", "Great risk", and "I do not know". Using "No risk" as the reference category, the variable was coded 0 for "No risk"; 1 for "Slight risk"; 2 for "Moderate risk"; 3 for "Great risk"; and 4 for "I do not know" and/or not stated.

*Covariates*

Analyses controlled for sociodemographic variables including sex (male or female), school grade, rurality, province of residence, and autonomy. School grade was used as a proxy for age (Health Canada did not permit an age measurement). Rurality was derived by assessing whether the respondent's school was in an urban or rural location. Urban and rural categories were derived from school postal codes that were based on Statistics Canada's Statistical Area Classification system. Province of residence was coded 0 for Ontario (the reference), with numbers from 1-8 for remaining provinces. Autonomy, defined by the survey as "our need for personal freedom to make choices or decisions that affect our lives", was measured using six items to capture students' overall autonomy in the past week (e.g., "I feel free to express myself at home", "I feel free to express myself with my friends", etc.). The scale had high internal consistency (Cronbach's $\alpha = 0.95$). Response options for the six items were: "Really false for me", "Sort of false for me", "Sort of true for me", and "Really true for me". An autonomy scale (scored 0-3, meaning least to most autonomy) was created for each of the six items, with a total

score ranging from 0-18 (lowest to highest autonomy). Autonomy score was divided into quartiles: "High" (the reference), "Moderate", "Low", and "Very low".

*Statistical Analysis*

All prevalence estimates and statistical tests accounted for the stratified cluster sample design and were based on survey weights and bootstrap weights. Survey weights were used to adjust for school selection and non-response at the school, grade, and student level, and to derive meaningful population estimates from the survey sample. Bootstrap weights were used to account for the effects of the survey design (e.g., the clustered data) on variance estimates, and to more precisely estimate sampling error.

Multinomial logistic regression was used to examine associations between perceived risk of regular cannabis use and cannabis-related driving behaviours. To determine whether these associations differed between males and females and/or rural and urban students, multinomial logistic regression was also employed, now with two stages of testing. In the first stage, effect modification was tested using a sex by perceptions interaction term (and a rurality by perceptions term) to see if we should proceed with stratification (stage two) by sex and/or rurality. To test the robustness of the main findings, a sensitivity analysis for the DUIC model was performed; the association between perceived risk of regular cannabis use and DUIC was tested separately for grade 11 and 12 students who had used cannabis at least once in the past year. To handle missing data, listwise deletion was used to achieve a complete case analysis. This reduced the sample to 14,147 students for analyses of DUIC, and to 33,116 students for analyses of RWCD. All multinomial logistic regression analyses were performed using Stata/IC 15.0. We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) cross-sectional checklist when writing our report[32].

**Results**

Nearly 10% of senior students reported DUIC in the past year, and almost 20% of students in grades 9-12 reported RWCD (Table 1). Approximately half (46%) perceived great risk associated with regular cannabis use, with 10% perceiving no risk (Table 1).

Table 2 presents unadjusted and adjusted results of a multinomial logistic regression model of DUIC by perceived risk of regular cannabis use among grade 11 and 12 students

including results for covariates. Adjusted results revealed a dose-response pattern, with greater perceived risk of regular cannabis use significantly associated with reduced risk of DUIC in the last 30 days and more than 30 days ago. Students perceiving that regular cannabis use posed great risk had 0.06 (95% confidence interval (CI): 0.04, 0.10) times the risk of past 30-day DUIC and 0.11 (95% CI: 0.08, 0.15) times the risk of DUIC more than 30 days ago, compared to students perceiving that regular use posed no risk. Adjusted estimates also indicated that male students and grade 12 students had a significantly increased risk of DUIC in the last 30 days and more than 30 days ago, compared to females and students in grade 11, respectively. Rural students had a significantly increased risk of past 30-day DUIC compared with urban students, but not for more than 30 days ago. Students in four provinces had a significantly increased risk of past 30-day DUIC compared to Ontario students. Similarly, compared to Ontario, the risk of DUIC more than 30 days ago was significantly increased among students in almost all provinces. Adjusted results found that students with very low autonomy scores had a significantly increased risk of DUIC more than 30 days ago. A sensitivity analysis revealed the same trend as the main analysis; however, the effect sizes were less robust. Unadjusted results from Table 2 were generally consistent with adjusted results.

Table 3 presents unadjusted and adjusted results of a multinomial logistic regression model of RWCD by perceived risk of regular cannabis use among students in grades 9-12 along with results for covariates. Adjusted estimates indicated a dose-response pattern, whereby greater perceived risk of regular cannabis use was significantly associated with reduced risk of RWCD in the last 30 days and more than 30 days ago. Students perceiving that regular cannabis use posed great risk had 0.08 (95% CI: 0.07, 0.10) times the risk of past 30-day RWCD and 0.23 (95% CI: 0.19, 0.28) times the risk of RWCD more than 30 days ago, compared to students perceiving that regular cannabis use posed no risk. Adjusted estimates also indicated a dose-dependent effect of school grade on risk of RWCD, whereby risk of RWCD (in the last 30 days and more than 30 days ago) increased significantly with school grade level. While male students had a significantly reduced risk of RWCD in the last 30 days and more than 30 days ago compared to females, adjusted results revealed that relative to urban students, students from rural schools had a significantly increased risk of RWCD in the last 30 days and more than 30 days ago. Compared to students in Ontario, students from most provinces had a significantly increased risk of RWCD in the last 30 days and more than 30 days ago. Finally, the risk of RWCD more

than 30 days ago increased significantly as students' self-reported level of autonomy decreased. Unadjusted results from Table 3 were consistent with adjusted results.

Interaction models for DUIC and RWCD by sex and by rurality were tested but were not significant.

**Interpretation**

The major findings presented here are as follows. First, adjusted analyses found that greater perceived risk of regular cannabis use was associated with reduced risk of DUIC and RWCD in a dose-response manner. These findings replicate results from recent empirical studies in the United States that explored cognitive risk factors for driving after cannabis use among youth[30,31]. Second, no evidence of effect modification by sex or rurality for either the association between risk perception and DUIC, or RWCD was observed; associations of risk perception of regular cannabis use with DUIC and RWCD were significantly protective for both males and females, and for urban and rural students. To our knowledge, this is the first Canadian study to consider whether associations of perceived risk of regular cannabis use with DUIC and RWCD varied between males and females, and urban and rural students.

Heightening the risk perceptions of students who feel that regular cannabis use poses no risk at all may be an effective strategy for reducing both behaviours. This assumes that increasing people's perceptions of risk (or their perceived threat) will engender behaviour change. This assumption is central to various health psychology models including the Health Belief Model[24] and supported by scientific evidence[33]. Education is considered the best practice for changing people's risk perceptions. Social marketing campaigns targeting youth at risk of DUIC or RWCD may also be effective in heightening risk perceptions and decreasing the prevalence of both behaviours. Allocating a share of Canada's cannabis tax revenues to fund public education and social marketing campaigns highlighting the risks of driving after cannabis use may be a cost-effective strategy for doing so.

This study has limitations. First, data were cross-sectional and therefore a cause-and-effect relationship between risk perception and cannabis-related driving behaviours cannot be made. Second, cannabis-related driving behaviours were self-reported and may reflect under and over-reporting. Next, our risk perception measure focused on cannabis use rather than DUIC and RWCD risk perception. As well, potential confounders including risk-engaging personality,

sexual orientation, and depression were not available for analysis. Lastly, due to the school-based nature of our study, the results may not be generalizable to home-schooled and absentee students (including truant students). Despite these limitations, this study has important strengths including the survey's national scope, high response rate, large sample size, and provincially generalizable estimates.

This study indicates perceptions of risk matter for young people: greater perceived risk of cannabis was associated with reduced risk of cannabis-related driving and passenger behaviour in a robust and dose-response manner. These associations were consistent for both sexes, and for urban and rural students. Given these associations, efforts are required to disseminate appropriate information regarding cannabis-related driving risks to high school students. Heightening risk perceptions of students who feel that regular cannabis use poses no risk at all is also warranted. To achieve this, a multi-pronged approach akin to what has led to substantial reductions in drinking and driving is needed – a combination of robust public health policy and regulation, education, social marketing, and effective enforcement approaches[34,35].

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**Table 1.** Sociodemographic and other characteristics of Canadian grade 9-12 students who participated in the 2016-2017 Canadian Student Tobacco, Alcohol and Drugs Survey (*n* = 33 915)

| Variables | High school students (*n* = 33 915) | | |
|---|---|---|---|
| | *n* | Weighted % | CI[a] |
| Sex | | | |
| Female | 16 938 | 48.7 | 0.5 |
| Male | 16 977 | 51.3 | 0.5 |
| School grade | | | |
| 9 | 10 643 | 25.4 | 0.5 |
| 10 | 8752 | 25.4 | 0.5 |
| 11 | 8257 | 25.2 | 0.5 |
| 12 | 6263 | 24.0 | 0.5 |
| Rural setting | | | |
| No | 25 665 | 83.0 | 0.4 |
| Yes | 8250 | 17.0 | 0.4 |
| Province | | | |
| Ontario | 7828 | 47.0 | 0.5 |
| Québec | 1943 | 15.6 | 0.4 |
| British Columbia | 4300 | 13.4 | 0.4 |
| Alberta | 6440 | 11.8 | 0.3 |
| Saskatchewan | 1905 | 3.4 | 0.2 |
| Manitoba | 2244 | 4.3 | 0.2 |
| Nova Scotia | 2624 | 2.7 | 0.2 |
| Prince Edward Island | 2778 | 0.4 | 0.1 |
| Newfoundland and Labrador | 3853 | 1.4 | 0.1 |
| Sqr. Autonomy score | | | |
| High | 5824 | 17.9 | 0.4 |
| Moderate | 9246 | 29.1 | 0.5 |
| Low | 10 170 | 30.4 | 0.5 |
| Very low | 8675 | 22.6 | 0.4 |
| Perceived risk of regular cannabis use | | | |
| No risk | 4086 | 10.0 | 0.3 |
| Slight risk | 4667 | 12.9 | 0.4 |
| Moderate risk | 7505 | 22.5 | 0.4 |
| Great risk | 14 581 | 46.9 | 0.5 |
| Don't know/Not stated | 3076 | 7.7 | 0.3 |
| DUIC (*n* = 14 520) | | | |
| No, never | 12 480 | 88.9 | 0.5 |
| Yes, in the last 30 days | 907 | 4.9 | 0.4 |
| Yes, more than 30 days ago | 760 | 3.9 | 0.3 |
| Missing | 373 | 2.3 | 0.2 |
| Not applicable | 19 395 | – | – |
| RWCD (*n* = 33 915) | | | |
| No, never | 26 443 | 80.4 | 0.4 |
| Yes, in the last 30 days | 3297 | 8.5 | 0.3 |
| Yes, more than 30 days ago | 3376 | 8.9 | 0.3 |
| Missing | 799 | 2.2 | 0.2 |

*Notes:* Sqr. = square transformation; DUIC = driving under the influence of cannabis; RWCD = riding with a cannabis-impaired driver.

[a] 95% Confidence interval.

**Table 2.** Multinomial logistic regression of driving under the influence of cannabis (DUIC) by perceived risk of regular cannabis use, sex, school grade, rural setting, province, and square of autonomy score among Canadian grade 11 and 12 students who participated in the 2016-2017 Canadian Student Tobacco, Alcohol and Drugs Survey ($n$ = 14 147)

| Variables | DUIC ($n$ = 14 147) | | Unadjusted RRR (95% CI) | | Adjusted RRR[b] (95% CI) | |
|---|---|---|---|---|---|---|
| | $n$[a] | Weighted estimated % | Past 30-day DUIC vs. Never | More than 30-day ago DUIC vs. Never | Past 30-day DUIC vs. Never | More than 30-day ago DUIC vs. Never |
| Perceived risk of regular cannabis use | | | | | | |
| No risk (referent) | 2061 | 12.1 | 1.00 | 1.00 | 1.00 | 1.00 |
| Slight risk | 2430 | 15.7 | 0.54 (0.39, 0.75)*** | 0.65 (0.49, 0.85)** | 0.56 (0.39, 0.80)** | 0.67 (0.51, 0.88)** |
| Moderate risk | 3458 | 25.3 | 0.17 (0.13, 0.22)*** | 0.30 (0.23, 0.39)*** | 0.19 (0.14, 0.27)*** | 0.34 (0.26, 0.44)*** |
| Great risk | 5205 | 41.4 | 0.05 (0.03, 0.08)*** | 0.09 (0.06, 0.12)*** | 0.06 (0.04, 0.10)*** | 0.11 (0.08, 0.15)*** |
| Don't know/Not stated | 993 | 5.5 | N/A | N/A | N/A | N/A |
| Sex | | | | | | |
| Female (referent) | 7126 | 49.2 | 1.00 | 1.00 | 1.00 | 1.00 |
| Male | 7021 | 50.8 | 2.17 (1.56, 3.02)*** | 1.80 (1.39, 2.33)*** | 1.74 (1.25, 2.41)*** | 1.50 (1.17, 1.93)*** |
| School grade | | | | | | |
| 11 (referent) | 8043 | 51.2 | 1.00 | 1.00 | 1.00 | 1.00 |
| 12 | 6104 | 48.8 | 1.91 (1.48, 2.47)*** | 1.86 (1.44, 2.39)*** | 1.91 (1.51, 2.42)*** | 1.83 (1.42, 2.36)*** |
| Rural setting | | | | | | |
| No (referent) | 10 516 | 82.6 | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 3631 | 17.4 | 2.17 (1.59, 2.95)*** | 1.72 (1.12, 2.65)* | 1.70 (1.30, 2.24)*** | 1.24 (0.90, 1.71) |
| Province | | | | | | |
| Ontario (referent) | 3475 | 51.7 | 1.00 | 1.00 | 1.00 | 1.00 |
| Québec | 670 | 9.8 | 0.66 (0.34, 1.30) | 0.72 (0.37, 1.40) | 1.59 (0.81, 3.13) | 1.50 (0.78, 2.89) |
| British Columbia | 1882 | 14.0 | 1.36 (0.78, 2.37) | 1.58 (0.86, 2.89) | 1.25 (0.72, 2.17) | 1.51 (0.81, 2.84) |
| Alberta | 2533 | 12.0 | 1.70 (1.12, 2.57)* | 2.16 (1.32, 3.53)** | 1.37 (0.99, 1.91) | 1.90 (1.23, 2.95)** |
| Saskatchewan | 788 | 3.5 | 3.08 (1.94, 4.88)*** | 3.55 (2.19, 5.74)*** | 2.10 (1.34, 3.29)*** | 2.91 (1.82, 4.67)*** |
| Manitoba | 962 | 4.5 | 1.47 (0.94, 2.31) | 2.32 (1.41, 3.81)*** | 1.04 (0.74, 1.47) | 1.88 (1.20, 2.96)** |
| Nova Scotia | 1033 | 2.7 | 3.39 (2.41, 4.77)*** | 3.61 (2.32, 5.60)*** | 2.59 (1.88, 3.58)*** | 2.89 (1.90, 4.39)*** |
| Prince Edward Island | 1103 | 0.4 | 2.13 (1.29, 3.51)** | 2.44 (1.50, 3.97)*** | 1.44 (1.07, 1.93)* | 2.02 (1.23, 3.31)** |
| Newfoundland and Labrador | 1701 | 1.4 | 2.28 (1.39, 3.74)*** | 2.67 (1.71, 4.16)*** | 1.82 (1.14, 2.89)* | 2.22 (1.45, 3.43)*** |
| Sqr. Autonomy score | | | | | | |
| High (referent) | 2536 | 18.4 | 1.00 | 1.00 | 1.00 | 1.00 |
| Moderate | 3864 | 29.0 | 1.09 (0.75, 1.58) | 1.15 (0.87, 1.52) | 0.99 (0.69, 1.43) | 1.05 (0.78, 1.40) |
| Low | 3317 | 23.4 | 1.05 (0.72, 1.54) | 1.44 (1.04, 2.01)* | 0.87 (0.58, 1.30) | 1.21 (0.88, 1.68) |
| Very low | 4430 | 29.2 | 1.91 (1.27, 2.87)** | 1.76 (1.30, 2.39)*** | 1.39 (0.90, 2.14) | 1.37 (1.02, 1.84)* |
| $F$ statistic | | | | | $F(36, 464) = 48.13$*** | |

*Notes:* DUIC = driving under the influence of cannabis; RRR = relative risk ratio; CI = confidence interval; N/A = not applicable; Sqr. = square transformation.

[a] The weighted prevalence estimates are based on 14 147 cases.

[b] Adjusted for perceived risk of regular cannabis use, sex, school grade, rural setting, province, and square of autonomy score.

* $p < 0.05$.

** $p < 0.01$.

*** $p \leq 0.001$.

**Table 3.** Multinomial logistic regression of riding with a cannabis-impaired driver (RWCD) by perceived risk of regular cannabis use, sex, school grade, rural setting, province, and square of autonomy score among Canadian grade 9-12 students who participated in the 2016-2017 Canadian Student Tobacco, Alcohol and Drugs Survey ($n$ = 33 116)

| Variables | RWCD ($n$ = 33 116) | | Unadjusted RRR (95% CI) | | Adjusted RRR[b] (95% CI) | |
|---|---|---|---|---|---|---|
| | $n$[a] | Weighted estimated % | Past 30-day RWCD vs. Never | More than 30-day ago RWCD vs. Never | Past 30-day RWCD vs. Never | More than 30-day ago RWCD vs. Never |
| Perceived risk of regular cannabis use | | | | | | |
| No risk (referent) | 4026 | 10.1 | 1.00 | 1.00 | 1.00 | 1.00 |
| Slight risk | 4623 | 13.0 | 0.54 (0.45, 0.66)*** | 0.86 (0.72, 1.03) | 0.54 (0.45, 0.65)*** | 0.85 (0.71, 1.03) |
| Moderate risk | 7442 | 22.9 | 0.28 (0.23, 0.33)*** | 0.55 (0.47, 0.65)*** | 0.28 (0.24, 0.33)*** | 0.54 (0.46, 0.64)*** |
| Great risk | 14 453 | 47.5 | 0.07 (0.06, 0.09)*** | 0.22 (0.18, 0.26)*** | 0.08 (0.07, 0.10)*** | 0.23 (0.19, 0.28)*** |
| Don't know/Not stated | 2572 | 6.5 | N/A | N/A | N/A | N/A |
| Sex | | | | | | |
| Female (referent) | 16 668 | 49.1 | 1.00 | 1.00 | 1.00 | 1.00 |
| Male | 16 448 | 50.9 | 1.01 (0.87, 1.17) | 0.87 (0.77, 0.98)* | 0.75 (0.65, 0.87)*** | 0.73 (0.63, 0.84)*** |
| School grade | | | | | | |
| 9 (referent) | 10 400 | 25.3 | 1.00 | 1.00 | 1.00 | 1.00 |
| 10 | 8546 | 25.4 | 1.96 (1.62, 2.37)*** | 2.02 (1.70, 2.41)*** | 1.78 (1.46, 2.16)*** | 1.92 (1.60, 2.32)*** |
| 11 | 8062 | 25.2 | 2.92 (2.30, 3.71)*** | 2.48 (2.10, 2.93)*** | 2.52 (1.99, 3.19)*** | 2.29 (1.94, 2.70)*** |
| 12 | 6108 | 24.1 | 4.27 (3.28, 5.56)*** | 3.74 (3.10, 4.52)*** | 3.82 (2.93, 4.99)*** | 3.86 (3.17, 4.69)*** |
| Rural setting | | | | | | |
| No (referent) | 25 047 | 83.0 | 1.00 | 1.00 | 1.00 | 1.00 |
| Yes | 8069 | 17.0 | 1.69 (1.34, 2.13)*** | 1.53 (1.17, 2.00)** | 1.43 (1.16, 1.75)*** | 1.26 (1.01, 1.56)* |
| Province | | | | | | |
| Ontario (referent) | 7638 | 47.0 | 1.00 | 1.00 | 1.00 | 1.00 |
| Québec | 1923 | 15.8 | 1.05 (0.81, 1.35) | 1.47 (1.16, 1.86)*** | 2.13 (1.64, 2.78)*** | 2.57 (2.03, 3.26)*** |
| British Columbia | 4168 | 13.3 | 1.42 (1.00, 2.02) | 1.36 (0.95, 1.94) | 1.34 (0.96, 1.86) | 1.36 (0.96, 1.92) |
| Alberta | 6315 | 11.9 | 1.34 (1.02, 1.77)* | 1.84 (1.36, 2.50)*** | 1.24 (1.01, 1.53)* | 1.82 (1.39, 2.39)*** |
| Saskatchewan | 1866 | 3.4 | 1.93 (1.22, 3.05)** | 2.52 (1.85, 3.42)*** | 1.55 (0.95, 2.54) | 2.32 (1.63, 3.31)*** |
| Manitoba | 2192 | 4.2 | 1.61 (1.20, 2.17)** | 1.62 (1.26, 2.08)*** | 1.35 (1.06, 1.72)* | 1.53 (1.24, 1.90)*** |
| Nova Scotia | 2570 | 2.6 | 3.37 (2.60, 4.36)*** | 3.13 (2.53, 3.88)*** | 2.80 (2.20, 3.55)*** | 2.87 (2.32, 3.56)*** |
| Prince Edward Island | 2725 | 0.4 | 1.76 (1.32, 2.33)*** | 1.94 (1.57, 2.38)*** | 1.41 (1.14, 1.74)*** | 1.77 (1.39, 2.24)*** |
| Newfoundland and Labrador | 3719 | 1.4 | 2.13 (1.66, 2.73)*** | 2.00 (1.60, 2.52)*** | 1.79 (1.43, 2.24)*** | 1.85 (1.49, 2.30)*** |
| Sqr. Autonomy score | | | | | | |
| High (referent) | 5752 | 18.1 | 1.00 | 1.00 | 1.00 | 1.00 |
| Moderate | 9157 | 29.4 | 1.10 (0.85, 1.43) | 1.37 (1.14, 1.65)*** | 1.05 (0.80, 1.38) | 1.33 (1.10, 1.61)** |
| Low | 10 044 | 30.8 | 1.49 (1.18, 1.90)*** | 1.50 (1.23, 1.83)*** | 1.34 (1.05, 1.72)* | 1.42 (1.18, 1.72)*** |
| Very low | 8163 | 21.7 | 1.83 (1.49, 2.26)*** | 1.78 (1.47, 2.17)*** | 1.45 (1.17, 1.80)*** | 1.61 (1.29, 2.01)*** |
| $F$ statistic | | | | | | $F(40, 460) = 70.16$*** |

*Notes:* RWCD = riding with a cannabis-impaired driver; RRR = relative risk ratio; CI = confidence interval; N/A = not applicable; Sqr. = square transformation.

[a] The weighted prevalence estimates are based on 33 116 cases.

[b] Adjusted for perceived risk of regular cannabis use, sex, school grade, rural setting, province, and square of autonomy score.

* $p < 0.05$.

** $p < 0.01$.

*** $p \leq 0.001$.

# Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

## Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectionalreporting guidelines, and cite them as:

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| | | Reporting Item | Page Number |
|---|---|---|---|
| **Title and abstract** | | | |
| Title | #1a | Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| Abstract | #1b | 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 | 4 |

| | | | |
|---|---|---|---|
| | | recruitment, exposure, follow-up, and data collection | |
| Eligibility criteria | #6a | Give the eligibility criteria, and the sources and methods of selection of participants. | 4 |
| | #7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 4, 5, 6 |
| 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. Give information separately for for exposed and unexposed groups if applicable. | 4, 5 |
| Bias | #9 | Describe any efforts to address potential sources of bias | 6 |
| Study size | #10 | Explain how the study size was arrived at | 4 |
| Quantitative variables | #11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why | 4, 5, 6 |
| Statistical methods | #12a | Describe all statistical methods, including those used to control for confounding | 6 |
| Statistical methods | #12b | Describe any methods used to examine subgroups and interactions | 6 |
| Statistical methods | #12c | Explain how missing data were addressed | 6 |
| Statistical methods | #12d | If applicable, describe analytical methods taking account of sampling strategy | 6 |
| Statistical methods | #12e | Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | #13a | 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. Give information separately for for exposed and unexposed groups if applicable. | n/a |
| Participants | #13b | Give reasons for non-participation at each stage | n/a |

| | | | |
|---|---|---|---|
| Participants | #13c | Consider use of a flow diagram | n/a |
| Descriptive data | #14a | Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable. | 6-7 (Table 1) |
| Descriptive data | #14b | Indicate number of participants with missing data for each variable of interest | Table 1 |
| Outcome data | #15 | Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable. | Table 1 |
| Main results | #16a | 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 | 7 & Table 1 |
| Main results | #16b | Report category boundaries when continuous variables were categorized | Top of 6 & Table 1 |
| Main results | #16c | If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | n/a |
| Other analyses | #17 | Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses | 7 |
| **Discussion** | | | |
| Key results | #18 | Summarise key results with reference to study objectives | 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. | 8-9 |
| Interpretation | #20 | Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence. | 8-9 |
| Generalisability | #21 | Discuss the generalisability (external validity) of the study results | 9 |
| **Other Information** | | | |
| Funding | #22 | Give the source of funding and the role of the funders for the present | 1 |

study and, if applicable, for the original study on which the present article is based

Notes:

- 14a: 6-7 (Table 1)
- 16a: 7 & Table 1
- 16b: Top of 6 & Table 1 The STROBE checklist is distributed under the terms of the Creative Commons Attribution License CC-BY. This checklist was completed on 11. March 2020 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai