

# Status Report

Insurance Institute for Highway Safety | Highway Loss Data Institute

## High claims

Legalizing recreational marijuana use is linked to increase in crashes

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THIS ISSUE  
Vol. 52, No. 4  
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- ▶ Research on alcohol is clear
- ▶ Lane maintenance systems still a turnoff for many drivers
- ▶ Tesla Model S doesn't follow the pack on claims for electric vehicles or luxury cars



Legalizing recreational marijuana use in Colorado, Oregon and Washington has resulted in collision claim frequencies that are about 3 percent higher overall than would have been expected without legalization, a new Highway Loss Data Institute (HLDI) analysis shows. This is HLDI's first look at how the legalization of marijuana since 2014 has affected crashes reported to insurers.



Marijuana flowers are weighed at a dispensary near Crested Butte, Colorado. The Rocky Mountain state was the first to begin retail sales of recreational marijuana in January 2014 after voters endorsed recreational use of pot for adults 21 and older in November 2012. Retail sales in Washington began six months after Colorado.

More drivers admit to using marijuana, and it is showing up more frequently among people involved in crashes. Though there is evidence from simulator and on-road studies that marijuana can degrade some aspects of driving performance, researchers haven't been able to definitively connect marijuana use with more frequent real-world crashes. Some studies have found that using the drug could more than double crash risk, while others, including a large-scale federal case-control study, have failed to find a link between marijuana use and crashes (see *Status Report*, May 12, 2015, at [iihs.org](http://iihs.org)). Studies on the effects of legalizing marijuana for medical use also have been inconclusive.

Colorado and Washington were the first to legalize recreational marijuana for adults 21 and older with voter approval in November 2012. Retail sales began in January 2014 in Colorado and in July 2014 in Washington. Oregon voters approved legalized recreational marijuana in November 2014, and sales started in October 2015.

HLDI conducted a combined analysis using neighboring states as additional controls to examine the collision claims experience of Colorado, Oregon and Washington before and after law changes. Control states included Idaho, Montana, Nevada, Utah and Wyoming, plus Colorado, Oregon and Washington prior to legalization of recreational use. During the study period, Nevada and Montana permitted medical use of marijuana, Wyoming and Utah allowed only limited use for medical purposes, and Idaho didn't permit any use. Oregon and Washington authorized medical marijuana use in 1998, and Colorado authorized it in 2000.

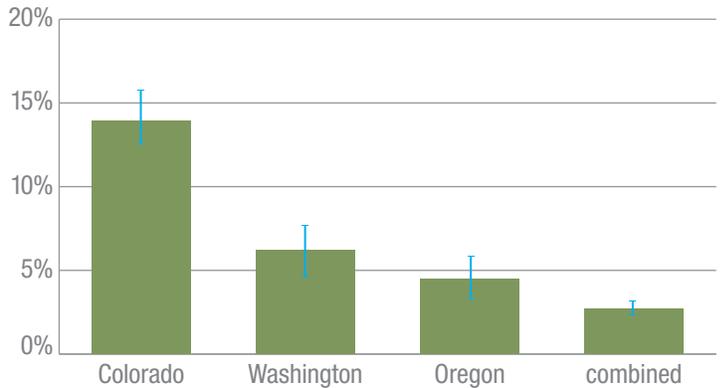
HLDI also looked at loss results for each state individually compared with loss results for adjacent states without legalized recreational marijuana use prior to November 2016. Data spanned collision claims filed between January 2012 and October 2016 for



# Collision claims

## Estimated effects of recreational marijuana sales in 3 states

Change in claim frequency for vehicles up to 33 years old, 2012-16



Colorado saw the biggest estimated increase in claim frequency compared with its control states. The combined effect for the three states was smaller but still significant at 3 percent. The combined-state analysis is a good representation of the effect of marijuana legalization overall, while the single-state analyses show how the effect can vary from state to state.

1981 to 2017 model vehicles. Analysts controlled for differences in the rated driver population, insured vehicle fleet, the mix of urban versus rural exposure, unemployment, weather and seasonality.

Collision claims are the most frequent kind of claims insurers receive. Collision coverage insures against physical damage to a driver's vehicle in a crash with an object or other vehicle, generally when the driver is at fault. Collision claim frequency is the number of collision claims divided by the number of insured vehicle years (one vehicle insured for one year or two vehicles insured for six months each).

"The combined-state analysis shows that the first three states to legalize recreational marijuana have experienced more crashes," says Matt Moore, senior vice president of HLDI. "The individual state analyses suggest that the size of the effect varies by state."

Colorado saw the biggest estimated increase in claim frequency compared with its control states. After retail marijuana sales began in Colorado, the increase in collision claim frequency was 14 percent higher than in nearby Nebraska, Utah and Wyoming. Washington's estimated increase in claim frequency was 6.2 percent higher than in Montana and Idaho, and Oregon's estimated increase in claim frequency was 4.5 percent higher than in Idaho, Montana and Nevada.

"The combined effect for the three states was smaller but still significant at 3 percent," Moore says. "The combined analysis uses a bigger control group and is a good representation of the effect of marijuana legalization overall. The single-state analyses show how the effect differs by state."

Each of the individual state analyses also showed that the estimated effect of legalizing recreational use of marijuana varies depending on the comparison state examined. For example, results for Colorado vary from a 3 percent rise in claim frequency when compared

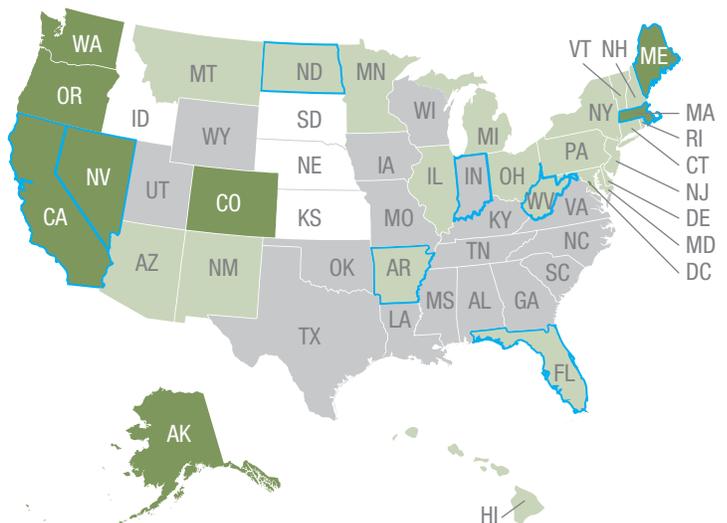
## Key dates for laws in study states

Colorado was first with retail sales of recreational marijuana

	Colorado	Washington	Oregon
Vote	November 2012	November 2012	November 2014
Retail sales	January 2014	July 2014	October 2015

## U.S. marijuana laws

States with some form of legalized marijuana use as of June 2017



■ all uses legal  
 ■ medical marijuana legal  
 ■ limited medical marijuana legal  
  enacted since November 2016

## Alcohol research is clear

When it comes to impaired driving, alcohol remains the biggest threat. A third of all drivers who die in crashes in the U.S. have a blood alcohol concentration (BAC) of 0.08 percent or higher. That proportion hasn't budged since 1994. Nearly 7,000 deaths could have been prevented in 2015 if all drivers were below the legal limit, IIHS estimates.

"The battle against alcohol-impaired driving isn't won," says Adrian Lund, IIHS president. "States and localities should keep channeling resources into proven countermeasures to deter impaired driving, such as sobriety checkpoints."

The Governors Highway Safety Association (GHSA) in April reported that "drugs were present in 43 percent of the fatally-injured drivers with known test results, appearing more frequently than alcohol." The finding was based on 2015 data from the Fatality Analysis Reporting System (FARS), a census of fatal crashes on U.S. roads. The report, sponsored by the Foundation for Advancing Alcohol Responsibility — a group funded by distillers — highlighted the top-line overall drug-prevalence percentage, which included marijuana but also amphetamines and other drugs. Marijuana in some form accounted for about 36 percent of the identified drugs, while 37 percent of drivers had a positive BAC test. Some journalists interpreted the findings as implying that drugs are now a bigger problem than alcohol on U.S. roads.

"Among all drugs, alcohol is still the biggest contributor to fatal crashes," Lund says. He cautions that FARS data aren't a reliable indicator of the overall presence of drugs other than alcohol among drivers or of drivers' level of impairment. He also warns against conflating the increased prevalence of drivers testing positive for marijuana or drivers self-reporting marijuana use with the recent rise in fatal crashes in the U.S., which is largely due to an improved economy (see *Status Report*, Dec. 10, 2015, at [iihs.org](http://iihs.org)).

GHSA noted that "drugged driving is more complicated than drunk driving" and called on states to increase training for law enforcement officers to help them identify and arrest drivers under the influence of drugs. ■

with Wyoming to a 21 percent increase when compared with Utah.

HLDI's new analysis of real-world crashes provides one look at the emerging picture of what marijuana's legalization will mean for highway safety as more states decriminalize its use. In the coming years, more research from HLDI and others will help sharpen the focus. As HLDI continues to examine insurance claims in states that allow recreational use of marijuana, IIHS has begun a large-scale case-control study in Oregon to assess how legalized marijuana use may be changing the risk of crashes with injuries. Preliminary results are expected in 2020.

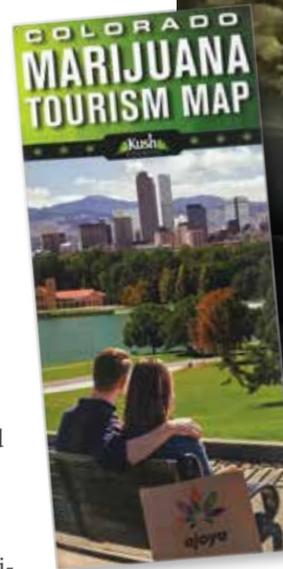
In addition to Colorado, Oregon and Washington, five other states and Washington, D.C., have legalized marijuana for all uses, and 21 states have comprehensive medical marijuana programs as of June. An additional 17 states permit limited access for medical use. Marijuana is still an illegal controlled substance under federal law.

## The business of pot

Marijuana is a booming business in states where its use is legal. Retail sales of recreational marijuana in the U.S. hit \$1.8 billion in 2016, led by Colorado and Washington, and are expected to grow to \$2.6 billion to \$2.9 billion in 2017, *Marijuana Business Daily* reports in its 2017 *Marijuana Business Factbook*. Colorado has reaped a nearly fivefold increase in tax revenue from retail sales of recreational marijuana since January 2014, an analysis of Colorado Department of Revenue data indicates.

Tourism is just one driver of state economies, and for pot-friendly locales, access to legalized marijuana is promoted as another reason to visit. A "Colorado marijuana tourism map" from Kush Tourism, for instance, touts the state's allure as a destination for "breathtaking mountain views, unparalleled outdoor recreation, and now high-quality legal cannabis!"

In 2015, 7 percent of tourists older than age 25 who visited Colorado cited a marijuana dispensary as a top reason for their trip, the Colorado Tourism Office



A new tourism industry has sprouted around legalized use of marijuana. A trip to a dispensary has been cited by some tourists as a top reason to visit Colorado.

reported. A year later, 4 percent of tourists surveyed cited that reason. The novelty of legalized marijuana may have drawn younger adult travelers in 2015, but visitor demographics returned to a more traditional pattern in 2016, the tourism office said.

## Mixed research on risk

As marijuana has won at the ballot box, public health officials, safety advocates and citizens have questioned the negative impact legalization might have on the road if stoned drivers were at the wheel. A 2016 IIHS survey found that drivers in Colorado, Oregon and Washington were more likely to view marijuana as a highway safety problem than drivers in states without legalized use (see *Status Report*, Dec. 8, 2016).

"Worry that legalized marijuana is increasing crash rates isn't misplaced," says David Zuby, IIHS executive vice president and chief research officer. "HLDI's findings on the early experience of Colorado, Oregon and Washington should give other states eyeing legalization pause."

Consuming THC just prior to driving has been shown to increase reaction time and



impair distance estimation and lane tracking in both simulator and on-road studies. THC, or tetrahydrocannabinol, is the psychoactive substance in marijuana. A recent study conducted using the National Advanced Driving Simulator found that drivers under the influence of marijuana had trouble maintaining constant lane position, but they tended to drive more slowly and with more headway than drivers not under the influence.

Due to a combination of factors, marijuana's role in crashes is hazier than the data on alcohol. Many states don't include consistent information on driver drug use in crash reports that the Fatality Analysis Reporting System (FARS) database aggregates, and policies and procedures for drug testing are inconsistent. More drivers in crashes are tested for alcohol than for drugs. When drivers are tested, other drugs are often found in combination with alcohol, which makes it difficult to isolate their separate effects.

What is more, unlike alcohol, experts don't agree on how much marijuana must be consumed for a driver to be impaired. A positive test for THC and its active metabolite doesn't mean the driver was impaired at the time of the crash. Habitual users of

marijuana may have positive blood tests for THC days to weeks after using the drug.

### Marijuana-positive drivers

About 1 in 5 weekend nighttime drivers tested positive for at least one legal or illegal drug in the 2013-14 National Roadside Survey of Alcohol and Drug Use by Drivers conducted by the National Highway Traffic Safety Administration (NHTSA) (see *Status Report*, May 12, 2015). Marijuana was much more prevalent than in a prior roadside survey. Nearly 13 percent of weekend nighttime drivers tested positive for marijuana use, compared with 8.6 percent in 2007.

A handful of studies have examined the prevalence of marijuana among crash-involved drivers in Washington since legalization. An AAA Foundation study published in 2016 estimated that the prevalence of drivers in fatal crashes with detectable THC in their blood roughly doubled from 8.3 percent in 2013 to 17 percent in 2014.

The authors note that it isn't clear whether the upward trend was due to legalization or other factors. They caution that "results of this study do not indicate that drivers with detectable THC in their blood at the time of the crash were necessarily impaired

by THC or that they were at-fault for the crash" and that the FARS data used in the study "are very limited with respect to toxicology results related to marijuana."

A Pacific Institute for Research and Evaluation (PIRE) study, published last year and sponsored by NHTSA and partially funded by IIHS, collected roadside data from drivers in three waves: before legal sales began, about six months afterward and again a year later. The researchers found that more drivers were THC-positive after one year of retail sales than just before sales began in the state.

Of the nearly 2,400 participants who provided oral fluid or blood samples, 15 percent of drivers were THC-positive in Wave 1, 19 percent were THC-positive in Wave 2 and 21 percent were positive in Wave 3. However, the differences weren't statistically significant. Separating the results by time of day, the researchers found a statistically significant increase in the daytime prevalence of THC-positive drivers between waves. The prevalence increased from 7.8 percent of daytime drivers in Wave 1 to 18 percent in Wave 2 and 19 percent in Wave 3. The prevalence also increased among nighttime drivers with each successive wave, but the increases weren't statistically significant.

The study didn't "address whether an increased prevalence of THC-positive drivers is related to greater impairment among drivers or greater crash risk," the PIRE researchers cautioned.

A NHTSA-sponsored case-control study by PIRE examined the crash risk associated with driver drug use and found that drivers who tested positive for marijuana were overrepresented in the crash-involved population (see *Status Report*, May 12, 2015). When the researchers controlled for driver demographics and alcohol use, however, they found no link between marijuana use and driver crash risk. Published in 2016, the study included 2011-12 data on drivers involved in police-reported crashes in Virginia Beach, Virginia, where it is illegal to use marijuana.

A 2016 study by researchers at Columbia University examined traffic fatalities in 19 states before and after enacting medical marijuana laws. Although on average there was an 11 percent reduction in fatality rates, the results varied across states. Seven states saw a reduction in fatalities, while two had an increase, and the other 10 didn't change. ■

# Lane maintenance systems still a turnoff for many drivers, new observations show

**A**mong vehicles with crash avoidance features, lane maintenance systems are turned off nearly half the time, a new IIHS survey shows.

The study confirms previous findings that lane departure warning and lane-keeping support systems are one of the less popular types of crash avoidance technology. However, it also suggests ways of designing systems to make them more likely to be used.

Technology that helps drivers keep their vehicles within lane markings could potentially have a substantial effect on fatalities. An earlier IIHS study estimated that lane departure warning could be relevant to 23 percent of fatal crashes (see *Status Report*, May 20, 2010, at [iihs.org](http://iihs.org)).

Unlike front crash prevention, lane maintenance systems haven't been shown to reduce insurance claims. One reason could be that claims are dominated by less serious crashes that can't be distinguished from those expected to be affected by lane departure systems. A forthcoming IIHS study using police-reported data finds lane maintenance systems are preventing more severe lane-drift crashes. It is also possible that

effectiveness is being limited by low use rates. Many drivers shut off lane maintenance systems because they find them annoying.

IIHS first looked at the operating status of crash avoidance features in an earlier study of Honda vehicles brought into dealerships for service. The researchers found that only one-third of vehicles had lane departure warning turned on, while all but one vehicle had forward collision warning turned on (see *Status Report*, Jan. 28, 2016).

The new study also observed vehicles that were brought in for service but this time included models from nine manufacturers.

All the vehicles had some kind of lane maintenance system, a category that includes systems that issue warnings, systems that actively nudge a departing vehicle back into the lane with automatic steering or braking to prevent departures, and systems that do both. It also includes systems that provide continuous steering input to keep vehicles in the lane. In all cases, the systems maintained the on/off status from the previous trip, rather than defaulting back to on or off. Some of the vehicles also had front crash prevention or other crash avoidance

systems, and the operating status of those systems was observed, too.

Of the 983 vehicles observed, 51 percent had their lane maintenance systems turned on. Among other types of crash avoidance systems, use rates were 90 percent or higher.

Results varied for lane maintenance features, depending on the characteristics of the system. Warning systems were more likely to be turned on if they had tactile warnings (54 percent) instead of auditory warnings (46 percent). Lane departure prevention systems, which guide the vehicle back into the lane when it begins to drift, also were more likely to be turned on than lane departure warning systems.

"Depending on the way you drive, lane departure alerts can go off fairly frequently in the course of regular driving even when there is no imminent danger," says Ian Reagan, an IIHS senior research scientist and the study's lead author. "Systems that beep seem to annoy people more than systems that warn the driver with vibrations of the seat or steering wheel."

Another important factor is how easy it is to turn off the system. Unlike front crash

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## Tesla Model S doesn't follow the pack on losses for electric vehicles or luxury cars

**W**hen it comes to insurance losses, the Tesla Model S is an outlier. The luxury sedan has higher claim frequencies and is costlier to fix than gasoline-powered large luxury cars, and it accumulates more miles on average per day than other battery-powered vehicles, a new HLDI report shows.

The Model S is among the nine vehicles HLDI studied in its latest analysis of insurance losses for all-electric models. Analysts compared the loss experience of the Model S, the Nissan Leaf and seven other electric vehicles with losses for similar conventional vehicles under collision and

property damage liability coverages and adjusted claim frequencies for mileage, based on data provided by CARFAX.

Collision coverage insures against physical damage to a vehicle in a crash if the driver is at fault. Property damage liability coverage insures against physical damage that at-fault drivers cause to other people's vehicles and property in crashes.

HLDI compared the BMW 1 Series ActiveE, Chevrolet Spark EV, Fiat 500 Electric, Ford Focus electric, Smart ForTwo Electric Drive two-door, Smart ForTwo Electric Drive convertible and Toyota RAV4 EV with gasoline-powered versions of the

same models. Nissan doesn't sell a gasoline-powered Leaf, so HLDI compared its losses against the similar Nissan Versa hatchback. Since Tesla only makes electric vehicles, HLDI compared the Model S against losses for conventional large luxury cars.

Under collision and property damage liability coverages, the seven electric vehicles with exact conventional counterparts had lower claim frequencies and higher claim severities than their comparison vehicles. When analysts controlled for mileage in the claim frequency analysis, the differences in the frequency benefits declined but were still significant. The Leaf largely



One active lane-keeping system from Volvo had a much higher than average observed use rate.

prevention, most of the lane maintenance systems studied could be deactivated with the push of a button. The Volvo XC90's active lane-keeping system had a much higher than average observed use rate of 86 percent. To turn the system off, drivers must navigate to a menu and go through several steps.

Reluctance to use lane maintenance systems is only one possible factor influencing the effectiveness of these systems. Another IIHS study found that incapacitation plays a role in one-third of lane-drift crashes. The finding raised questions about whether drivers would be able to adequately respond to

lane departure alerts or retake control after an active system brings the vehicle back to the lane (see *Status Report*, Sept. 1, 2016).

For a copy of "Crash avoidance and driver assistance technologies – are they used?" by I.J. Reagan et al., email [publications@iihs.org](mailto:publications@iihs.org). ■

followed the same pattern but had lower claim severities compared with the Versa.

In comparison, the Model S had higher claim frequencies, higher claim severities and higher overall losses than other large luxury cars. Under collision coverage, for example, analysts estimated that the Model S's mileage-adjusted claim frequency was 37 percent higher than the comparison group, claim severity was 64 percent higher, and overall losses were 124 percent higher.

Electric vehicles as a class aren't known for their speed, but that's not the case with the Model S. Tesla calls it "the quickest production car in the world" in promotional literature. Car enthusiast reviews of the Model S seldom fail to mention how fast it accelerates from 0 to 60 mph.

Teslas also are on the road more than comparable large luxury cars. On average, Teslas travel three more miles per day than

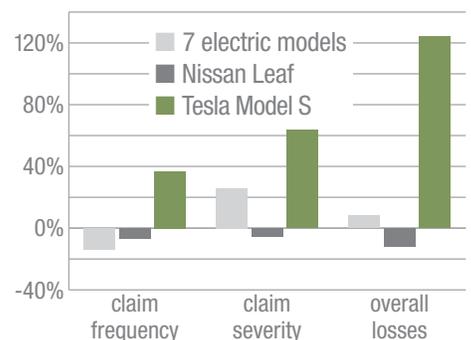
other large luxury cars, HLDI found. The other electric vehicles in the study logged 11-12 fewer miles per day than their conventional counterparts.

Higher claim severities relate to how pricey it is to repair collision damage relative to average estimates. Electric vehicles in general are more expensive than their gasoline-powered cousins. The average base price of an electric vehicle in HLDI's analysis is about 79 percent higher than it is for a conventional counterpart. The Leaf's base price, for example, is 117 percent higher than the Versa, while the Model S's base price is 33 percent higher than that of a conventional large luxury car.

For a copy of HLDI Bulletin Vol. 33, No. 4 "Insurance losses – comparison of electric vehicles and their conventional counterparts while adjusting for mileage," email [publications@iihs.org](mailto:publications@iihs.org). ■

### Estimated collision losses

Electric vs. conventional counterparts



The Model S had higher collision claim frequencies, severities and overall losses than other large luxury cars. The Nissan Leaf's losses were lower than the gasoline-powered Versa. The 7 electric-series models had lower claim frequencies but higher severities than conventional cars.

**Legalizing recreational use of marijuana is linked to increase in crashes ▶ 2**

**Lane maintenance systems are still unpopular with vehicle owners ▶ 6**

**Tesla Model S has higher losses than other electric vehicles or luxury cars ▶ 6**

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**IIHS** is an independent, nonprofit scientific and educational organization dedicated to reducing the losses — deaths, injuries and property damage — from motor vehicle crashes.

**HLDI** shares and supports this mission through scientific studies of insurance data representing the human and economic losses resulting from the ownership and operation of different types of vehicles and by publishing insurance loss results by vehicle make and model.

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