Coalition of Alcohol and Drug Educators

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"Medicinal" Cannabis and Driving – is it an Issue?

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“Medicinal” Cannabis and Driving – is it an Issue?

With several global jurisdictions legalizing cannabis for either ‘medicinal’ or recreational use, the issue of its influence on public safety, particularly in motor vehicle crashes and the subsequent injuries and deaths, a more robust understand of harms must be established.

The presence of THC, specifically Delta 9 Tetrahydrocannabinol (potentially other THC variations) as the psychotropic constituent of some cannabis-based medicines does interfere with driving competencies.

As we are aware, may properly vetted and approved prescribed pharmaceutical grade/ manufactured medicines of various origins can create impairment via drowsiness, and the slower reaction times this diminished state can bring. Consequently, these prescriptions come with clear warnings that driving whilst on this medicine is ‘warned’ against.

However, intoxication is a different state, and one that ensures, for example, that the intoxicated is prohibited from driving under current drink driving laws.

What is important to note is that whilst drowsiness can be one symptom of intoxication, it is not the only one. Intoxication brings another level of diminished capacity to the driver, and along with the idiosyncratic nature of intoxicants – not least THC – the potential for multi-level public harms is markedly increased.

One of the big ‘pushes’ from one sector is to have THC based ‘medicinal’ cannabis, as it is promoted, added to the list of medications and removed from the list of prohibited substances for driving. This lobby group site an ‘unfairness’ in the legislation that states their ‘medicine’ is treated differently from other prescriptions and those using such formulations are unfairly penalized.

Under the current Pharmaceutical Benefits Scheme, there are only two THC based preparations that are certified by the TGA as medicines, these are Sativex® and Marinol®. Other proposed formulations that have not been fully clinically double blind, placebo accounted for trailed, and have not been given that pharmaceutical status, and in scientific terms are not medicine.

However, now that the Australian Therapeutic Goods Administration (TGA) have allowed and now actively promoting a ‘new’ category for ‘medicinal cannabis’, the number of THC contained ‘medicines’ are exponentially increased. Making the now Category 4 & 5 (non-clinically trialled) products easier to access for ‘prescribing’ purposes.

The potential for abuse of this *new opportunity to access cannabis* ‘legally’ has grown substantially, and to state the obvious, how will law enforcement know from which source the THC came? Supplementing and misuse of this substance will now be made easier, and the potential for intoxicated driving be given a free pass on the basis of ‘it’s my medicine’ and exempted from penalty.

That very credible hypothetical aside, it is important for everyone’s public safety, not least the THC user, that clear boundaries be set, and that *no driving be permitted at all* for a prolonged period of time for those using this psychotropic substance.

For example, if a base line is to be drawn to maximize safety at say 24 hours, then it

would become clear that someone using this psychotropic substance daily, will not be permitted to drive with any degree of assured safety. Even if it is 12 hours, clear issues present.

The following information and data makes clear that excising Cannabis use (THC) from the prohibition from driving a vehicle legislation would be a public safety mistake.

* * * * *

The jurisdictions with the most experience of this issue are the ones with laws allowing either 'medicinal' or recreational use of cannabis – Two significant jurisdictions are the United States and Canada. There records and research will feature strongly in this work.

The following advice one such example from the **Prevention Policy Alliance** in Ohio, USA:

> *Marijuana use is not without risks and has potentially dangerous consequences - especially for drivers on the road. Since medical marijuana is now legal in Ohio, it's important to understand the risks of marijuana use and driving.*
>
> *While we all know that impaired driving is problematic, driving while high on marijuana carries unique risks. According to the National Highway Traffic Safety Administration, there has been a 48% increase in nighttime drivers who tested positive for THC - the chemical responsible for marijuana's psychological affects. Marijuana can slow reaction time and the ability to make decisions. Driver's high on marijuana hit more pedestrians, exceed the speed limit more often, make fewer stops at red lights and make more center line crossings.*
>
> *Drivers who consume both marijuana and alcohol and then drive experience impaired judgement that leads to some of the most dangerous driving on the road. According to the Traffic Safety Culture Index, drivers who use both marijuana and alcohol were significantly more prone to driving under the influence of alcohol. They are more likely to speed, text, intentionally run red lights and drive aggressively.*
>
> *Prevention professionals understand that legalization of substances lowers an individual's perception of risk, altering an individual's judgement about the likelihood of negative occurrences related to that substance. As Ohio considers expanding marijuana legalization, it is important to understand the dangers it will pose to traffic safety.*

However, this state is only recently coming to grips with this growing public safety problem, where as other jurisdictions, not least the Sate of Colorado, have seen the devastating impact that THC driving has had on both road and public safety.

Colorado's Department of Public Health and Environment have made definitive recommendations around marijuana use and driving. In the 2018 summary, the following evidence-based realities were presented.

Marijuana use and driving

The committee reviewed driving impairment and motor vehicle crash risk relative to marijuana use, as well as evidence indicating how long it takes for impairment to resolve after marijuana use. The risk of a motor vehicle crash increases among drivers with recent marijuana use. In addition, using alcohol and marijuana together increases impairment and the risk of a motor vehicle crash more than using either substance alone. For less-than-weekly marijuana users, using marijuana containing 10 milligrams or more of THC is likely to impair the ability to safely drive, bike or perform other safety-sensitive activities. Less-than-weekly users should wait at least six hours after smoking or eight hours after eating or drinking marijuana to allow time for impairment to resolve. Research is lacking on marijuana and impairment in frequent marijuana users.

Monitoring Health Concerns Related to Marijuana in Colorado: 2018 Summary, Colorado Dept of Public Health & Environment. Detailed findings and data available at colorado.gov/marijuanahealthinfo

This evidence has been affirmed in other arenas, as the video presentation below will confirm, and any 'medicines' with THC preparations involved are going to cause impair, regardless of the perceived impact on the marijuana user https://youtu.be/ToOy2imdYOY

Marijuana

Cannabinoid screens were conducted for 5,032 case filings, representing one-fifth of all case filings (see Table 16). Of these, 34% indicated that no cannabinoids were detected.32 Cases with a positive cannabinoid screen (66%, n=3,335) were further confirmed for Delta 9-THC and other cannabis metabolites.33 The testing positivity rate in 2018 was nearly identical to the 2017 rate, and both years' rates represent a decline from 2016's. Furthermore, among all case filings screened for cannabinoids (n=5,032), 57% tested positive for Delta 9-THC. The presence of Delta 9-THC recorded in a linked toxicology report might indicate the driver's recent use of cannabis preceding the offense. The median value of Delta 9-THC among individuals screened was 5.2 and the mean was 8.2 ng/mL, both of which are over the permissible inference level.

Table 16. Cannabinoid screen results among DUI case filings, 2016-2018

Screen Result n (%)	*2016*	*2017*	*2018*
Cannabinoids Not Present	*1,061 (26.9%)*	*1,622 (33.8%)*	*1,697 (33%)*
Cannabinoids Present	*2,885 (73.1)*	*3,170 (66.2)*	*3,336 (66.3)*
Total N	*3,946*	*4,792*	*5,032*

Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

Table 17 compares the various levels of Delta 9-THC detected among case filings undergoing confirmatory testing (n=3,335 in 2018). About a sixth of these case filings had no Delta 9-THC detected or levels that were less than one ng/mL, approximately one-third had levels between one and the permissible inference level of five ng/mL, and about half had a level at or above the permissible inference level.

Table 17. Delta 9-THC levels for case filings with Delta 9-THC confirmation test, 2016-2018

	2016	2017	2018
N	*2,885*	*3,170*	*3,335*
Delta 9-THC level n (%)			
None Detected	*396 (13.7%)*	*431 (13.6%)*	*459 (13.8%)*
Present but <1.0	*90 (3.1)*	*63 (2.0)*	*88 (2.6)*
1.0-4.9	*1,030 (35.7)*	*1,069 (33.7)*	*1,134 (34.0)*
5.0+	*1,369 (47.5)*	*1,607 (50.7)*	*1,654 (49.6)*
Median level (ng/mL)	*5.9*	*5.4*	*5.2*
Mean level (ng/mL)	*8.7*	*8.2*	*8.2*

Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

Common Charges Associated with Marijuana

A total of 6,303 final non-DUI charges were associated with the presence of Delta 9-THC; see Appendix I for the top 20 charges. Similar to alcohol, the top four charges were for careless driving (n=665), failure to display proof of insurance (n=437), lane usage violation (n=434), and speeding (n = 208).

Time to Blood Test

Time to blood test data is difficult to capture because it requires manual data entry from CBI's Requests for Laboratory Exam forms. This data entry was completed in 2017 but time constraints precluded this undertaking for the 2018 data. For the current analysis, instead, 2,012 ChemaTox records with draw time data were analyzed, although this represents only 12% of all DUI case filings with toxicology matches. Due to the lower number of cases available, the data from 2016 to 2018 were combined and the aggregate results are presented in Table 18. The higher mean time and lower median time in 2018 compared to 2017 and 2016 data may reflect the increased variability in the data due to the lower sample size.

Table 18. Descriptive statistics and toxicology source for time-to-test analyses by year, 2016-2018

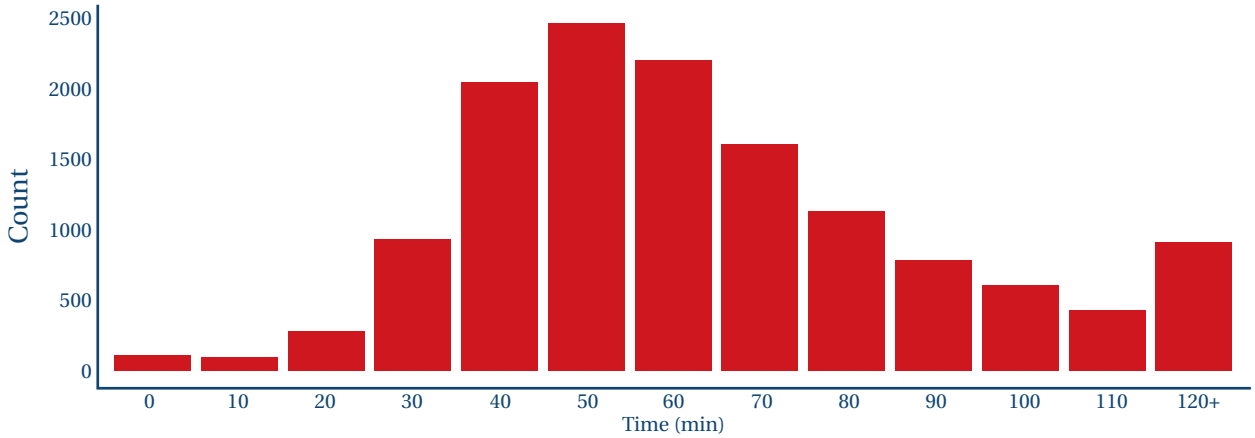
Year	Mean (min)	Median (min)	No. of Case Filings	Toxicology Source
2016	*72.5*	*64*	*4,154*	*ChemaTox*
2017	*75.7*	*64*	*7,667*	*ChemaTox & Colorado Bureau of Investigation*
2018	*88.5*	*60.5*	*2,012*	*ChemaTox*
All	*76.6*	*64*	*13,833*	

Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

For the combined 2016 through 2018 data, 310 records reporting test times of over 200 minutes were excluded in an attempt to analyze measurements that might be more associated with impairment. This sample of case filings (n=13,539) was used in the analyses below.

The frequency for time-to-test is depicted in Figure 9. The time interval of 50–59 minutes (category 50 in Figure 9) had the greatest number of blood draws (n=2,469), accounting for 21% of the time categories. Nine percent (n=910) of records exceeded an elapsed time of 120 minutes from time of offense to time of blood draw.

Figure 9. Time-to-test for DUI case filings, 2016-2018 (n=13, 539)

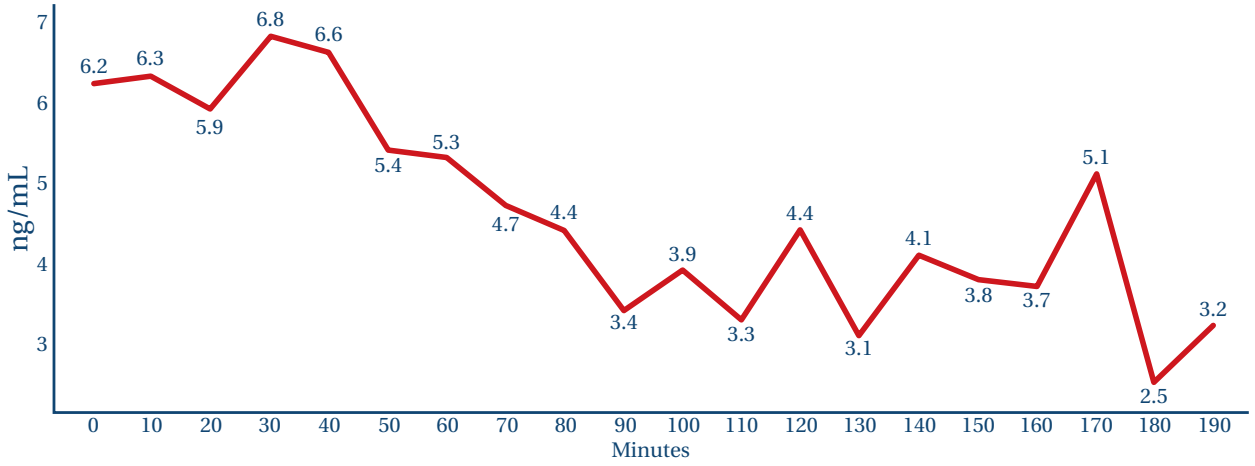


Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

Marijuana and Time-to-Test

A comparison of time to blood test by median Delta 9-THC value for 2016 to 2018 can be seen in Figure 10. Median Delta 9-THC values peaked between 30-39 minutes for the time of the offense to blood draw and then gradually fell for blood draws collected between 40-99 minutes. The changes in the slope in the Delta 9-THC levels for blood draws collected after 100 minutes might highlight the fragility of this relationship, and/or the presence of a threshold where time to draw may be more reflective of residual Delta 9-THC in the driver.

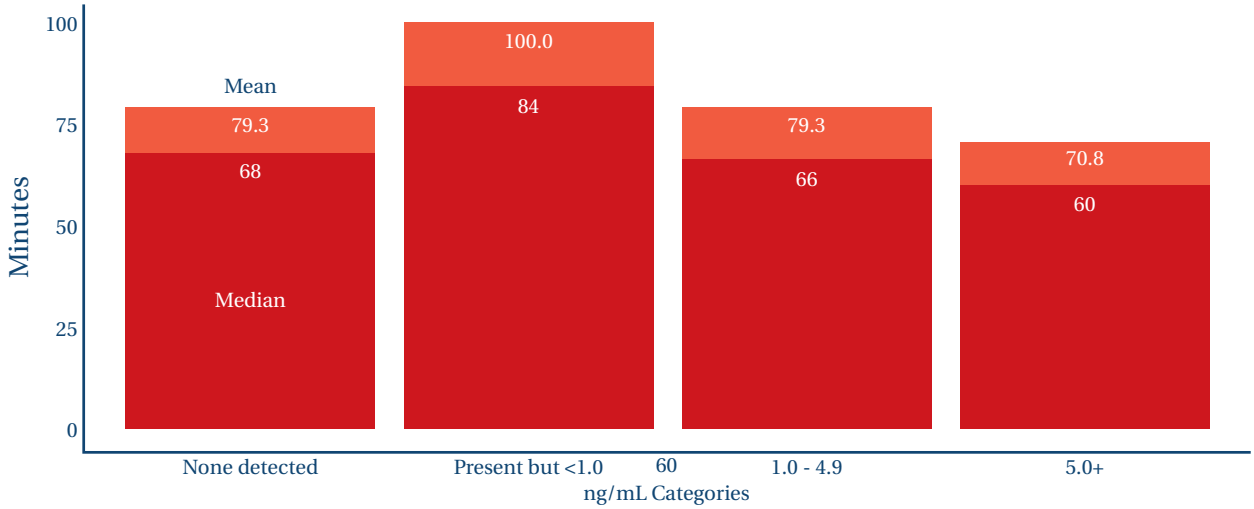
Figure 10. Median Delta 9-THC value by time-to-test and number of cases, 2016-2018 (n=13, 539)



Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

In addition, we also compared the mean and median time to draw for each of the Delta 9-THC categories for case filings with positive cannabinoid screenings, as shown in Figure 11. The median and mean of the elapsed draw time for the quantified Delta 9-THC category decreased as the Delta 9-THC values increased. This trend aligns with evidence in the research literature that Delta 9-THC levels peak early and then quickly dissipate.

Figure 11. Mean and median Delta 9-THC value by time-to-test, 2016-2018 (n=13, 539)



Data source: State Judicial Department, Denver County Court, CBI, and ChemaTox. Analyzed by the Office of Research and Statistics, Division of Criminal Justice, Colorado Department of Public Safety.

(Source: *Driving Under the Influence of Drugs and Alcohol: A Report Pursuant to House Bill 17-1315 (state.co.us)*)

Cannabis Legalization and potential Associations with an Increase in Cannabis-related Motor Vehicle Crash Fatalities.

Cannabis use is a risk factor for motor vehicle crash (MVC) fatalities, but the degree of a driver's intoxication varies by tetrahydrocannabinol (THC) level. However, cannabis testing does not assess THC levels in most US states, and testing rates among MVC decedents vary among states and over time, which may bias estimates of cannabis involvement. Researchers assessed cannabis involvement and THC levels among fatally injured drivers in Washington State before and after the legalization of non-medical ("recreational") cannabis use, with and without imputation of missing cannabis testing data among the roughly half of decedents who were not tested.

- Using data from all MVC decedent drivers based on observed and imputed values, the prevalence of cannabis involvement in MVC fatalities was 9% prior to legalization and 19% after.
- In adjusted analyses, the proportion of decedent drivers with high THC levels (>10 ng/mL) increased nearly 5-fold after legalization.
- Although cannabis testing rates increased during the study period, findings were generally similar when restricted to those with completed cannabis testing.

Comments: This study is one of the first to impute cannabis involvement in MVC fatalities among decedents without testing, and to measure and impute THC levels (rather than simply the presence or absence of THC). Legalization of non-medical cannabis use in Washington State was associated with increases in cannabis involvement in MVC fatalities, including at levels clearly associated with impairment. These results add to literature suggesting that legalizing cannabis may increase MVC fatalities, and highlights the need to better characterize and mitigate those risks.

(Source: *Is Cannabis Legalization Associated with an Increase in Cannabis-related Motor Vehicle Crash Fatalities? | Alcohol, Other Drugs, and Health: Current Evidence (bu.edu)***)**

The Canadian Perspective

Marijuana impairment. In comparison to alcohol, less is known about marijuana and driving in terms of how marijuana specifically impairs driving skills. Marijuana studies have shown the psychoactive chemical delta-9-tetrahydrocannabinol (or THC) enters the user's bloodstream and brain immediately after smoking or consuming it. Since marijuana is very soluble in fat tissue, the absorption, distribution, and elimination of marijuana does not occur at a steady rate. Instead, it varies based on biological processes according to several factors, including route and frequency of intake; THC dose; titration of dose when smoked or vaporized; and, user characteristics. Not only do these factors affect the amount of marijuana intake and metabolism, they also affect the degree of behavioural impairment exhibited by users. For example, if marijuana is ingested, the onset of the impairing effects of edible marijuana products occurs more slowly and last longer as compared to smoking.

Furthermore, marijuana does not display a dose-response (in this case concentration) relationship, as is the case with alcohol. Unlike BACs, peak THC concentrations do not correlate well with the degree of behavioural impairment (Huestis 2007; Compton 2017). For example, studies of marijuana use and driving impairment have shown the level of THC measured in blood or oral fluid and the degree of impairment are not closely related; peak THC levels can occur when low levels of impairment are measured, and high levels of impairment can be measured when THC levels are low (Compton, 2017; Marcotte, 2020). The lack of definitive knowledge to quantify a concentration-response relationship for marijuana may be in part due to typical differences in research methods, tasks, subjects and dosing that have been used to date (Compton, 2017). Additionally, some studies have reported a wide variability in THC levels in the blood which are affected by the means of ingestion (smoking, oil, and edibles), potency, and user characteristics (Compton, 2017). This may indicate the concentration-response relationship can vary according to specific types of marijuana products consumed and individual biology. The lack of a concentration-response relationship for marijuana has important implications. Notably, there is much debate concerning the validity of a per se limit for marijuana due to the lack of strong scientific consensus regarding THC concentration in blood that constitutes driving impairment (Grotenhermen et al. 2007; Newmeyer et al. 2017). However, generally speaking, studies on marijuana showed:

Low doses of marijuana produce mild to moderate impairment in cognitive and psychomotor abilities; and Larger doses showed significant impairment in cognitive, psychomotor and driving performance.

Laboratory studies of the impairment effects of marijuana use on psychomotor and cognitive functions suggested marijuana consumption can impair driving task-related abilities such as motor control, executive function, visual processing, short-term memory, and working memory in a dose-dependent fashion (Broyd et al. 2016; Ramaekers et al. 2004; Ramaekers et al. 2006). Reviews of studies on the effects of marijuana on driving skills demonstrated marijuana can specifically impair certain skills necessary for safe driving (Hartman et al., 2012; Compton 2017; Battistella et al., 2013), such as:

- controlling speed variability;
- lane positioning;
- reaction time;
- divided attention;
- attention maintenance;
- route planning;
- decision-making; and,
- risk-taking.

In some driving simulator studies, marijuana use was shown to increase driver reaction time and the number of incorrect responses to emergencies. In addition, drivers crashed more frequently into a sudden obstacle on a high dose of THC, although this was not seen at low doses (Sewell et al., 2009: citing Smiley, 1986; Smiley et al., 1981). Starkey and Charlton (2017) conducted a systematic review of marijuana-related behavioural studies and found that marijuana use was associated with reckless driving and speeding, signaling errors and decreased ability on tracking tasks.

A recent study involving participants who smoked marijuana and used a driving simulator demonstrated a moderate effect of THC on driver performance. Some subjects showed reduced performance compared to a placebo group, while other subjects showed little difference (Marcotte, 2020). Driving performance was assessed in terms of ability to maintain lateral position while undertaking a distracting task as well as maintaining the distance from a leading vehicle. Furthermore, the effects were seen to be most pronounced in the first two hours after use, with some recovery seen after three and a half hours.

Marijuana use has been associated with a significantly increased risk of fatal crash involvement. Drivers using marijuana are at an increased risk of injury anywhere from 1.8 to 2.8 times higher. Furthermore, the odds of drivers being found responsible for a crash increased with rising marijuana concentrations in the blood (Li et al., 2013; Asbridge et al., 2012; Starkey and Charlton 2017; Els et al., 2019; Drummer et al., 2003; Drummer et al. 2004). In fact, research on drivers in fatal crashes has shown THC-positive drivers were more than twice as likely to crash as drivers without THC (Grondel 2016).

However, while marijuana use has been shown to have impairing effects on skills required for driving, simulator studies investigating behavioural changes driving under the influence of marijuana have concluded marijuana use by drivers may result in compensatory behaviours, such as:

- ✓ decreased speeds;
- ✓ fewer attempts to overtake; and,
- ✓ an increased following distance to the vehicle in front.

These findings are in sharp contrast to studies investigating the effects of alcohol use (Hartman et al., 2016; Sewell et al. 2009). Other studies have demonstrated no adverse effects of marijuana use on sign detection, a sudden lane-changing task, or the detection of and response to hazardous events. (Sewell et al., 2009: citing Sexton et al., 2000; Smiley, 1986; Stein et al., 1983). It has been hypothesized that despite the impairing effects of marijuana, drivers using marijuana alone tend to overestimate their level of impairment and rely on compensatory behaviours to reduce crash risk. In one study, following a 7 ng dose of THC, drivers rated themselves as impaired even though their driving performance was not. Conversely,

alcohol at a relatively low BAC of .04 resulted in impaired driving performance although drivers rated themselves as unimpaired (Sewell et al.,2009: citing Robbe and O'Hanlon, 1993). In other words, drivers using marijuana may be more aware of their level of impairment whereas drivers using alcohol under-estimate their impairment. However, this may not always be the case. One study (Marcotte, 2020) measuring driver performance in a simulator showed subjects perceived the impairing effects of THC to be eliminated before a measurable improvement in driving performance was seen.

(Source: *ALCOHOL, MARIJUANA & DRIVING RISK December 2020 By Craig Lyon & Robyn D. Robertson (Traffic Injury Research Foundation of Canada - SoberSmartDriving.tirf.ca)***)**

The recently released Australian research Determining the magnitude and duration of acute Δ9-tetrahydrocannabinol (Δ9-THC)-induced driving and cognitive impairment: A systematic and meta-analytic review

Highlights:

- Meta-analyses confirm that acute Δ^9-THC administration impairs aspects of driving performance.
- Meta-regression analyses suggest regular cannabis users experience less Δ^9-THC-induced impairment than occasional users.
- Other factors also influence the degree of impairment observed (e.g. dose, post-treatment time interval, type of skill).
- Most driving-related skills are predicted to recover within ~5-hs (and almost all within ~7-hs) of inhaling 20 mg Δ^9-THC.
- Oral Δ^9-THC-induced impairment may take longer to subside.

(Source: *https://www.sciencedirect.com/science/article/pii/S0149763421000178?via%3Dihub November 2021***)**

The analysis concluded as much of the other research has at least landed on that 'minimum times of waiting until doing sensitive tasks' applied, and the disturbing caveat that "regular cannabis users experience less THC induced impairment..." Before any further challenging of some of these findings, not least is the concern that self-reporting capacity to drive from the seasoned cannabis user can easily be related to the alcoholic who believes they too can manage to drive safely over the legal limit, regresses our world leading drink/drug driving regulations back to old 'sobriety tests' for every subjective situation.

That (as important as it is) aside, we submit the following review of this research.

- The proposal of permitting a medical exemption to the "presence offense" if there was no impairment and the cannabis was prescribed and taken as prescribed is a low-risk modification to Australian laws. But it's the camel's nose in the tent problem. Pretty soon you have the whole camel in your sleeping bag. (As per the alcohol issue above)
- Few users would be impacted by the proposal. It seems that only 1.8% of "medical" marijuana users get it by prescription and 89% of that is oils and sprays. Because of the admittedly large number of users who supplement their "medication" with illicit product, we see the proposal fairly innocuous except for the nose in the tent problem.

- The current cannabis warning label is insufficient. It only recognizes drowsiness as a consequence of taking THC-containing products. If the recommendation is adopted, there should be a much stronger warning about the dangers of both impairment and brain damage especially to adolescents.

- The crash risk studies chosen are ones on the low side, yielding relative risks (RR) or odds ratios (OR) in the 1.2-1.4 range, whereas the accepted average level is closer to two. If the average OR is 2.0, for example, that means that some subjects are below that number, and some are above that number. Because of the way in which the OR studies were done, measuring crash risk for drivers with a presence of THC, even though they may not have been impaired significantly, the number of study subjects is dominated by drivers with an OR of 1.1 or less. Those who are truly impaired have to have an OR well above 2.0 for the average to be 2.0. Drummer, for example, showed OR of 10.0 for those with very high THC levels and I have found RR to be in the 7-10 range for drivers convicted of DUI where THC was the only drug found (unpublished data currently in peer review). There is frequently a tendency to discount the danger of THC impairment, but we need to recognize that impairment is a dose-related phenomenon. The higher the dose, the greater the impairment. And that holds for both occasional users as well as for addicts who have developed some level of tolerance. So someone on a high dose of THC will be more dangerous than someone on a low dose of alcohol. The fact is that these people are impaired. They should not be permitted to put others at risk. A 9 mm bullet is half as deadly as a .45 caliber bullet and a .22 caliber bullet is half as deadly as a 9mm bullet. That doesn't mean we should shoot people with .22 caliber bullets because it's safe to do so.

- Page 5 cites studies by Cook and Santaella-Tenorio saying that there is no increase in traffic fatalities when medical marijuana is permitted. See the attached unpublished letter to the American Journal of Public Health criticizing the Santaella-Tenorio study. The journal has a habit of publishing pro-marijuana studies, unfortunately. And they declined to publish other critiques.

- Our last comment refers to their statement that medical users develop a tolerance to the impairing effects of THC. They are very careful to state this correctly, *"development of tolerance to impairing effects in patients could be expected to partially, but not fully, diminish potential effects on driving skills compared with an occasional recreational cannabis consumer taking a similar dose."* But his entirely misses the point that when tolerance takes effect, the user simply increases the dose. This is recognized in two places (P2 and P8) in the manuscript.

Research published in Accident Analysis and Prevention in 2021, investigated driving impairment due to cannabis use, by comparing occasional and regular users of the substance. The issue of 'tolerance' was a key focus in this work, as proponents of cannabis use have argued, subjectively, that driving impairment is lesser with those who are regular or chronic users, as they have developed a tolerance for it's affect and therefore are less likely to be involved in traffic accidents due to intoxication. (As we mention at different times, the same argument for the alcohol using driver does not give them a 'pass' from prosecution).

The Lambert Initiative – Cannabis Industry Article

In a recent release from the University of Sydney's Lambert Initiative for Cannabinoid Therapeutics decided that, according to the article … "that blood and oral fluid THC concentrations are relatively poor or inconsistent indicators of cannabis-induced impairment." Professor MacGregor went on to reiterate the *'perception of impairment' argument in the following statement in the article*

> *"A cannabis-inexperienced person can ingest a large oral dose of THC and be completely unfit to drive yet register extremely low blood and oral fluid THC concentrations. On the other hand, an experienced cannabis user, might smoke a joint, show very high THC concentrations, but show little if any impairment.*
>
> *"We clearly need more reliable ways of identifying cannabis-impairment on the roads and the workplace. This is a particularly pressing problem for the rapidly increasing number of patients in Australia who are using legal medicinal cannabis yet are prohibited from driving"*

This circles back to the to an retrograde argument by many 'seasoned drinkers' posited in opposition to 'breathalysers' that their ability to drive was barely influence by their blood alcohol limit. Many tragic examples exist of people, who could arguably be legally 'dead' with Blood Alcohol Limits of over 3.4, actually driving with only little 'impairment'.

A quick analysis of the Lambert Initiative article THC in blood and saliva are poor measures of cannabis impairment - The University of Sydney brings the following concerns to the fore.

Issue A:

"This study was funded by the Lambert Initiative for Cannabinoid Therapeutics." "Acknowledgements This research was not funded by a **specific** grant from any funding agency in the public, commercial, or not-for-profit sectors. However, D. M., R.C.K. and I.S.M. receive salary support from the Lambert Initiative for Cannabinoid Therapeutics, a philanthropically funded centre **for medicinal cannabis research** at the University of Sydney." The 'conflict of interest' is a best dubious.

- there is an EXTREME risk for bias due to financial interest in the product being investigated by those who are funded by organizations responsible for researching "the product"
- prolonging research leads to prolonged employment/salary for these "researchers"

Issue B:

They need to explain why the Hartman study Cannabis effects on driving lateral control with and without alcohol - PubMed (nih.gov) showed that 13.1 ng/ml THC created the same amount of weaving as 0.08 BAC. The hydrophobic THC molecule rapidly leaves hydrophilic blood since THC distributes readily into the brain - fatty tissue. The study shows the very low (2- 4 ng/ml THC levels within 1 - 2 hrs). Here was their ***admission* that this study did** perform appropriate assessments for impairment ***and*** the timely monitoring of THC levels/biomarkers: *"Very few studies have measured the effects of THC on SDLP in combination with a relevant (and appropriately timed) biomarker (Arkell et al., 2019a; Brands et al., 2019; Micallef et al., 2018; Hartman et al., 2015; Ronen et al., 2010; Fares et al., 2021). Further research using simulated and on-road driving methods (or other measures that have a known relationship with driving performance) would permit better characterisation of the relationships between THC-related biomarkers and driving impairment."*

- Yet the authors of the article simply call for ***more*** research rather than adopt their findings (a very common tactic used by the marijuana industry to allow more addiction and marijuana sales to occur - **not** to "adopt these results until additional research changes the conclusions")

Issue C:

The authors treat driving as a right - it is not. It is a privilege. There are many other options that ***do not*** involve having someone put the entire public at risk of losing their life (or being injured) from an impaired driver. Note: they ***do not*** make claims that marijuana is ***never*** impairing of one's ability to drive.

Issue D:

Zero tolerance or using the **US Depart of Transport (DOT)** standard of urine marijuana metabolites is ***a much safer*** alternative for the public **safety** (rather than allow **one** marijuana impaired driver to **kill** another human, or even themselves). The authors need to answer how many innocents can be injured or harmed to allow **one** marijuana-impaired driver to operate a vehicle. The US DOT uses urine levels for ***all drugs except*** alcohol - since they recognized a long time ago that blood level limits for these hydrophobic substances are NOT accurately measured in the blood. The same method (urine levels) should be used by all governments when looking at these impairing substances.

Issue E:

The authors use the delay is THC distribution phase (seen primarily with an orally administered intoxication) to make this claim *"Likewise, drivers who are impaired immediately following cannabis use may not register as such."* - oral peak THC blood levels may take hours (2-3 hrs) to attain - they acknowledge this distribution time when they state "A cannabis-inexperienced person can ingest a **large oral dose** of THC and be completely unfit to drive yet register extremely low blood and oral fluid THC concentrations"

- they go on to promote a claim *"A cannabis-inexperienced person can ingest a large oral dose of THC and be completely unfit to drive yet register extremely low blood and oral fluid THC concentrations"* but this is Assuming that testing will be made HOURS after a crash. A study that I was involved (attached) with shows that it takes usually 2 hours in a fatal crash to draw blood or those in which someone was injured (but not killed) - due to delays in processing the scene in these cases due to the mayhem involved.

Issue F:

We also note some concerns around the disingenuous use of words in this statement - *"blood and oral fluid THC concentrations are relatively poor or inconsistent indicators of cannabis-induced impairment."*

- it does ***not*** say that "blood and oral fluid THC concentrations cannot ever be used as indicators of cannabis-induced impairment."

- due to the justice system being warped into being more concerned about the defendant and ***not*** The victim - this claim is being warped even when blood levels are extremely high - 40 ng/ml THC 45 minutes after the crash - Judgement withheld on Brady Robertson's sobriety during deadly crash as constitutional challenge around driving laws & cannabis use continues | The Pointer

Issue G:

Re' "No significant relationship between blood THC concentration and driving performance was observed for 'regular' (weekly or more often) cannabis users."

- the reason why blood levels are inappropriate for chronic users - is that they may be chronically impaired and

they **do** have residual THC remaining in the fatty brain tissue which is coming out and being turned into THC metabolites (including the ***higher*** intoxicating THC-OH molecule than the parent THC molecule).

- they have conveniently NOT included the Doroudgar study which showed chronic impairment in chronic users

Issue H:

The article **never** addresses the issue of multi-substance impaired driving - which is on also on the rise, with cannabis and alcohol use a common pairing. There is **no way** to determine the numerous amounts of combinations to determine accurate impairing blood (or oral levels) of each substance when combining. ***The Only safe measure is ZERO tolerance.***

The paper titled ***Simulated driving performance among daily and occasional cannabis users*** revealed the following:

Highlights:

- *Occasional users had a similar drug effect as daily users but lower blood THC.*
- *Smoked cannabis led to an increase in SDLP among daily and occasional users.*
- *Only daily cannabis users drove slower after smoking cannabis (15–30% THC).*

The **Objective** of the paper was *'Daily cannabis users develop tolerance to some drug effects, but the extent which this diminishes driving impairment is uncertain. This study compared the impact of acute cannabis use on driving performance in occasional and daily cannabis users using a driving simulator.'*

The conclusion of the research revealed that 'tolerance' did not attribute to safer or more competent driving *.. We observed a decrement in driving performance assessed by standard deviation of lateral placement (SDLP) after acute cannabis smoking that was statistically significant only in the occasional users in comparison to the non-users. Direct contrasts between the occasional users and daily users in SDLP were not statistically significant. Daily users drove slower after cannabis use as compared to the occasional use group and non-users. The study results do no conclusively establish that occasional users exhibit more driving impairment than daily users.*

(Source: *Science Direct Accident Analysis & Prevention Volume 160, September 2021, https://doi.org/10.1016/j.aap.2021.106326***)**

A 2018 paper, one of the earliest on the issue of THC impact on driving abilities was published in the USA National Institute of Health's National Library of Medicine concluded the following:

> ## The effects of cannabis intoxication on motor vehicle collision revisited and revised
>
> ***Conclusions:*** *Acute cannabis intoxication is associated with a statistically significant increase in motor vehicle crash risk. The increase is of low to medium magnitude. Remaining selection effects in the studies used may limit causal interpretation of the pooled estimates.*
>
> **(Source:** *PubMed.Gov https://pubmed.ncbi.nlm.nih.gov/26878835/***)**

A review of this research and conclusions raised some concerns, not least depth-integrity of research. Rogeberg and Elvik attempted to determine the Odds Ratio (OR) of being in a crash after using THC. It did so using a meta-analysis that is akin to a weighted average of research papers published by others. Two of those studies were ones done by Li and by Romano.

Even both Li and Romano used identical FARS data for subjects and identical National Survey data for controls for overlapping time periods, they reached opposite conclusions. Li reported the OR for a fatal crash associated with marijuana to be 1.83 (95% CI 1.39, 2.39). Romano reported the OR to be 0.92 (95% CI 0.6, 1.40), essentially saying that use of marijuana exerted a crash protective effect on the user. Since both researchers used the same data to arrive at different conclusions, Romano published another study, examining why that happened. He concluded that there were biases in the selection of FARS data to be included, more so in his paper than in Li's paper. When he removed those biases from both papers, he ended up with results similar to Li's. You can see his analysis at Romano E, Torres-Saavedra P, Voas RB, Lacey JH. ***Marijuana and the Risk of Fatal Car Crashes: What Can We Learn from FARS and NRS Data?*** *J Primary Prevent (2017) 38:315-328*.

But perhaps Romano's most important conclusion was"...the FARS database should neither be used to examine trends in drug use nor to obtain precise risk estimates."

The 21 studies used in Rogeberg's meta-analysis reported Odds Ratios ranging from 0.22 to 13.40. He weighted some as low as 0.46% of the total and others as high as 10.68% of the total. The flawed NHTSA report and three different FARS-based reports received a combined weight of 35.41% in Rogeberg's meta-analysis. Rogeberg included Romano's 0.92 OR in his meta-analysis, rather than the higher one that Romano admitted to later. For the NHTSA report, Rogeberg chose to use the later OR 1.0 result, rather than the first-released OR 1.05. He should have consistently chosen either the first-published result by those authors, or the corrected result, preferably the latter.

Rogeberg and Elvik's study used a biased selection of previously published work that included discredited NHTSA and FARS reports, and weighted those discredited reports more highly than they deserved.

The Colorado Department of Health and Environment has empanelled a group of "experts" to review the literature to answer that question and many others pertaining to THC. They concluded that there is substantial evidence that *"waiting at least 6 hours after smoking less than 18 mg allows driving impairment to resolve or nearly resolve."* However, a typical joint has 400 mg of flower. If the THC concentration is a very modest 15%, that provides 60 mg of THC, and if the bioavailability is 30% (due to pyrolysis, side-stream loss, etc) you'll get an 18 mg dose administered. So, they 'resolve' time is at the very least out by some factor for ever the low use cannabis smoker.

Conclusion

Both the limited research and the clear unpredictability of Cannabis intoxication, along with the idiosyncratic nature of THC impact on individual biological units, should be enough to move forward, only with extreme caution.

As this product has very limited evidence-based impact on health issues, but a considerable placebo effect, it's therapeutic outcomes in no way come close to the accompanying risks of driving whilst medicating.

Our Nation has worked long and hard to arrest and 'wind in' drink driving and the incredible toll it has taken on our communities. To add any mechanism to legislation that allows or even permits any other version of intoxicated use over a vehicle is at best incredibly unwise – at worst culpable.

The campaign in play at the moment to have Cannabis is 'medicinal' form excised from the legislation to enable the users of such formulations to consume this psychotropic substance and drive with impunity is ill-advised at best. It is our conclusion that enabling people who use cannabis to drive – even as 'medicine' – is not on the best interest of public safety.

Research Team @ Dalgarno Institute

Appendix

Cannabis & Driving - THC, How Much is Too Much?

High Truths on Drugs and Addiction. Edward Wood, Founder and President of DUID Victim Voices. Marijuana drugged driving.

Alcohol-Marijuana-and-Driving-21-3.pdf (drugfreekidscanada.org)

AJGP report (The Royal Australian College of General Practitioners 2021):
The AJGP report relies on a badly flawed and previously referenced above pair of studies from Rogeberg and Elvik that the risk of crash from cannabis-positive drivers is a mere 1.1-1.4. We have some concerns as to why the NHTSA report should be ignored. The Brubacher report had an average time of 101 minutes from the crash before taking a blood sample for testing. Since it has been shown that the peak THC blood concentration can decline an average of 76% within the first 25 minutes after starting to smoke a joint, the Brubacher report is pretty meaningless.

NIDA report

NIDA report referenced the following:

- Two large European studies that found drivers with THC in their blood were roughly twice as likely to be culpable for a fatal crash than sober drivers,
- Several meta-analysis showed a significant crash risk - double or more, and
- A NHTSA study failed to find a significant crash risk due to cannabis.

You need to understand the following:

Impairment, whether it be from alcohol, THC, or some other drug, is a function of four things:

- ✓ The dose consumed,
- ✓ The mode of consumption,
- ✓ The time since consumption,
- ✓ Biological variables

When determining the effect of alcohol on crash risk, virtually all studies do so by measuring crash risk as a function of the blood level of alcohol in the driver (or breath level, converted to BAC equivalents). That can be done because there is a very high correlation between BAC and crash risk.

When determining the effect of THC on crash risk, researchers typically study crash risk as a function of a dichotomous independent variable (presence or absence of THC). They do this because there is absolutely no correlation between THC blood levels and the level of impairment.

But in measuring crash risk as a function of the presence or absence of THC, the pool of drivers with THC being present is not homogeneous. Some are very highly impaired (crash risk of 10 times or more) as well as those who are functionally unimpaired (THC remains in the blood, even though their acute impairment has subsided or the dose was too small to create impairment or...).

Consequently, the results of the European studies and the meta-analyses are of limited value. They aren't to be discarded, but their value is limited. They do NOT conclude that someone impaired by THC is only twice as likely to be culpable.

The pool, for example, could consist of 20 drivers, all positive for THC. 10 were unimpaired, 8 were modestly impaired with an Odds Ratio of 2.0, similar to someone with a BAC of .08 gm/dL, 2 were more seriously impaired with an Odds Ratio of 10.0. On average, the Odds Ratio would be 2.3. But that doesn't represent the crash risk of any of the 20 drivers in the pool.

Data published by Colorado's Office of Research and Statistics, for example, allows us to assess the crash risk of drivers who were convicted of impaired driving when THC was the only intoxicant found in blood. Since they were convicted of DUI, one should expect that they were likely more impaired than someone who simply had THC on board. That pool of drivers had a 7.1% incidence of crash, compared with 24.8% incidence of crash for drivers convicted of impairment by alcohol only. The alcohol-only pool of drivers had a mean and median BAC of .166 and .160 respectively. Drivers with that much alcohol on board typically have a crash risk of 25-30, depending on which research report you wish to rely upon. Clearly, the THC-impaired drivers who were convicted of impaired driving had a far higher risk than 2.0. These data are still being reviewed for publication.

I've appended that ORS report as well.

The last study by NHTSA is problematic. It is commonly referenced by the pot lobby to claim the study found there was no correlation between THC use and crash risk. That's incorrect. In fact, the study failed to find a statistically significant relationship between crash risk and the use of any drug (including methamphetamine, heroin, etc.) except for alcohol. But an absence of evidence is not evidence of absence. It's like when you can't find your car keys, it's not because the keys no longer exist. You just didn't look where they do exist.

In the NHTSA case, the results are because the study was never designed to detect any such correlation in the first place. There were four major flaws in the study, including reliance on volunteers only. It's not clear why someone who knew they were impaired would volunteer for the study, but we know that some did, since they did find a correlation with crash risk and alcohol.

So the NHTSA study should simply be ignored. It was a waste of $6 million in taxpayers' money. Even worse, it muddies the waters about drug impairment.

University of Sydney Arkell study

The U of Sydney press release of Arkell's study was a bit misleading. The study consisted of 14 subjects with a history of light cannabis use. The intent of the study was to determine if a 50:50 mix of THC:CBD had a less impairing effect than THC alone. Some have speculated that CBD would reduce the impairing effects of THC since it does lower some of the effects of THC. It didn't reduce impairment. The study used a very low vaporized dose of THC – 125 mg of 11% THC concentration. Typical doses are 300-500 mg with a minimum of 15% THC concentration flower. So, any conclusions about impairment lasting 4 hours should be limited to the conditions studied.

Coalition of Alcohol and Drug Educators

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