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A comparison of the prevalence of cannabis and alcohol use among drivers and passengers in British Columbia and Ontario, Canada

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ABSTRACT

Background: Similar to drink driving, the prevalence of driving under the influence of cannabis (DUIC) is expected to depend on the availability and cost of cannabis which would impact cannabis use in both drivers and passengers, and factors that specifically target cannabis use in drivers such as the deterrent effect of traffic laws and driver's opinion about the risks and acceptability of DUIC. To disentangle these effects, we aimed to compare the prevalence of alcohol and tetrahydrocannabinol (THC) detection 1) in drivers vs. passengers involved in motor vehicle accidents and 2) in drivers and passengers from BC vs. Ontario.
Methods: Chart review and toxicology data from an ongoing prospective study of moderately injured motor vehicle occupants were analyzed. Log-binomial regression models were used to obtain prevalence ratios (PRs).
Results: This manuscript reports on data from 3004 drivers and 941 passengers. Approximately half (55.1%) were male, and the mean (SD) age was 43.8 (19.1) years. Alcohol and THC detection prevalence was 14.2% and 12.4%, respectively. Passengers had higher prevalence of alcohol than drivers (aPR [95% CI]: 1.22 [1.06, 1.40]). No difference in THC prevalence was observed between drivers and passengers. Ontario drivers had higher prevalence of alcohol detection than BC drivers (aPR [95% CI]: 1.33 [1.13, 1.58]) but lower prevalence of THC detection (aPR [95% CI]: 0.80 [0.64, 0.99]). Among passengers, no significant interprovincial differences were observed for alcohol or THC detection.
Conclusion: These findings may be partially explained by differences in provincial traffic laws, public opinion, and overall consumption rates.

1. Introduction

Impaired driving is a major public health problem. While alcohol-impaired driving is a leading cause of fatal motor vehicle crashes (MVCs) in Canada, driving under the influence of cannabis (DUIC) is also a threat to road safety. (Simpson et al., 2006) DUIC is now as common as driving after drinking alcohol (drink driving) in Canada, (Beasley and Beirness, 2000; Beasley and Beirness, Vancouver 2010.; Beirness et al., 2014; Solomon and Clarizio, 2016 April 19; Brubacher et al., 2016) and the prevalence may be increasing. (Ialomiteanu et al., 2016) Cannabis impairs the skills required for safe driving; it slows reaction time and impairs automated tasks such as tracking ability (e.g., staying within a lane) or monitoring the speedometer. (Ronen et al., 2008; Hartman et al., 2015; Grotenhermen F, Leson G, Berghaus G, Drummer OH, Krüger HP, Longo M, et al. Developing Science-Based Per Se Limits for Driving under the Influence of Cannabis (DUIC): Findings and Recommendations by an Expert Panel. Report. Washington, DC: International Association for Cannabis as Medicine;, 2005; Sewell et al., 2009; Ramaekers et al., 2004; Berghaus G, Scheer N, Schmidt P, editors. Effects of Cannabis on Psychomotor Skills and Driving Performance - a Metaanalysis of Experimental Studies. International Council on Alcohol Drugs and Traffic Safety (ICADTS);, 1995) Drivers who use cannabis are

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at increased risk of collisions, (Rogeberg and Elvik, 2016; White and Burns, 2021) although the risk is less than that with alcohol. (Sewell et al., 2009; Drummer et al., 2020; Brubacher et al., 2019)

Drink driving, and related collisions, are reduced by policy that decreases alcohol consumption in the general population by regulating alcohol sales and distribution, setting a minimum legal drinking age, or taxing alcohol beverages. (Chang et al., 2012; Cohen et al., 2002; Elder et al., 2010; Campbell et al., 2009) Drink driving is also reduced by deterrence-based traffic laws accompanied by visible enforcement and media campaigns. (Fell et al., 2015; Davey and Freeman, 2011; Bergen et al., 2014; Elder et al., 2004) Similarly, but not well studied, the prevalence of DUIC is expected to depend on the availability and cost of cannabis, the deterrent effect of traffic laws, and driver's opinion about the risks and acceptability of DUIC. These factors can be influenced by cannabis sales/distribution policy, traffic policy targeting DUIC, traffic law enforcement, media campaigns, and societal norms. The Canadian Substance Use Survey 2023 reported higher prevalence of cannabis consumption in British Columbia (BC) compared to Ontario (24.0 % vs. 21.6 %, past 30-day cannabis use), (Government of Canada. Canadian Substance Use Survey, 2023) likely due to differences in availability, regulation of sales, and public opinion and acceptance. If DUIC can be deterred by effective traffic policy, then differences in traffic policy and how DUIC is portrayed in media and educational campaigns in different jurisdictions may also contribute to differences in DUIC prevalence between jurisdictions. A recent analysis of media reports published in BC and Ontario on the topic of cannabis and impaired driving found that media portrayal of the effect of cannabis legalization on driving after cannabis use tended to be more negative in Ontario and more neutral in BC. (Boicu et al., 2024).

In Canada, it is illegal to drive a vehicle while impaired. Since 2008, the Canadian Criminal Code provides a standardized approach for evaluating impaired drivers including administration of a Standardized Field Sobriety Test at roadside and further examination by a specially trained drug recognition expert for drivers who "fail" the roadside sobriety test. Canada's provinces can target DUIC through implementation and enforcement of federal traffic laws and through provincial traffic laws that target DUIC through fines, license suspension or vehicle impoundment. There is evidence that traffic laws against drink driving result in a lower rate of drinking in drivers than in passengers. (Voas et al., 2013; Foss RD, Beirness D, editors. Drinking drivers and their passengers. Roadside survey results. 40′th Annual Proceedings of the Association for the Advancement of Automotive Medicine;, 1996) Similarly, comparing the prevalence of cannabis use in drivers versus passengers might disentangle the effects of provincial traffic policy or public education campaigns, which aim to deter DUIC, from cannabis sales/distribution policy, which targets cannabis availability and use. If traffic laws or public education campaigns deter DUIC, then the prevalence of cannabis use in drivers would be expected to be lower than that in passengers. Conversely, policy that limits cannabis sales or distribution would be expected to impact cannabis use in drivers and passengers equally.

This manuscript compares the prevalence of alcohol and tetrahydrocannabinol (THC) detection 1) in drivers versus in passengers involved in motor vehicle accidents and 2) in drivers and passengers from BC versus from Ontario. BC and Ontario were selected as they represent the two largest English-speaking provinces in Canada by population.

2. Methods

This manuscript uses data from an ongoing prospective study of moderately injured drivers and passengers of motor vehicles who visited the emergency department (ED) of a participating hospital in BC or Ontario between August 2020 and March 2024. This included five participating trauma centres in BC (Vancouver, New Westminster, Kelowna, Prince George, Victoria) and three in Ontario (Ottawa, Toronto, Sudbury). These hospitals treat patients from large urban centres and more remote areas in both provinces. Moderate injury was defined pragmatically as meaning that bloodwork (blood count or electrolyte measurement) was required for clinical assessment. Detailed methods have been published previously. (Brubacher et al., 2019; Brubacher et al., 2016; Masud et al., 2020) All participants were old enough to have a driver's license (≥16 years of age). The study was approved by institutional research ethics boards at all participating sites.

2.1. Study procedures

Motor vehicle drivers and passengers treated for injuries at participating EDs following an MVC were identified. Injured individuals who had blood obtained within 6 h of a collision were eligible for study inclusion. Research assistants identified eligible drivers and passengers and obtained excess blood before it was discarded. Blood was frozen and shipped to a centralized lab for later toxicology analysis. We excluded drivers/passengers with minor injuries who did not require bloodwork, cases where blood samples were obtained more than 6 h after the crash, and cases with no excess blood available. Ambulance and ED records of eligible drivers/passengers were reviewed and basic demographic, medical and collision information was recorded.

2.2. Toxicology analysis

We conducted broad spectrum toxicology testing for alcohol and cannabinoids, with detection limits of 0.2 ng/mL for THC and 0.01 % (10 mg/dL) for alcohol. In most cases, samples consisted of whole blood. In a small number of cases only plasma specimens were obtained. In this case, plasma results were adjusted to equivalent whole blood results according to international standards. (Giroud et al., 2001; Couper and Logan, 2014) This analysis reports the following substance categories: THC detectable; THC > 2 ng/mL; THC > 5 ng/mL; blood alcohol concentration (BAC) detectable; BAC > 0.08 %. Note that it is a criminal offence to operate a motor vehicle with BAC > 0.08 % in Canada. For cannabis, it is illegal to drive with blood THC > 2 ng/mL with higher penalties for THC > 5 ng/mL. We report prevalence for the overall cohort as well as disaggregated by road user type (driver vs. passenger) and province (BC vs. Ontario).

2.3. Statistical analysis

The primary outcomes were binary indicator variables for i) BAC detectable, ii) BAC > 0.08 %, iii) THC detectable, iv) THC > 2 ng/mL, and v) THC > 5 ng/mL. For each outcome, we reported crude prevalence ratios (PRs) for all injured drivers and passengers. We obtained adjusted PRs using separate log-binomial regression models. The models included the following predictors: province (BC or Ontario), sex (male or female), age group (<19, 19–24, 25–44, 45–64, or ≥ 65 years), residence type (urban or rural), time of crash (night [18:01–06:00] or daytime [06:01–18:00]), time between crash and blood draw, year of crash, season of crash (spring, summer, fall, or winter), type of crash (single-vehicle or multi-vehicle), need for hospital admission, and detection of other drugs including central nervous system depressants, opioids, and central nervous system stimulants. All statistical analyses were performed in R version 4.1.2.

3. Results

3.1. Participants

Over the study period, 3004 drivers and 941 passengers met the inclusion criteria and had blood analyzed for toxicologic results. Approximately half of the entire sample (55.1 %) were male, and the mean (standard deviation (SD)) age was 43.8 (19.1) years. Approximately two thirds of drivers (61.9 %) were male compared to only a third of passengers (33.4 %). Most road users resided in urban areas (90.7 %), were involved in a multivehicle collision (69.0 %) occurring in the daytime (60.0 %), and were discharged home from the ED (70.6 %). Crash characteristics were similar between injured drivers and passengers (Table 1).

3.2. THC and alcohol levels

Table 2 summarizes the prevalence of alcohol and cannabis detection among drivers and passengers. Alcohol and THC were detected in 14.2 % and 12.3 % of injured road users, respectively. Overall, passengers had higher prevalence of alcohol than drivers (aPR [95 % CI]: 1.26 [1.10, 1.44]). No differences in THC prevalence was observed between drivers and passengers.

3.3. Patterns of drug use between British Columbia and Ontario

The BC and Ontario cohorts had similar demographics (Table 3), but a greater proportion of individuals were admitted to hospital in Ontario than in BC (45 % vs. 20 %), which may indicate differences in admission criteria between the two provinces or a more severely injured cohort from Ontario (see **Limitations**). Table 4 summarizes the prevalence of alcohol and THC detection between drivers and passengers in the two provinces. In BC, a higher percentage of passengers than drivers had BAC detected (aPR [95 % CI]: 1.33 [1.07, 1.64]); however, this pattern was not observed in Ontario, where passengers had a comparable prevalence of alcohol detection to drivers. No significant differences were identified for cannabis detection between drivers and passengers in the two provinces; however, there was a trend towards higher detection in passengers vs. drivers which increased in magnitude with increasing THC thresholds in Ontario, but not in BC.

Ontario drivers had a significantly higher prevalence of alcohol detection than BC drivers (aPR [95 % CI]: 1.25 [1.06, 1.48]). Conversely, a significantly lower percentage of Ontario drivers had THC detected compared to BC drivers (aPR [95 % CI]: 0.80 [0.64, 0.99]). Among passengers, no significant interprovincial differences were observed for alcohol or THC detection (Table 5).

4. Discussion

This report summarizes the prevalence of alcohol and cannabis use among drivers and passengers injured in an MVC and presents a cross-jurisdictional comparison between BC and Ontario. Overall, 14 % of the 3,004 drivers in our cohort had detectable BAC and one in nine (11 %) had BAC > 0.08 %. These numbers, although lower than reported in injured drivers from the United States (24.2 % of drivers positive for alcohol in 2019/2020), (Thomas et al., 2020) Australia (15.8 % in 2013–2018) (DiRago et al., 2019) or Europe (24.4 % in the DRUID study; 2007–2010), (Legrand et al., 2013) are concerning. Driving with BAC > 0.08 % causes a six-fold increase in collision risk, (Blomberg et al., 2009) and has been a criminal offense in Canada since 1969. Canada has had decades of public education campaigns designed to prevent people from driving after drinking. As such, the fact that one in nine injured drivers in this sample had BAC > 0.08 % is somewhat discouraging. Overall, passengers had a higher prevalence of alcohol detection than drivers (aPR [95 % CI]: 1.26 [1.10, 1.44]). This finding is consistent with the hypothesis that traffic laws or societal norms deter people from driving after drinking; that is, people who travel after drinking are more likely to be passengers than drivers. As discussed below, this overall trend was mainly driven by data from BC, while the pattern in Ontario was less evident.

We also found that DUIC is a concern in the two provinces; 12 % of drivers in our cohort had detectable THC, 5.2 % had THC > 2 ng/mL and 2.5 % had THC > 5 ng/mL. We caution that the presence of THC, even at levels above 2 ng/mL, does not necessarily indicate that the person used cannabis recently (Peng et al., 2020) nor that they are impaired. (McCartney et al., 2022) However, at a population level, driving after using cannabis is associated with increased risk of collisions, (Rogeberg

Table 1
Sociodemographic and Crash Characteristics of Study Cohort by Road User Type[a]

	All (n = 3,945)	Road user type Drivers (n = 3,004)	Passengers (n = 941)
Age, years	43.8 (19.1)	44.4 (18.7)	41.8 (20.4)
Sex			
Male	2,172 (55.1 %)	1,858 (61.9 %)	314 (33.4 %)
Female	1,773 (44.9 %)	1,146 (38.1 %)	627 (66.6 %)
Residence type			
Urban	3,522 (90.7 %)	2,664 (90.1 %)	858 (92.7 %)
Rural	360 (9.3 %)	292 (9.9 %)	68 (7.3 %)
Disposition			
Discharged home	2,779 (70.6 %)	2,135 (71.3 %)	644 (68.5 %)
Admitted to hospital	1,156 (29.4 %)	860 (28.7 %)	296 (31.5 %)
Crash type			
Single-vehicle	1,221 (31.0 %)	959 (32.0 %)	262 (27.9 %)
Multi-vehicle	2,716 (69.0 %)	2,040 (68.0 %)	676 (72.1 %)
Crash time			
Daytime	2,351 (60.0 %)	1,835 (61.5 %)	516 (55.4 %)
Nighttime	1,563 (39.9 %)	1,147 (38.5 %)	416 (44.6 %)
Province			
British Columbia	2,506 (63.5 %)	1,889 (62.9 %)	617 (65.6 %)
Ontario	1,439 (36.5 %)	1,115 (37.1 %)	324 (34.4 %)

[a] Values are mean (SD) or n (%).

Table 2
Prevalence of Alcohol and Cannabis Detection in Drivers and Passengers[a]

Substance	All (n = 3,945)	Road user type Drivers (n = 3,004)	Passengers (n = 941)	Prevalence ratio: passengers vs. drivers Crude	Adjusted[b]
Alcohol					
BAC > 0 %	555 (14.2 %)	409 (13.7 %)	146 (15.7 %)	1.14 [0.96, 1.36]	1.26 [1.10, 1.44]
BAC > 0.08 %	433 (11.1 %)	335 (11.2 %)	98 (10.5 %)	0.94 [0.76, 1.16]	1.12 [0.92, 1.37]
Cannabis					
THC level > 0 ng/mL	486 (12.3 %)	369 (12.3 %)	117 (12.5 %)	1.02 [0.83, 1.23]	1.06 [0.86, 1.28]
THC level > 2 ng/mL	206 (5.2 %)	152 (5.1 %)	54 (5.8 %)	1.13 [0.83, 1.52]	1.16 [0.83, 1.58]
THC level > 5 ng/mL	100 (2.5 %)	70 (2.3 %)	30 (3.2 %)	1.37 [0.88, 2.06]	1.38 [0.87, 2.13]
COOH-THC > 0	921 (23.4 %)	709 (23.6 %)	212 (22.6 %)	0.96 [0.84, 1.10]	1.04 [0.91, 1.18]
Cannabis and alcohol (THC > 0 and BAC > 0)	128 (3.3 %)	95 (3.2 %)	33 (3.6 %)	1.11 [0.74, 1.61]	1.08 [0.70, 1.62]

[a] Values are n (%) or prevalence ratio [95% confidence interval]. BAC: blood alcohol concentration; THC: tetrahydrocannabinol.
[b] Adjusted prevalence ratios were obtained from a log-binomial regression model that was adjusted for crash year, season (winter, spring, summer, or fall), sex (male or female), age group (<19, 19–24, 25–44, 45–64, ≥65 years), injury severity (admission to hospital or discharge from emergency department), time of collision (daytime or nighttime), type of collision (single-vehicle or multi-vehicle), province (British Columbia or Ontario), time from crash to blood draw, residence type (urban or rural), and detection of other drugs. Bolded values indicate statistical significance (p < 0.05).

Table 3
Sociodemographic and Crash Characteristics by Province and Road User Type[a]

	British Columbia All (n = 2,506)	Drivers (n = 1,889)	Passengers (n = 617)	Ontario All (n = 1,439)	Drivers (n = 1,115)	Passengers (n = 324)
Age, yrs	44.4 (18.9)	45.2 (18.4)	42.1 (20.0)	42.6 (19.6)	43.0 (19.0)	41.3 (21.2)
Sex						
Male	1,310 (52.3 %)	1,133 (60.0 %)	177 (28.7 %)	862 (59.9 %)	725 (65.0 %)	137 (42.3 %)
Female	1,196 (47.7 %)	756 (40.0 %)	440 (71.3 %)	577 (40.1 %)	390 (35.0 %)	187 (57.7 %)
Disposition						
Discharged home	1,985 (79.4 %)	1,518 (80.5 %)	467 (75.8 %)	794 (55.4 %)	617 (55.6 %)	177 (54.6 %)
Admitted to hospital	516 (20.6 %)	367 (19.5 %)	149 (24.2 %)	640 (44.6 %)	493 (44.4 %)	147 (45.4 %)
Crash type						
Single-vehicle	709 (28.4 %)	549 (29.1 %)	160 (26.1 %)	512 (35.6 %)	410 (36.8 %)	102 (31.5 %)
Multi-vehicle	1,789 (71.6 %)	1,335 (70.9 %)	454 (73.9 %)	927 (64.4 %)	705 (63.2 %)	222 (68.5 %)
Crash time						
Daytime	1,547 (62.1 %)	1,204 (64.2 %)	343 (55.8 %)	804 (56.5 %)	631 (57.0 %)	173 (54.6 %)
Nighttime	943 (37.9 %)	671 (35.8 %)	272 (44.2 %)	620 (43.5 %)	476 (43.0 %)	144 (45.4 %)

[a] Values are mean (SD) or n (%).

Table 4
Prevalence of Alcohol and Cannabis Detection in Drivers vs. Passengers by Province[a]

Substance	British Columbia Road user type		Prevalence ratio:passengers vs. drivers (ref)		Ontario Road user type		Prevalence ratio:passengers vs. drivers (ref)	
	Drivers (n = 1,889)	Passengers (n = 617)	Crude	Adjusted[b]	Drivers (n = 1,115)	Passengers (n = 324)	Crude	Adjusted[b]
Alcohol								
BAC > 0 %	187 (10.0 %)	98 (16.1 %)	1.61 [1.29, 2.02]	1.33 [1.07, 1.64]	222 (19.9 %)	48 (14.9 %)	0.74 [0.55, 0.98]	1.01 [0.79, 1.29]
BAC > 0.08 %	147 (7.9 %)	62 (10.2 %)	1.30 [0.98, 1.72]	1.23 [0.95, 1.58]	188 (16.9 %)	36 (11.1 %)	0.66 [0.46, 0.91]	1.00 [0.75, 1.33]
Cannabis								
THC > 0 ng/mL	233 (12.3 %)	78 (12.7 %)	1.03 [0.80, 1.30]	1.03 [0.80, 1.32]	136 (12.2 %)	39 (12.1 %)	0.99 [0.70, 1.37]	0.97 [0.69, 1.36]
THC > 2 ng/mL	100 (5.3 %)	33 (5.4 %)	1.01 [0.68, 1.46]	1.04 [0.68, 1.55]	52 (4.7 %)	21 (6.5 %)	1.39 [0.83, 2.23]	1.27 [0.74, 2.11]
THC > 5 ng/mL	50 (2.6 %)	18 (2.9 %)	1.10 [0.63, 1.84]	1.13 [0.62, 1.95]	20 (1.8 %)	12 (3.7 %)	2.06 [0.99, 4.11]	1.86 [0.86, 3.90]

[a] Values are n (%) or prevalence ratio [95% confidence interval]. BAC: blood alcohol concentration; THC: tetrahydrocannabinol.
[b] Adjusted prevalence ratios were obtained from a log-binomial regression model that was adjusted for crash year, season (winter, spring, summer, or fall), sex (male or female), age group (<19, 19–24, 25–44, 45–64, ≥65 years), injury severity (admission to hospital or discharge from emergency department), time of collision (daytime or nighttime), type of collision (single-vehicle or multivehicle), time from crash to blood draw, residence type (urban or rural), and detection of other drugs. Bolded values indicate statistical significance ($p < 0.05$).

Table 5
Comparison of Alcohol and Cannabis Detection Prevalence between BC and Ontario Drivers and Passengers[a]

Substance	Drivers Province		Prevalence ratio:Ontario vs. BC (ref)		Passengers Province		Prevalence ratio:Ontario vs. BC (ref)	
	BC (n = 1,889)	Ontario (n = 1,115)	Crude	Adjusted[b]	BC (n = 617)	Ontario (n = 324)	Crude	Adjusted[b]
Alcohol								
BAC > 0 %	187 (10.0 %)	222 (19.9 %)	2.00 [1.67, 2.40]	1.25 [1.06, 1.48]	98 (16.1 %)	48 (14.9 %)	0.92 [0.66, 1.26]	0.94 [0.71, 1.24]
BAC > 0.08 %	147 (7.9 %)	188 (16.9 %)	2.16 [1.76, 2.65]	1.35 [1.10, 1.65]	62 (10.2 %)	36 (11.1 %)	1.09 [0.73, 1.60]	1.00 [0.69, 1.44]
Cannabis								
THC > 0 ng/mL	233 (12.3 %)	136 (12.2 %)	0.99 [0.81, 1.21]	0.80 [0.64, 0.99]	78 (12.7 %)	39 (12.1 %)	0.95 [0.66, 1.36]	0.81 [0.55, 1.19]
THC > 2 ng/mL	100 (5.3 %)	52 (4.7 %)	0.89 [0.63, 1.22]	0.78 [0.54, 1.11]	33 (5.4 %)	21 (6.5 %)	1.21 [0.70, 2.05]	1.06 [0.59, 1.92]
THC > 5 ng/mL	50 (2.6 %)	20 (1.8 %)	0.68 [0.40, 1.12]	0.55 [0.31, 0.94]	18 (2.9 %)	12 (3.7 %)	1.27 [0.60, 2.58]	0.95 [0.42, 2.14]

[a] Values are n (%) or prevalence ratio [95% confidence interval]. BC: British Columbia; BAC: blood alcohol concentration; THC: tetrahydrocannabinol.
[b] Adjusted prevalence ratios were obtained from a log-binomial regression model that was adjusted for crash year, season (winter, spring, summer, or fall), sex (male or female), age group (<19, 19–24, 25–44, 45–64, ≥65 years), injury severity (admission to hospital or discharge from emergency department), time of collision (daytime or nighttime), type of collision (single-vehicle or multivehicle), time from crash to blood draw, residence type (urban or rural), and detection of other drugs. Bolded values indicate statistical significance ($p < 0.05$).

and Elvik, 2016; White and Burns, 2021) and there is evidence that the risk increases at higher THC levels. (Albrecht et al., 2025) Unlike the case with alcohol, no differences were found between drivers and passengers for THC detection. This may indicate less effective public education campaigns for DUIC compared to the well-established "no drinking and driving" and "designated driver" messages. (Elder et al., 2004) There is also skepticism around the dangers associated with DUIC, especially from people who use cannabis regularly and are more likely to believe that it does not impair driving. (Boicu et al., 2024) A 2022 report commissioned by Public Safety Canada showed the nearly one in four (24 %) Canadians say that DUIC is less dangerous than driving under the influence of alcohol. (Public Safety Canada) However, nearly nine in ten (86 %) Canadians agree that using cannabis impairs one's driving ability and that it negatively impacts reaction time and ability to concentrate. (Public Safety Canada) Another factor leading to DUIC may be the perception that people who DUIC are unlikely to be caught by police. To prevent an increase in DUIC when cannabis was legalized, the Government of Canada introduced *per se* limits for THC and provided a new tool for police to detect DUIC; police who reasonably suspect that there is THC in a driver's body may now demand a sample of oral fluid that they can analyze at roadside using approved drug screening equipment. However, for these traffic laws to deter DUIC, the public must be aware of the laws and believe that the probability of being detected, apprehended, and punished for breaking them is high. (Stafford and Warr, 1993; Wright, 2014-08-13.; Nagin and Pogarsky, 2001) Public messaging and how the media frames an issue plays a critical role in shaping public knowledge, opinion, and behaviour. A recent media analysis of messaging surrounding DUIC in Canada found that the majority of news reports on DUIC depicted it as dangerous, (Boicu et al., 2024) and some reports described the new traffic laws designed to prevent DUIC as severe. However, there was also concern about the role of roadside oral fluid testing (e.g., reliability, accuracy, role in court) and police readiness for preventing DUIC following cannabis legalization (e.g., time to train officers regarding new laws, shortage of trained drug recognition experts). Messages around lack of police preparedness and limitations of roadside testing devices may signal to the public that the probability of detection is low and suggest that drivers who DUIC are unlikely to face legal repercussion. (Boicu et al., 2024) In fact, despite increased public awareness campaigns and new and enhanced tools for police to enforce drug-impaired driving laws, only 25 % of Canadians believe that it is likely that they will get caught if they DUIC. (Public Safety Canada, 2023).

Ontario drivers had a significantly higher prevalence of alcohol detection than BC drivers (aPR [95 % CI]: 1.25 [1.06, 1.48]). This is in contrast to the lower per capita alcohol consumption in Ontario vs. BC (6.8 L vs. 7.8 L in 2023/2024). (Statistics Canada. Control and sale of alcoholic beverages and cannabis, April 1, 2022) Furthermore, BC passengers, but not passengers from Ontario, were found to have a higher prevalence of alcohol use than drivers, as would be expected with effective traffic policy and messaging against drink driving. While both provinces enforce a legal age of 19 years and older to buy and consume alcohol and cannabis as well as a zero-tolerance policy on alcohol and drugs for novice and young drivers, these findings may be explained by multiple factors that differ between the two provinces, including differences in provincial traffic laws pertaining to drink driving. In addition to federal laws which make it a criminal offense to drive with BAC > 0.08 %, both provinces have additional administrative sanctions (fines or license suspension) for drivers with BAC > 0.05 %. In September 2010, BC introduced harsh penalties for drinking drivers including administrative license prohibitions and vehicle impoundments (up to 30 days for repeat offenders) that are issued immediately at the roadside on the basis of results of a handheld breathalyzer. These laws were designed to deter drinking and driving by increasing the severity, certainty, and speed of punishment for drivers with BAC > 0.05 %. They were promoted through public awareness and educational campaigns and received considerable media coverage. (Brubacher et al., 2015) The laws changed driver behaviour in BC. Fewer evening and nighttime drivers tested positive for BAC, (Beasley and Beirness, 2012) and there was a 52 % reduction in alcohol-related fatal crashes, an 8 % reduction in hospital admissions, and a 7 % reduction in ambulance calls for road trauma. (Brubacher et al., 2014) In both BC and Ontario, drivers with BAC > 0.08 % are subject to license suspension, vehicle impoundments (up to 7 days in Ontario and up to 30 days in BC) and possibly criminal code convictions. However, unlike the case in BC, vehicle impoundment does not apply to Ontario drivers in the warn range (BAC between 0.05 % and 0.08 %). (Canadian Centre on Substance Use and Addiction).

In contrast to alcohol, we found a lower prevalence of THC detection in Ontario drivers compared to BC drivers (aPR [95 % CI]: 0.80 [0.64, 0.99]); there was no difference between passengers in either province. This finding is consistent with results from the Canadian Substance Use Survey 2023 where a greater percentage of the BC population reported driving a vehicle following cannabis consumption compared to the Ontario population (4.7 % in BC vs. 3.9 % in Ontario reported that, in the past 12 months they drove a vehicle within 2 h of smoking or vapourizing cannabis; 3.3 % in BC vs. 2.7 % in Ontario reported that in the past 12 months they drove a vehicle within 4 h of ingesting a cannabis product). (Government of Canada. Canadian Substance Use Survey, 2023) Differences in provincial traffic policy may contribute to higher DUIC rates in BC. Specifically, unlike Ontario, BC does not have substantial immediate roadside penalties for DUIC. Ontario traffic law includes provisions for license suspensions of up to 30 days for drivers suspected of using cannabis who fail the Standardized Field Sobriety Test (7-day suspension for first offenders). In contrast, the only immediate roadside penalty for BC drivers suspected of DUIC is a 12- or 24-hour license suspension. (Canadian Centre on Substance Use and Addiction) Anecdotal evidence from Ontario police officers indicate that oral fluid tests are being used mostly for administrative presence-based offences (i.e., for drivers subject to zero-tolerance conditions for whom the presence of any THC in body fluids is not allowed). Both BC and Ontario have zero-tolerance laws that prohibit novice drivers in the Graduated Licensing Program from driving after any cannabis use. Ontario also has zero-tolerance for THC in all drivers under 22 years of age and in commercial drivers. These laws, which are combined with roadside license suspensions, may partially explain why a lower prevalence of Ontario drivers tested positive for THC. The interprovincial differences in DUIC that we observed may also reflect higher rates of cannabis use in BC than in Ontario. Based on the 2021 Canadian Community Health Survey, the percentage of Canadians aged 15 or older using cannabis in the previous 12 months was 26 % in BC compared to 24 % in Ontario. (Statistics Canada. Research to Insights: Cannabis in Canada, 2023) Public perception of the dangers associated with DUIC may also differ between the two provinces. In a recent media review of cannabis and impaired driving, fewer media reports were from BC compared to Ontario. (Boicu et al., 2024) This may be partly because of more local news outlets in Ontario. The number of public service announcements were approximately the same in BC as in Ontario; however, in BC, they made up a higher percentage of total media reports (13 % vs. 5 % in Ontario). (Boicu et al., 2024) Interestingly, reports about DUIC from Ontario tended to be negative whereas those from BC were more neutral, (Boicu et al., 2024) a contrast that may reflect differences in public opinion about DUIC in the two provinces.

Strengths and Limitations. Strengths of this study include comprehensive toxicology testing on all injured drivers and passengers for whom excess blood was available, minimizing the selection bias that would result if toxicology testing was based on clinical suspicion of drug use. Additionally, refusal bias as a result of individuals who used drugs or alcohol being less likely to consent and participate was not a concern as REB approval for waiver of consent was obtained. Finally, data were collected prospectively over a four-year period, which mitigates the risk of having results skewed by transient events that may temporarily impact substance use. Limitations include our inability to link drivers and passengers to the same MVC. Additionally, we were unable to interview or examine participants and data obtained from chart review was limited. As such, we could not ascertain whether an individual was impaired nor when they used an impairing substance nor the route of ingestion. Information on behavioural factors (e.g., smoking/vaping, alcohol consumption, diet, etc.), comorbid health conditions, social determinants of health (e.g., employment, income, race, marital status, etc.), vehicular details and driving conditions were also unavailable in this study. Since our methods excluded minor collisions that did not require blood tests, our findings may not apply to these crashes. Differences in admission rates between the BC and Ontario cohorts may be due to differences in blood testing practices or indications for hospital admission between the two provinces. If Ontario hospitals had a higher threshold for blood testing (ordered fewer blood tests on less severely injured drivers), then the Ontario drivers in this study may have been more severely injured than the BC drivers. As the prevalence of alcohol tends to be higher in drivers with more severe injuries, this factor could partially explain the higher prevalence of alcohol detection in ON drivers; our analysis attempts to control for this latter possibility by adjusting for admission rate. Conversely, if the Ontario hospitals had a lower threshold for admission (i.e. tended to admit less severely injured patients), then the admitted drivers in Ontario would be less severely injured than those in BC and our findings may underestimate the difference in alcohol prevalence between drivers in the two provinces. The study period included cases from during and after the COVID-19 pandemic which may have impacted drug and alcohol use due to stay-at-home orders, closures or reduced hours of bars, and changes in how police enforced traffic laws. Note that during the height of the pandemic, data collection was halted at all participating EDs because non-essential personnel were not allowed in hospital.

5. Conclusions

We compare the prevalence of alcohol and cannabis use among drivers and passengers injured in an MVC in BC and Ontario. BC had a lower prevalence of drinking drivers but a higher prevalence of drivers who tested positive for THC. In BC but not in Ontario, passengers had a higher prevalence of alcohol detection than drivers. These findings may be partially explained by differences in provincial traffic laws, public opinion towards impaired driving, and overall consumption rates.

CRediT authorship contribution statement

Lulu X Pei: Writing – original draft, Formal analysis. **Herbert Chan:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Floyd Besserer:** Writing – review & editing, Investigation. **Jeffrey Eppler:** Writing – review & editing, Investigation. **Jacques Lee:** Writing – review & editing, Investigation. **Andrew MacPherson:** Writing – review & editing, Investigation. **Michael McGrath:** Writing – review & editing, Validation. **Robert Ohle:** Writing – review & editing, Investigation. **John Taylor:** Writing – review & editing, Investigation. **Christian Vaillancourt:** Writing – review & editing, Investigation. **Jeffrey R Brubacher:** Writing – review & editing, Supervision, Project administration, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The data that has been used is confidential.

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