Traffic Injury Prevention

ISSN: 1538-9588 (Print) 1538-957X (Online) Journal homepage: http://www.tandfonline.com/loi/gcpi20

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To cite this article: Ed Wood, Ashley Brooks-Russell & Phillip Drum (2016) Delays in DUI blood testing: Impact on cannabis DUI assessments, Traffic Injury Prevention, 17:2, 105-108, DOI: 10.1080/15389588.2015.1052421

To link to this article: http://dx.doi.org/10.1080/15389588.2015.1052421

Accepted author version posted online: 11 Jun 2015.
Published online: 11 Jun 2015.

TRAFFIC INJURY PREVENTION
2016, VOL. 17, NO. 2, 105–108
http://dx.doi.org/10.1080/15389588.2015.1052421

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Delays in DUI blood testing: Impact on cannabis DUI assessments

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ABSTRACT

Objective: This study examined the time from law enforcement dispatch to the first blood draw in cases of driving under the influence (DUI) vehicular homicide and a subset of DUI vehicular assault cases in Colorado in 2012. Laboratory toxicology results were also examined to understand the implications of delays in blood draws in cases of driving while under the influence of marijuana's delta-9-tetrahydrocannabinol (THC).

Methods: Colorado court records were reviewed and information regarding charges, presence of alcohol and/or drugs, time of law enforcement contact and blood draw, crash location, and other contextual factors were identified. The distributions of first blood draw times were studied by charge and by responding law enforcement agency. Toxicology data from a different cohort of DUI traffic arrests in Colorado and Washington were examined to determine the proportion of blood tests for THC that were above specified legal limits in those states.

Results: The average time from law enforcement dispatch to blood draw in cases of vehicular homicide and vehicular assault was 2.32 h (SD $\pm$ 1.31 h), with a range of 0.83 to 8.0 h and a median of 2.0 h. Data from DUI traffic arrests found that between 42 and 70% of all cannabinoid-positive traffic arrests tested below 5 ng/ml THC in blood, which is the legal limit in Colorado and Washington.

Conclusion: Given the current delays to blood testing in cases of arrests for vehicular homicide and vehicular assault in Colorado, many blood tests are unlikely to confirm that drivers who are impaired from smoking marijuana have THC levels above established legal limits.

ARTICLE HISTORY
Received 25 February 2015
Accepted 13 May 2015

KEYWORDS
driving under the influence of drugs (DUID); marijuana-impaired driving; vehicular homicide

Introduction

The Federal Bureau of Investigation reports that there were over 1.1 million driving under the influence (DUI) arrests in 2013 (Federal Bureau of Investigation 2013). States routinely use blood tests to confirm the presence or absence of alcohol and/or drugs suspected of causing driving impairment. Some states have zero tolerance drug laws to convict impaired drivers of driving under the influence of drugs (DUID) if any traces of specified drugs are present in the driver's blood (Walsh 2009). Other states have established *per se* limits of drug levels, beyond which a driver is defined as being DUID *per se* (Walsh 2009). With the legalization of recreational marijuana, Colorado instituted a permissible inference level for THC of 5 ng/ml in whole blood and Washington established a 5 ng/ml *per se* limit in blood if drawn within 2 h of the incident (Colorado Revised Statutes 2015; Revised Code of Washington 2014).

Alcohol is metabolized at a linear rate. This fact may be used by forensic toxicologists to backward-extrapolate what the blood alcohol content was at the time of arrest when multiple blood determinations are available. Marijuana's intoxicant delta-9-tetrahydrocannabinol (THC) is more problematic. THC's primary metabolite is nonpsychoactive 11- nor-9-carboxy-THC (THC-COOH; Couper and Logan 2004) and is not a reliable marker for impairment because it can be detected in blood for hours or even days after signs of impairment disappear. It can be detected in urine even longer, depending on the habits and body mass of the marijuana user. Prior studies have demonstrated that the body's metabolism of THC is dramatically nonlinear (Huestis et al. 1992; Toennes et al. 2008). The blood level of THC is determined by its initial dose, the metabolic rate, and the redistribution of THC from the blood to and from the body's fat stores. This latter effect is why, even though the estimated metabolic half-life of THC ranges from hours to days (Huestis 2007), the blood concentration can drop 90% within the first hour after smoking marijuana (Huestis et al. 1992; Toennes et al. 2008).

The combination of the nonlinear metabolism of THC and the highly variable and rapid decline of THC in the blood means that there is no accepted method to extrapolate backward from the time of blood draw to the time of police contact to determine the relevant THC blood level, as can be done with alcohol. Thus, if there is a delay in collecting a blood sample, THC levels in the tested blood can be substantially lower than when the incident or arrest occurred (Hartman and Huestis 2013). The time needed to draw blood for a charge of DUID has been reported to be up to 90 min in a Swedish study (Jones et al. 2008) and up to 3 h in a French study (Biecheler et al. 2008). DUI laws in the United States typically require biological samples taken in evidence to support a DUI charge be drawn within two hours of a DUI arrest or incident (Colorado Revised Statutes 2015; Revised Code of Washington 2014). If that is not possible, laws may permit results from multiple blood samples to be used to extrapolate backward

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Associate Editor Kathy Stewart oversaw the review of this article.

to estimate the blood content of an intoxicant at the time of the DUI arrest or incident, which is possible for alcohol but not for THC.

The first purpose of this brief report is to identify the time required to obtain blood draws from DUID suspects in Colorado in cases of vehicle homicide (VH) and vehicle assault (VA). We report the time from law enforcement dispatch to the first blood draw and discuss the data in relationship to the blood clearance rate of THC. The second purpose is to examine results from toxicology laboratories in Colorado and Washington that provide blood testing services in cases of traffic arrests to determine the proportion of blood tests for THC that are above specified legal limits and the implications of these findings for state policies and practices regarding marijuana-impaired driving.

Methods

Data

Court records

Court case records were requested from the Colorado State Judicial Branch for all charges of VH or VA for cases filed in 2012. The Colorado State Judicial Branch provided information on VH, VA, and DUI charges and convictions. There were 246 defendants, 35 of whom received VH charges and 211 of whom received only VA charges.

Next, either the entire court file or the Register of Actions and Affidavit of Probable Cause was reviewed for each case in which there was a VH-DUI charge or a VA-DUI charge that had been pled down to a lesser charge. All 29 of the 35 cases where VH defendants charged with DUI were studied. Of the 211 VA defendants, 178 were also charged with DUI. Due to the large number of VA-DUI charges, it was not practical to examine all VA-DUI charges. A subset of all VA-DUI charges ($n = 37$, 21%) that were pled down to a lesser felony level was selected to support a separate research program that is still in progress.

The court records that were reviewed are kept at each district court in the state. Data were extracted from court records regarding the charges, presence of alcohol and/or drugs, time of law enforcement contact and blood draw, crash location, and other contextual factors. The law enforcement agency for each case was also identified as either the local police department or the Colorado State Patrol. Colorado makes a distinction between DUI (driving under the influence means that one is incapable of safe driving) and DWAI (driving while ability impaired means that one is affected to a slight degree by intoxicants). DWAI is a milder offense than DUI and is commonly used in plea bargains. All cases in this study that were charged with DWAI were also charged with DUI.

Laboratory data

Three toxicology laboratories were asked to provide data on blood test results for a different cohort of arrested drivers. The laboratories were the primary forensic labs used to test blood drug and alcohol content in DUI suspects in Washington (Washington State Patrol Forensic Laboratory Services, Seattle, Washington [WSP]) and Colorado (Colorado Department of Public Health and Environment, Denver, Colorado [CDPHE], and Chematox Laboratory, Inc., Boulder, Colorado [Chematox]), 2 states that have legalized the recreational use of marijuana.

The Colorado Multiple Institutional Review Board approved this study.

Measures

Charges

VH and VA can be charged under 2 different prongs in Colorado: DUI or reckless driving. Only VH and VA cases charged under the DUI prong were included in this study ($N = 66$).

Time to first blood draw

Based on the report of law enforcement dispatch time and time of blood draw, the time to first blood draw was calculated in hours, rounded to the second decimal.

Responding agency

The location of the crash determines whether it falls under the jurisdiction of the local police or the state patrol.

Laboratory test results

Laboratories may report "Cannabinoid Positive" when blood-screening results are positive for cannabinoids, including but not limited to THC. A laboratory report of "THC Positive" denotes confirmatory test results that are positive specifically for THC and is a more accurate indicator of likely impairment.

Analysis

We examined the distribution of the time to first blood draw and calculated the mean, standard deviation, and median. We used Student's t test to test for differences in time to test by the charge (VH or VA) and responding agency (local police or state patrol). We examined the proportion of laboratory test results that were above and below the 5 ng/mL blood level standards set by Colorado and Washington.

Results

Time to first blood draw

Blood draws were not done in all cases. Of the 66 cases studied, 49 cases (74%) recorded the time between law enforcement dispatch and the first blood draw. When conducted, the blood sample was tested for alcohol, drugs, or both. When multiple blood draws to enable backward extrapolation of alcohol content at the time of arrest were reported in court records, only the first blood draw time was used for this study, because extrapolation of drug content was not done.

The mean time to first blood draw was 2.32 h (SD $\pm$ 1.31 h), with a range of 0.83 to 8.0 h and median of 2.0 h (see Table 1). Times to first blood draw were slightly longer for VH cases compared to VA cases (2.66 vs. 2.01 h, $P = .08$). There was a significantly longer time to first blood draw for the cases under the jurisdiction of the state patrol compared to local police departments (2.90 vs. 1.91 h, $P < .01$).

Table 1 Time to first blood draw by charge and responding law enforcement agency.

	N	Mean (h)	Test statistic	SD (h)	Median (h)	Range (h)
All	49	2.32		1.31	2.00	0.83–8.00
Charge						
Vehicular homicide	23	2.66		1.57	2.17	1.17–8.00
Vehicular assault	26	2.01	$t = 1.78$, $P = .08$	0.097	1.75	0.83–4.00
Responding agency						
State patrol	19	2.90		1.54	2.50	1.17–8.00
Local police	28	1.91	$t = 2.75$, $P < .01$	0.097	1.67	0.83–5.17

Laboratory data and legal limits for THC

Another source of data is laboratory test results in cases of general DUI arrests. We examined the proportion of blood test results for THC above specified legal limits in Colorado and Washington. Table 2 summarizes laboratory test results for THC provided by 3 different laboratories, 2 in Colorado and one in Washington. Laboratories typically perform an initial screening test for any cannabinoid, including THC-COOH, and, if positive, perform a confirmatory quantitative test specifically for THC and for THC-COOH separately. Data are presented both ways in Table 2. Between 42 and 70% of cannabinoid-positive screening samples were confirmed to be below Colorado and Washington's legal limit of 5 ng/ml THC in blood.

Discussion

Time to test and THC clearance from blood

Due to the complexity of THC clearance from blood, there is no accepted method to extrapolate backward from the time of the blood draw to determine the THC blood level at the time of arrest or a crash, as can be done with alcohol. If there is a delay in collecting a blood sample, THC levels in the blood can be substantially lower than when the arrest occurred. This study used 2 sources of data, court records and toxicology results, to investigate marijuana-impaired driving. In our study of a sample of VH and VA cases, we found that the average time to blood draw was more than 2 h. The high metabolic rate of THC and its rapid sequestration into the body's fat stores mean that blood concentrations can drop below legal levels, and even below laboratories' level of quantification during the typical time delay to acquire a blood sample. This can make the quantitative blood test results both irrelevant and misleading. The tests results are irrelevant because the THC level at the time of the blood draw will not represent the THC level at the time of the arrest and there is no accepted method to extrapolate backward to project the THC concentration at the time of arrest. The results are misleading because the majority of cases, as suggested by the laboratory results we present in this study, would indicate that the driver had a THC level below legal limits, whereas other evidence such as behavioral assessments by the arresting officer may suggest that the driver was driving under the influence.

Although research consistently shows a dramatic drop in THC concentration in blood after smoking (Huestis et al. 2007; Toennes et al. 2008), Huestis has shown a very different, lower, and more gradual concentration profile for THC from marijuana ingested in edible forms. Therefore, laboratory blood tests can more fairly represent the concentration of THC from edibles at the time of arrest than they can for the THC concentration from smoked marijuana. Neither court records nor laboratory data identified how defendants in this study consumed their marijuana. The 2 Colorado laboratories in this study served different law enforcement agencies. One might speculate that the laboratories' differences reported in the percentage of defendants testing below the 5 ng/ml limit could be attributable to differences in how marijuana was commonly consumed in the different markets served by the 2 laboratories. But this is merely speculation, because there are no data to confirm this.

There is an emergent need for further scientific study to determine the effects of driving when the body is exposed to increasingly high levels of THC and the effects of different routes of THC administration.

There are several reasons for delays in blood testing. First, the circumstances during a crash can lead to delays. Officers' first priority is to help victims, not to collect evidence. Even in cases of no victims, logistics will cause time delays. Second, there is a lack of understanding on the part of some law enforcement officials of the need for a rapid blood draw. Third, there is response time, which may be longer in a rural setting, and the time necessary to travel to a suitable site to draw blood. Finally, if the blood draw is involuntary, there is a delay caused by the need to get a warrant. Even in instances of voluntary blood draws, there can be a delay in seeking a warrant for a blood draw due to a lack of understanding of the requirements for a voluntary blood draw. As might be expected with the multiple events with conflicting priorities that occur after a vehicular homicide, the average time to draw a blood sample from a driver involved with a vehicular homicide is longer than in cases of a driver involved with vehicular assault, but that time difference was not statistically significant in this study. However, the mean time difference (0.65 h) does represent a large amount of time that would impact the reported THC value. The state patrol has a higher proportion of its cases in rural areas, more remote from phlebotomy sites than usually found in urban areas, so it may not be surprising that there is a longer delay before blood draws in state patrol cases compared with local police agencies.

Results from laboratory data (Table 2) show that a sizeable proportion of those tested for drug impairment are found to be below the legal limits. These tests are expensive and thus only conducted when behavioral evidence of impairment justifies the expenditure, and yet between 42 and 70% of the cannabinoid-positive drivers arrested on suspicion of driving under the influence of THC tested below state-mandated legal limits.

There are several ways to mitigate the delays in blood testing. In this study, none of the court records indicated that a warrant was needed to collect blood. However, if that were a cause for delay, law enforcement agencies can utilize electronic warrants. Time to obtain a warrant can range from less than 15 min to several hours. Rapid warrants are possible using an electronic warrant system as has been established in jurisdictions such as Arizona (Chan 2013). Second, emergency medical personnel or

Table 2 Number of laboratory results for blood tests that included tests for THC[a].

Laboratory	Location	Year(s)	Cannabinoid-positive screen[b] (*n*)	Confirmed THC positive[c] (*n*)	≥5 ng/ml THC in blood[c] (*n*)	Cannabinoid positive < 5 ng/ml (%)[b]	THC positive < 5 ng/ml (%)[c]
CDPHE	CO	2010–2013	6,595	3,910	1,998	69.7	48.9
Chematox	CO	2013	2,159	1,561	1,252	42.0	19.8
WSP	WA	2011		1,036	593		42.8

Notes. [a]THC and cannabis are measured in nanograms per milliliter in whole blood.
[b]"Cannabinoid Positive" indicates blood-screening results that were found positive for cannabinoids, including but not limited to THC.
[c]"THC Positive" indicates blood test results that were found positive for THC, which is one of many cannabinoids.

law enforcement officers, particularly drug recognition experts, can be trained to draw blood samples as soon as possible at the scene. In contrast, drug recognition expert protocol and/or common practice in the field is to obtain a blood sample as the last step in a dozen protocol steps. Third, recent advancements in oral fluid testing suggest that this may be a viable alternative to blood tests in the future (Verstraete 2004), because oral fluids may be obtained at the roadside without delays inherent to blood draws.

Many have struggled in vain to define a blood level of THC (and other drugs and combinations of drugs) above which everyone is impaired and below which no one is impaired. Politicians may agree to such levels, even if scientists cannot (Reisfield et al. 2012). This study presents a difficulty with a "legal limit" approach to dealing with DUID; the level found in a laboratory test may not represent the level at the time of arrest. This should serve to increase the importance of behavioral assessments of impairment performed at the roadside by law enforcement officers, including drug recognition experts. Laboratory tests should be used to confirm the presence of drugs responsible for an impairment that is otherwise noted and documented by law enforcement officials. If used for that limited purpose, concerns about quantitative levels of drugs become less important.

Strengths and limitations

The court records used in this study were limited to cases of VH-DUI and a subset of VA-DUI cases in 2012 in Colorado. Given the difficulty of extracting data from court records, it is not feasible to examine the full range of traffic arrest cases; thus, we limited our study to only the most egregious infractions. The average delay for blood draws in nondeath and noninjury traffic arrests for DUI may be different (Urfer et al. 2014).

Furthermore, we were only able to examine a subset of VA-DUI cases, which may be systematically different from other VA-DUI cases. Because the VA-DUI subset that was selected does not represent all VA-DUI cases, one cannot make unbiased inference from these data about such factors as causes for DUI, but it should not bias inferences of time to draw blood. Data from a study in progress confirm this belief.

Our discussion of metabolism of THC and delays to testing are based on smoked marijuana. Marijuana consumed as "edibles" (e.g., cookies, candies, brownies) follows a more gradual metabolism curve. Furthermore, no data have been published on the blood clearance curves of THC from THC concentrates such as butane hash oil, honey oil, wax, shatter, budder, or any of its variants. Therefore, these conclusions may not apply to impairment from those forms of THC.

Given the current delays to blood testing in cases of arrests for VH and VA, many blood tests are unlikely to confirm that drivers who are impaired from smoking marijuana have THC levels in their blood above established legal limits.

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