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Driving under the influence of cannabis among recreational and medical cannabis users: A population study

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ABSTRACT

Background: Comparisons of individuals using cannabis for medical versus recreational purposes have identified differences in health status, alcohol and drug use, and perceived risk of drug use. All of these factors are associated with aggressive and impaired driving and collision risk. Yet, few studies comparing medical and recreational cannabis users have considered differences in driver behaviour and road safety.

Aim: This study examined the association between type of cannabis use (medical versus recreational-only) and engaging in driving under the influence of cannabis (DUIC), controlling for suspected confounding variables.

Method: Data were derived from a regionally stratified cross-sectional general population telephone survey of adults (18+ years) in Ontario, Canada conducted from 2014 to 2019. Respondents reporting past-year operation of a vehicle and past-year use of cannabis were selected (N = 1392). A binary logistic regression was conducted to assess the association between type of cannabis user (medical versus recreational-only) and self-reported DUIC, controlling for cannabis use frequency, hazardous drinking, perceived general and mental health, demographic characteristics, driving exposure, and interview year.

Results: In total, 9.7 percent of recreational-only users reported DUIC compared to 27.0 percent of medical users. Adjusting for covariates, medical cannabis users had almost two times greater odds of DUIC than recreational-only users (AdjOR = 1.78, p = .037, 95%CI = 1.03, 3.05).

Discussion: A higher proportion of medical cannabis users, relative to recreational-only users, engaged in DUIC. This finding has important implications for improving the effectiveness of

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public health interventions designed to reduce DUIC. Further research examining the harms of medical versus recreational cannabis use for road safety is needed.

1. Introduction

According to the 2020 Canadian Cannabis Survey, 27 percent of Canadians aged 16+ years used cannabis for non-medical (i.e., recreational) purposes in the previous 12 months, and 14 percent used cannabis for medical purposes (Statistics Canada, 2020). In an effort to understand potential treatment and health education needs of cannabis users, many studies have compared individuals who use cannabis for recreational versus medical purposes. Relative to recreational-only users, those who use cannabis for medical purposes are typically older, have lower income, have poorer physical and mental health, report more frequent use of and problems with cannabis, but less use of and problems with alcohol (Choi et al., 2017; Goulet-Stock et al., 2017; Hamilton et al., 2017; Lankenau et al., 2018; Lin et al., 2016; Rotermann and Pagé, 2018; Roy-Byrne et al., 2015; Subbaraman and Kerr, 2018; Turna et al., 2020; Wardell et al., 2021). Among adolescents, medical users of cannabis are also more likely to perceive cannabis as less harmful (Wardell et al., 2021).

Many of the factors that differentiate medical and recreational cannabis users have previously been identified as correlates of driving under the influence of cannabis (DUIC). The odds of a driver engaging in DUIC, a contributor to collision risk (Asbridge et al., 2012; Mann et al., 2010), are greater among those experiencing mental health issues and those who report problems with the use of alcohol or cannabis (Asbridge et al., 2005; Salas-Wright et al., 2021). Higher intoxication levels perceived as safe for driving are also correlated with intention to engage in and frequency of DUIC (Borodovsky et al., 2020; Ward et al., 2017). Cannabis is the most frequently detected drug after alcohol in injured drivers (Brubacher et al., 2016; Woodall et al., 2015). Toxicological analysis of injured drivers treated in one of seven emergency departments in British Columbia, Canada from 2010 to 2012 detected cannabis metabolites in 12.6 percent of injured drivers and delta-9-tetrahydrocannabinol (THC) in 7.3 percent of drivers, indicating recent use (Woodall et al., 2015). Likewise, toxicological analysis of drivers fatally injured in Ontario, Canada from 2011 to 2012 found that 27 percent tested positive for cannabis (THC or metabolites) (Brubacher et al., 2016). Reviews of case-control and other epidemiological data have concluded that acute cannabis consumption is associated with increased collision risk (Asbridge et al., 2012; Li et al., 2012), and a growing body of experimental driver simulation studies have found cannabis to reduce lateral and steering control (Arkell et al., 2019; Fares et al., 2022), speed (Brands et al., 2019; Hartman et al., 2016), and reaction time (Lenné et al., 2010; Ronen et al., 2008).

Few studies to date have explored driving-related differences between recreational and medical cannabis users. Cuttler et al. (2018) recruited cannabis users in the U.S. aged 16+ years for an online survey to assess beliefs, practices, and experience of incidents related to driving under the influence of cannabis (DUIC). Descriptive analyses comparing participants who reported using cannabis for recreational, medical, and both recreational and medical purposes combined found no differences in the percentage of participants who believed DUIC is safe, reported engaging in the behaviour, or had received a ticket or been involved in a collision associated with the behaviour. Lloyd et al. (2020) examined data from the U.S. 2016-17 National Survey on Drug Use and Health (NSDUH) and found that the relationship between the purpose of cannabis use (i.e., exclusively medical, exclusively recreational, combined medical and recreational) and DUIC varied as a function of sex. Among females, the probability of DUIC was similar across reasons of use, ranging from 0.20 to 0.26. Among females, those who used cannabis for recreational-only purposes were more likely to DUIC than medical-only users. Among males, the probability of DUIC varied more across purposes of use, ranging from 0.28 to 0.40. Among males, those who used cannabis for both medical and recreational purposes were more likely to DUIC than medical-only users. Overall, the difference between combined and recreational-only users was greater among males than females.

Although there are many reported differences between recreational and medical cannabis users, it is unclear whether the prevalence of DUIC differs between recreational and medical users. The current study addresses this gap in the literature by comparing the prevalence of DUIC among medical versus recreational-only cannabis users while controlling for suspected confounding variables.

2. Materials and methods

2.1. Sample

Data were derived from the 2014 to 2019 cycles of the Centre for Addiction and Mental Health (CAMH) Monitor, an ongoing cross-sectional telephone survey of adults (18+ years) in Ontario, Canada. The CAMH Monitor is approved annually by institutional research ethics boards at both CAMH and York University. Prior to and including 2016, the CAMH Monitor was administered using random-digit-dialing methods via Computer Assisted Telephone Interviewing, which facilitated access to listed and unlisted telephone numbers including those associated with cellular telephones. In 2017, the CAMH Monitor switched to a dual-frame sampling design, including both a landline and a cellular telephone sampling frame. The CAMH Monitor is based on annual accumulation of rolling samples, conducted quarterly with independent samples of approximately 750 completions each. The CAMH Monitor uses regional stratification with equal allocation of respondents within each region of the province. The data were weighted to adjust for regional representation and varying selection probabilities, and a final post-stratification adjustment was used to restore the age by gender distribution based on the most recently available census figures. The final weighted sample is considered representative of the non-institutionalized population of Ontario adults. The annual response rate from 2014 to 2019 ranged from 28 percent to 45 percent. These response rates are comparable to other recent Canadian alcohol and drug use surveys. Additional information about this survey

and its sampling design is available in the CAMH Monitor technical guide (Ialomiteanu et al., 2020). The current study examined only those respondents who reported using cannabis in the past 12 months and reported having driven a motor vehicle in the past 12 months; the final sample consisted of 1392 respondents.

2.2. Variables

The dependent variable was past-year DUIC and was measured with the item: "During the past 12 months, have you driven a motor vehicle within an hour of using marijuana or hash?" (no, yes).

The main independent variable was purpose of cannabis use and was measured by two survey items. First, respondents were asked: "How often, if ever, have you used cannabis, marijuana or hash during the past 12 months?" Second, those who indicated any use of cannabis in the past year were also asked: "In the past 12 months have you ever used cannabis, marijuana or hash to manage pain, nausea, glaucoma, the symptoms of multiple sclerosis, or any other medical condition?" Responses to these two survey items were then combined and recoded to create two groups: past-year recreational cannabis use only, and past-year medical use with or without recreational cannabis use (referred to as medical users henceforth). A group dedicated to medical cannabis use only could not be created due to the limitations of the existing items in the CAMH Monitor survey. However, this approach of defining medical users as anyone who has used cannabis for medical purposes regardless of use for recreational purposes has been adopted by other surveys and analyses of this topic (e.g., Rotermann and Pagé, 2018), and is consistent with the finding that recreational cannabis use is common among medical cannabis users (Morean and Lederman, 2019; Turna et al., 2020).

Other variables in the analysis included important sociodemographic variables or reflected additional factors known to differ between recreational and medical users. Demographic variables in the analysis included sex (female, male), age (18–34 years, 35–54 years, 55+ years), marital status (married or common law, previously married, never), education (less than high school, completed high school, some post-secondary, completed university), and income (less than $30,000, $30,000 to $49,999, $50,000 to $79,999, $80,000 or higher, don't know or refused to answer). The potential influence of driving exposure was controlled by including the average distance driven per week (continuous variable). The year in which the interview was conducted was also included to control for any influence of time.

In light of existing evidence of more frequent cannabis use but less frequent alcohol use among medical compared to recreational cannabis users (Choi et al., 2017; Goulet-Stock et al., 2017; Lin et al., 2016; Turna et al., 2020), cannabis use frequency was included in the analysis, with responses converted to binary scoring (less than weekly, at least weekly user). Hazardous or harmful drinking was measured by the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001; Saunders et al., 1993). This ten-item screening questionnaire was developed by the World Health Organization to detect less severe problematic drinking. An AUDIT score of 8 or more has been identified as a valid screening threshold indicative of likely hazardous or harmful drinking (Ialomiteanu et al., 2020). Self-rated general health was measured by an item from the Centers for Disease Control's Health-Related Quality of Life Measures (Moriarty et al., 2003; Ôunpuu et al., 2000). Specifically, participants were asked: "In general, would you say your health is excellent, very good, good, fair or poor?" Self-rated mental health was measured by a similar item: "In general, would you say your mental health is excellent, very good, good, fair or poor?" Responses for both items were converted to binary scoring (excellent/very good/good, fair/poor).

2.3. Analyses

Reported percentages were based on the weighted sample size. With the exception of the income variable, refusals and 'don't know' responses were excluded from analyses listwise. Chi-square analyses (and *t*-test for the continuous driving exposure variable) were conducted to examine the bivariate association of DUIC with independent variables. Binary logistic regression analysis was used to assess the association of medical cannabis use, relative to recreational use only, with DUIC after controlling for age, sex, marital status, education, income, hazardous drinking, fair health and mental health, and cannabis use frequency as independent variables and with interview year (continuous) and driving exposure as covariates. In light of research exploring variations in DUIC among men and women (Lloyd et al., 2020), regression analysis included two-way interactions to assess whether the association between type of cannabis use and DUIC was moderated by sex. Analyses stratified by sex were not conducted due to insufficient sample size. Disproportionate stratification and diverse inclusion weights (a situation giving rise to understated variances relative to occurring under simple random sampling estimation) result in the violation of independence of observations assumption. In response, pseudo maximum likelihood estimation (a weighted maximum likelihood approach required because standard maximum likelihood estimation is violated by nonindependent observations) was used to estimate point estimates. Taylor Series Linearization (TSL - a robust nonparametric estimator) was used to estimate variances. Both pseudo maximum likelihood estimation and TSL were implemented using the Complex Sample module in SPSS V20.0 (Heeringa et al., 2017; Korn and Graubard, 1999; West, 2008). Finally, because the stages are hierarchically nested, stage 2 variances (respondents) roll up into stage 1 units (telephone); for simplicity in estimation, it is restricted solely to the primary stage (Heeringa et al., 2017). It should also be noted that due to complex survey adjustments, decimal degrees of freedom may occur for some statistical tests.

3. Results

Of the cannabis users captured in our sample, 65.5 percent reported using cannabis only for recreational purposes while 34.5 percent reported using cannabis for medical purposes. Table 1 presents self-reported past-year DUIC by sociodemographic

characteristics, driving exposure, and other relevant risk factors. The overall prevalence of past-year DUIC in the current sample was 15.7 percent. Design-based Rao-Scott adjusted chi-square analyses revealed that the prevalence of DUIC was significantly greater among medical (27.0 percent) versus recreational-only (9.7 percent) cannabis users ($\chi^2(1, 1048) = 36.82$, $p < .001$) and among those who used cannabis at least weekly (33.4 percent) versus less than weekly (4.4 percent; $\chi^2(1, 1057) = 121.72$, $p < .001$). DUIC was also more prevalent among males than females (20.7 percent versus 8.0 percent; $\chi^2(1, 1057) = 23.93$, $p < .001$) and among those with less than a university education (ranging from 18.2 to 23.3 percent versus 9.3 percent among university-educated; $\chi^2(2.90, 3059.18) = 3.53$, $p = .015$).

Table 2 presents the results of the logistic regression analysis. The resulting model accounted for more than 24 percent of the variance in reported DUIC (McFadden $R^2 = 0.243$; $\chi^2(19) = 106.24$, $p < .001$). After adjusting for sociodemographic characteristics,

Table 1
Self-reported driving under the influence of cannabis (DUIC) in the past 12 months by demographic characteristics and related risk factors among adults aged 18+ years who report past-year cannabis use: Ontario CAMH Monitor, 2014–2019 (n = 1093).

	Total N	Driving Under the Influence of Cannabis [a]	
		% Yes [b] (n)	95% CIs [c]
Total	1093	15.7 (165)	13.1, 18.7
Primary variable:			
Type of cannabis use [a]		***	
Recreational use	683	9.7 (71)	7.5, 12.5
Medical and recreational use	401	27.0 (91)	21.4, 33.4
Demographic variables:			
Sex		***	
Female	502	8.0 (43)	5.7, 11.3
Male	591	20.7 (122)	16.9, 25.2
Age			
18–34 years	384	15.5 (67)	11.8, 20.2
35–54 years	354	13.4 (42)	9.7, 18.3
55+ years	351	19.3 (55)	13.8, 26.3
Marital status			
Married/partner	583	15.5 (80)	12.1, 19.6
Previously married	147	23.0 (23)	13.2, 36.8
Never married	359	14.3 (61)	10.7, 18.9
Education		*	
< high school	57	23.3 (15)	13.3, 37.6
Completed high school	252	18.2 (42)	12.8, 25.2
Some post-secondary	467	18.2 (74)	14.0, 23.3
Completed university	316	9.3 (34)	6.0, 14.2
Income [d]			
<$30,000	83	12.1 (13)	6.0, 23.0
$30,000-$49,999	115	21.9 (23)	13.1, 34.5
$50,000-$79,999	162	20.5 (29)	13.5, 29.8
$80,000+	584	14.7 (82)	11.5, 18.6
Don't know/refused	149	13.3 (18)	7.5, 22.5
Other risk factors:			
Cannabis use frequency		***	
Less than weekly	667	4.4 (31)	3.0, 6.5
At least weekly	426	33.4 (134)	27.8, 39.5
Hazardous drinking (AUDIT 8+)			
No	712	15.3 (101)	12.1, 19.2
Yes	332	15.1 (52)	11.0, 20.4
Health [a]			
Good to excellent	939	16.6 (146)	13.7, 19.8
Fair or poor	152	9.5 (18)	5.3, 16.4
Mental health [a]			
Good to excellent	923	15.3 (135)	12.6, 18.5
Fair or poor	168	17.8 (29)	11.5, 26.5
Covariate:			
Km driven-typical week (100s) [e]			
Mean (SE) DUIC No	859	2.64 (0.20)	2.24, 3.04
DUIC Yes	154	3.66 (0.50)	2.68, 4.65

Design-based Rao-Scott adjusted chi-square statistical significance. *$p < .05$. **$p < .01$. ***$p < .001$.

[a] In the last 12 months.

[b] Percentages reported are based on weighted sample size.

[c] 95% confidence intervals.

[d] Canadian dollars.

[e] Driving distance was divided by 100 so that the adjusted odds ratio presented in Table 2 reflected the change in risk for each additional 100 km of weekly driving.

other risk factors and covariates, medical cannabis users had almost two times greater odds of engaging in DUIC than recreational-only cannabis users (AdjOR = 1.78, p = .037, 95%CI = 1.03, 3.05). At least weekly users of cannabis had nearly ten times the odds of reporting DUIC than less than weekly users (AdjOR = 9.63, p < .001, 95%CI = 5.27, 17.58). Males had more than twice the odds of engaging in DUIC than females (AdjOR = 2.19, p = .006, 95%CI = 1.26, 3.83), and those with fair or poor health had lower odds of reporting DUIC relative to those in good to excellent health (AdjOR = 0.29, p = .008, 95%CI = 0.11, 0.73). A separate binary logistic regression analysis added the multiplicative interaction of sex and type of cannabis user to the existing model, but the effect was not statistically significant (p = .926), thus results are not reported in table form.

Follow-up analyses evaluated whether level of driving exposure was similar for medical versus recreational-only cannabis users. No statistically significant difference was found (p = .646). Likewise, follow-up analyses revealed no statistically significant difference in driving exposure as a function of either self-reported health (p = .793) or mental health (p = .418).

4. Discussion

This study found that respondents who reported using cannabis medically in the past year had nearly twice the odds of engaging in DUIC relative to recreational-only past-year users, even after controlling for confounding variables including frequency of cannabis use. This demonstrated relationship between type of cannabis use and DUIC is contrary to the findings of Cuttler et al. (2018), who reported no difference in DUIC between medical and recreational cannabis users. Lloyd et al. (2020) explored whether the association between reason for cannabis use and DUIC was moderated by sex, and found that the predicted probability of DUIC was greater among recreational-only versus medical-only cannabis users for females but greater among combined purpose versus medical-only cannabis users for males. The divergence in our findings from those of Cuttler et al. (2018) and Lloyd et al. (2020) may have resulted from differences in methodology; both studies distinguished between medical-only and combined recreational and medical cannabis users whereas these types of users were combined in the current analysis. As well, the Cuttler et al. (2018) sample was recruited through word-of-mouth and online advertising, and therefore was not population-representative. Furthermore, Lloyd et al. assessed interaction

Table 2
Multivariate logistic regression analysis of driving under the influence of cannabis (DUIC) in the past 12 months among adults aged 18+ years who report past-year cannabis use: Ontario CAMH Monitor, 2014–2019 (n = 951).

	Driving Under the Influence of Cannabis [a]	
	Adjusted OR [b,c]	95% CIs [d]
Primary variable:		
Type of cannabis use [a] (ref = recreational cannabis use)	1.78*	1.03, 3.05
Demographic variables:		
Sex (ref = female)	2.19**	1.26, 3.83
Age (ref = 18–34 years)		
35–54 years	1.19	0.50, 2.86
55+ years	0.78	0.37, 1.63
Marital status (ref = married/partner)		
Previously married	1.55	0.66, 3.62
Never married	0.85	0.42, 1.71
Education (ref=<high school)		
Completed high school	0.93	0.30, 2.94
Some post-secondary	1.23	0.40, 3.77
Completed university	0.81	0.24, 2.75
Income [e] (ref=<$30,000)		
$30,000-$49,999	3.48	0.97, 12.41
$50,000-$79,999	2.81	0.79, 9.94
$80,000+	2.64	0.77, 9.05
Don't know/refused	1.36	0.31, 5.93
Other risk factors:		
Cannabis use frequency (ref = less than weekly)	9.63***	5.27, 17.58
Hazardous drinking (AUDIT 8+; ref = no)	0.70	0.39, 1.27
Fair or poor health [a] (ref = good to excellent)	0.29**	0.11, 0.73
Fair or poor mental health [a] (ref = good to excellent)	1.12	0.51, 2.44
Covariates:		
Km driven-typical week (100s) [f]	1.02	0.97, 1.08
Interview year	0.96	0.85, 1.09
Corrected model	$\chi^2(19) = 106.24$, p < .001	

Ref. = reference category. Wald chi-square statistical significance. *p < .05. **p < .01. ***p < .001.

[a] In the last 12 months.

[b] Adjusted odds ratio (adjusted for type of cannabis use, demographic characteristics, driving exposure, cannabis use frequency, hazardous drinking, and perceived general and mental health).

[c] Based on weighted sample size.

[d] 95% confidence intervals.

[e] Canadian dollars.

[f] Driving distance was divided by 100 so that the adjusted odds ratio reflected the change in risk for each additional 100 km of weekly driving.

using predicted probabilities whereas we assessed interaction on the multiplicative scale. Further systematic study is warranted.

The current study demonstrated that a substantial proportion of medical users (27 percent) engage in DUIC. This estimate is consistent with some studies, but well below the values reported by others. A survey of Australian medical cannabis users found that 19.0 percent reported driving within 1 h of using cannabis and 34.6 percent reported driving within 3 h of use (Arkell et al., 2020). A study of Michigan medical cannabis users found that 56.4 percent reported driving within 2 h of using cannabis; 50.5 percent said they had driven while feeling a "little high" and 21.1 percent had driven while feeling "very high" (Bonar et al., 2019). Differences in samples and definitions of DUIC likely contributed to differences in estimated prevalence of DUIC among medical and recreational cannabis users across studies. Existing research has demonstrated that using a greater quantity of cannabis or using the drug more frequently is associated with greater risk for DUIC (Arkell et al., 2020; Bonar et al., 2019); results of the current study are consistent with these findings. Compared to recreational cannabis users, medical users are more likely to perceive cannabis as less harmful (Wardell et al., 2021). Among medical cannabis users, those who believe they can accurately assess their own driving ability after cannabis are less likely to believe that cannabis affects their driving and more likely to engage in DUIC (Arkell et al., 2020).

The current study found that males were more likely to engage in DUIC than females. This is consistent with numerous studies of cannabis users (Lloyd et al., 2020; Salas-Wright et al., 2021). DUIC was also found to be less prevalent among those reporting fair or poor health relative to those reporting good to excellent health. Follow-up analyses found no indication in the data that medical cannabis users or those reporting fair or poor health drove less frequently than their counterparts. However, it may be that individuals with fair or poor health perceive a greater impact of cannabis on their driving and are thus less likely to engage in DUIC. Further research is needed to confirm that the negative association between fair or poor health and DUIC is a true effect and to explore possible mechanisms underlying this effect.

4.1. Limitations

Potential limitations of this research must be acknowledged. First, survey data are correlational, barring cause-and-effect conclusions from being drawn. These data are also based on self-report and may be subject to social desirability bias; however, self-report measures of alcohol and drug use have been shown to be valid in general population samples (Harrison, 1997). Second, this study used data from a survey that had a modest response rate ranging between 28 percent and 45 percent from 2014 to 2019; however, existing research indicates that survey data with response rates as low as 10 percent can generate highly accurate estimates (Dawson et al., 2014; Keeter et al., 2000; Wright, 2015). Third, due to limitations of the survey questions, those who use cannabis for exclusively medical purposes could not be assessed separately; however, recreational cannabis use is common among medical cannabis users (Morean and Lederman, 2019; Turna et al., 2020), suggesting that medical-only users would constitute a small group. Moreover, combining medical-only cannabis users with those who use cannabis for both medical and recreational purposes has precedent in the literature as a valid analytical strategy (e.g., Rotermann and Pagé, 2018). Fourth, recreational cannabis use in Canada was legalized in 2018, potentially impacting respondent willingness to identify as a medical or recreational-only cannabis user partway through data collection; to address this concern, year of interview was controlled in the multivariate analyses. Finally, the survey excluded non-English speakers and individuals without telephone access, which included those who are homeless, institutionalized, or in the military. The potential impact of these exclusions is mitigated somewhat by the fact that there are likely few drivers among the homeless and institutionalized.

4.2. Implications and future directions

The finding of greater prevalence of DUIC among medical versus recreational-only cannabis users has important implications for public health initiatives aimed to reduce the harms of cannabis use on road safety. In order for interventions designed to reduce DUIC to be effective, they must be appropriately targeted. Recognizing the relevance of both frequency and purpose of cannabis use to DUIC, future education campaigns might consider targeting not only more frequent cannabis users, but also medical users. Further exploration of the beliefs and perceptions of medical users regarding the risks of DUIC, reasons for engaging in the behaviour, and frequency of DUIC among this population, would inform the content of education campaigns, maximizing their effectiveness and providing a basis for their evaluation. Two years following legalization of recreational cannabis use in Canada, only 3 percent of Canadians aged 16 years and older reported having documentation from a healthcare professional when using cannabis for medical purposes (Statistics Canada, 2020); however, cannabis laws in the United States continue to vary by jurisdiction, with numerous states still legalizing medical use only (National Conference of State Legislatures, 2022). For those medical users who continue to obtain their cannabis through prescription, there may be a role for physicians to educate patients about the risks of DUIC. A similar role could potentially be played by pharmacists or medical dispensers.

Recognizing the relationship between cannabis use and collision risk (Asbridge et al., 2012; Mann et al., 2010), it will be important for future studies to assess differences in collision involvement between medical and recreational cannabis users. There is debate concerning whether drivers who use cannabis for recreational versus medical purposes pose the same road safety risks. Although medical users are more likely to engage in driving under the influence of cannabis, they may be more likely than recreational-only users to opt for products with lower THC levels, potentially reducing collision risk associated with cannabis use (Turna et al., 2020). Alternatively, many believe that frequent cannabis users, including more medical users, can drive safely after cannabis exposure (Wickens et al., 2019) and, although the results are mixed, there is some experimental evidence to suggest that frequent cannabis users experience less impairment than occasional users when administered a fixed dose of THC (McCartney et al., 2021). However, outside of the laboratory, it is possible that frequent cannabis users may use larger doses of THC than occasional users to

offset any tolerance to the subjective effects of the drug, resulting in more equivalent impairment when operating a motor vehicle (McCartney et al., 2021). As noted previously, there is strong evidence to suggest that individuals who use cannabis for medical purposes do so more frequently and with higher quantities of cannabis (Lankenau et al., 2017; Rotermann and Pagé, 2018; Turna et al., 2020) than recreational users. Thus, more research in this area, both observational and experimental, is needed to determine whether limited interventional resources are best used to address DUIC by medical and/or recreational users and if interventional strategies should differ as a function of purpose of cannabis use.

5. Conclusion

In a population-level survey of Ontario adults aged 18+ years, 27.0 percent of medical cannabis users reported engaging in DUIC. After adjusting for suspected confounding variables, including cannabis use frequency, medical cannabis users had almost twice the odds of DUIC compared to recreational-only users. This finding has important implications for the targeting and content of public health interventions designed to reduce DUIC. Further research examining the harms of medical versus recreational cannabis use for road safety is needed.

Authors' note

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Credit statement

All authors contributed in a significant way to the manuscript.
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Writing — review and editing: All authors.
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