GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety

Drug-Impaired Driving

Marijuana and Opioids Raise Critical Issues for States

IN PARTNERSHIP WITH

RESPONSIBILITY.ORG

Contents

Executive summary

Drug use and abuse are critical social issues in the United States in 2018. Two drug families in particular stand out: marijuana (cannabinoids) and opioids.

Marijuana and opioid use affect driving and can cause crashes. State highway safety offices are concerned: in a survey, virtually all said drugged driving is a problem and the majority rated it equal to or more important than driving while impaired by alcohol. States must find effective strategies to address impaired driving resulting from marijuana or opioids.

This report should help states understand the key facts. It incorporates information from a February 2018 survey of state highway safety offices on their challenges and strategies for dealing with marijuana- and opioid-impaired driving.

The report provides recommendations for state actions to address marijuana- and opioid-impaired driving within their impaired driving programs:

>>> *Add drug-impaired driving messages, especially regarding marijuana- and prescription drug-impaired driving, to their impaired driving campaigns.*

>>> *Consider a campaign with physicians and pharmacists on prescription opioid warnings.*

>>> *Train at least a majority of patrol officers in Advanced Roadside Impaired Driving Enforcement (ARIDE).*

>>> *Seriously consider at least a test of oral fluid devices.*

>>> *Closely follow the development of marijuana breath test instruments and seriously consider a pilot test if and when they become available.*

>>> *Train an adequate number of Drug Recognition Experts (DREs) to address the Driving Under the Influence of Drugs (DUID) problem, consistent with law enforcement resources.*

>>> *Encourage prosecutors and judges assigned to DUID cases to participate in appropriate training.*

>>> *Encourage officers to investigate drug impairment even when alcohol is suspected. Encourage prosecutors to pursue DUID charges when they are supported by the evidence.*

>>> *Authorize electronic search warrants for drug tests. When authorized, law enforcement agencies should implement electronic warrants as needed.*

Marijuana and opioid use affect driving and can cause crashes.

» *Provide appropriate penalties for drug test refusal.*

» *Require blood testing for drugs rather than urine testing.*

» *Invest in forensic laboratory capabilities to provide adequate testing for drivers arrested for DUID.*

» *Test all fatally-injured drivers, and all surviving drivers in a fatal crash who may be at fault, for drugs and alcohol.*

» *Establish a separate DUID offense equivalent to DUI. Record suspected and confirmed DUID drivers in arrest and crash records.*

The report also includes three research recommendations to support state drug-impaired driving programs.

» *Develop a consistent marijuana message based on research, such as "Don't drive within XX hours of using marijuana," where XX is a number supported by research.*

» *NHTSA should publish its evaluation of oral fluid devices promptly. If some devices are acceptable, NHTSA should publish a list of approved devices. States conducting oral fluid field tests should publish the results.*

» *Agree on national recommended standards for laboratory test procedures.*

States have a critical mission to convince drivers to drive responsibly, alertly, and unimpaired. Marijuana and opioids add different forms of impairment. They require some new tactics to detect impaired drivers, link the impairment to the drug, prosecute and adjudicate offenders, and above all educate drivers and the public. They join with and build on the familiar methods to address alcohol-impaired driving. Impaired driving program focus should not shift to marijuana and opioids but should expand to include marijuana and opioids along with alcohol.

Impaired driving program focus should not shift to marijuana and opioids but should expand its critical focus on alcohol to include all impairing substances.

About this report

Drug use and abuse are critical social issues in the United States in 2018. Two drug families in particular stand out: marijuana (cannabinoids) and opioids. Marijuana use is rapidly becoming normalized, with recreational marijuana legal in 9 states and the District of Columbia and medical marijuana approved in 29 states and the District of Columbia (NCSL, 2018a; 2018b). Opioid addiction and opioid overdose deaths have become a national crisis, with overdoses producing an estimated 115 deaths daily (NIDA, 2018).

Marijuana and opioid use affect driving and can cause crashes. State Highway Safety Offices (SHSOs) are concerned: in a survey, virtually all said drugged driving is a problem and the majority rated it equal to or more important than driving while impaired by alcohol (GHSA, 2018a). The National Highway Traffic Safety Administration (NHTSA) held a Drugged Driving Call to Action Summit on March 15, 2018, a public meeting with key stakeholders to kick off NHTSA's "new initiative to lead national dialogue and begin setting a course of action to combat this growing problem." States must find effective strategies to address impaired driving resulting from use of marijuana and opioids.

This report should help states and other stakeholders understand the key facts. It incorporates information from a February 2018 survey of SHSOs on their challenges and strategies for dealing with marijuana- and opioid-impaired driving (GHSA, 2018a). For information on driving under the influence of drugs (DUID) in general see the 2017 report Drug-Impaired Driving: A Guide for States, 2017 Update (GHSA, 2017).

This report begins by describing the size of the DUID problem, using the best available data but pointing out the substantial limitations in these data. The next two sections discuss marijuana and opioids, respectively: how frequently each is used and what is known about how each affects driving ability and crash risk. These sections document current state laws, active legislation, and public knowledge and attitudes regarding marijuana and opioids.

The next section documents current state DUID detection, arrest, and prosecution strategies that apply to marijuana or opioids. It discusses legal and policy issues that may hinder these strategies.

Finally, the report provides recommendations for what states can and should do to address marijuana- and opioid-impaired driving within their impaired driving programs. Marijuana and opioids require some new tactics to detect impairment at the roadside, provide chemical evidence of impairment, convince judges and juries of their impairing effects, and above all educate drivers and the public about the

115

The number of deaths that opioid addiction and opioid overdose cause daily in the U.S.

dangers of driving while impaired. The impaired driving message changes only by adding marijuana, opioids, and other drugs to alcohol: Don't drive if you are impaired by alcohol or drugs because you will put yourself and others at risk. But if you do, you may be detected, arrested, and sanctioned.

The report contains information available as of April 1, 2018. The references provide greater detail.

Size of the problem
How frequently drugs are detected in drivers

No data sources accurately document how frequently drivers have a measurable amount of some drug in their systems, much less how frequently they are impaired by drugs. These sections report data from two sources: NHTSA's Fatality Analysis Reporting System (FARS) and roadside surveys in the United States and Canada.

FARS data

FARS is the best data source that includes information from all states. Within FARS, the most accurate and complete data are for fatally-injured drivers because they are tested for drugs more frequently than surviving drivers. However, as documented by Berning and Smither (2014):

>> *Testing rates vary considerably by state, from very low (2%) to very high (96%). States test for different drugs, using different testing protocols and different cutoff values. This means that FARS data cannot be used to compare states.*

>> *Testing protocols and cutoff values can change over time. This means that conclusions regarding change over time must be considered carefully.*

No data sources accurately document how frequently drivers have a measurable amount of some drug in their systems.

FILING FACTS

NHTSA releases the Fatality Analysis Reporting System (FARS) annual report file for any given year in the summer of the year following the year in question (e.g. the 2016 FARS annual report file was released in the summer of 2017). The annual report files contains all data available at the time of release. NHTSA accepts additional data from the states for the given year until December 31 (e.g. NHTSA accepted additional 2016 data until December 31, 2017). At that time the file is closed and is called the final file.

This section summarizes FARS data on drug presence in fatally-injured drivers and draws conclusions that respect the FARS data limitations. Data for 2016 are from the FARS annual report file, 2006 data are from the final FARS file, and 2015 data are from both files. Drug and alcohol presence is slightly higher in each year's final file because some test results are not available when the annual report file is produced.

Drug and alcohol presence, 2016 and 2015, fatally-injured drivers:

» **Drugs in drivers:** *In 2016, 43.6% of the drivers with known drug test results were drug-positive. In 2015, of the drivers with known test results, 43.0% in the annual report file and 43.4% in the final file were drug-positive.*

» **Alcohol in drivers:** *Of the drivers with known alcohol test results, 37.9% were alcohol-positive (any alcohol at all) in 2016 compared to 38.0% in the 2015 annual report file and 38.1% in the final file.*

» **Poly-drug and drug-alcohol:** *In 2016, 50.5% of the drug-positive drivers were positive for two or more drugs and 40.7% were positive for alcohol.*

Ten-year changes, 2006 to 2016, fatally-injured drivers

» **Drugs:** *In 2006, 27.8% of drivers with known drug test results were drug-positive compared to 43.6% in 2016. The number of known drug-positive drivers increased from 3,994 in 2006 to 5,365 in 2016.*

» **Alcohol:** *In 2006, 41.0% of all drivers with known test results were alcohol-positive compared to 37.9% in 2016. The number of known alcohol-positive drivers decreased from 7,750 in 2006 to 5,473 in 2016.*

» **Final file:** *Both the percentage and number of drug-positive and alcohol-positive drivers will increase slightly in the 2016 final file.*

On the following page, Figure 1 shows alcohol and drug presence in fatally-injured drivers with known test results in 2015 and 2016. Figure 2 shows how alcohol and drug presence in fatally-injured drivers with known test results has changed from 2006 to 2016.

Supporting information

» **Drug testing rate:** *the proportion of fatally-injured drivers known to have been tested for drugs is similar in 2016, 2015, and 2006.*

2016 annual report file:	2015 annual report file:	2015 final file:	2006 final file:
54.3%	57.1%	64.2%	59.3%

» **High testing rate states:** *in the 19 states that tested over 75% of all fatally-injured drivers in 2016, drug presence was very similar to that for all states combined.*

In 2016:

43.6%
of drivers with known drug test results were **drug-positive**

37.9%
of drivers with known alcohol test results were **alcohol-positive**

50.5%
of drug-positive drivers were **positive for two or more drugs**

40.7%
of drug-positive drivers were **positive for alcohol**

LEGEND:
- 2006 FARS Final File
- 2015 FARS Final File
- 2015 FARS Annual Report
- 2016 FARS Annual Report

Source: NHTSA Fatality Analysis Reporting Systems (FARS)

FIGURE 1

Drug and alcohol, percentage of fatally-injured drivers, known test results

% alcohol if known alcohol test result: 41%, 38%, 38.1%, 37.9%

% drug if known drug test result: 27.8%, 43%, 43.4%, 43.6%
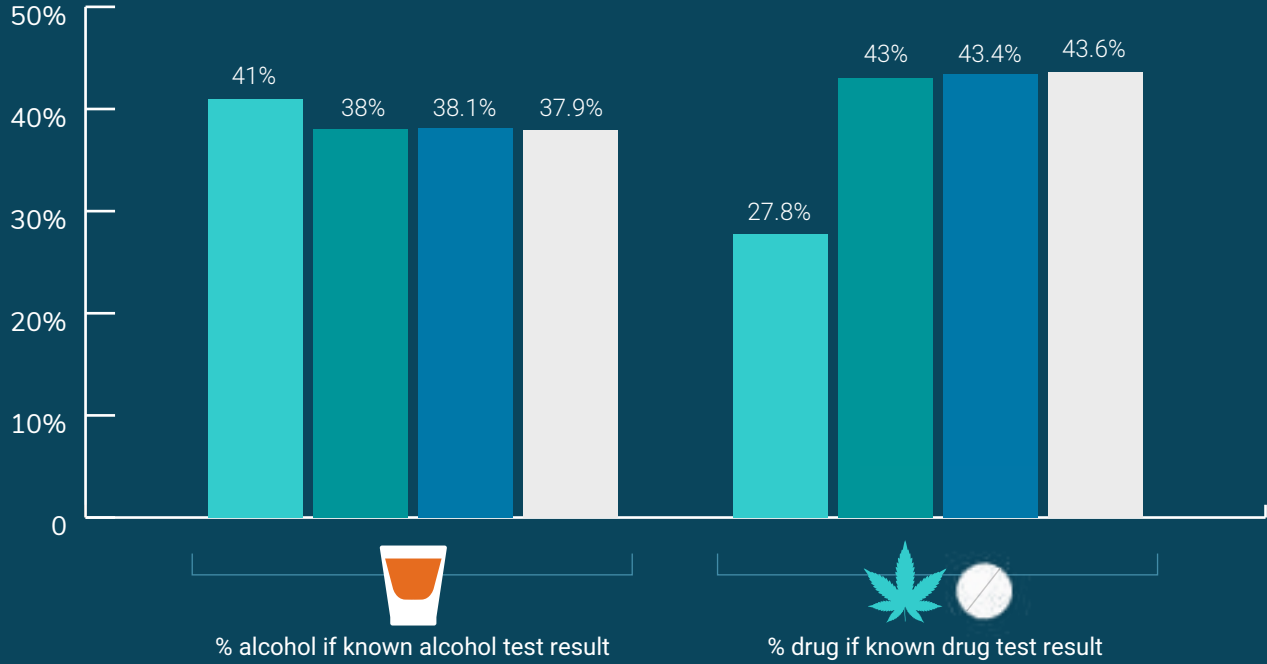
FIGURE 2

Poly-Drug Use: Drug and alcohol, percent of fatally-injured drivers, with known test results for both drugs and alcohol

% alcohol if drug-positive: 46.3%, 40.3%, 40.8%, 40.7%

% drug if alcohol-positive: 32.8%, 47.7%, 47.8%, 48.5%
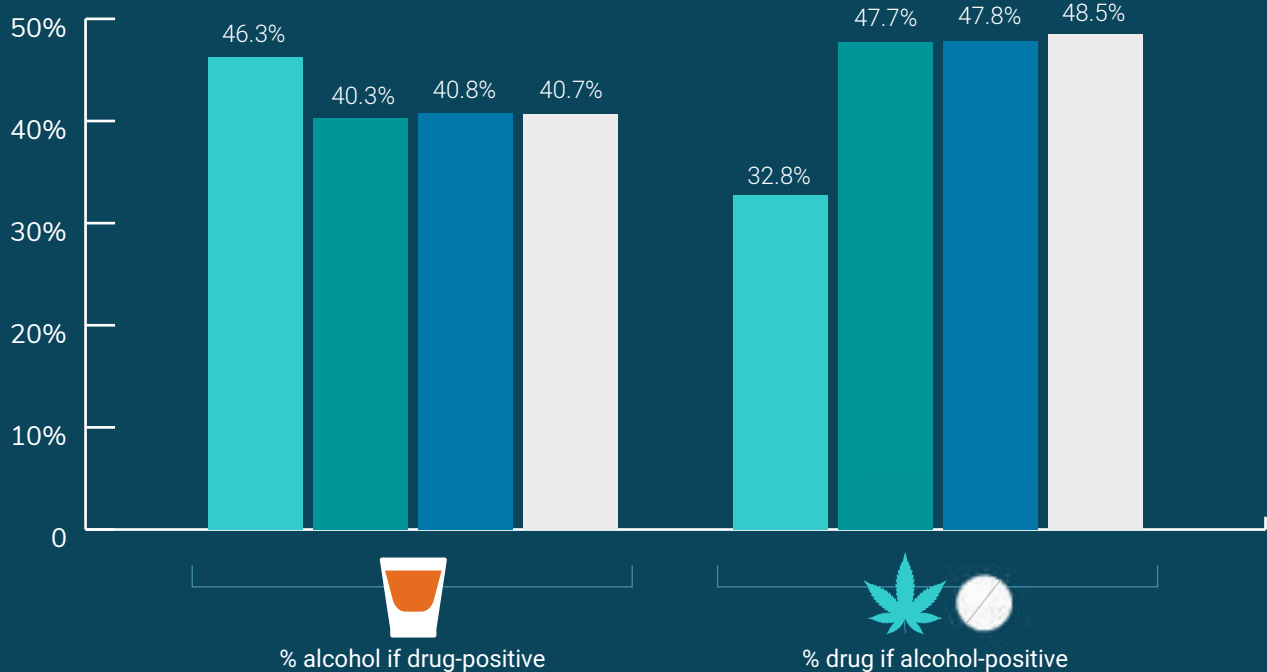
>> **Drug presence does not imply impairment:** *there is no established relation between drug presence, as measured by a drug test, and impairment, for any drug. In particular, some drugs reported in drug tests are non-impairing metabolites.*

The limitations of the FARS data mean that precise quantitative conclusions cannot be made about the level of drug presence or the amount that drug presence has changed over time. However, the following qualitative conclusions regarding fatally-injured drivers are fully supported:

>> *Drug presence probably increased slightly from 2015 to 2016.*

>> *Alcohol presence was about the same in 2016 as in 2015.*

>> *More drivers were drug-positive than alcohol-positive both in 2016 and 2015.*

>> *Many drivers combine more than one drug or combine drugs and alcohol.*

>> *Drug presence increased substantially from 2006 to 2016.*

>> *Alcohol presence decreased somewhat from 2006 to 2016.*

Washington State FARS data

Washington State recently analyzed drug and alcohol use among drivers involved in fatal crashes in their 2016 FARS data (Grondel et al., 2016). There were more than twice as many poly-drug drivers—with two or more drugs, or alcohol and at least one drug—than alcohol-only drivers and five times more than THC-only drivers.

Roadside survey data

In 2013-14, NHTSA conducted a roadside survey of drivers during weekday days and weekend nights (Berning et al., 2015). In each time period, 22% of the drivers tested positive for some drug or medication (Kelly-Baker et al., 2017). Alcohol presence was considerably lower: 8.3% of the weekend night drivers had a positive breath alcohol concentration (BrAC) level (.005 BrAC or above) with 1.5% at a BrAC of 0.08 or above. On weekday days, only 1.1% had a positive BrAC and 0.4% a BrAC of 0.08 or above.

Alcohol concentration is measured either in blood (BAC) or breath (BrAC). Both use the same units and are equivalent for all practical purposes.

ALCOHOL PREVALENCE

Data Collection Time Period	% Alcohol Positive (%BrAC > .005)	% BrAC > .08
Weekday Daytime	1.1%	0.4%
Weekend Nighttime	8.3%	1.5%

Source: Adapted from Berning, et al., 2015

OVERALL DRUG PREVALENCE

Time of Day	% Drug-Positive Oral Fluid Test	% Drug-Positive Blood Test	% Drug-Positive Oral Fluid and/or Blood Test
Weekday Daytime	19.0%	21.6%	22.4%
Weekend Nighttime	19.8%	21.2%	22.5%

Source: Adapted from Berning, et al., 2015

NHTSA conducted a similar roadside survey in 2007. The two surveys differed slightly in the specific drugs tested and cutoff levels used. When adjusted to the same drugs and cutoffs, the proportion of drivers testing positive for any illegal drug (including marijuana) rose from 12.4% in 2007 to 15.1% in 2013-14 and the proportion testing positive for a medication rose from 3.9% to 4.9%.

Roadside survey data are limited because they come from a sample of drivers in 60 locations. Driver participation was voluntary; 71% of the eligible drivers provided a blood or oral fluid sample. Nevertheless, the roadside survey data support the conclusions from FARS that drug presence in drivers has increased in the past decade.

A 2012 Canadian roadside survey reported lower levels: 7.4% were positive for any drug and 6.5% had a positive BAC (Beirness, 2014).

Marijuana

Marijuana use is increasing in the general population and among drivers. Marijuana is no longer just smoked, it's vaped, eaten, drunk, dabbed, chewed, or wiped, often in much higher concentrations than traditional smoked joints. Marijuana affects driving-related skills but its effect on crash risk is uncertain. There's no public consensus on whether marijuana increases crash risk or whether it's acceptable to drive after using marijuana. State laws regarding marijuana possession and use range from prohibition to varying degrees of legalization. This section documents these issues.

It's important to understand the many ways in which marijuana differs from alcohol. Alcohol in the body can be measured in breath, blood, or urine. Blood alcohol concentration (BAC) reaches a peak about 20 minutes to an hour after drinking and drops steadily and gradually thereafter (Figure 3A). BAC is closely related to impairment of behavior (balance, coordination, reaction time), attention, decision-making, risk taking, and judgment. Many studies have documented how a driver's crash risk increases as

FIGURE 3A
Blood Alcohol Concentration (BAC) Over Time After Drinking

BAC (mg %)

Legend:
- One drink
- Two drinks
- Three drinks
- Four drinks

Time (hours)
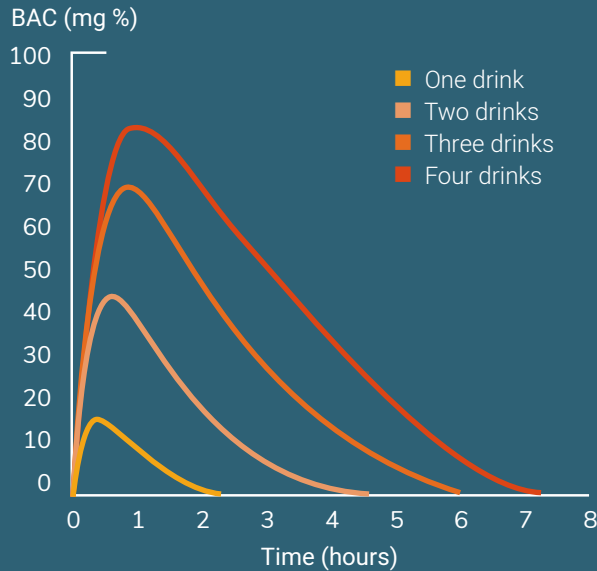
Source: Adapted from NIAAA (1997)

FIGURE 3B
Marijuana (THC) Concentration, Subjective High, and Impairment Over Time After Smoking

THC concentration, ng/mL

Legend:
- THC concentration
- Subjective high
- Performance

Time after smoking (minutes)
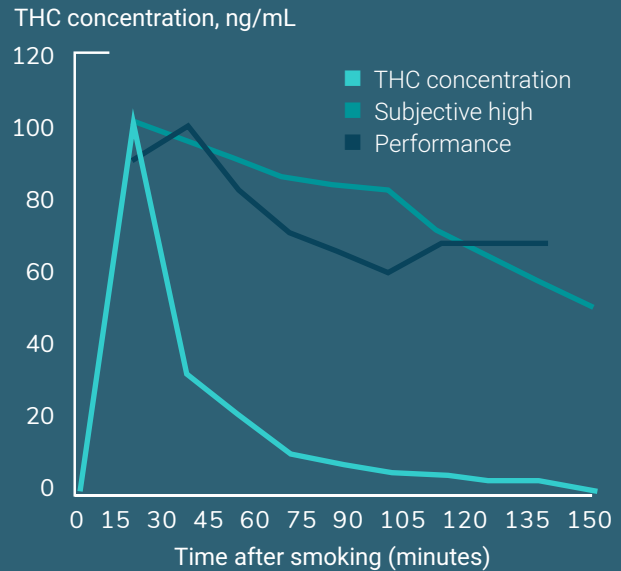
Source: Adapted from Compton (2017), Figure 4.

BAC increases. They form the basis for laws in each state prohibiting driving with a BAC exceeding 0.08 g/dL (0.05 in Utah).

Marijuana differs substantially. At present, marijuana cannot be measured accurately in breath but must be measured in blood, urine, or saliva. The blood concentration of its active component, delta 9-tetrahydrocannabinol (THC), rises very quickly after consumption but then drops rapidly (Figure 3B). Impairment rises rapidly and remains for some time. As a result, THC measured in blood or urine is not closely related to impairment. To add to the confusion, non-impairing marijuana metabolites can remain in the body for weeks. Finally, marijuana's impairing effects vary substantially across individuals. Compton (2017) provides a detailed discussion of these differences.

About marijuana

Marijuana, or cannabis, is a psychoactive drug from the cannabis plant. Marijuana can be smoked, inhaled as a vapor, added to food, or applied directly to the skin. Signs of marijuana use may include bloodshot eyes, increased heart rate, sleepiness, poor coordination, delayed reaction time, and increased appetite (American Addiction Centers, 2018; Narconon, 2018).

Marijuana use varies widely by state, correlated strongly with state laws, as shown in Table 1.

There's no public consensus on whether marijuana increases crash risk or whether it's acceptable to drive after using marijuana.

TABLE 1. MARIJUANA USE IN THE PAST MONTH BY AGE AND STATE MARIJUANA LAW.

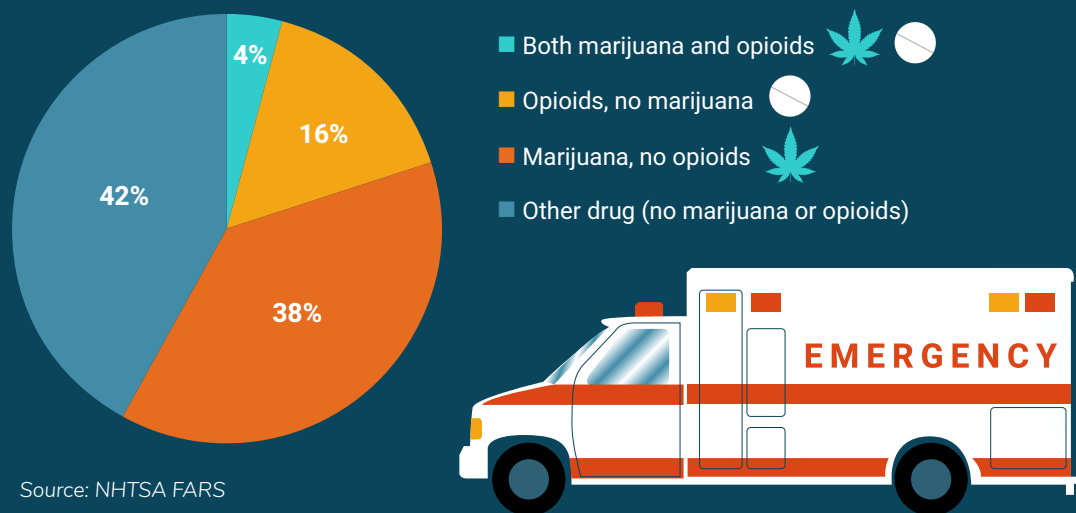| Age	STATE MARIJUANA LAW		
	All use illegal	Medical use only	Recreational use
12-17	6.2 %	8.6 %	10.1 %
18-25	16.8 %	23.1 %	26.2 %
26 and above	5.1 %	8.0 %	12.0 %

In the United States in 2016, 6.5% (1.6 million) of adolescents age 12 to 17, 20.8% (7.2 million) of young adults age 18 to 25, and 7.2% (15.2 million) of adults age 26 and above reported using marijuana in the past month (NSDUH, 2016). Together there were 24.0 million users, or about 8.9% of the population age 12 and above. In Canada in 2012, 12% of persons aged 15 and above reported using marijuana in the past year (Capler et al., 2017).

Marijuana use may increase when a state authorizes recreational use. In Colorado, in the three years (2013-2015) after the state legalized recreational marijuana compared to the three prior years (2010–2012), use by youth (age 12-17) increased by 12 percent to 11.8%; use by young adults (age 18-25) increased by 16 percent to 31.5%; and use by adults aged 26 and above increased by 71 percent to 13.6% (RHMIDTA, 2017).

Marijuana use by drivers

Fatally-injured drivers, reported in FARS: In 2016, 41.1% of the drug-positive fatally-injured drivers were positive for some form of marijuana. About three-quarters of these drivers were positive for active marijuana, coded as Delta 9 or THC. In 2006, the marijuana-positive proportion was 34.5%.

FIGURE 4
Marijuana and opioids in drug-positive fatally-injured drivers, FARS 2016

- 4% — Both marijuana and opioids
- 16% — Opioids, no marijuana
- 38% — Marijuana, no opioids
- 42% — Other drug (no marijuana or opioids)

EMERGENCY

Source: NHTSA FARS

In 2016, 54.3% of the fatally-injured drivers were tested. This means that 22.3%—almost one-quarter—of all fatally-injured drivers were known to have been marijuana-positive.

While the limitations of FARS data discussed above apply, the general conclusions are clear: marijuana is the most common drug found in fatally-injured drivers and marijuana presence has increased substantially in the past decade.

Canadian national fatality data: Canadian data show lower levels of marijuana but similar trends. Among those drivers tested for drugs, 12.4% of fatally-injured drivers were positive for marijuana in 2000. This percentage gradually rose to 21.9% in 2013 before declining to 18.6% in 2014 (TIRF, 2017).

Roadside survey data: In NHTSA's 2013-14 roadside survey, marijuana was by far the most prevalent drug, with 12.7% of drivers testing positive on weekend nights and 8.7% on weekday days. Nighttime presence in the 2007 survey was 8.7% (Kelly-Baker et al., 2017).

In the 2012 Canadian roadside survey, 3.3% were positive for marijuana. As in the United States, marijuana was by far the most common drug detected (Beirness, 2014).

Survey data: In a national survey in 2017, 4.7% of drivers reported having driven within one hour of using marijuana in the past year (AAAFTS, 2018).

In a Canadian national survey in 2012, approximately 2.4% of drivers reported driving at least once within two hours of using marijuana (Capler et al., 2017).

Drivers in Colorado and Washington: Colorado and Washington were the first two states to authorize recreational marijuana use. In roadside surveys in Washington conducted immediately before and 6 and 12 months after legal sales began in July 2014, the proportion of THC-positive drivers increased from 14.6% to 19.4% and then to 21.4%, though the increases were not statistically significant (NHTSA, 2016). The increase was concentrated in the daytime: from 8% THC-positive before sales began to 23% afterwards, compared to nighttime proportions of 19% before and 20% afterwards (Eichelberger, 2018). In Colorado, the number of traffic fatalities in which a driver tested positive for THC increased from 18 in 2013 to 77 in 2016 (CDOT, 2018).

In a September 2014 survey of drivers in Colorado and Washington who reported any marijuana use in the past month, 43.6% reported driving under the influence of marijuana in the past year and 23.9% had driven within one hour of using marijuana at least five times in the past month (Davis et al., 2016).

Marijuana impairment and crash risk

Many experimental studies document that marijuana affects psychomotor skills and cognitive functions critical to driving including vigilance, drowsiness, time and distance perception, reaction time, divided attention, lane tracking, coordination, and balance (Capler et al., 2017; Compton, 2017; Strand et al., 2016). Marijuana effects

> **Marijuana is the most common drug found in fatally-injured drivers and marijuana presence has increased substantially in the past decade.**

vary substantially across individuals. For example, chronic marijuana users may not be impaired even with high levels of marijuana in their bodies (NHTSA et al., 2017).

Marijuana's effect on crash risk is far less clear. While there are many recent studies, methodological flaws are common. The studies are complicated by the difficulty in estimating a driver's THC at the time of a crash, by the lack of a relationship between THC level and impairment, and by tests that do not distinguish between THC and non-impairing metabolites. The most supportable conclusions are that marijuana has caused or contributed to some crashes; that it can, but need not necessarily, increase crash risk in a driver; and that the best overall estimate of marijuana's effect on crash risk in general is an increase of 25-35%, or a factor of 1.25 to 1.35.

The best overall estimate of marijuana's effect on crash risk in general is an increase of 25-35%, or a factor of 1.25 to 1.35.

These conclusions are based on several recent summaries and reviews of marijuana crash risk studies. The summaries and reviews provide references to many individual studies.

›› *Compton (2017) summarizes recent epidemiological studies, frequently-cited meta-analyses, the extensive DRUID study (Schulze et al., 2012), and the NHTSA crash risk study (Compton and Berning, 2015). The NHTSA study, perhaps the most methodologically sound of all marijuana crash risk studies, found an increase of 25%, most of which was due to associated driver factors such as age and gender.*

›› *Gjerde et al. (2015) summarize 36 epidemiological studies, 23 of which found a statistically significant effect of marijuana on crashes and injuries with effect sizes ranging up to 400%.*

›› *Rogeberg and Elvik (2016a) replicate two previous meta-analyses and conduct a new one of 21 studies. They conclude that marijuana increases crash risk by 22-36%. See also Gjerde and Mørland (2016) for comments and Rogeberg and Elvik (2016b) for a response.*

›› *White (2017) reviews 11 epidemiological studies. He concludes that cannabis does not increase crash risk by more than 30%.*

›› *Capler et al. (2017) review and comment on all previous reviews and studies and conclude that marijuana increases crash risk by about 20-30%.*

›› *Romano, Torres-Saavedra et al. (2017) examine in detail the issues of attempting to estimate marijuana crash risk using FARS data. They conclude that FARS data cannot be used for precise risk estimates. They concur with the many studies in the studies and reviews cited above that the crash risk of marijuana is less than that of alcohol.*

Two studies of the overall effects of marijuana legalization arrive at different conclusions. Colorado and Washington legalized recreational marijuana in 2012. Aydelotte et al. (2017) examined overall traffic fatality rates per travel mile in Colorado, Washington, and eight control states between 2009 and 2015. After controlling for overall trends and state-specific characteristics they concluded that fatality rate changes in Colorado and Washington were similar to changes in the control states. A Highway Loss Data Institute (HLDI) study found that collision claim frequencies increased by about 3% after recreational marijuana use was legalized in Colorado, Oregon, and Washington compared to neighboring control states (IIHS, 2017).

Driver views on marijuana and driving

In a 2017 national survey, 89.1% of drivers said that they feel it is unacceptable to drive after using marijuana (AAAFTS, 2018).

In contrast, in surveys and focus groups in Colorado and Washington, almost all regular marijuana users believed that marijuana doesn't impair their driving and some believed that marijuana improves their driving (CDOT, 2014; PIRE, 2014; Hartman and Huestis, 2013). Most of these regular marijuana users drove "high" on a regular basis. They believed it is safer to drive after using marijuana than after drinking alcohol. They believed that they have developed a tolerance for marijuana's effects and can compensate for any effects, for instance by driving more slowly or by allowing greater headways. However, Ramaekers et al. (2016) found that marijuana's effects on cognitive performance were similar for both frequent and infrequent marijuana users.

Some regular marijuana users incorrectly believe that marijuana improves their driving.

In a survey of regular marijuana and hashish users in Colorado and Washington, Allen et al. (2016) asked respondents if they were high or feeling the effects of marijuana or hashish when they took the survey. Those who reported being high were more likely to believe they could drive safely under the influence of either marijuana or alcohol. In another survey, drivers who reported using marijuana, and those who reported driving within an hour of use in the past year, were less likely to believe that using marijuana increases crash risk and more likely to believe that it does not affect or decreases crash risk (Arnold and Tefft, 2016). In a final survey, drivers who reported using marijuana were more supportive of and had a greater intention to drive after using marijuana (Ward et al., 2016).

In a nationwide survey of 2,800 high school students and their parents conducted by Liberty Mutual and Students Against Destructive Decisions (SADD), 33% of the students and 27% of their parents believed that it is legal to drive under the influence of marijuana in states where it's been legalized for recreational use. Additionally, 88% of the students and 93% of the parents said that driving under the influence of alcohol is dangerous, while only 68% of students and 76% of parents said the same for marijuana. Finally, 22% of teens admitted that driving under the influence of marijuana is common among their friends (Liberty Mutual, 2017).

State marijuana laws

Recreational or medical marijuana is legal in more than half the states, with more states likely to liberalize marijuana laws in 2018. As of April 2018, medical marijuana use was
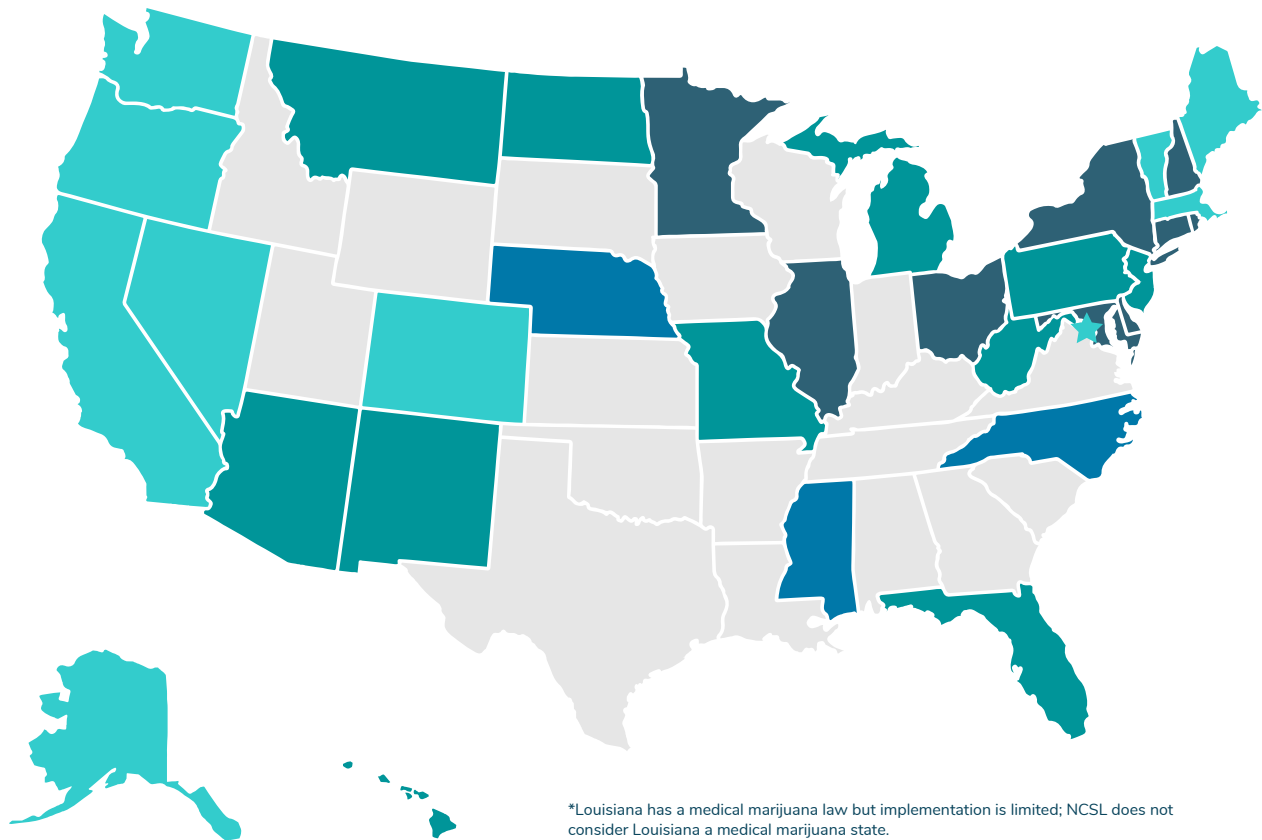
allowed in 29 states and the District of Columbia. An additional 17 states allowed the use of "low THC, high cannabidiol (CBD)" products for medical reasons (NCSL, 2018a). Recreational use was allowed in nine states and the District of Columbia. Most recently, Vermont's legislature authorized recreational use effective July 1, 2018. Canada also authorized recreational use effective July 1, 2018. Marijuana possession and use was decriminalized in 22 states (NCSL, 2018b). Figure 1 shows state marijuana possession and use laws as of April 2018.

As of April 30, 2018, recreational marijuana bills had been introduced in 20 states (in addition to Vermont), medical bills in 14 states, and decriminalization bills in 12 states (Marijuana Policy Project, 2018). In contrast, the US Drug Enforcement Agency classifies marijuana, along with heroin, LSD, and other drugs, as a Schedule 1 drug which has "no currently accepted medical use and a high potential for abuse" (USDEA, 2018).

FIGURE 5
State marijuana possession and use laws

*Louisiana has a medical marijuana law but implementation is limited; NCSL does not consider Louisiana a medical marijuana state.

Click to highlight states in applicable category

| SHOW ALL	Legal Use	Medical Only	Decriminalized	Medical/Decrim.
	Legalized for adult use	Legalized for medical use only	Decriminalized	Legal for medical use / decriminalized

Source: Adapted from NCSL, 2018a.

Three types of state laws apply to driving under the influence of marijuana.

Driving Under the Influence of Drugs (DUID) is illegal in every state.	Zero Tolerance laws prohibit driving with any amount of specified drugs in the body.	Per se laws prohibit driving with an amount of a drug above a specified per se limit, similar to the 0.08 or 0.05 BAC per se laws for alcohol.
DUID has two requirements: an officer must observe signs that the driver is impaired and the impairment must be linked to a drug. Marijuana can impair, so DUID laws apply to marijuana.	As of April 2018, 12 states have zero tolerance laws for marijuana: 9 states for THC or a metabolite and 3 states for THC but with no restriction on metabolites (GHSA, 2018b; NCSL, 2018c). South Dakota's zero tolerance law applies only to drivers under the age of 21.	As of April 2018, 7 states have marijuana per se laws with THC limits of 1 ng (Pennsylvania), 2 ng (Nevada and Ohio), 3 ng (West Virginia, for state-registered medical marijuana patients), and 5 ng (Illinois, Montana, and Washington). Colorado has a "permissible inference" law with a 5 ng limit. (ibid.)

Figure 2 shows state marijuana impaired driving laws as of April 2018.

FIGURE 6
State marijuana impaired driving laws—DUID
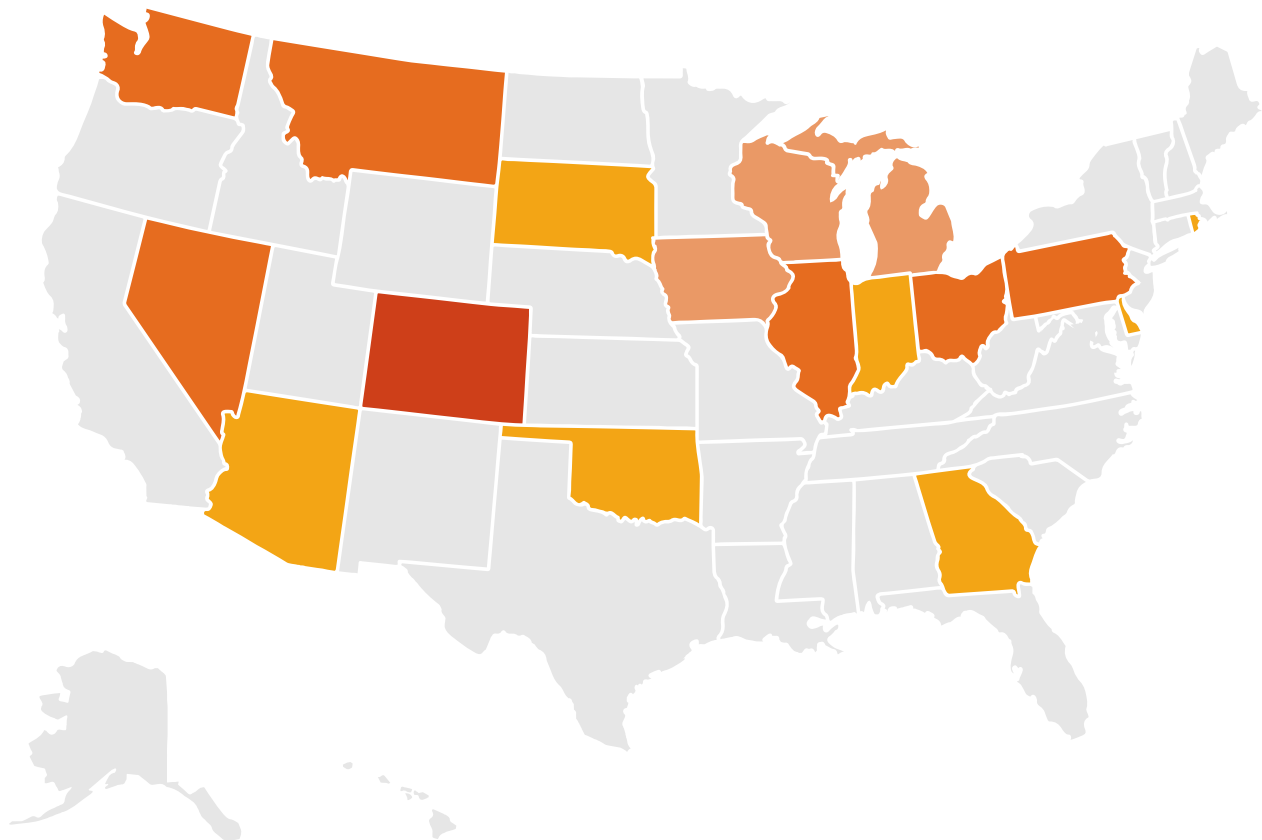
Click to highlight states in applicable category

SHOW ALL	ZT THC / Metabs	ZT THC only	Per se THC	Permissible Inf.
	Zero Tolerance THC and Metabolites	Zero Tolerance THC only	Per se THC	Permissible Inference

Source: Adapted from NCSL, 2018b.

Opioids

On October 26, 2017, Acting Health and Human Services Secretary Hargan declared a nationwide public health emergency regarding the opioid crisis. While overdose deaths from the abuse of prescription or illegal opioids have received the most attention, opioids also affect driving and can cause crashes. This section documents the role of opioids in driving.

About opioids

Opioids are a class of drugs that includes heroin, synthetic opioids such as fentanyl, and pain relievers available legally by prescription including oxycodone (OxyContin), hydrocodone (Vicodin), codeine, morphine, and many others. Opioid pain relievers are generally safe when taken for a short time and as prescribed by a doctor, but because they produce euphoria in addition to pain relief, they can become addictive. Regular use, even as prescribed by a doctor, can lead to dependence (NIDA, 2018). Synthetic opioids such as fentanyl or carfentanil can be hundreds or even thousands of times more powerful than prescription opioids.

Opioid prescriptions rose from 107 million in 1992 to nearly 277 million in 2012 before declining to 239 million in 2016 (Pezalla et al., 2017). Nearly 92 million adults, or about 38% of the population, reported that they took a legitimately prescribed opioid in 2015 (Han et al., 2017). Roughly 21% to 29% of patients prescribed opioids for chronic pain misuse them and between 8% and 12% develop an opioid use disorder. In 2016, about 42,000 deaths, or 115 deaths every day, were attributed to an opioid overdose (NIDA, 2018).

FARS has codes for 158 different opioids.

FIGURE 7

Opioid Prescriptions, 1992–2016

Opioid prescriptions, millions
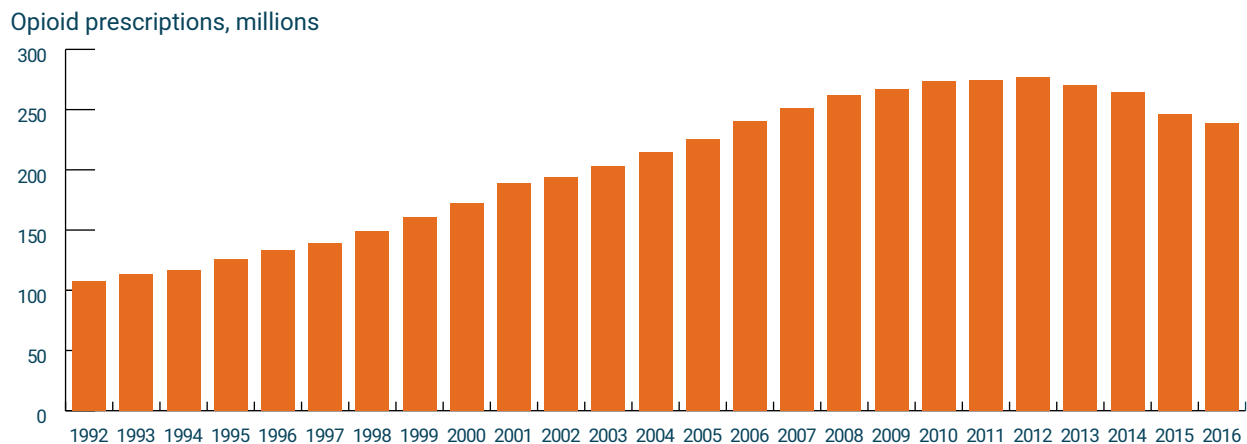
Source: Pezalla, et. al. (2017)

Opioid use by drivers

Fatally-injured drivers, reported in FARS: In 2016, 1,064 drivers, or 19.7% of the drug-positive drivers, were positive for some opioid, slightly less than half as many as were positive for marijuana. The most frequent opioids were oxycodone (OxyContin, Percodan, Percocet) at 20% of all opioids, hydrocodone (Vicodin, Lortab, Lorcet) at 19%, morphine at 14%, fentanyl at 11%, and methadone at 8%. In 2006, 679 drivers, or 17.0% of drug-positive drivers, were opioid-positive.

In 2016, 54.3% of the fatally-injured drivers were tested for drugs. This means that 10.7% of all fatally-injured drivers were known to have been opioid-positive.

While the limitations of FARS data discussed above apply, the general conclusions are clear: opioids are present about half as frequently as marijuana in fatally-injured drivers and opioid presence has increased in the past decade.

Roadside survey data: In NHTSA's 2013-14 roadside survey, 4.7% of drivers on weekend nights and 5.5% on weekday days tested positive for opioids, considerably fewer than tested positive for marijuana (12.7% and 8.7%, respectively) (Kelly-Baker et al., 2017).

Opioid impairment and crash risk

Many studies document that opioids can cause drowsiness and can impair cognitive function, both of which can have obvious effects on driving (Dhingra et al., 2015; Strand et al., 2016).

Two reviews summarize what is known about opioid effects on crash risk. Gjerde et al. (2015) review 25 epidemiological studies. Seventeen of these found a statistically significant effect of opioid use on crash risk while the other eight did not. However, seven of these eight studies had either low statistical power or questionable designs. The authors conclude that opioids increase crash risk but do not provide a numerical estimate of the effect.

Chihuri and Li (2017) conducted a meta-analysis of 15 studies of prescription opioid effects, 10 of which analyzed crash involvement and 5 of which analyzed crash culpability. The summary effects across all studies were an increased risk of 2.29 for involvement and 1.47 for culpability.

Estimating the effect on crash risk is even more difficult for opioids than for marijuana. The most supportable conclusion is that opioids can increase crash risk by a factor of no more than about 2.

Drivers' views on opioids and driving

The opioid crisis results from a wide variety of societal issues produced by illegal opioids and the misuse of prescription opioids, most notably opioid-related deaths, not from opioid-impaired driving. Drivers probably consider illegal and prescription opioids quite differently. Illegal opioids, including prescription opioids taken illegally, are drugs which

Opioids are present about half as frequently as marijuana in fatally-injured drivers and opioid presence has increased in the past decade.

Opioids can cause drowsiness, impair cognitive function, and increase crash risk.

have no medical benefit and can impair driving. Driving after using them should be discouraged or prohibited. Opioids taken by prescription are medicines, taken to relieve pain. Their use is fairly common. In a 2017 national survey of drivers age 21 and above, 17% reported taking a prescription opioid in the past month. Of those who did, 64% said that they felt it was safe to drive (NSC, 2017).

In another 2017 national survey of drivers, 90.8% said that other drivers who have used illegal drugs are a serious or somewhat serious threat to them, compared to 78.1% for other drivers who have used prescription drugs (AAAFTS, 2018).

Physicians prescribing opioids and pharmacists filling prescriptions may not warn patients of their possible effects. For example, FDA's prescribing advice for OxyContin says only "Warn patients not to drive or operate dangerous machinery unless they are tolerant to the effects of OxyContin and know how they will react to the medication" and the package insert says "Do not drive, operate heavy machinery, or participate in any other possibly dangerous activities until you know how you react to this medicine. OxyContin can make you sleepy." (FDA, 2018a; 2018b).

State opioid laws

Driving under the influence of opioids is covered by the same three types of state laws as driving under the influence of marijuana.

FIGURE 8
State opioid impaired driving laws

■ ZT
*South Dakota: under 21 only
■ Per se

Adapted from NCSL, 2018b.

Driving Under the Influence of Drugs (DUID) is illegal in every state.	*Zero Tolerance laws* prohibit driving with any amount of specified drugs in the body.	*Per se laws* prohibit driving with an amount of a drug above a specified per se limit, similar to the 0.08 or 0.05 BAC per se laws for alcohol.
DUID has two requirements: an officer must observe signs that the driver is impaired and the impairment must be linked to a drug. Opioids can impair, so DUID laws apply to opioids.	As of April 2018, 16 states have zero tolerance laws for some or all opioids. South Dakota's zero tolerance law applied only to drivers under the age of 21. (NCSL, 2018d)	As of April 2018, Nevada and Ohio had per se laws applying to some opioids. (NCSL, 2018d)

Figure 8 (previous page) shows state opioid impaired driving laws as of April 2018.

Detecting marijuana- or opioid-impaired drivers

All impaired driving detection begins with a law enforcement officer stopping a driver for a traffic violation or observing a driver at a crash or a checkpoint. The officer determines if there is any reason to suspect that the driver is impaired by alcohol or a drug. This is based on what the officer observes about the driver's behavior and any other signs such as the odor of alcohol or marijuana, beer bottles, marijuana cigarettes, opioid pills, or the like.

Standardized Field Sobriety Tests (SFSTs)

If impairment is suspected, the officer usually will begin by checking for impairment from alcohol using the SFSTs or Preliminary Breath Test (PBT) instruments. The SFSTs can rule out alcohol impairment and can provide a reasonable initial screen for impairment from marijuana and opioids (Porath-Waller and Beirness, 2014).

The procedures for making an arrest, obtaining a BAC from a breath or blood sample, prosecuting a Driving Under the Influence of alcohol (DUI) charge, and obtaining a conviction are far easier, quicker, and cheaper than for DUID. As a result, if an officer observes impairment and detects or suspects that alcohol is a cause, often only DUI evidence and charges will be pursued. Other drugs will be considered only if alcohol is ruled out or if the observed impairment is not consistent with the driver's BAC level (GHSA, 2015, 2018a). In states where marijuana use is illegal, officers who observe a driver impaired by marijuana often will pursue a charge of marijuana possession rather DUID (GHSA, 2018; NHTSA et al., 2017).

Advanced Roadside Impaired Driving Enforcement (ARIDE)

Many officers have not been trained to recognize the behavioral signs of impairment by

FIGURE 9
Impaired Driving Detection

1. Law enforcement officer stops a driver due to reasonable suspicion, at a checkpoint, or observes a crash

2. Officer makes personal contact with and assesses the driver and the vehicle for evidence

3. Officer administers a Standardized Field Sobriety Test and/or preliminary breath test and/or oral fluid screening

4. Probable Cause to Arrest the Driver for Impaired Driving

5. Evidentiary Blood Test and/or Drug Recognition Expert Evaluation

Note: this process includes many additional steps and differs from state to state

drugs other than alcohol (GAO, 2015). The 16-hour ARIDE course provides officers with basic information on drug impairment, including the signs and symptoms of impairment produced by marijuana and opioids. Unlike the SFSTs, ARIDE typically is not included in basic police academy training. As a result, the number of ARIDE-trained officers varies considerably by state, from most patrol officers in some states to only a few in others (GHSA, 2015). In 2015, the last year for which nationwide data are available, 561 in-person ARIDE classes trained approximately 10,350 officers (IACP, 2017). Since 2009, approximately 55,000 officers have received classroom ARIDE training, only about 8% of the approximately 700,000 patrol officers nationwide. ARIDE training also is available online but the number of officers who have been trained online is not known. In a recent survey, 17 states reported that more than 20% of their officers have been ARIDE-trained (Fell et al., 2018). Several states would like to train more officers but resources are limited (GHSA, 2018a).

Oral fluid screening

A good oral fluid (saliva) device to test for the presence of marijuana or opioids would help roadside enforcement substantially (GAO, 2015). It would provide objective data to justify an arrest and to require a blood or urine sample for an evidential test and would identify the drug category that the evidential test should examine. It should be quick, easy, minimally invasive, and inexpensive. As of April 2017, 14 states authorize officers to collect oral fluid and test for drugs (Fell et al., 2018).

Several oral fluid devices are now available. The best current models may serve as useful roadside screeners. They are easy to use, are not intrusive, and can identify

55,000
The number of officers who have received ARIDE training between 2009 and 2015.

active marijuana (THC) and opioids as well as other major drug categories. They cost about $20 per use and produce results in fewer than 5 minutes. They produce few false positives, and they correctly identify most drug-negative drivers. At least ten states have conducted field tests of oral fluid screeners, with promising results (Compton, 2017; Fell et al., 2018; Flannigan et al., 2017). In a formal evaluation, DRUID evaluated eight devices and found three that correctly identified more than 80% of both drug-positive and drug-negative drivers (Schulze et al., 2012). Lee and Huestis (2014) summarize the scientific basis of oral fluid testing as of 2014. Asbridge and Ogilvie (2015) summarize five studies that assessed the ability of four most commonly used oral fluid devices when used to detect six families of drugs. Beirness and Smith (2016) give a combined assessment of three common devices.

The currently available devices are not yet of evidential quality. While they may identify many drug-positive and drug-negative drivers, and help establish probable cause for an impaired-driving arrest, they cannot accurately measure drug concentrations. GAO (2015) concluded that "currently, there is no validated roadside drug-testing device." Compton (2017) agrees that "the accuracy and reliability of these devices has not yet been clearly established." NHTSA is evaluating five oral fluid devices with results expected shortly (NHTSA et al., 2017). Michigan began a year-long test of one device in five counties in November 2017. Results will be available in early 2019. Nine other states have conducted or are conducting pilot tests (Fell et al., 2018).

If oral fluid also could be used for evidential tests of marijuana and opioids, the advantages would be substantial:

›› *Samples could be collected at roadside and later sent to a laboratory for confirmation, eliminating the delay in acquiring a blood or urine sample;*

›› *Oral fluid samples do not require a warrant in some states;*

›› *A positive oral fluid test indicates recent use (Flannigan et al., 2017); and*

›› *An oral fluid test combined with a breath alcohol test can identify poly-drug or drug-alcohol use.*

Breath and fingerprint screening

A portable breath test device for marijuana similar to the PBT test for alcohol also would be valuable for roadside screening. Several companies, including Hound Labs and Cannabix, are developing marijuana breath test devices (Hound Labs, 2018; Cannabix, 2018). Hound Labs has begun field tests and hopes to have a device on the market in 2018 (Entrepreneur, 2017). Talpins, Holmes, Kelly-Baker et al. (2017) discuss the technology and legal implications of marijuana breath testing.

Devices which detect drug metabolites through traces of sweat in a fingerprint also are being developed. If successful, they also could be used for roadside screening. Talpins, Holmes, and Sabet (2017) briefly discuss how transdermal drug detection has been used in other settings for some time and give development plans for one company's device.

Oral fluid screening devices may identify drug-positive drivers and help establish probable cause for an impaired-driving arrest, but they cannot accurately measure drug concentrations.

Arrest, prosecution, and adjudication of marijuana- or opioid-impaired drivers

If an officer has sufficient evidence at the roadside to justify a DUID charge, the driver is arrested and taken to a police station or other processing area. There are two main tasks at the station in addition to the standard procedures for an arrest: to obtain additional behavioral evidence of impairment by drugs and to obtain a blood or urine sample for chemical analysis.

Behavioral evidence: DEC

The Drug Evaluation and Classification (DEC) program trains officers to be Drug Recognition Experts (DREs) who can identify the signs and symptoms of impairment by different categories of drugs. At the police station a DRE performs a 90-minute 12-step evaluation including both behavioral tests and a physical examination. See IACP (2017) for more information on DEC.

FIGURE 10
The DRE 12 Step Process

|	
1 Breath Alcohol Test	7 Dark Room Examinations
2 Interview of the Arresting Officer	8 Examination for Muscle Tone
3 Preliminary Examination and First Pulse	9 Check for Injection Sites and Third Pulse
4 Eye Examination	10 Subject's Statements and Other Observations
5 Divided Attention Psychophysical Tests	11 Analysis and Opinions of the Evaluator
6 Vital Signs and Second Pulse	12 Toxicological Examination

Source: IACP (2018)

DREs usually are quite accurate in confirming a driver's drug impairment and identifying the type of drug responsible for the impairment (Porath-Waller and Beirness, 2014), in particular, identifying marijuana (Hartman et al., 2016). The DEC program's main challenges are the expense of training and the need to provide adequate coverage. The DRE training of 72 hours in the classroom and 40 to 60 hours in the field takes an officer away from regular duties for three to four weeks. DREs typically are highly qualified officers. They often are promoted rapidly to an administrative position, so that another officer must be trained to replace them as a DRE.

To be effective, a DRE should be available to evaluate a substantial proportion of drivers suspected of impairment by drugs. This means that a state must have an adequate number of DREs and they should be located throughout the state. Several states would like to have more DREs but resources are limited (GHSA, 2018). GHSA has partnered with Responsibility.org since 2016 to provide training grants to states. Nine states received a

total of $180,000 in these two years, which helped train 940 officers in ARIDE and 107 in DRE. More grants will be awarded in 2018. The US Department of Transportation's FY 2018 spending bill enacted in March 2018 provides an additional $5,000,000 for activities to reduce impaired driving, including ARIDE and DEC training.

In 2016, the last year for which national data are available, 1,543 DREs were trained, bringing the total of active DREs to 8,277 (IACP, 2018). They conducted 31,421 evaluations of drivers suspected of impairment due to drugs. Marijuana was the most frequently identified drug category in 2016 at 13,603, or 31% of all drivers evaluated. Stimulants were second at 10,543, followed by depressants at 10,446 and opioids at 8,678.

2016 DRE enforcement evaluation opinions, by drug category
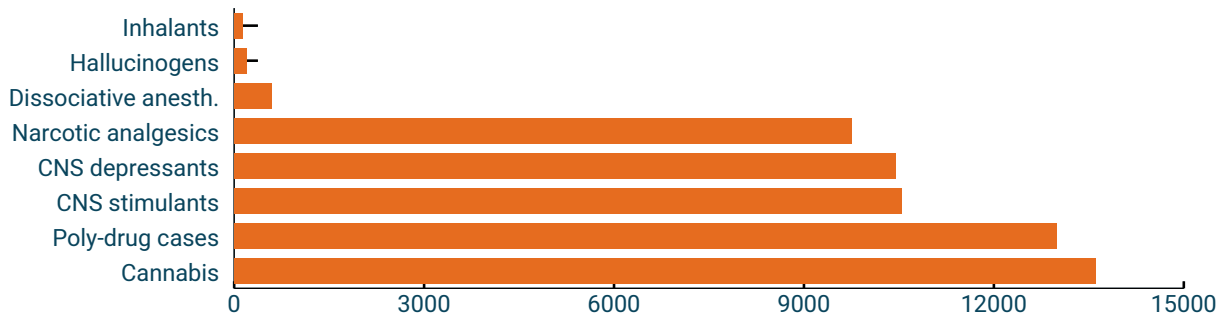
Source: Adapted from IACP (2017)

While a DRE evaluation can add substantially to a DUID case, it's not essential. The critical components are behavioral evidence consistent with impairment by a drug and a laboratory test to confirm the drug's presence.

Chemical evidence: blood or urine tests

A chemical test of a driver's blood, urine, or saliva provides objective proof of the presence or absence of drugs in a driver's body. Blood tests are the most accurate and most commonly used (Logan et al., 2013; GAO, 2015). An officer can request a blood sample from a driver arrested for DUID, but the driver may refuse, as did 31% of recent DUI arrestees in Colorado (Davis, 2015). State laws on the consequences of refusal vary substantially.

Obtaining a blood sample can take several hours. A search warrant from a judge is required for a non-voluntary blood draw except in rare circumstances. Electronic warrants (e-warrants) can speed up this step considerably, allowing officers to request and receive warrants in their patrol cars on tablets, smartphones, or computers. Currently, 45 states include language either in legislation or in court rules allowing e-warrants (Borakove and Banks, 2018). Although legislation is recommended for e-warrant systems as it creates consistency, it is not necessary. Many law enforcement agencies are currently considering transitioning to an electronic warrant system to improve efficiency. See Borakove and Banks (2018) for more information on e-warrants.

If a trained phlebotomist is not available to draw a blood sample at the police station, the driver may need to be transported to a hospital or clinic. The delay from the driver's

Obtaining a blood sample can take several hours. Electronic warrants (e-warrants) can speed up this step considerably.

first contact with law enforcement at the roadside until a blood sample is drawn may allow the driver's drug concentration to drop considerably (GAO, 2015). Some law enforcement agencies are training officers to serve as phlebotomists so that blood can be drawn quickly (Grondel, 2018).

Analyzing a blood sample can be expensive: about $250 in Vermont (NHTSA et al., 2017) and $300 in Colorado (Davis, 2015). Some states do not have the capacity to process all the blood tests produced by DUID arrests so must use expensive private laboratories. Laboratory backlogs may produce long delays until results are available, sometimes up to six months, so that some DUID cases may need to proceed without the test results (GAO, 2015; GHSA, 2015; NHTSA et al., 2017). Laboratory test procedures are not standardized so that different laboratories test for different drugs and use different threshold values, even within the same state (Logan et al., 2014; GAO, 2015; GHSA, 2018a).

Finally, as with marijuana, a driver with a detectable amount of an opioid is not necessarily impaired.

Prosecution and adjudication

Many prosecutors and judges are not familiar with DUID cases. If a case involves both DUID and DUI, prosecutors usually will bring only the DUI charge because it is easier to explain to the judge and jury and is less expensive to prosecute (NHTSA et al., 2017; Thomka, 2014). Marijuana in particular may be perceived by judges and juries as "just marijuana" and medical or recreational marijuana may be legal in the state where the case is tried.

Prosecutors, judges, and juries accustomed to alcohol impairment may not understand that drug impairment differs. Judges and juries understand drunk driving. But they may not believe that marijuana, especially in recreational or medical marijuana states, or opioids, used as prescribed, may impair driving. An officer's description or a video recording of a drug-impaired driver's roadside behavior will differ from what judges and juries expect of a drunk driver (Thomka, 2014). Some states report that judges expect a specific drug concentration that's considered impairing, similar to .08 BAC (GHSA, 2015). Others note that judges may not accept DRE evidence of impairment (GHSA, 2015, 2018).

Prosecutors and judges both need training in DUID (GAO 2015; NHTSA et al., 2017). Prosecutor training is provided by the National Traffic Law Center (NTLC) and the National Center for DWI Courts (NCDC). Information is available from the National District Attorneys Association and NCDC.

Most states have a Traffic Safety Resource Prosecutor (TSRP) who can help provide education and training to prosecutors. See the contact list as well as for other resources available through NTLC.

Courses and webcasts for judges are offered through the National Judicial College (NJC) Recent offerings include Properly and Effectively Adjudicating Drugged Drivers, Marijuana and Impaired Driving, Drugged Driving Essentials, and The Role of the Judge in Drug-Impaired Driving Cases. See www.judges. org/2018courses/ for the complete schedule.

Some states have developed their own training for law enforcement, prosecutors, and judges.

Challenges and opportunities: strategies to reduce marijuana- and opioid-impaired driving

The previous sections have described briefly the complex and confusing state of knowledge and state practices surrounding the issue of driving while impaired by marijuana or opioids. This section summarizes the challenges faced by states and provides recommendations on strategies to address them.
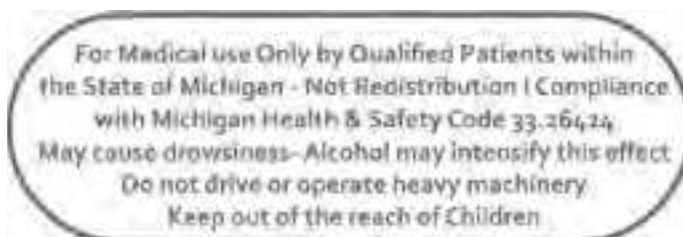
Public attitudes and education

The public in general does not understand that marijuana and opioids can impair driving and can cause crashes. In particular, many drivers who use marijuana regularly also drive after use. They often believe that their marijuana use doesn't impair or even improves their driving. Similarly, many drivers who use prescription opioids feel that they can drive safely after use.

Education is needed to inform the public and change these beliefs. Unless drivers understand the risks of driving after using marijuana or opioids, other strategies will have limited effectiveness. States are well aware of the need for better public education on marijuana, opioids, and driving (GHSA, 2018; NHTSA et al., 2017).

Marijuana messaging must address two points: that marijuana can impair driving and that driving while impaired by marijuana is illegal. A deterrent message alone – that marijuana-impaired drivers will be arrested and punished – may have little effect because of the low rate of successful detection, arrest, and prosecution. Information on marijuana's impairing effects also may help create a social norm regarding marijuana use and driving similar to the well-established norm regarding alcohol-impaired driving (Capler et al., 2017; Davis et al., 2016; TIRF, 2017; Aston et al., 2016). The marijuana industry should help establish this norm.

Medical marijuana states may provide explicit warnings on the marijuana container regarding driving after using marijuana. Figure 11 shows Michigan's label.

The public in general does not understand that marijuana and opioids can impair driving and can cause crashes.

FIGURE 11

For Medical use Only by Qualified Patients within the State of Michigan - Not Redistribution | Compliance with Michigan Health & Safety Code 33.26424 May cause drowsiness- Alcohol may intensify this effect Do not drive or operate heavy machinery Keep out of the reach of Children

Opioid messaging must address two audiences. Drivers who take prescription opioids to relieve pain need to understand the warnings on the medication bottle regarding how long they must wait after taking the medication before driving. Physicians and pharmacists can deliver this message when a prescription is written and filled. While many physicians and pharmacists provide appropriate warnings for prescription opioids, some do not (Pollini et al., 2017).

Drivers who use opioids illegally may not be affected by information about opioids and driving. For them, the deterrent message of detection, arrest, and prosecution may have more effect. It may not be necessary to mount a specific campaign because users already know that possession and use is illegal and will lead to penalties if detected. SHSOs may be able to join with public health agencies in a combined message that opioid abusers can be detected through their impaired driving.
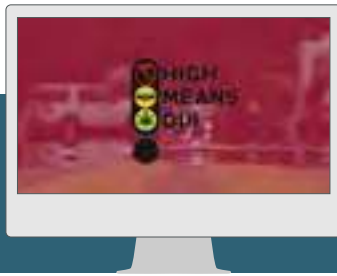
Several states have ongoing drug-impaired driving campaigns addressing impaired driving in general, marijuana, or opioids. Examples include:

The marijuana industry should establish social norms regarding marijuana use and driving similar to the norms surrounding alcohol-impaired driving.

FIGURE 12
Drug-impaired driving campaigns

Click to view states' driving campaigns

California: DUI Doesn't Just Mean Booze

Wisconsin: Dose of Reality

New York: Drugged Driving is Impaired Driving

Colorado: The Cannabis Conversation; Drive High, Get a DUI

Ohio: Drugged Driving = Done Driving

New Mexico: Don't Drive Drugged

Florida: Drive Baked, Get Busted

>> *Marijuana information under the slogan High Means DUI is available from* Smart Approaches to Marijuana.

Recommendation: *States should add drug-impaired driving messages, especially regarding marijuana and prescription drugs, to their impaired driving campaigns. Marijuana messages are particularly important in states in which recreational or medical use is legal or is likely to be authorized.*

Research need: *Develop a consistent marijuana message based on research, such as "Don't drive within XX hours of using marijuana," where XX is a number supported by research. Develop national drugged-driving messages and materials that states can use for state-level campaigns.*

Recommendation: *States should consider a campaign with physicians and pharmacists on prescription opioid warnings. States may wish to cooperate with public health agencies to deliver joint messages to the public.*

Roadside detection

States recognize that roadside detection is the critical first component in enforcing DUID laws (GHSA, 2018). The initial step in evaluating a driver's impairment, SFST, is fully established nationwide. The next step, to identify the behavioral signs of impairment by drugs, is not. ARIDE provides that step. ARIDE training for at least a majority of patrol officers should be within a state's budget. Several states recognize the need for more ARIDE-trained officers (GHSA, 2018).

Recommendation: *States should train at least a majority of their patrol officers in ARIDE.*

Oral fluid screening

Oral fluid screening offers substantial opportunities for improving marijuana and opioid detection. It would be quick, easy, relatively inexpensive, require little training, and would provide objective evidence of drug presence. It would identify poly-drug or drug-alcohol use.

Recommendation: *States should seriously consider at least a test of oral fluid devices.*

Research recommendation: *NHTSA should publish its evaluation of oral fluid devices promptly. If some devices are acceptable, NHTSA should publish a list of approved devices. States conducting oral fluid field tests should publish the results.*

Breath tests

The marijuana breath test instruments currently in development hold great promise. They likely would be cheaper and quicker to use than oral fluid devices. While they are specific to marijuana, that is by far the drug detected most frequently in drivers.

Recommendation: *States should closely follow the development of marijuana breath test instruments and should seriously consider a pilot test if and when they become available.*

Marijuana breath test instruments in development hold great promise.

Arrest

DEC, while expensive, is a highly effective method to confirm a driver's impairment, determine the category of drugs that produced the impairment, provide a solid foundation for obtaining a blood sample for testing, and produce evidence that can be presented in court if necessary. Many states would like to have more trained DREs (GHSA, 2018).

Recommendation: *States should train an adequate number of DREs to address their DUID problem, consistent with law enforcement resources. Grant funds have been and may continue to be available to help states train DREs.*

Prosecution and adjudication

Many prosecutors and judges need training in all aspects of drug-impaired driving.

Recommendation: *States should encourage prosecutors and judges assigned to DUID cases to participate in appropriate training.*

Failure to pursue DUID when a driver is impaired by alcohol

If a driver's BAC exceeds the per se limit of .08 (.05 in Utah), officers often will not check for drug impairment. A DUID charge requires far more time and resources to obtain evidence. Prosecutors may drop a DUID charge in favor of DUI because DUI is easier to present in court and obtain a conviction. Even if convicted, the penalties may be the same as for DUI alone. This failure has consequences. The size of the drugged driving problem is underestimated. Also, drivers are led to believe that DUID is less serious than DUI.

Recommendation: *Officers should be encouraged to investigate drug impairment even when alcohol is suspected. Good roadside oral fluid or marijuana breath test devices would make drug investigation considerably easier, faster, and cheaper. Similarly, prosecutors should pursue DUID charges when they are supported by the evidence.*

Electronic warrants

A blood draw in most states requires the office to obtain a warrant (NHTSA et al., 2017). This can take an hour or more, which is an inefficient use of the officer's time and

means that drug concentrations in the blood can diminish. Electronic warrants solve this problem: they can be obtained quickly, without a personal visit. Currently, 45 states include language either in legislation or in court rules allowing e-warrants (Borakove and Banks, 2018).

Recommendation: *States that do not allow electronic warrants should authorize them. If authorized, law enforcement agencies should implement electronic warrants as needed.*

Test refusal

Some states noted that drivers may refuse to provide a blood sample or refuse to submit to a DRE's evaluation. States typically have addressed this issue in DUI investigations by making the penalty for refusing a test equivalent to that for failing the test.

Recommendation: *States should examine their laws and should provide appropriate penalties for drug test refusal.*

Urine tests

Some states test for drug presence using urine rather than blood. Urine tests will not measure THC but only non-impairing metabolites.

Recommendation: *States should require blood testing for drugs rather than urine testing.*

Laboratory procedures, costs, and delays

An accurate assessment of drug-impaired driving requires standardized laboratory test procedures across the country. The National Safety Council has developed recommendations which should be accepted and implemented (NHTSA et al., 2017). Forensic laboratories in some states lack the capacity to conduct the volume of drug tests produced by the rise in marijuana and opioid use by drivers.

Recommendation: *States should invest in forensic laboratory capabilities to provide adequate testing for drivers arrested for DUID.*

Research recommendation: *Agree on national recommended standards for laboratory test procedures.*

Changes in laboratory test procedures are difficult and may take considerable time. A promising solution lies with roadside testing. Good roadside oral fluid test devices or marijuana breath test devices may reduce the need for prompt laboratory test confirmation. An evidential-quality oral fluid device may reduce it even further.

Per se laws

DUI charges, prosecution, and adjudication are simplified by per se laws: if a driver's BAC exceeds the per se limit, the driver is presumed guilty of DUI, though behavioral evidence of impairment is needed to back up the chemical evidence. The DUI per se

laws are justified because of the overwhelming scientific evidence that drivers are impaired when their BAC reaches the per se level.

While many wish that per se limits could be justified similarly for drugs in general and marijuana in particular, they cannot (Compton, 2017; GAO, 2015). This hasn't stopped some states from implementing either zero tolerance or per se laws, as discussed previously. Zero tolerance laws are easy to understand and can be justified for illegal drugs. However, they are problematic for opioids taken by prescription or for marijuana in medical or recreational states.

Laws with a positive per se limit are even more problematic to justify. They send a message that lower levels do not impair, which is false. Unlike alcohol per se limits, they are difficult for the driving public to understand. A "standard drink" of alcohol is a 12 oz. beer, a 5 oz. glass of wine, or a normal mixed drink. Drivers generally understand how many standard drinks are required for them to reach the per se limit. There's nothing equivalent for marijuana or opioids. It is usually straightforward to measure a driver's BAC within an hour of a crash or arrest using the evidential breath test equipment found in police stations. Because BAC dissipates gradually, this gives a reasonably accurate estimate of BAC before the crash or arrest. THC and opioids require blood to be drawn, which can take hours from the time of the crash or arrest, enough time for their concentrations to decrease substantially. And drug concentration in blood does not correlate well with impairment.

Recommendation: *Per se laws for marijuana or opioids are not recommended. States wishing to consider them should understand that they have little scientific basis and should consider the message they may send to drivers. Zero tolerance laws for illegal drugs may be appropriate.*

> ### Data
> Marijuana and opioid involvement in impaired driving crashes are underestimated because of poor data. Improving the data will not be easy but is necessary.

Drivers in fatal crashes

Only 64% of fatally-injured drivers were tested for drugs in 2015. Some states test well over 90% of fatally-injured drivers. This typically results from a medical examiner policy of drawing blood from all persons who died accidentally and testing for drugs and alcohol. Better data would help understand the role of marijuana and opioids in these most serious of crashes.

Recommendation: *Test all fatally-injured drivers, and all surviving drivers in a fatal crash who may be at fault, for drugs and alcohol.*

Per se **laws for marijuana or opioids are not recommended. States wishing to consider them should understand that they have little scientific basis.**

Drivers arrested for impaired driving

Ideally, all impaired driving arrestees should be tested for both alcohol and drugs. The costs of laboratory testing make this impractical at present. When and if good and cheap roadside oral fluid or marijuana breath test devices are available, states should consider testing all arrestees.

Recording impaired driving

Some states do not have a separate DUID offense but use DUI for driving impaired by either alcohol or drugs. While 34 states and D.C. report DUI and DUID arrests separately, only 2 states—Maryland and Washington—have state laws that distinguish DUI and DUID (Fell et al., 2018). This makes it difficult to estimate the role of drugs in crashes and on the road.

Recommendation: *States should establish a separate DUID offense equivalent to DUI.*

Another method of recording drug-impaired drivers is to include arrest and crash data elements for law enforcement to record. The 2017 Model Minimum Uniform Crash Criteria (NHTSA, 2017) provides models. The crash and driver drug data elements follow; the alcohol elements are similar.

» **C26. Drug involvement.** *Law enforcement suspected or documented that at least one driver or non-motorist involved in the crash had used drugs.*

» **P22. Law enforcement suspects drug use.** *Driver or non-motorist involved in the crash suspected by law enforcement to have used drugs.*

» **P23. Drug test** *(test status, type, result)*

These data elements would allow states to track drug-involved drivers much more accurately than at present without requiring changes to their impaired-driving laws and without requiring full DUID investigations.

Recommendation: *States should record suspected and confirmed DUID drivers in their arrest and crash records.*

Moving forward

After deciding what can or should be done, the critical question is how to get it done. Here are some broad conclusions from this review and some suggestions on how to implement the recommended strategies.

It's not drugs or alcohol, it's impaired driving

The basic traffic safety issue is to prevent driving while impaired by a substance that a driver has swallowed or injected or otherwise introduced into his or her body. While alcohol has been the most common impairing substance for many years, drug use has increased recently. The basic components of and strategies for addressing impaired driving are the same for alcohol and drugs: convincing drivers not to drive while impaired, detecting an impaired driver, observing and recording behavioral evidence of impairment consistent with alcohol or a drug, obtaining chemical evidence of alcohol or drugs, and assessing and treating alcohol or drug dependence or addiction.

> **The basic components of and strategies for addressing impaired driving are the same for alcohol and drugs.**

>> *Drivers choose to use both alcohol and drugs. While some drugs are prescribed by physicians, for example to relieve pain, alcohol and many drugs are used because they make the driver "feel good" in some way.*

>> *Driving after using alcohol or drugs also is a choice. Drivers can choose not to drive after using alcohol or drugs, or they can choose not to use alcohol or drugs before driving. Impaired driving messages make this point: "Don't drink and drive." "Choose a designated driver." "Do not drive or use heavy machinery (after using this drug)."*

>> *Drivers impaired by alcohol or drugs are detected initially in the same way. A law enforcement officer may observe someone driving erratically or violating a traffic law, or a driver may be involved in a crash or stopped at a checkpoint. The officer then determines if the driver shows signs of impairment and if any impairment could be due to alcohol or drugs. If the officer has probable cause to believe the driver is impaired by alcohol or drugs, then the driver is arrested.*

>> *A DUI or DUID charge usually requires solid behavioral evidence of impairment backed up by chemical evidence of alcohol or drugs.*

>> *Drivers arrested for DUI or DUID should be assessed for substance dependence and mental health disorders, and treated if appropriate.*

DUID differs from DUI only in some methods needed to implement the basic strategies.

>> *Education: messages to drivers differ somewhat for alcohol and for different drugs.*

>> *Behavioral signs of impairment: alcohol and different drugs affect behavior in different ways and so produce different behavioral signs.*

>> *Chemical evidence: alcohol can be measured accurately in breath while drugs must be measured in blood, urine, or saliva. Impairment from alcohol is strongly related to the amount of alcohol in the body, measured by BAC. There is no similar relation between the amount of a drug in the body and impairment.*

DUID consequently requires some additional tools to be added to the alcohol-impaired driving toolkit. But it's the same toolkit.

To integrate marijuana and opioids, as well as other drugs, into a state's impaired driving activities, states should address the five issues discussed in this report.

>> *Public education, by including messages that drugs can impair driving and by educating physicians and pharmacists on opioid warnings.*

>> *Roadside detection of drugs, perhaps with oral fluid or marijuana breath test devices.*

>> *Training for law enforcement via ARIDE and DEC; education for prosecutors and judges.*

>> *Policies and laws, including electronic warrants, test refusal, use of blood rather than urine tests, and laboratory procedures.*

>> *Data, to provide more accurate and complete data on DUID in arrests and crashes.*

How to do it?

Implementing these recommendations requires resources. States should consider three ways to supplement their usual funding sources. First, some grants are available to assist DUID; more may be forthcoming. Next, consider joining with public health agencies and health care providers as partners in addressing the opioid epidemic. Finally, if a state legalizes recreational marijuana, then some of the tax revenue from marijuana sales should be directed to marijuana-impaired driving programs.

The last word

A critical SHSO mission is to convince drivers to drive responsibly, alertly, and unimpaired. Marijuana and opioids add different forms of impairment. They require some new tactics to detect impaired drivers; link impairment to a drug; prosecute, adjudicate, and treat offenders; and above all educate drivers and the public. They join with and build on the familiar methods to address alcohol-impaired driving. Impaired driving program focus should not shift to marijuana and opioids exclusively but should expand to include marijuana and opioids along with alcohol.

References

AAAFTS (2018). *2017 Traffic Safety Culture Index.* Washington, DC: AAA Foundation for Traffic Safety. https://aaafoundation.org/2017-traffic-safety-culture-index/

Allen, J.A., Davis, K.C., Duke, J.C., et al. (2016). Association between self-reports of being high and perceptions about the safety of drugged and drunk driving. *Health Education Research.* http://her.oxfordjournals.org/content/early/2016/05/03/her.cyw023.short

American Addiction Centers (2018). *What Are the Signs That Someone Is High?* Brentwood, TN: American Addiction Centers. https://americanaddictioncenters.org/marijuana-rehab/how-to-tell-if-someone-is-high/

Arnold, L.S. and Tefft, B.C. (2016). *Driving Under the Influence of Alcohol and Marijuana: Beliefs and Behaviors, United States, 2013-2015.* Washington DC: AAA Foundation for Traffic Safety. https://www.aaafoundation.org/driving-under-influence-alcohol-and-marijuana-beliefs-and-behaviors-united-states-2013-2015.

Asbridge, M. and Ogilvie, R. (2015). *A Feasibility Study of Roadside Oral Fluid Drug Testing.* Oakville,Ontario: MADD Canada. http://www.madd.ca/media/docs/feasibility-roadside-oral-fluid-drug-testing.pdf.

Aston, E.R., Merrill, J.E., McCarthy, D.M., et al. (2016). Risk factors for driving after and during marijuana use. *Journal of Studies on Alcohol and Drugs, 77*(2), p. 309 - 316

Aydelotte, J.D., Brown, L.H., Lutman, K.M., et al. (2017). Crash fatality rates after recreational marijuana legalization in Washington and Colorado. *American Journal of Public Health.* doi: 10.2105/AJPH.2017.303848

Borakove, E. and Banks, R. (2018). *Improving DUI System Efficiency: A Guide to Implementing Electronic Warrants.* Arlington, VA: Justice Management Institute and Alexandria, VA: Foundation for Advancing Alcohol Responsibility. https://www.responsibility.org/end-impaired-driving/initiatives/e-warrants/

Beirness, D.J. (2014). *Nature and Magnitude of the Drugs and Driving Problem in Canada.*
2nd International Symposium on Drugs and Driving. Wellington, NZ: New Zealand Drug Foundation.

Beirness, D.J. and Smith, D'A. R. (2016). An assessment of oral fluid drug screening devices.
Canadian Society of Forensic Science Journal. http://dx.doi.org/10.1080/00085030.2017.1258212.

Berning, A., Compton, R., and Wochinger, K. (2015). *Results of the 2013–2014 National Roadside Survey of Alcohol and Drug Use by Drivers.* Traffic Safety Facts Research Note. DOT HS 812 118. Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812118-roadside_survey_2014.pdf

Berning, A. and Smither, D.D. (2014). *Understanding the limitations of drug test information, reporting, and testing practices in fatal crashes.* DOT HS 812 072. Washington, DC: National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812072

Cannabix 2018). Technology. Vancouver, BC: Cannabix Technologies. http://www.cannabixtechnologies.com/thc-breathalyzer.html

Capler, R., Bilsker, D., Van Pelt, K., et al. (2017). *Cannabis Use and Driving: Evidence Review.* Canadian Drug Policy Coalition. http://drugpolicy.ca/wp-content/uploads/2016/11/CDPC_Cannabis-and-Driving_Evidence-Review-Full_Jan31-2017_FINAL.pdf

CDOT (2014). *Drive High, Get a DUI: CDOT Marijuana Impaired Driving Campaign.* Powerpoint presentation. Denver, CO: Colorado Department of Transportation.

CDOT (2018). *Marijuana-involved Fatalities in Colorado, by THC Type.* Denver, CO: Colorado Department of Transportation. https://www.codot.gov/safety/alcohol-and-impaired-driving/druggeddriving/drugged-driver-statistics

Chihuri, S. and Li, G. (2017). Use of prescription opioids and motor vehicle crashes: A meta-analysis. *Accident Analysis & Prevention* 109, 123-131. https://doi.org/10.1016/j.aap.2017.10.004

Compton, R. (2017). *Marijuana-Impaired Driving - A Report to Congress.* DOT HS 812 440. Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/behavioral-research

Compton, R. and Berning, A. (2015). *Drug and alcohol crash risk.* (Traffic Safety Facts Research Note. DOT HS 812 117). Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/staticfiles/nti/pdf/812117-Drug_and_Alcohol_Crash_Risk.pdf

Davis, G. (2015). Personal conversation. Denver, CO: Colorado Department of Transportation.

Davis, K.C., Allen, J., Duke, J. et al. (2016). Correlates of marijuana drugged driving and openness to driving while high: Evidence from Colorado and Washington. Plos One. https://doi.org/10.1371/journal.pone.0146853

Dhingra, L., Ahmed, E., Shin, J, et al. (2015). Cognitive effects and sedation. *Pain Medicine* 16, suppl_1, S p. 37–S43 https://doi.org/10.1111/pme.12912.

Eichelberger, A.H. (2018). *Marijuana Use and Driving in Washington State: Opinions and Behaviors Before and After Implementation of Retail Sales*. Arlington, VA: Insurance Institute for Highway Safety. http://www.iihs.org/bibliography/topic/2154

Entrepreneur (2017). A California company believes it has invented a viable marijuana breathalyzer. Dec. 28, 2017. https://www.entrepreneur.com/article/306676

FDA (2018a). OxyContin prescribing information for physicians. https://www.accessdata.fda.gov/drugsatfda_docs/label/2015/022272s027lbl.pdf

FDA (2018b). Package insert OxyContin. https://www.accessdata.fda.gov/drugsatfda_docs/label/2009/020553s060lbl.pdf

Fell, J.C., Kubelka, J., and Treffers, R. (2018). *Advancing Drugged Driving Data at the State Level: State-by-State Assessment*. Washington, DC: AAA Foundation for Traffic Safety. https://aaafoundation.org/advancing-drugged-driving-data-at-the-state-level-state-by-state-assessment/

Flannigan, J., Talpins, S.K, and Moore, C. (2017). Oral fluid testing for impaired driving enforcement. *The Police Chief,* January 2017. http://www.policechiefmagazine.org/magazine-issues/january-2017/

GAO (2015). *Drug-Impaired Driving: Additional Support Needed for Public Awareness Initiatives*. Washington, DC: United States Government Accountability Office. http://gao.gov/products/ GAO-15-293?source=ra.

GHSA (2015). *Survey of State Highway Safety Offices*. Washington, DC: Governors Highway Safety Association

GHSA (2017). *Drug-Impaired Driving: A Guide for States, 2017 Update*. Washington, DC: Governors Highways Safety Association. (https://www.ghsa.org/resources/drugged-driving-2017).

GHSA (2018a). *Survey of State Highway Safety Offices*. Washington, DC: Governors Highway Safety Association.

GHSA (2018b). *Marijuana Drug-Impaired Driving Laws*. Washington, DC: Governors Highways Safety Association. https://www.ghsa.org/state-laws/issues/drug%20impaired%20driving

Gjerde, H., Strand, M.C., and Mørland, J. (2015). Driving under the influence of non-alcohol drugs – an update. Part I: Epidemiological studies. *Forensic Science Review* 27(2).

Gjerde, H. and Mørland, J. (2016). Risk for involvement in road traffic crash during acute cannabis intoxication. *Addiction* 111(8), 1492-1495.

Grondel, D. (2018). Personal communication. Olympia, WA: Washington Traffic Safety Commission.

Grondel, D.T., Hoff, S., and Doane, D. (2018). *Marijuana Use, Alcohol Use, and Driving in Washington State: Emerging Issues With Poly-Drug Use on Washington Roadways*. Olympia, WA: Washington Traffic Safety Commission. http://wtsc.wa.gov/research-data/traffic-safety-studies/

Han, B., Compton, W.M, Blanco, C., et al. (2017). Prescription Opioid Use, Misuse, and Use Disorders in U.S. Adults: 2015 National Survey on Drug Use and Health. *Annals of Internal Medicine* 167(5), pp.293-301.

Hartman, R. L. and Huestis, M. A. (2013). Cannabis effects on driving skills. *Clinical Chemistry* 59(3), 478–492.

Hartman, R.L., Richman, J.E., Hayes, C.E., et al.(2016). Drug Recognition Expert (DRE) examination characteristics of cannabis impairment. *Accident Analysis and Prevention* 92, 219-229.

Hound Labs (2018). Product testing. Oakland, CA: Hound Labs.https://houndlabs.com/product-testing/

IACP (2018). *The 2016 Annual Report of the IACP Drug Evaluation and Classification Program*. Alexandria, VA: International Association of Chiefs of Police. http://www.decp.org/

IACP (2018). The International Drug Evaluation and Classification Program. The International Association of Chiefs of Police. http://www.decp.org/drug-recognition-experts-dre/12-step-process/

IIHS (2017). *Legalizing Recreational Marijuana Is Linked to Increased Crashes*. IIHS Status Report 52 (4). Arlington, VA: Insurance Institute for Highway Safety. http://www.iihs.org/iihs/sr/statusreport/article/52/4/1

Kelley-Baker, T., Berning, A., Ramirez, A., et al. (2017). *2013-2014 National Roadside Study of alcohol and drug use by drivers: Drug results*. DOT HS 812 411. Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/behavioral-research

Lee, D., and Huestis, M.A. (2014). Current knowledge on cannabinoids in oral fluid. *Drug Testing and Analysis*, 6(0), 88–111. http://doi.org/10.1002/dta.1514

Liberty Mutual (2017). *One-Third of Teens Think Driving Under The Influence of Marijuana is Legal in States Where Recreational Use By Adults is Permitted.* Boston, MA: Liberty Mutual Insurance. https://www.prnewswire.com/news-releases/weed-out-the-confusion-one-third-of-teens-think-driving-under-the-influence-of-marijuana-is-legal-in-states-where-recreational-use-by-adults-is-permitted-300535938.html

Logan, B.K., Lowrie, K.J., Turri, J.L. et al. (2013). Recommendations for toxicological investigation of drug-impaired driving and motor vehicle fatalities. *Journal of Analytical Toxicology.* doi:10.1093/jat/bkt059

Marijuana Policy Project (2018). *2018 Marijuana Policy Reform Legislation.* Washington, DC: Marijuana Policy Project. https://www.mpp.org/states/key-marijuana-policy-reform/

Narconon (2018). *Signs and Symptoms of Marijuana Use.* Los Angeles, CA: Narconon International. http://www.narconon.org/drug-abuse/signs-symptoms-marijuana-use.html

NCSL (2018a). *State Medical Marijuana Laws.* Denver, CO: National Conference of State Legislatures. http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx

NCSL (2018b). *Marijuana Overview.* Denver, CO: National Conference of State Legislatures. http://www.ncsl.org/research/civil-and-criminal-justice/marijuana-overview.aspx#2

NCSL (2018c). *Drugged Driving.* Denver, CO: National Conference of State Legislatures. http://www.ncsl.org/research/transportation/drugged-driving-overview.aspx

NCSL (2018d). *Drugged Driving Per Se Laws.* Denver, CO: National Conference of State Legislatures. www.ncsl.org/documents/transportation/per_se_chart_Feb_2017.pdf.

NHTSA (2016). Drivers' Use of Marijuana in Washington State. Traffic Tech. DOT HS 812 307. www.nhtsa.gov/staticfiles/nti/pdf/812307-TT-Marijuana_Use_in_WA.pdf

NHTSA (2017). *Model Minimum Uniform Crash Criteria.* DOT HS 812 433. Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/mmucc.

NHTSA, GHSA, and the Volpe National Transportation Systems Center (2017). *Impact of the legalization and decriminalization of marijuana on the DWI system: Highlights from the expert panel meeting.* DOT HS 812 430. Washington, DC: National Highway Traffic Safety Administration. https://www.nhtsa.gov/behavioral-research

NIAAA (1997). *Alcohol Alert.* Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism. https://pubs.niaaa.nih.gov/publications/aa35.htm

NIDA (2018). *Opioid overdose crisis.* Washington, DC: National Institute on Drug Abuse. https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis

NSC (2017). *Driver Safety Public Opinion Poll.* Itasca, IL: National Safety Council. www.nsc.org/NewsDocuments/2017/Driver-Safety-Poll.pdf

NSDUH (2016). *Key substance use and mental health indicators in the United States: Results from the 2016 National Survey on Drug Use and Health* (HHS Publication No. SMA 17-5044, NSDUH Series H-52, NSDUH Series H-51). https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR1-2016/NSDUH-FFR1-2016.htm#illicit2 /

Pezalla, E.J., Rosen, D., Erensen, J.G., et al. (2017). Secular trends in opioid prescribing in the USA. *Journal of Pain Research* 10, p. 383–387. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5319424/

PIRE (2014). *Washington State Roadside Survey, October 2014.* Calverton, MD: Pacific Institute for Research & Evaluation.

Pollini, R.A., Waehrer, G., and Kelley-Baker, T. (2017). Receipt of warnings regarding potentially impairing prescription medications and associated risk perceptions in a national sample of U.S. drivers. *Journal of Studies on Alcohol and Drugs*, 78(6), pp. 805–813.

Porath-Waller, A.J. and Beirness, D.J. (2014). An examination of the validity of the Standardized Field Sobriety Test in detecting drug impairment using data from the Drug Evaluation and Classification program. *Traffic Injury Prevention* 15(2), 125-131.

Ramaekers, J. G., van Wel, D. B., Spronk, J.H., et al. (2016). Cannabis and tolerance: acute drug impairment as a function of cannabis use history. https://www.nature.com/articles/srep26843

RMHIDTA (2016). *The Legalization of Marijuana in Colorado: The Impact; Vol. 5* Rocky Mountain High Intensity Drug Trafficking Area. https://rmhidta.org/default.aspx?menuitemid=781&menugroup=RMHIDTA+Public+Overview

Rogeberg, O. and Elvik, R. (2016a). The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction* 111(8), 1348–1359.

Rogeberg, O. and Elvik, R. (2016b). Response: Cannabis intoxication, recent use and road traffic crash risks. *Addiction* 111(8), 1495-1498.

Romano, E., Torres-Saavedra, P., Voas, R.B., and Lacey, J.H. (2017). Marijuana and the risk of fatal car crashes: What can we learn from FARS and NRS data? *Journal of Primary Prevention* 38(3), pp. 315-328.

Schulze, H., Schumacher, M., Urmeew, R., et al. (2012). *DRUID Final Report: Work Performed, Main Results and Recommendations.* Bergisch Gladbach, Federal Republic of Germany: Federal Highway Research Institute (BASt). http://www.druid-project.eu/Druid/EN/Dissemination/downloads_and_links/Final_Report.html.

Strand, M.C.,Gjerde, H., and Mørland, J. (2016). Driving under the influence of non-alcohol drugs – an update. Part II: Experimental studies. *Forensic Science Review* 28(2).

Talpins, S.K., Holmes, E., Kelley-Baker, T. et al. (2017). *Breath Testing for Cannabis: An Emerging Tool with Great Potential for Law Enforcement.* Alexandria, VA: National Traffic Law Center. https://www.ndaa.org/pdf/BTL-v25-n2.pdf

Talpins, S.K., Holmes, E., and Sabet, K (2017). Fingerprint sweat testing: A viable option for testing drugged drivers? *Tennessee DUI News,* 58, p. 4-5. dui.tndagc.org/newsletters/DUI%20News%20-%20Issue%2058.pdf

Thomka, J.E. (2014). *Enforcement and Prosecution of Driving while Under the Influence of Cannabis.* Presentation at TRB Alcohol, Other Drugs and Transportation Committee 2014 Midyear Meeting.

TIRF (2017). *Marijuana Use Among Drivers in Canada, 2000-2014.* Ottawa, ON: Traffic Injury Research Foundation. tirf.ca/TIRFCAD17M

USDEA (2018). *Drug Schedules.* Washington, DC: United States Drug Enforcement Agency. www.dea.gov/druginfo/ds.shtml

Voas, R.B., Torres, P., Romano, E., et al., (2012). Alcohol-related risk of driver fatalities: an update using 2007 data. *J. Studies on Alcohol and Drugs* 73, pp 341.350.

Ward, N., Otto, J., Finley, K., et al. 2016). *An Assessment of Traffic Safety Culture Related to Driving After Cannabis Use: Summary Report.* Helena MT: Western Transportation Institute. http://www.mdt.mt.gov/research/projects/cannabis-use.shtml

White, M. (2017). *Cannabis and Road Crashes: A Close Look at the Best Epidemiological Evidence.* Personal communication. mawhite8@bigpond.com.

GHSA
Governors Highway Safety Association
The States' Voice on Highway Safety

www.ghsa.org

RESPONSIBILITY.ORG

The Governors Highway Safety Association (GHSA) is a nonprofit association representing the highway safety offices of states, territories, the District of Columbia and Puerto Rico. GHSA provides leadership and representation for the states and territories to improve traffic safety, influence national policy, enhance program management and promote best practices. Its members are appointed by their Governors to administer federal and state highway safety funds and implement state highway safety plans.

The Foundation for Advancing Alcohol Responsibility (Responsibility.org) is a national not-for-profit that leads the fight to eliminate drunk driving and underage drinking and is funded by the following distillers: Bacardi U.S.A., Inc.; Beam Suntory Inc.; Brown-Forman; Constellation Brands, Inc.; DIAGEO; Edrington; Hood River Distillers, Inc.; and Pernod Ricard USA. Recognizing 25 years of impact, Responsibility.org has transformed countless lives through programs that bring individuals, families and communities together to guide a lifetime of conversations around alcohol responsibility and offering proven strategies to stop impaired driving.

@GHSAhq | @goFAAR