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The RAND Corporation Report on marijuana legalization commissioned by Governor Shumlin describes traffic accidents as one possible acute health risk associated with marijuana use. The purpose of this report is to further examine the issue of traffic safety as it relates to marijuana use. To date, it does not appear that one can conclude that marijuana legalization in Washington and Colorado has resulted in a significant increase in the number of traffic fatalities. While it is clear marijuana use can impair drivers, available crash data reveals few changes to any major indices of traffic safety in Colorado and Washington following legalization of marijuana.

As of July 2013, possession of less than one ounce of marijuana by individuals 21 and older is considered a civil violation in Vermont; individuals convicted of possession may be fined up to \$200 for their first offense.<sup>2</sup> No changes to DUI law have coincided with decriminalization. Current statutes prohibit operating any vehicle on a highway when under the influence of any drug.<sup>3</sup> Medical marijuana has been legal in Vermont since 2004. Yearly trends in total traffic fatalities have not changed since the decriminalization of marijuana in 2013.

<sup>&</sup>lt;sup>1</sup> Caulkins, Jonathan P

Colorado voters passed an initiative ballot measure to add Amendment 64, regulating and legalizing the personal use of marijuana to the state constitution on November 6th, 2012. Possession of marijuana and growing marijuana for personal use by persons 21 and older became legal on December 10th, 2012.<sup>4</sup> Commercial sales began on January 1st, 2014.

The Colorado law prohibiting driving while impaired was amended following legalization to establish a per se limit—similar to the alcohol limit of .08 BAC—of five nanograms of active THC per milliliter of blood. What we refer to as in this report is \_\_\_\_\_\_\_, which is the psychoactive chemical that causes intoxication; is just the metabolite that can stay in a \_\_\_\_\_\_\_ system for up to 30 days after use without causing intoxication.<sup>5</sup> Drivers with a higher concentration of active THC in their blood may be prosecuted for driving while ability impaired.<sup>6</sup>

Possession of usable marijuana and marijuana-infused products in small quantities by individuals 21 and older became legal on December 6th, 2012; commercial sale of marijuana began in July 2014.<sup>7</sup> As in Colorado, DUI laws in Washington were amended to establish a *per se* limit for cannabis intoxication at 5 nanograms of active delta-9-

influence if chemical analysis indicates a THC concentration of 5.00 ng/ mL or hig two hours after driving.8

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instruction and field training exercises.<sup>27</sup> Certified DREs possess the expertise required to assess driver impairment from non-alcoholic drugs.

All 50 states currently participate in the Drug Evaluation and Classification program. <sup>28</sup> Colorado has 212 active DRE officers, more than 80 of who were certified since the legalization of marijuana. <sup>29,30</sup> Colorado DRE Coordinator Carol Gould explains that increases in the number of drivers determined to be impaired by DRE officers may be a consequence of the increasing number of DRE certified officers working in Colorado. <sup>31</sup>

Washington has also

In January 2016, the VT Department of Health conducted a Health Impact Assessment

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related to marijuana use and risk of motor vehicle accidents the HIA states:

Research shows increased odds of crashing, crash culpability, and fatality with increasing blood THC levels. A blood THC concentration of 5 ng/ mL increased the odds of crash responsibility from 2.7 to 6.6 odds similar to that of a blood alcohol content of 0.15 percent. The exact blood level of THC associated with impairment is not known, and it is not entirely clear if blood level alone is a sufficient indicator of impairment for all users.<sup>33</sup>

The VT Department of Health cites evidence from three meta-analyses in addition to one longitudinal study published in 2013 (Brady and Li) for this conclusion.<sup>34</sup> We believe that the complexities and limitations of the extant research on this subject merit further discussion, a discussion that might lead a reader to a different conclusion from that arrived at by the VT Department of Health.

## The HIA statement

responsibility from 2.7 to 6.6 odds similar to that of a blood alcohol content of 0.15 percent, was drawn from a 2003 study of fatally-injured drivers in Australia. Drummer et al. compared the toxicology screens of drivers classified as either culpable or non-culpable in fatal accidents. Logistic regression was conducted to explore any association between likelihood of culpability and driver characteristics including age, gender, and drug use. This modelling indicated that odds of culpability in drivers testing positive for both THC and a BAC of more than .05 (units) was 2.9 times greater than the odds of drivers with BAC greater than .05 alone. This data suggests that THC enhances the impairing effects of alcohol. In cases where carboxy-THC was present but active THC was not detected, the

unimpaired drivers.	
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trends in toxicology reports for drivers involved in

fatal collisions over a ten-year

-related fatal motor vehicle accidents in the United

States tripled fr

37 The HIA fails to mention that the state toxicology data used by Brady and Li does not distinguish between active THC and inactive metabolites, which may remain present in the blood for up to a week after use. 38 For this reason, the authors write that toxicology reports positive for drugs other than alcohol

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Additionally, tests of deceased drivers were coded as related to as many as four drugs. Test results for a single driver which indicate a .15 BAC and any trace of THC

- 39 Lastly, the study authors note that the period of 1999-2010 captured the implementation of medical marijuana programs in three of the six states tested, including California.40 While the

Asbridge et al. set cutoff levels for THCintoxication in deceased drivers between 1-2 ng/ mL of active THC when categorizing crashes as cannabis-related.<sup>47</sup> As a result, a large number of cases considered by studies in this analysis are categorized as cannabis-related when the drivers involved would not exceed per se levels for marijuana intoxication in any state.<sup>48</sup>

Neither study design could control for a number of confounding variables. While regression analyses produce odds ratios adjusted for driver age, sex, and alcohol use, these methods -taking propensity. Li et al.

another factor which may confound the association between marijuana exposure and risk of motor vehicle accidents. Furthermore, both meta-analyses used studies which did not provide sufficient data related to drugs other than marijuana or alcohol. For this reason Asbridge et al. calculated odds ratios for crash risk for drivers testing positive for cannabis without any other drugs or alcohol present. Li et al. write at greater length regarding the issues of assessing traffic accident risks associated with polydrug use:

motor vehicle crashes. Polydrug use by drivers is common, with up to a quarter of drivers injured in crashes testing positive for 2 or more drugs (including alcohol) (42, 73, 74). Although it is necessary to understand the effect of individual drugs on driving performance, the high prevalence of polydrug use by dri

alike were tested for intoxicatio

trends. Summary reports from both states use data collected for Analysis Reporting System (FARS).<sup>57</sup> A FARS summary of fatality data for all states is published annually. Currently, FARS data is available only through 2014.

The report prepared by the WTSC summarizing trends in driver toxicology testing from 2010 to 2014 highlights some limitations associated with the FARS data. FARS data is not coded to distinguish between carboxy-THC and active THC. Additionally, FARS reports only

observed amount.58

The FARS analysts involved with the WTSC report gleaned cannabinoid drug results for drivers involved in fatal crashes from state toxicology reports to analyze data from marijuana-related accidents.<sup>59</sup> Test results for drivers who are suspected of DUI during the course of traffic stops or crash investigations are sent to the Washington State Patrol Toxicology Lab for analysis. Currently the lab only uses drug result data in the case of roadway fatalities.

The WTSC report considers fatal crash data only, not a population-based dataset. The

Figure 2 shows data collected by VTrans including the number of total number of major crashes, incapacitating injury crashes, and fatal crashes in Vermont since 2005.66 These data show that the number of major crashes and incapacitating injury crashes have declined each year since 2010. This includes 2015, for which FARS data are not yet available.67

Figure 3 illustrates the number of marijuana-positive drivers in fatal collisions in Colorado from 2003-2014 and Washington from 2008-2014. This data was collected by each state Department of Transportation as part of the FARS data collection.

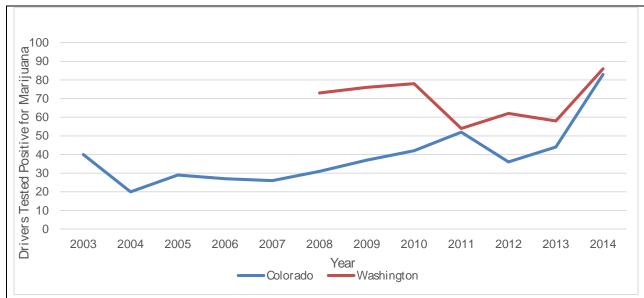


Figure 3: Marijuana Positive Drivers in Fatal Collisions

Sources: Drugged Drivers in Fatal Collisions, 2015, prepared by the Colorado Department of Transportation, accessed February 23, 2016, <a href="https://www.codot.gov/library/traffic/safety-crash-data/fatal-crash-data-city-county">https://www.codot.gov/library/traffic/safety-crash-data/fatal-crash-data-city-county</a>. Staci Hoff, Research Director for Washington Traffic Safety Commission, in an e-mail to the authors, January 18, 2016.

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While Figure 3 shows a rise in marijuana-positive drivers in fatal collisions, the data are imperfect for a number of reasons. First, this data do not distinguish between the active and inactive THCso the actual impairment of these drivers is unknown.<sup>68</sup> That increase would be expected to show up on this chart as well. It does not mean more drivers were

February 23, 2016,

http://legislature.vermont.gov/assets/ Documents/ 2016/ WorkGroups/ House%20Judiciary/ Bills/ H.560/ W~ Kevin%20Marshia~Vermont%20Major%20Crashes~1-6-2016.pdf.

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<sup>&</sup>lt;sup>68</sup> Staci Hoff, Research Director for Washington Traffic Safety Commission, in e-mail message to authors, January 18, 2016

found that drivers testing positive for active THC were no more likely to be involved in a traffic accident than sober drivers, after controlling for driver demographics and alcohol use. 72d alcohol