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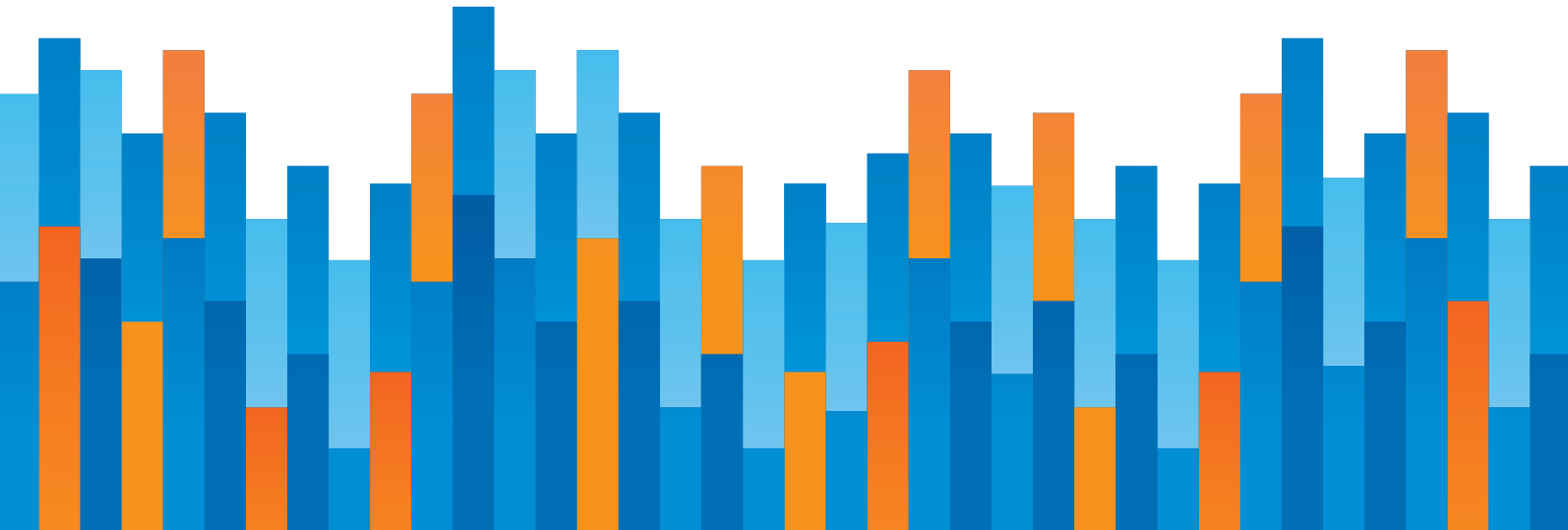
IT'S HIGH TIME: A COMMON SENSE APPROACH TO MARIJUANA-IMPAIRED DRIVING

by Teri Moore and Dr. Adrian T. Moore, Ph.D.
January 2019



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The authors would like to thank Sgt. Thomas E. Page, LAPD (Ret.), for his advice and assistance.

EXECUTIVE SUMMARY

Recent wide-spread legalization of medical marijuana and, in many U.S. states, of recreational use of marijuana also, demands that officials must forge a just, coherent and effective law enforcement and legal response to marijuana-impaired driving. More and more states are legalizing marijuana for medical and recreational use, which demands policies toward marijuana-impaired driving that protect public safety without penalizing legal marijuana users who are sober at the time they drive.

“More and more states are legalizing marijuana for medical and recreational use, which demands policies toward marijuana-impaired driving that protect public safety without penalizing legal marijuana users who are sober at the time they drive.”

Marijuana—or its more technical name, cannabis—and its effects are still quite literally under the microscope. Cannabis containing high levels of THC is typically used recreationally, but may also have therapeutic applications. Because it is the psychoactive component in cannabis, THC is the cannabinoid that impairs driving, and is therefore the focus of this study. This analysis examines the evidence on marijuana-impaired driving and

lays the groundwork for a regulatory approach that is scientifically grounded, safety-minded and fair.

In the past 10 years, prevalence of alcohol use by drivers has fallen in the U.S., and use of marijuana has increased dramatically. Alcohol's composition and effects on drivers have been thoroughly studied over the years and are well understood. It's tempting to use a similar approach to that used for alcohol—the only other legal intoxicant—and to build policies around per se standards. But since cannabis body fluid levels don't parallel impairment, that's not a fair gauge of impairment as it is with alcohol. Indeed, it's possible for some cannabis users to register above per se levels when completely sober. It's also tempting to use the easy idea of zero tolerance, but that's not fair to sober drivers who still have measurable cannabis in their systems.

The only fair solution is for police to assess drivers for impairment as we now do for low-blood-alcohol-content impaired drivers and drug-impaired drivers, and to conduct toxicology screens to corroborate that cannabis is present, rather than measuring irrelevant levels in body fluids. Fortunately, screenings are less expensive, quicker and easier to do than measuring body fluid levels. It's concerning that this means impairment will be assessed entirely by police officers, but that is the most just option currently available. To address this concern, police should use dash- and bodycams to document impairing behavior—such as driving behavior leading to the traffic stop and impairing behavior on field sobriety tests—when possible.

This approach suggests that police departments should prioritize their funding toward training DRE-qualified and/or ARIDE-qualified officers, as well as purchasing dash- and bodycams. States should also prioritize funding toward toxicology labs to prevent current backlogs, to ensure the speedy trials guaranteed by the U.S. Constitution.

This evidence-of-impairment-based approach leads to these recommendations:

1. Avoid per se standards and conduct THC detection screenings rather than assessing blood plasma levels, which don't correlate to impairment.
2. Mandate evidence of drug impairment as the main criterion for arrest. This targets the true danger to the public without penalizing sober users with detectable levels of marijuana in their systems.

3. Prioritize law enforcement training in ARIDE/DRE and dashcams and bodycams for more accurate and corroborative identification and assessment of drug-impaired drivers, and to generate more useful data on marijuana-impaired drivers.
4. Prioritize cutting down backlogs in toxicology laboratories so that justice for both impaired and unimpaired drivers is swift and fair. Rather than invasive testing of irrelevant blood plasma levels, use quicker and less expensive cannabis detection screenings.
5. At the federal level, deschedule marijuana to encourage research into marijuana-impaired driving. This would remove obstacles to growing and procuring cannabis for research purposes. While some regulations have loosened recently, it is not enough to encourage cannabis research. As well, the federal government should prioritize on-going NHTSA and university research on marijuana use and driving, and encourage development of reliable technology to aid in roadside impairment determination.

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PART 1

INTRODUCTION

In the past 10 years, prevalence of alcohol use by drivers has fallen in the U.S., and use of marijuana has increased dramatically (see Table 1 below). While alcohol's composition and effects have been thoroughly studied over the years and are well understood, marijuana—or its more technical name, cannabis[1]—and its effects are still quite literally under the microscope. In discussing its effects, it's useful to know the basics about cannabis.

TABLE 1: WEEKEND NIGHT-TIME PREVALENCE OF ALCOHOL AND MARIJUANA USE BY DRIVERS IN 2007 COMPARED TO 2013-2014

Substance	2007	2013-2014
Alcohol	12.4%	8.3%
Marijuana	8.6%	12.6%

SOURCE Berning, Amy, Richard Compton and Katherine Wochinger. "Results of the 2013-2014 National Roadside Survey of Alcohol and Drug Use by Drivers." DOT HS 812 118. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf

[1] This study uses both terms interchangeably.

Of the nearly 500 natural compounds in cannabis, those unique to the plant are called "cannabinoids," including CBD. Oils made from CBD are increasingly used in medical applications, and do not contain THC,[2] the psychoactive substance in cannabis, and are therefore not impairing. Cannabis containing high levels of THC is typically used recreationally, but may also have therapeutic applications. Because it is the psychoactive component in cannabis, THC is the cannabinoid that impairs driving, and is therefore the focus of this study.

Recent wide-spread legalization of medical marijuana and, in many U.S. states, of recreational use of marijuana also, demands that officials must forge a just, coherent and effective law enforcement and legal response to marijuana-impaired driving.

Recent wide-spread legalization of medical marijuana and, in many U.S. states, of recreational use of marijuana also, demands that officials must forge a just, coherent and effective law enforcement and legal response to marijuana-impaired driving. While some studies find minimal or no increased crash risk by drivers under the influence of cannabis, the majority do find an increased crash risk,[3] with a significantly heightened crash risk when alcohol is used concomitantly with marijuana.[4] With motor vehicle fatalities as the current leading cause of death in young people ages 8-24, and in the top ten causes of

[2] THC is short for delta-9 tetrahydrocannabinol.

[3] Studies that do find a heightened crash risk for marijuana-impaired drivers assign it a far lower crash risk than that of alcohol-impaired drivers. See Berghaus, G., N. Scheer and P. Schmidt. *Effects of cannabis on psychomotor skills and driving performance—a meta-analysis of experimental studies*. In Kloeden, C. N., and A. J. McLean (Eds.), Proceedings of the 13th International Conference on Alcohol, Drugs and Traffic Safety. Adelaide: NHMRC Road Accident Research Unit, 1995. Also, Compton, Richard. *Marijuana-Impaired Driving: A Report to Congress*. National Highway Traffic Safety Administration. July 2017. And Romano, E., P. Torres-Saavedra, R. Voas and J. H. Lacey. "Drugs and Alcohol: Their Relative Crash Risk." *Journal of Studies on Alcohol and Drugs*. 2014. 1-9.

[4] Romano, et al. "Drugs and Alcohol." 1-9.

death for all ages under 65,[5] and with a large portion of those fatalities due to driving under the influence of alcohol and/or drugs,[6] it's vital to protect the driving public from impaired drivers. Yet it's also just as important to guard against an overly cautious approach that punishes unimpaired legal marijuana users who are sober, attentive and alert drivers. This study examines the evidence on marijuana-impaired driving and lays the groundwork for a regulatory approach that is scientifically grounded, safety-minded and fair.

[5] U.S. Department of Transportation. National Highway Traffic Safety Administration. Traffic Safety Facts: Research Note, Summary of Statistical Findings. "Motor Vehicle Crashes as a Leading Cause of Death in the United States, 2015." Table "The 10 Leading Causes of Death in the United States in 2015, by Age Group." DOT HS 812 499. 4. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812499

[6] National Highway Traffic Safety Administration. *Traffic Safety Facts 2016 data: alcohol-impaired driving*. U.S. Department of Transportation, Washington, DC. 2017. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812450 Accessed 2 October 2018.

PART 2

USING THE ALCOHOL-IMPAIRED DRIVING TEMPLATE FOR MARIJUANA

Ideally, drugged driving impairment should be measurable against a biological standard of some sort, as seen with blood alcohol concentration (BAC) measurement in alcohol-impaired drivers. Such a standard allows legal drug users—whether on prescription medication, cannabis medication, or recreational use of alcohol or cannabis—to gauge their use responsibly. For example, alcohol users can estimate the strength of their drinks against their own physical size and what they've eaten to get a rough idea of their BAC. Because all U.S. states[7] peg per se alcohol impairment at .08% BAC level, drivers can get a sense of the amount of drinking that is likely to impair their driving. There are many variables, and many people are impaired well before reaching .08% BAC, but both drivers and law enforcement have a distinct level under which impairment is assumed, which is a scientifically based standard. Logically, states have turned to this high-utility template for

[7] Utah's bill to drop the per se limit to .05% BAC is set to go into effect December 30, 2018. Romboy, Dennis. "Utah House committee rejects bill to delay .08% DUI law." *Deseret News*. February 28, 2018. https://www.deseretnews.com/article/900011697/utah-house-committee-rejects-bill-to-delay-05-dui-law.html

cannabis-impaired driving. But alcohol and cannabis differ dramatically, especially in how they metabolize in the body, which is critical to impairment detection and assessment.

2.1 METABOLISM OF ALCOHOL AND PER SE STANDARDS

Unlike many drugs, alcohol is "hydrophilic," meaning it is water-soluble, dispersing throughout the body's water storage and processing systems. Taking into account a person's size, blood volume, stomach contents and metabolic rate, among other variables, a given dose of alcohol can be calculated to accurately estimate the level of blood alcohol concentration in a subject. Since alcohol begins metabolizing immediately, quickly overwhelming the liver's ability to process it, and then continues to metabolize at a constant, predictable rate, BAC can be determined not only at the time a sample was given, but can also be extrapolated back in time with some accuracy, which is helpful in assessing impairment levels in post-crash circumstances.

> *Currently, scientific evidence finds that significant impairment occurs in the majority of drivers at .05 BAC and in nearly all drivers at .08 BAC.*

Because alcohol impairment tracks directly with BAC, impairment levels can be estimated at various BAC levels. Currently, scientific evidence finds that significant impairment occurs in the majority of drivers at .05 BAC and in nearly all drivers at .08 BAC.[8] In the U.S., this association has led to all 50 states establishing a .08 BAC as a per se quantitative cut off point for assumption of impairment.[9] While police can arrest a driver for lower BAC levels by providing evidence of impairment, drivers who meet the .08% BAC level can be charged

[8] Moskowitz, H. and D. Fiorentino. "A Review of the Literature on the Effects of Low Doses of Alcohol on Driving-Related Skills." Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration; 2000. (DOT HS 809 028). Also, Moskowitz, H. and C. D. Robinson. "Effects of low doses of alcohol on driving-related skills: A review of the evidence." (Report No. DOT HS 807 280) Washington, DC: National Highway Traffic Safety Administration, SRA Technologies, Inc. 1988.

[9] Utah's bill to drop the per se limit to .05% BAC is set to go into effect December 30, 2018. Romboy. "Utah House committee rejects bill to delay .08% DUI law."

without evidence of impairment. It is alcohol's water-soluble characteristic that allows for this correlation with impairment, a characteristic that renders it an outlier among many psychoactive drugs in current widespread recreational use.

2.1.1 BENEFITS OF PER SE LEVELS

Establishing per se levels, as all states have done for alcohol, has many benefits:

- Per se levels are specific, applicable to all regardless of size, gender, etc. and simple to understand.
- Drivers know the law and can estimate how much they can drink and how long a given dose of alcohol will likely take to process through their system.
- Prosecutors need only meet the easily and accurately testable .08% BAC to bring charges, without the lengthy, labor-intensive process of having to establish impairment. Meeting or exceeding .08% BAC cleanly and clearly stipulates impairment in a court of law.
- Because the per se level for alcohol is scientifically sound based on thorough studies since the 1950s, standardized throughout the nation, and quick and easy to determine biologically in drivers, court cases tend to resolve quickly, either through pleas or trials, saving the courts and defendants time and money.
- Using the fairly simple and affordable technology used in alcohol breathalyzers, police officers can test drivers at roadside during the traffic stop, allowing for timely, non-invasive results that do not require lengthy observed behavioral sobriety testing to assess and arrest for impairment (although such field sobriety testing is routinely done anyway). Because this allows for quicker arrests, more police officers are available for other calls, and less time is spent on the side of the road, which is inherently dangerous, especially for impaired persons.
- Per se levels give a sense of fairness to the general public and the justice system. Because alcohol impairment tracks so closely to blood alcohol concentration, truly impaired drivers are being removed from the roadways—a policy that garners high public approval.

It's no wonder that many states legalizing recreational marijuana use—and some states that have legalized only medical use—have followed the template employed to determine alcohol-impaired driving by criminalizing per se levels of THC concentrations in blood.

2.2 CANNABIS AND PER SE STANDARDS

U.S. states run the gamut regarding cannabis-impaired driving approaches. As of this study's publication, 30 states,[10] many of which have legalized medical marijuana use, have zero tolerance policies for THC in drivers. A few that have legalized only medical cannabis have per se standards for impaired driving.[11] While some states with legal recreational cannabis have set per se limits that assume impairment, most have no specific set limits, preferring to establish impairment through other means.

TABLE 1: HOW STATES WITH CANNABIS PER SE LIMITS AND/OR LEGALIZED CANNABIS APPROACH THC-IMPAIRED DRIVING

State	Medical MJ Legal?	Recreational MJ Legal?	Impaired Driving
Alaska	Yes	Yes	No Specific Law
California	Yes	Yes	No Specific Law
Colorado	Yes	Yes	Reasonable Inference For THC 5 Ng*
Washington, D.C.	Yes	Yes	No Specific Law
Maine	Yes	Yes	No Specific Law
Massachusetts	Yes	Yes	No Specific Law
Montana	Yes	No	THC Per Se 5 Ng
Nevada	Yes	Yes	THC Per Se 2 Ng
Ohio	Yes	No	THC Per Se 2 Ng
Oregon	Yes	Yes	No Specific Law
Pennsylvania	Yes	No	THC Per Se 1 Ng
Washington	Yes	Yes	THC Per Se 5 Ng

***NOTE: "Reasonable Inference for THC 5 NG means that it can be inferred (by a jury or other legal parties) that a driver with at least 5ng/ml of THC in their blood is likely to be impaired. Such a designation is one step removed from the presumptive assumption of impairment inherent in per se levels.**
Source: Governors Highway Safety Association. https://www.ghsa.org/state-laws/issues/drug%20impaired%20driving

[10] See the Governors Highway Safety Association state-by-state list of cannabis-impaired driving laws here: https://www.ghsa.org/state-laws/issues/drug%20impaired%20driving

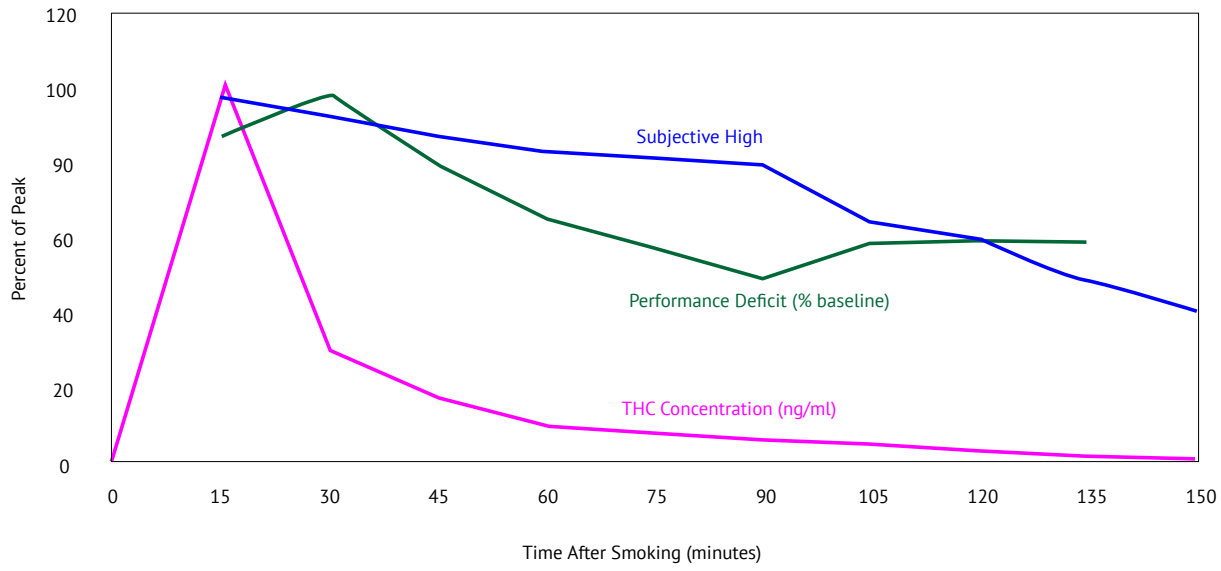
[11] In the table, "ng/ml" means "nanograms of THC per milliliter of blood plasma."

It's important to remove impaired drivers from the road without unfairly implicating the unimpaired. With per se limits, that involves establishing a direct and parallel relationship between blood levels of THC and levels of impairment. Using the data from DUI arrests, researchers have studied this very relationship. Overall, they find that per se laws face many challenges when cannabis's metabolic factors are taken into account.

2.3 METABOLISM OF CANNABIS

Unlike alcohol, which is "hydrophilic," cannabis is "lipophilic," meaning that it is stored in the fatty tissues of the body. This characteristic means that cannabis compounds, including the psychoactive THC, store and are detectable long term, up to a month or longer of abstinence, as THC leaches into the bloodstream from fatty tissues. Blood plasma levels and impairment vary greatly in subjects given the same dose. But blood plasma levels do follow a general trajectory after use.

FIGURE 1: TIME COURSE OF STANDARDIZED THC CONCENTRATION IN PLASMA, PERFORMANCE DEFICIT AND SUBJECTIVE HIGH AFTER SMOKING MARIJUANA



Source: National Highway Traffic Safety Administration. *Marijuana-Impaired Driving: A Report to Congress*. July 2017. Chart adapted from Berghaus et al. 1998, Sticht and Kaeferstein 1998 and Robbe 1994.

> *… THC level in blood plasma rises sharply after smoking, then peaks and rapidly declines.*

As Figure 1 shows, THC level in blood plasma rises sharply after smoking, then peaks and rapidly declines. Meanwhile, during that blood plasma level decline, performance deficit (a.k.a. impairment) is still rising, then peaks and remains relatively strong, even after THC levels have declined below many state per se levels. Peak impairment, occurring at 90 minutes after smoking, coincides with an 80% drop in THC level. Indeed, studies have found that the majority of DUI arrestees with only cannabis in their systems had blood plasma THC levels below the 5mg/mL per se standard.[12] This is likely because, in the real world of police work, the time between the traffic stop and drawing the biological specimen averages 165 minutes, rendering such a high per se standard virtually irrelevant. As the National Highway Traffic Safety Administration (NHTSA) finds, "While very high levels of THC do indicate recent consumption (by smoking marijuana) it is very unlikely a police officer would encounter a suspect and obtain a sample of blood or oral fluid within a short enough time for high THC levels to be detected…."[13] This means that states that rely on per se levels are likely to release drivers with below-per-se levels who are still quite impaired. As the chart shows, per se levels do not track parallel to impairment. Therefore, low blood plasma levels of THC are not a reliable indicator of recent cannabis use.

The initial peak blood plasma level in the chart shows that very high blood plasma levels of THC do indicate recent use, pointing to setting a high per se level. But such a high per se level suggests that under that amount a driver is not likely to be impaired, which is not supported by the chart. Such a policy is likely to also result in the release of many very impaired drivers on the roadway. Beyond the failure of blood plasma levels to correlate to impairment, THC metabolism is subject to several other variables, making for a highly individualized response.

12 Logan, Barry, Sherri Kacinko, Douglas Beirness. "An Evaluation of Data from Drivers Arrested for Driving Under the Influence in Relation to Per se Limits for Cannabis." AAA Foundation for Traffic Safety. May 2016.

13 Compton, Richard. *Marijuana-Impaired Driving: A Report to Congress*. National Highway Traffic Safety Administration. July 2017.

2.3.1 VARIABLE: METHOD OF INGESTION

While Figure 1 shows the trajectory of impairment for smoking cannabis, it does not account for the other methods of ingestion that have different trajectories. For example, eating cannabis via cannabis-laced edibles takes longer to impart impairment due to the time it takes to absorb through the digestive system. Because THC takes a longer time to be felt by the user, often higher quantities are ingested, making for inadvertent higher impairment. Moreover, even at these higher doses, edible cannabis is metabolized primarily by the liver, which sends less THC to the bloodstream, resulting in lower blood plasma levels compared to smoked cannabis, yet with a similar or higher peak quantity of THC in the body.[14] Figure 2 contrasts the rise, peak and decline of THC for smoked and eaten cannabis. As these quantities are metabolizing in the body, impairment is rising, peaking and remaining quite high long after the amount of THC measurable in the body, both for smoked and eaten cannabis, has fallen. The researchers note that edible THC registered much lower plasma concentrations and much slower onset and longer effects than smoked cannabis did in the dosed subjects.[15]

Other ingestion methods skew the correlation with impairment as well. The Ohlsson study showed a similar THC effect and blood plasma concentration trajectory between smoked and injected cannabis, and a quite different one for edibles, which register a much lower THC blood plasma level for the same dose.[16] Still other research finds that rectal use of cannabis (in this case via suppositories) imparts virtually immediate absorption—faster than all other methods of ingestion.[17] Research finds that "The bioavailability of the rectal route was approximately twice that of the oral route due to higher absorption and lower first-pass metabolism."[18]

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[14] Hollister L. E., H. K. Gillespie, A. Ohlsson, J. E. Lindgren, A. Wahlen and S. Agurell. "Do plasma concentrations of delta 9-tetrahydrocannabinol reflect the degree of intoxication?" Aug-Sep 1981. 21(S1).171S-177S. https://www.ncbi.nlm.nih.gov/pubmed/6271822

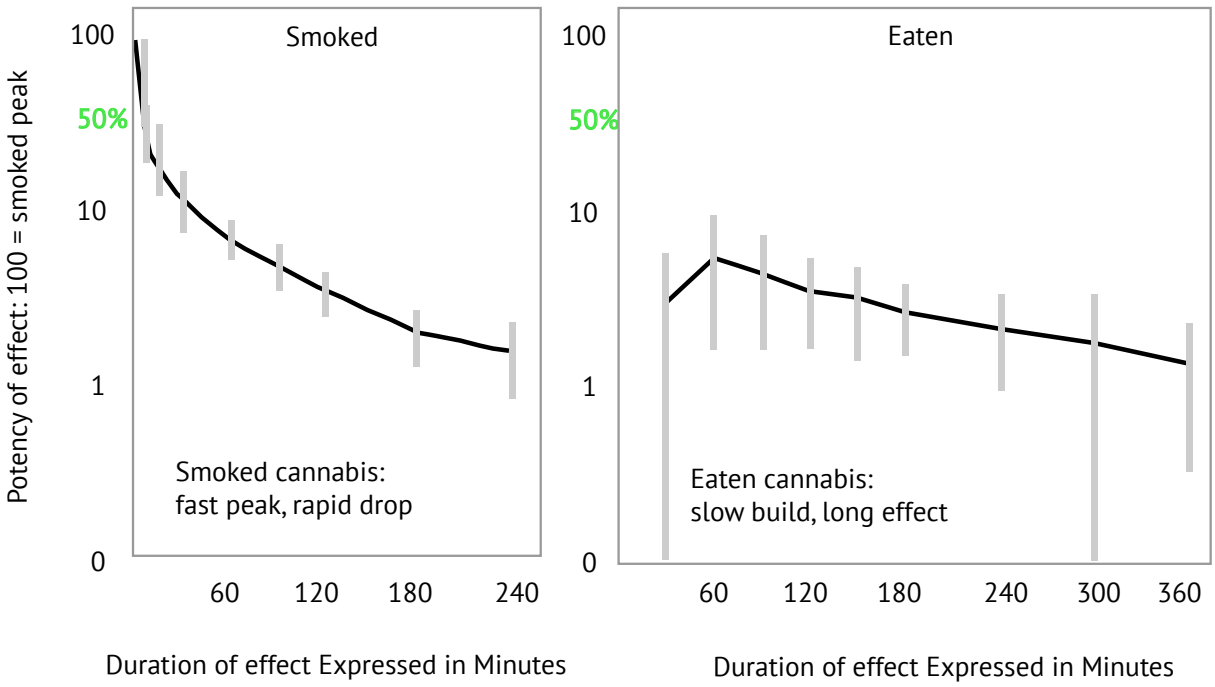
[15] Ohlsson, A., J. E. Lindgren, A. Wahlen, S. Agurell, L. E. Hollister and H. K. Gillespie. "Plasma delta-9 tetrahydrocannabinol concentrations and clinical effects after oral and intravenous administration and smoking." *Clinical and Pharmaceutical Therapeutics*. Sep. 1980 28(3):409-416.

[16] Ibid. Also see Huestis, Marilyn A. "Human Cannabinoid Pharmacokinetics." *Chemical Biodiversity*. Aug. 2007. 4(8). 1770-1804. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2689518/

[17] This is true of the majority of drugs, including alcohol, due to immediate access to the arterial bloodstream.

[18] Huestis. "Human Cannabinoid Pharmacokinetics."

FIGURE 2: INTOXICATING EFFECT DURATIONS OF SMOKED VS. EATEN CANNABIS



Source: Ohlsson, A. et al. "Plasma delta-9 tetrahydrocannabinol concentrations and clinical effects after oral and intravenous administration and smoking." ***Clinical and Pharmaceutical Therapeutics*****. Sep. 1980 28(3):409-416.**

2.3.2 VARIABLE: FREQUENCY OF USE

Another variable is whether the user is new to THC or a frequent user—a variable that significantly skews impairment levels among users at the same dosage, as well as their blood plasma levels. This is due to the cannabis's long half-life (67 days) in humans.[19] Research on frequent and long-term recreational cannabis users finds that, since cannabis stores in the fatty tissues of the body and can be released long after sobriety, chronic users maintain a certain amount of measurable THC in their plasma at all times, even while sober, sometimes exceeding the typical per se standard of 5 ng.[20] NHTSA finds that "Low

[19] Huestis, M. A., J. E. Henningfield and E. J. Cone. "Blood cannabinoids. I. Absorption of THC and formation of 11-OH-THC and THCCOOH during and after smoking marijuana." *Journal of Analytical Toxicology*. 1992 (16). 276-282.

[20] Bergamaschi, Mateus, Erin L. Karschner, Robert S. Goodwin, Karl B. Scheidweiler, Jussi Hirvonen, Regina H.C. Queiroz and Marilyn A. Huestis. "Impact of Prolonged Cannabinoid Excretion in Chronic Daily Cannabis Smokers' Blood on Per Se Drugged Driving Laws." *Clinical Chemistry*. March 2013 59(3) 519-526.

THC levels of a few nanograms per milliliter (ng/ml) in blood can result from relatively recent use (e.g., smoking within 1-3 hours) when some slight or even moderate impairment is likely to be present, or it can result from chronic use where no recent ingestion has occurred and no impairment is present."[21] In a state with per se limits, such drivers, while not impaired, would be assumed impaired and prosecuted under per se laws, without evidence of impairment.

> *…since cannabis stores in the fatty tissues of the body and can be released long after sobriety, chronic users maintain a certain amount of measurable THC in their plasma at all times, even while sober, sometimes exceeding the typical per se standard of 5 ng.*

In addition to the variable methods of ingestion, strength of THC in the cannabis product (which may not be known by the user), individualized intoxication levels at the same dose, and dosage over time all affect the trajectory of absorption and the rise, peak, decline and intensity of impairment, without tracking parallel to blood plasma level. Such inconsistencies limit the utility of blood-plasma determinations. As a result, NHTSA's *Report to Congress* concludes that "Thus, in contrast to the situation with alcohol, someone can show little or no impairment at a THC level at which someone else may show a greater degree of impairment." Echoing the same assertion, AAA's Foundation for Traffic Safety, in its 2016 study of cannabis-only impaired drivers and sober drivers, concluded that "a quantitative threshold for per se laws for THC following cannabis use cannot be scientifically supported."[22] Fairness demands that the justice system look past these highly variable numbers to assess actual impairment.

21 Compton. *Marijuana-Impaired Driving*. 7.

22 Logan, B., S. L. Kacinko and D. J. Beirness. "An Evaluation of Data from Drivers Arrested for Driving Under the Influence in Relation to Per se Limits for Cannabis." AAA Foundation for Traffic Safety. 2016. This study examined law enforcement and laboratory findings on 602 DUI-marijuana-only drivers in a pool of 4,799 non-specific DUI drivers and compared them with 349 sober drivers.

> *…NHTSA's Report to Congress concludes that "Thus, in contrast to the situation with alcohol, someone can show little or no impairment at a THC level at which someone else may show a greater degree of impairment."*

2.4 ZERO TOLERANCE CANNABIS-POSITIVE DRIVING POLICIES

With such a complexity of variables to consider and no valid biological measurement that correlates to impairment, most states have adopted zero tolerance policies for drivers who test positive for cannabis. Certainly, zero tolerance laws attempt to keep the roads free of impaired drivers. By the same token, banning drivers over 60 or under 25, anyone on psychiatric medications, anyone who hasn't had a full night's sleep, etc. would aim to make the roads a safer place as well. But such blunt instruments punish drivers based on statistical tendencies rather than culpable impairment.

> *While a zero-tolerance bright line is convenient for arrest and prosecution, and can feel clean and simple from a moral perspective, it inevitably punishes the unimpaired along with the impaired.*

While a zero-tolerance bright line is convenient for arrest and prosecution, and can feel clean and simple from a moral perspective, it inevitably punishes the unimpaired along with the impaired. To consider this from a purely scientific standpoint, disregarding the decades-old vestiges of social stigma associated with cannabis use, it's useful to imagine how the driving population would react if alcohol or prescription medicines were treated in the same manner:

- If alcohol use could be detected days or weeks after use, long after sobriety, and such detection would result in a driver's arrest without evidence of impairment, would that be just?
- If any driver with a constant low blood plasma level due to continuous use of anti-anxiety medication (8.3% of Americans), anti-depressants or other psychiatric drug (one in six Americans),[23] pain medication, cough syrup or even head cold medicines could be arrested without evidence of impairment, would that be just?

2.5 RAMIFICATIONS OF PER SE-BASED ARRESTS AND ZERO TOLERANCE POLICIES AND THE NEED FOR STANDARDS

The consequences of per se-based or zero tolerance-based DUI arrest should not be treated lightly. In many states, a DUI due to per se limits or zero tolerance requires the officer to immediately suspend the subject's driver's license before the case is tried, and then final dispensation can only occur after the toxicology tests are completed and received by the courts. According to NHTSA's *Report to Congress*, "The [toxicology] tests take a few hours or less to conduct, but large backlogs in many State laboratories conducting the testing can result in long delays before results are available."[24] This means that before the accused has the opportunity to defend himself in court, his means of transportation, which often is his means for making a living, has been confiscated. While some people have the financial wherewithal to find other means of transportation, many do not, affecting their employment and the family members who depend on them.

> *"…before the accused has the opportunity to defend himself in court, his means of transportation, which often is his means for making a living, has been confiscated."*

[23] Moore, Thomas J. and Donald R. Mattison. "Adult Utilization of Psychiatric Drugs and Differences by Sex, Age, and Race." *Journal of the American Medical Association*. February 2017. https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2592697

[24] Compton. *Marijuana-Impaired Driving*. 14.

In addition to license suspension, usually the driver's vehicle is impounded.[25] If so, the driver—often even if acquitted of the DUI charge—must pay the towing and daily storage fees to get the car out of impound. The fees are typically hundreds of dollars—beyond the reach of many families. In this way, these policies constitute punishment before conviction, violating our innocent-until-proven-guilty legal framework. While no standard is perfect, such consequential impact of DUI-cannabis arrest, combined with the lack of correlation between THC impairment and biological testing, argues for a more-just standard. The next section examines current laws on impaired driving.

[25] Impounding is common practice. Most of the time, the vehicle cannot be parked safely and/or legally by the highway, or on nearby private property, such as a business. Obviously, a suspected impaired driver cannot be permitted to drive the car home either, however a licensed and sober passenger—in the rare case there is one—may do so if the driver consents to it.

PART 3

ASSESSMENT OF CANNABIS-IMPAIRED DRIVING

3.1 CURRENT LAWS ON DRUG-IMPAIRED (INCLUDING ALCOHOL-IMPAIRED) DRIVING

In many states, arrests for driving under the influence of illegal drugs do not need to establish impairment because driving under the influence of illegal drugs of any quantity is prohibited.[26] In instances of legal drugs, there often must be evidence of impairment. It's useful to compare the way we approach impaired driving due to illegal drugs, legal drugs (medications), legalized marijuana (for medical or recreational use) and alcohol (the only recreational drug that is legal in all 50 states). While laws and policies vary somewhat among states, the following approach is generally true for the U.S. as a whole.

[26] But some states have per se laws for illegal drugs, even street drugs like heroin and cocaine. For a state-by-state breakdown, see: Lacey, John, Katharine Brainard and Samantha Snitow. *Drug Per Se Laws: A Review of Their Use in States*. Pacific Institute for Research and Evaluation, for the Office of Behavioral Safety Research of the National Highway Traffic Safety Administration. July 2010.

Driving under the influence of illegal drugs: Often, a driver with any amount of illegal drugs in his system, such as heroin or cocaine, is considered under the influence of that drug, regardless of impairment. The initial traffic stop is usually triggered by reckless or improper driving behavior observed by law enforcement, which may include drug-specific markers,[27] and confirmed through laboratory testing of body fluids where possible.[28] Simple detection—or in some cases, assessment through drug evaluation (field sobriety testing and other observations, which will be explained in detail in the next section)—meets probable cause for arrest, and a positive laboratory specimen, if available, provides additional evidence for prosecution. For many years and still in many states, cannabis falls under this category when it comes to driving under the influence.

Drivers under 21 under the influence of drugs (including alcohol): Since the legal age for drinking alcohol is 21 nation-wide,[29] and for marijuana consumption in marijuana-legal states, drivers under 21 years old with any amount of drugs[30] (including alcohol, in some states up to .02% BAC, which is considered zero tolerance) in their systems can be charged for driving under the influence regardless of impairment. Again, mere detection is the legal bar, which is met through laboratory testing of body fluids or roadside breath testing for alcohol.

Driving under the influence of prescription medication: Because prescription medication is legal, suspected DUI drivers on legally prescribed medications with possible psychoactive effects require a rigorous determination of impairment through sobriety assessment by law enforcement combined with laboratory testing of body fluids to confirm which drug was ingested.

Driving under the influence of alcohol: Since alcohol is legal for recreational use in all states, a driver who has consumed alcohol must be assessed for impairment. Mere

[27] This refers to driving characteristics that correlate to specific classes of drugs, for example making a turn too soon is a marker for stimulant use, whereas turning too late is correlated with central nervous system depressants. See the next section for more detail.

[28] Many drugs cannot be detected by laboratory testing, and testing for intoxicants other than commonly used illegal drugs (such as Tide pods or "designer" drugs) is generally outside of crime labs' capabilities.

[29] This went nation-wide in 1986 when Congress required all states to raise their alcohol drinking ages to 21 or lose some federal transportation funding.

[30] Excluding legally prescribed medication present at the legal dosage.

detection of alcohol is not enough to constitute being impaired by alcohol. Impairment can be met through two means:

- *Determination of impairment*: A driver with a blood-alcohol level below .08% can be arrested for DUI through determination of impairment by law enforcement. The arresting officer must establish impairment—typically through observed driving behavior, physiological markers of alcohol impairment and/or field sobriety testing.
- *Per se law*: Since 2004, all U.S. states stipulate that .08% blood alcohol concentration (BAC) and above constitutes impairment too great to operate a vehicle safely. The legal bar is met when the driver submits a specimen (breath, urine, blood, etc.) for testing and the test returns a BAC of .08% or above.[31]

3.2 THE LOGICAL SOLUTION FOR CANNABIS-IMPAIRED DRIVING ASSESSMENT

Due to blood-alcohol content's consistent correlation with impairment, per se laws are fair assessments of alcohol impairment, but not of marijuana impairment. Since alcohol is a legal drug, mere detection of it in a driver's system is not probable cause for arrest. In this way, zero tolerance policies are not appropriate for legal drugs, such as alcohol, prescription medication, medical marijuana and legal recreational marijuana. Where marijuana use is legal, either for medical or recreational use, it is logical and fair for the legal bar of impaired driving to be met by assessment of impairment. The next section discusses how this is currently accomplished and common-sense steps jurisdictions can take to anticipate the legalization of marijuana in terms of assessing marijuana-impaired drivers.

Due to blood-alcohol content's consistent correlation with impairment, per se laws are fair assessments of alcohol impairment, but not of marijuana impairment.

[31] As of publication time, Utah's stricter .05% BAC per se standard is set to go into effect December 30, 2018.

PART 4

HOW LAW ENFORCEMENT DETERMINES AND ASSESSES DRIVING IMPAIRMENT

4.1 FIELD SOBRIETY TESTS

Driving is a divided-attention skill involving observation, perception, reaction, coordination and judgment, among other aptitudes. Lack of sobriety inhibits a drivers' ability to observe changes in the driving environment, perceive them correctly, judge them accurately, anticipate situations and assess risks, make quick and logical decisions, and possess the reaction time and physical coordination to act swiftly, skillfully and safely. Field Sobriety Tests (FSTs) evolved originally as a means for police to ascertain alcohol impairment, largely through divided-attention skills testing. Since the widespread use of legal and

illegal drugs, the FST has evolved to allow police to assess other drug use as well as level of impairment. The basic-level Standardized Field Sobriety Test (SFST) uses three metrics:[32]

1. Horizontal Gaze Nystagmus (HGN): Ingestion of alcohol causes involuntary horizontal jerking of the eyes when the gaze is held at the extreme outer corner of the eye. The range of jerking varies directly with the driver's BAC. In this test, the driver is instructed to keep his head still while following with his eyes an object, such as a pen, moving horizontally in front of him. The officer is looking for this involuntary jerking of the eyes, and "lack of smooth pursuit" of the driver's gaze, which are physiological markers specific to alcohol,[33] to assess the presence of alcohol. It also allows the officer to observe the driver's eyes for known markers of medical conditions, such as concussion, that may have caused the impairment that triggered the traffic stop, or known markers of other drug use, which may be relevant to cannabis.[34]
2. Walk-and-Turn Test (WAT): This divided attention test requires the driver to walk heel-to-toe in a straight line, turn and walk back again in a specific manner as demonstrated by the officer. It tests the driver's coordination, balance and ability to follow instructions.
3. One Leg Stand (OLS): This test requires the driver to stand on one leg and count out loud, dividing the attention between moving and thinking. This tests the driver's balance, coordination, and his ability to follow instructions.

> *Field Sobriety Tests (FSTs) evolved originally as a means for police to ascertain alcohol impairment, largely through divided-attention skills testing.*

[32] NHTSA. "DWI Detection and Standardized Field Sobriety Test (SFST) Refresher: Instructor Guide." https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/sfst_ig_refresher_manual.pdf

[33] And other central nervous system depressants, PCP, and some other drugs. High levels of alcohol (and CNS depressants and PCP) will also present vertical gaze nystagmus, which is a vertical jerking of the eyes. These are not known markers for cannabis.

[34] For cannabis this would include rebound dilation and bloodshot eyes, as described later in this section.

Additional optional sobriety tests involve standing on both feet, leaning slightly backward and estimating 30 seconds (called the "Modified Romberg"), touching the nose with the right or left index finger six times as directed by the officer (the Finger-to-Nose), and others. Whether the driver fails, *and how he fails*, inform the officer's opinion as to whether the driver is impaired or not, and by which classes of drugs. Because field sobriety tests evaluate divided attention skills, they provide fairly accurate assessments of driving impairment, no matter what substance the driver may have ingested. In the case of cannabis, a driver's failure to perform a field sobriety test as demonstrated, combined with a THC-positive reading on a roadside testing device, provides adequate reasonable suspicion for further investigation or, more typically, probable cause for DUI arrest, as well as cause to invoke "implied consent." All 50 states confer driver's licenses on the condition that if a driver is suspected of impairment, his consent to biological testing for impairing substances is implied by electing to drive a vehicle.

4.2 DRUG RECOGNITION EXPERT EVALUATIONS

For many years, police used field sobriety tests and often alcohol breathalyzers to identify alcohol-impaired drivers. Then, in the 1960s, when illicit drug use became popular and accessible to mainstream society, police officers found that many dramatically impaired drivers registered zeroes on the alcohol breathalyzer machines. With impaired driving laws focused on alcohol, there was little legal justification in removing drugged drivers from the roadway, creating roadway hazards and lack of accountability.

In response, in the 1970s a group of Los Angeles Police Department traffic officers developed an evaluation process that officers could use to accurately assess, through physical observation and behavioral evaluation, what types of drugs were impairing individual drivers, paving the way for legal arrest and prosecution of drug-impaired drivers. This program currently operates in all 50 states, training "drug recognition expert" (DRE) officers to recognize the signs and symptoms of drug use for investigating suspected drug-impaired driving cases.[35] Drug

[35] IACP, the International Association of Chiefs of Police, administers the program, which is now international. In some jurisdictions, these officers are known as "drug recognition evaluators." A shorter drug recognition training program called ARIDE (Advanced Roadside Impaired Driving Enforcement) trains officers in some basic forms of drug evaluation.

recognition expert officers (DREs) are trained to conduct evaluations that accurately[36] identify which drug(s), including cannabis, are impairing a driver.

The DRE evaluation includes the SFST and examination for physiological markers specific to certain classes of drugs, including cannabis, that are used to determine current psychoactivity specifically by those drugs. Physiological markers[37] for cannabis include, but are not limited to:

- bloodshot eyes,
- rebound dilation (pupils that, under bright light, initially constrict, then dilate),
- eyelid tremors,
- lack of convergence (eyes cannot cross when observing an object moving toward the bridge of the nose) and
- pulse elevated beyond normal rate.

DRE evaluations do not consider just one or two markers as proof of use of a certain drug, but the totality of the markers and behavioral observations to determine use and assess impairment.

DRE evaluations do not consider just one or two markers as proof of use of a certain drug, but the totality of the markers and behavioral observations to determine use and assess

[36] NHTSA studies verify DRE evaluation accuracy rates—where toxicology results confirm the drug(s) identified by the DRE officer—at between 94% and 98%. Bigelow, G.E., W. E. Bickel, J. D. Roache, I. A. Liebson and P. Nowowieski. "Identifying types of drug intoxication: laboratory evaluation of the subject examination procedure." Washington, D.C.: National Highway Traffic Safety Administration. 1985. DOT HS 806 753 (the 98% finding); Richard P. Compton. "Field evaluation of the Los Angeles Police Department drug detection program." Washington, D.C.: National Highway Traffic Safety Administration. 1986. DOT HS 807 012 (the 94% finding).

[37] Bloodshot eyes were found at or above 5ng/ml THC blood plasma levels in Ohlsson, A. et al. "Plasma delta-9 tetrahydrocannabinol concentrations and clinical effects after oral and intravenous administration and smoking." *Clinical and Pharmaceutical Therapeutics*. Sep. 1980 28(3):409-416.

impairment. The DRE evaluation is not conducted roadside, but DRE officers are often called to traffic stops to conduct quick assessments to assess whether a driver is likely drug-impaired and DRE evaluation is an appropriate step. Typically, DRE evaluations are conducted in police stations. They not only assess drug use and impairment, but also rule out impairment due to non-drug causes such as medical conditions or simple lack of physiological markers associated with drug use.

DRE evaluations, corroborated by laboratory results,[38] can establish legal impairment sufficient for DUI-D (driving while under the influence of drugs) charges. As NHTSA explains:

> *A properly trained officer who follows good investigatory techniques and carefully documents their observations can make a convincing case that a driver was too impaired by alcohol to drive safely. The same is true for suspected marijuana-impaired drivers. The lack of an "impairment standard" equivalent to BAC level does not prevent the successful prosecution of a marijuana-impaired driver. The lack of toxicological evidence simply means that the officer has to offer other evidence that the driver was under the influence of marijuana and too impaired to drive safely.*[39]

DRE evaluations are not always conducted in DUI traffic stops. Even if drugs are a suspected cause of a driver's impairment, if a driver has a BAC above the legal per se limit of .08%, usually the investigation will stop at that point and the driver will be charged with DUI-alcohol. This policy is common in departments because, compared to the far quicker and more easily prosecuted per se DUI arrest, DRE evaluations take one to two hours to conduct and document, removing officers from the field for a long time for what is usually only a misdemeanor arrest. For traffic arrests, DRE evaluations are usually used only when dramatically impaired drivers have below .08% BAC and must be assessed for drug use so as to be removed from the road for public safety. As a result, the cannabis- and alcohol-impaired driver is often arrested for DUI-alcohol only, skewing the statistics on DUI driving toward DUI-alcohol only.

[38] In cases where laboratory confirmation is difficult or impossible, the DRE evaluation can be the sole evidentiary determination of impairment.

[39] Compton. *Marijuana-Impaired Driving*. 28.

> *For traffic arrests, DRE evaluations are usually used only when dramatically impaired drivers have below .08% BAC and must be assessed for drug use so as to be removed from the road for public safety.*

NHTSA, AAA and others have conducted research using DRE arrests and evaluations of cannabis-only impaired drivers, finding:

- significantly poorer performance on the psychophysical tests (walk-and-turn test, one-leg-stand test, and finger-to-nose test) in THC-positive drivers compared to sober drivers, as well as markers such as bloodshot and watery eyes, eyelid tremors, lack of convergence and rebound dilation.[40]
- while the FST could predict impairment, it did not exhibit markers specific to THC except on the finger-to-nose test
- the combination of the physiological, cognitive and psychomotor indicators could reliably predict THC use, but not whether the driver's THC concentration was above or below 5 ng/ml threshold.[41]
- "there is no evidence from the data collected, particularly from the subjects assessed through the DRE exam, that any objective threshold exists that establishes impairment based on [blood plasma level] THC concentrations in suspects placed under arrest for impaired driving."[42]

Because DRE evaluations document physiological markers (such as rebound dilation and bloodshot eyes), coordination/balance and judgment/reaction time (through field sobriety testing) that appear when a drug is currently psychoactive in a driver, they are a much more accurate indicator of marijuana impairment than blood-plasma levels. Establishing impairment through DRE evaluation, corroborated by toxicological screening for marijuana,

40 Ibid. 29.

41 Logan, Kacinko and Beirness. "An Evaluation of Data from Drivers Arrested for Driving Under the Influence in Relation to Per se Limits for Cannabis." 29.

42 Ibid.

is the most accurate means for detecting and assessing marijuana-impaired drivers, rather than simply marijuana-positive drivers.

4.3 COMPENSATING FOR LAW ENFORCEMENT SUBJECTIVITY

Relying entirely on officer observation and DRE evaluations in arrest and prosecution of DUI-drug cases is a compromise. The general public is uncomfortable with a driver's conviction being based entirely on evidence that cannot be independently reviewed. And yet, given the biology of cannabis ingestion, this is the most just approach currently available. Still, modern technology can and should be used to corroborate law enforcement findings where possible.

4.3.1 MORE RESEARCH NEEDED ON CANNABIS-IMPAIRED DRIVING

Establishing a biologically measurable threshold that correlates to THC impairment would make cannabis-impaired driving arrests as objective as per se alcohol DUI arrests are currently. Research continues to explore options, but is challenged by cannabis's Schedule 1 drug designation. While recent federal regulations have loosened restrictions on growing cannabis for research purposes, any restriction hampers research. In addition to removing the scheduling of cannabis, research needs to be a higher priority.

> *"Research continues to explore options, but is challenged by cannabis's Schedule 1 drug designation."*
>
> Teri Moore and Dr. Adrian Moore

4.3.2 VIDEO CORROBORATION OF IMPAIRED DRIVING, FIELD SOBRIETY TESTING AND DRE EVALUATIONS

While dashcams and bodycams are an added expense for law enforcement, they provide some objective verification of the observations the officer used to form the opinion of impairment. Many police departments use dashcams and bodycams, and as more court cases are corroborated by video footage, more court cases will be expected to have video corroboration. But there are some caveats to the mandated use of dashcams and bodycams.

While dashcams and bodycams are an added expense for law enforcement, they provide some objective verification of the observations the officer used to form the opinion of impairment.

Requiring dashcam footage of driver impairment demands that police officers follow impaired drivers until significant video-obvious impairment is shown. Such a requirement changes an officer's behavior, prioritizing prosecutability over safety. This puts the public, the impaired driver, and his passengers at increased crash risk. As soon as an officer believes a driver is likely to be intoxicated, and the vehicles are at a safe place to do so, he or she should pull the car over.

Police officers are trained to recognize numerous driving behaviors that are markers of intoxication. For example, NHTSA's "The Visual Detection of DWI Motorists" manual identifies driving observation cues that are associated with intoxicated drivers, including stopping problems (too far, too short, or too jerky), accelerating or decelerating for no apparent reason, turning too late or too soon, lane-straddling, stopping abruptly and/or for no apparent reason, slow response to traffic signals, etc. These cues are so closely correlated that NHTSA has assigned each group of cues a numerical likelihood of the driver being intoxicated. The p-values in Table 2 show the likelihood of driver impairment for each category of cues.[43] For example, "p= .65" for "weaving plus any other cue" means that the driver who exhibits this behavior has a 65% chance of being intoxicated, based on DUI and traffic arrest statistics. These cues lead to targeted stopping of impaired drivers; in contrast, stopping traffic randomly at night results in a mere 3% probability of detecting intoxicated driving (p= .03).[44]

For purposes of space, Table 2 shows the cues related to only one category: Problems Maintaining Proper Lane Position. The guide documents many cues for each of the other

[43] NHTSA. "The Visual Detection of DWI Motorists." https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/808677.pdf

[44] Ibid.

categories of impaired driving behaviors as well: Speeding and Braking Problems, Vigilance Problems and Judgment Problems.

TABLE 2: DWI DETECTION GUIDE

Weaving plus any other cue: p = at least .65 Any two cues: p = at least .50
Problems Maintaining Proper Lane Position p=.50–.75

- Weaving
- Weaving across lane lines
- Straddling a lane line
- Swerving
- Turning with a wide radius
- Drifting
- Almost striking a vehicle or other object

Many of these cues may not be visible in dashcam footage, especially at night. Mandating that officers postpone pulling over a likely impaired driver so as to get footage for prosecution is a danger to public safety.

> *Traffic stops are almost always the result of observed driving behavior—with or without a violation.*

Traffic stops are almost always the result of observed driving behavior—with or without a violation. Mandating that police refrain from stopping a suspected impaired driver while waiting for a moving violation to occur puts the public at risk. Officers should be required to articulate the observed driving behavior, whether it's a violation or an impaired driving cue, such as driving at night without headlights (p = .55-.65), to meet the bar of reasonable suspicion that is grounds for a legal traffic stop. Corroborative video is helpful and should be encouraged, but should not be required for conducting a traffic stop or for charges to be filed. Video of the impaired driving behavior cues without a traffic violation occurring can and should be explained in court by the officer to provide corroborative evidence where possible.

Once the car is stopped, bodycams often provide visible evidence of intoxication. But, similar to dashcam use, the impairment cues in field sobriety testing may or may not be visible on video footage, especially at night. For example, while cues of coordination problems are most easily apparent, judgment cues often are not, especially in something like time estimation. Bodycam video of the DRE evaluation is generally helpful, but it cannot show many DRE evaluation assessments, such as pupil size under near total darkness, body temperature, heart rate, blood pressure, muscle tone, etc. Unless there is evidence to the contrary or some other reason for doubt, the officer's stated opinion should meet the bar of evidence. Otherwise, it is likely that officers will release impaired drivers whose impairment is not obvious on video, endangering the public.

4.3.3 THE LEAST-IMPERFECT OPTION FOR MARIJUANA-IMPAIRED DRIVING INTERDICTION

Ideally, the public could judge every action a police officer takes, but mandating that video footage corroborate the basis of every police officer opinion is simply not realistic. Such realities must be considered when crafting policies for DUI identification, arrest and prosecution.

Ideally, the public could judge every action a police officer takes, but mandating that video footage corroborate the basis of every police officer opinion is simply not realistic.

While objective evidence should be encouraged, to some degree, police officers must be trusted to conduct themselves with integrity. Therefore, it is critical that applicant selection be judicious, as police must be trustworthy and respectful of the rule of law—especially when no one is looking. Officers who are found to abuse such public trust must be removed from duty.

Determining driver impairment will never be perfect, but an approach that targets the real public danger—demonstrated impairment—is the most-just option currently available.

PART 5

TYPES OF ROADSIDE CANNABIS TESTING AND EFFICACY

5.1 IMPLIED CONSENT LAWS

In the U.S., driving is considered a privilege rather than a right. As such, states confer driver's licenses with a condition of "implied consent." This means that, by operating a vehicle, a driver consents to providing a biological specimen for testing when impairment is questioned by law enforcement. Refusal to provide a test specimen results in immediate suspension or revocation of a driver's license, and such a refusal has been found to result in harsher average penalties than provision of a specimen.[45]

> *"In the U.S., driving is considered a privilege rather than a right."*

[45] Voas, Robert B., Tara Kelley-Baker, Eduardo Romano and Radha Vishnuvajjala. "Implied-Consent Laws: A review of the literature and examination of current problems and related statutes." *Journal of Safety Research*. 40(2). 2009. 77-83.

In most states, implied consent does not extend to warrantless blood draw to measure THC through blood plasma testing, due to its physical invasiveness, except in cases of significant injury or fatality.[46] State-level cannabis legalization has increased the demand for less-intrusive and more-practical options for law enforcement. As a result, more THC-detection testing alternatives are now available, but objective research into their efficacy remains scant.

State-level cannabis legalization has increased the demand for less-intrusive and more-practical options for law enforcement. As a result, more THC-detection testing alternatives are now available, but objective research into their efficacy remains scant.

5.2 TYPES OF TESTING FOR MARIJUANA-IMPAIRED DRIVERS

Several types of biological testing for drug use are currently in use or in development:

Blood Plasma:[47] This is considered the gold standard for THC detection, but is fraught with impracticality, because blood plasma levels fall so rapidly and DUI-drug arrests are so lengthy. For example, in a typical DUI arrest scenario, a police officer must take the following time-consuming steps listed in Table 3, making blood plasma level detection at time of the traffic stop effectively impossible.

46 "A recent U.S. Supreme Court case decision said that warrantless blood tests of alcohol concentration are not generally allowed (*Missouri v. McNeely*, No. 11-1425, decided April 17, 2013), although warrantless breath alcohol tests are generally permissible as they are less intrusive than blood tests of alcohol concentration (*Birchfield v. North Dakota*, No. 14-1468, decided June 23, 2016)." Compton. *Marijuana-Impaired Driving*. 8.

47 This liquid remains after red and white blood cells have been sequestered and removed from centrifuged blood. Men and women have differing levels of plasma to red and white blood cell counts, which must be accounted for during testing. Still, blood plasma is regarded as the gold standard for cannabis testing, and is used especially in traffic fatalities and crashes to determine level of THC in the driver's system. Since approximately 90% of THC in blood is circulated in plasma and the rest in red blood cells, blood plasma is generally used for cannabis blood testing, unlike alcohol, which is measured in whole blood. The whole blood level for cannabis would be significantly less than the blood plasma level due to dilution by red and white blood cells.

TABLE 3: ESTIMATED TIME SPENT BY PROCEDURE

Estimated Time Spent	Procedure
10-15 minutes	The officer conducts the traffic stop, investigates, and forms the opinion that the driver may be impaired, and, if available, conduct a roadside alcohol breathalyzer test to determine if alcohol is present.48
30-60 minutes	Then the officer must find a safe location to conduct a field sobriety test and do so, and record the results—usually a 10- to 15-minute test. If the impairment demonstrated exceeds the alcohol present—if any—and if the driver does not have a sober, licensed passenger whom he will allow to drive his car, the officer will likely have to call a tow truck, conduct a required impound inventory of the car (a search for illegal, live, flammable, valuable or hazardous items), and wait for the car to be towed. This takes 30 to 60 minutes at best.
60-90 minutes	Then the officer must transport the subject to the station. In departments that have them, specially trained officers who can evaluate subjects for drug use may be summoned to conduct a drug-recognition expert evaluation to determine which drugs, if any, are likely the impairing substance, typically a one to one-and-a-half-hour procedure.
30-60 minutes	Unless the arrest was crash-related with serious bodily injury or death, the officer must then request a search warrant for a blood draw. This can be conducted over the phone, but after hours may result in a lengthy process to contact a judge to obtain the necessary warrant.
30 minutes	Finally, unless the department staffs a trained phlebotomist, the officer must transport the subject to a facility to obtain the blood specimen.

Unsurprisingly, the average time between traffic stop and blood draw is 165 minutes—or two and a half hours.[49] *Even if the driver had smoked the cannabis one minute before the traffic stop*, the driver's blood plasma THC level would have fallen 80%-90% in the first hour after ingestion, and even more so after two and a half hours, as shown in Figure 1 previously. Such time lags create a high likelihood that if THC is detected at all, it would have fallen

[48] If the driver's alcohol level is above the .08% per se standard, the driver will, in most cases, be arrested for that charge at this time, even if there is evidence that drugs may be contributing to impairment. As well, if the driver's alcohol level is dangerously high (typically around .3%-.4%) he or she will be transported to the hospital for treatment of alcohol poisoning.

[49] Banta-Green, Caleb, Ali Rowhani-Rahbar, Beth E. Ebel, Lydia M. Andris, and Qian Qiu." Cannabis Use among Drivers Suspected of Driving Under the Influence or Involved in Collisions: Analyses of Washington State Patrol Data." AAA Foundation for Traffic Safety. May 2016. https://aaafoundation.org/wp-content/uploads/2017/12/CannabisUseAmongDriversInWashington.pdf

below typical per se levels. Meanwhile, the driver's impairment at the time of the traffic stop may have been quite significant, and would likely continue to be so, even after THC blood levels have declined dramatically after two and a half hours.

Of course, the time lag problem can be overcome by setting very low per se levels. In that situation, the THC detected and measured in the delayed blood specimen could fulfill the requirement for per se-based charges, but such low per se limits are almost certain to risk incarcerating frequent users who are sober at the time of the traffic stop, or even, some studies suggest, unimpaired drivers with environmental exposure only.[50] On the other hand, if the driver's method of ingestion was edibles, it's likely that blood plasma will register a minimal THC level, even with high impairment, as discussed in Part 2 of this study.

Urine: Urine samples are tested for THC metabolites. They are less invasive than a blood draw, conform to implied consent policies, and therefore do not typically require a warrant. But the specimen must be collected at the police station or at a laboratory facility, and thus is subject to the initial time delays of alcohol breathalyzer testing, field sobriety testing, vehicle inventory and impound, transport to the station and drug evaluation testing. The results can show use, but not impairment.

Vapor: Testing via breathalyzer is another form of non-invasive testing that has promise for high sensitivity in detecting recent use of cannabis. Several companies, such as Cannabix Technologies and Hound Labs, are currently in the development stage with marijuana breathalyzer devices, but none is available as of this writing.

Sweat/Hair: Hair samples detect past drug use and have little utility for impaired driving. Plus, hair can be contaminated by environmental exposure to cannabis. Sweat is in the early stages of development as a test for cannabis use and cannot be currently employed.

Oral Fluid: This much quicker and simpler test involves the officer swabbing the interior of the subject's mouth for a period of time. It provides the practicality of virtually immediate results from portable machines into which the swab is inserted. Examples of devices now available on the market include the Draeger DrugTest 5000 and Alere's DDS2. But, as with other detection methods, oral fluid demonstrates wide variation among individuals with the

[50] Cone, E. J., G. E. Bigelow, E. S. Herrmann, J. M. Mitchell, C. LoDico, R. Flegel and R. Vandrey. "Nonsmoker Exposure to Secondhand Smoke. III. Oral Fluid and Blood Drug Concentrations and Corresponding Subjective Effects." *Journal of Analytical Toxicology*. 2015. 39. 497-509.

same dose, and does not track with impairment.[51] The National Highway Traffic Safety's *Report to Congress* on marijuana-impaired driving found that the accuracy of oral fluids devices has not yet been clearly established. NHTSA also found that detectable THC in a driver (blood, oral fluid, etc.) did not establish impairment or distinguish between active use of marijuana, environmental exposure or contamination.

Confounding oral fluid testing even further, a study comparing two oral fluid tests (the Draeger Drugtest 5000 and Alere's DDS2) found that the devices registered differing levels of THC from the same sample and could not convert THC concentrations to blood concentrations.[52] This means the devices cannot accurately pinpoint blood plasma levels for per se-based arrest purposes. As well, the devices have trouble detecting orally ingested edible cannabis at all, limiting their use for simple THC screening.

One study found that edibles register far lower on oral fluid testing than smoked cannabis at equal dose.[53] Another study dosed participants round the clock with edibles for eight days and found that THC was detected in only 20.7% of participants via oral fluid testing, with that percentage decreasing as the study progressed.[54] And yet another study found that passive exposure to marijuana smoke produced positives in oral fluid for up to 30-45 minutes after exposure, peaking at 7.2 ng/ml, far higher than per se levels, although this contamination was

51 Huestis. "Human Cannabinoid Pharmacokinetics."

52 Newmeyer, Matthew N., Madeleine J. Swortwood, Maria Andersson, Osama A. Abulseoud, Karl B. Scheidweiler, Marilyn A. Huestis. "Cannabis Edibles: Blood and Oral Fluid Cannabinoid Pharmacokinetics and Evaluation of Oral Fluid Screening Devices for Predicting Δ^9-Tetrahydrocannabinol in Blood and Oral Fluid following Cannabis Brownie Administration." *Clinical Chemistry*. February 2017.

53 Newmeyer, Matthew N., Madeleine J. Swortwood, Allan J. Barnes, Osama A. Abulseoud, Karl B. Scheidweiler and Marilyn A. Huestis. "Free and Glucuronide Whole Blood Cannabinoids' Pharmacokinetics After Controlled Smoked, Vaporized, and Oral Cannabis Administration in Frequent and Occasional Cannabis Users: Identification of Recent Cannabis Intake." *Clinical Chemistry*. November 2016; Madras, Bertha K. "Are THC Levels in Oral Fluids, Blood Plasma Comparable After Oral Ingestion of Edibles Containing Cannabis or THC*?" Clinical Chemistry*. February 2017.

54 Milman, Garry, Allan J. Barnes, David M. Schwope, Eugene W. Schwilke, William D. Darwin, Robert S. Goodwin, Deanna L. Kelly, David A. Gorelick, Marilyn A. Huestis. "Disposition of Cannabinoids in Oral Fluid after Controlled Around-the-Clock Oral THC Administration." *Clinical Chemistry*. July 2010.

erased when the test was conducted away from the source of smoke.[55] Still, such findings suggest that oral fluid devices may need more testing and are of limited use currently.

5.3 CANADA AT THE FOREFRONT

In Canada, recreational use legalization took effect on October 17, 2018. In preparation, Canadian police departments have been on the forefront of assessing roadside THC screening/measuring devices. Even though the Draeger DrugTest 5000 was federally approved in Canada, many Canadian police departments, such as Ottawa, Vancouver and Delta, announced they will not be using the device to screen for marijuana-impaired drivers.[56] Instead, Ottawa's police department is doubling its DRE-trained officers, stating that Draeger only tests for THC presence, so the DRE evaluation is still needed anyway.[57] As the Royal Canadian Mounted Police concluded, "despite the incoming Draeger units, "the use of Standardized Field Sobriety Test training and Drug Recognition Experts will continue to be the primary enforcement tools against drug-impaired drivers."[58]

[55] Niedbala R. S, K. W. Kardos, D. F. Fritch, K. P. Kunsman, K. A. Blum, G. A. Newland, J. Waga, L. Kurtz, M. Bronsgeest and E. J. Cone. "Passive cannabis smoke exposure and oral fluid testing. II. Two studies of extreme cannabis smoke exposure in a motor vehicle." *Journal of Analytical Toxicology*. October 2005. 29(7). 607-615.

[56] "Pair of police forces in BC decides against using federally approved pot-screening device." Sept. 25, 2018. https://www.cbc.ca/news/canada/british-columbia/vancouver-police-delta-police-drager-marijuana-testing-device-1.4837466

[57] Kupfer, Matthew. "Ottawa police won't use roadside checks for pot checks." CBC News. Sept. 11, 2018. https://www.cbc.ca/news/canada/ottawa/ottawa-police-cannabis-test-1.4819520

[58] Davlos, Penny. CTV News. "Vancouver lawyer demonstrates pot test problems." Sept. 5, 2018.

PART 6

CONCLUSION AND RECOMMENDATIONS

More and more states are legalizing marijuana for medical and recreational use, which demands policies toward marijuana-impaired driving that protect public safety without penalizing legal marijuana users who are sober at the time they drive.

It's tempting to use a similar approach to that used for alcohol—the only other legal intoxicant—and to build policies around per se standards. But since cannabis body fluid levels don't parallel impairment, that's not a fair gauge of impairment as it is with alcohol. Indeed, it's possible for some cannabis users to register above per se levels when completely sober. It's also tempting to use the easy idea of zero tolerance, but that's not fair to sober drivers who still have measurable cannabis in their systems.

> *"The only fair solution is for police to assess drivers for impairment as we now do for low BAC alcohol-impaired drivers and drug-impaired drivers, and to conduct toxicology screens to corroborate that cannabis is present, rather than measuring irrelevant levels in body fluids."*
>
> Teri Moore and Dr. Adrian Moore

The only fair solution is for police to assess drivers for impairment as we now do for low BAC alcohol-impaired drivers and drug-impaired drivers, and to conduct toxicology screens to corroborate that cannabis is present, rather than measuring irrelevant levels in body fluids. Fortunately, screenings are less expensive, quicker and easier to do than measuring body fluid levels. It's concerning for some that this means impairment will be assessed entirely by police officers, but that is the most just option currently available. To address this concern, police should use dash- and bodycams to document impairing behavior when possible.

This approach suggests that police departments should prioritize their funding toward training DRE-qualified and/or ARIDE-qualified officers, as well as purchasing dash- and bodycams. States should prioritize funding toward toxicology labs to prevent backlogs, to ensure the speedy trials guaranteed by the U.S. Constitution.

Meanwhile, researchers continue to search for a biological cannabis test that gauges impairment. To that end, the federal government should demote cannabis from its Schedule 1 designation and remove current obstacles to growing and procuring cannabis for research purposes. While some regulations have loosened recently, it is not enough to encourage cannabis research.

This evidence-of-impairment-based approach leads to these recommendations:

1. Avoid per se standards and conduct THC detection screenings rather than assessing blood plasma levels, which don't correlate to impairment.
2. Mandate evidence of drug impairment as the main criterion for arrest. This targets the true danger to the public without penalizing sober users with detectable levels of marijuana in their systems.
3. Prioritize law enforcement training in ARIDE/DRE and dashcams and bodycams for more accurate and corroborative identification and assessment of drug-impaired drivers, and to generate more useful data on marijuana-impaired drivers.
4. Prioritize cutting down backlogs in toxicology laboratories so that justice for both impaired and unimpaired drivers is swift and fair. Rather than invasive testing of irrelevant blood plasma levels, use quicker and less expensive cannabis detection screenings.
5. At the federal level, deschedule marijuana to encourage research into marijuana-impaired driving. Prioritize NHTSA and university research on marijuana use and driving, and development of reliable technology to aid in roadside impairment determination.

ABOUT THE AUTHORS

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