

# Letters

## RESEARCH LETTER

### Change in Traffic Fatality Rates in the First 4 States to Legalize Recreational Marijuana

Marijuana use impairs driving,<sup>1</sup> but researchers have not yet conclusively determined if a state's legalizing recreational marijuana is associated with traffic fatality rates. Two early studies reported no significant change in roadway deaths following legalization in Colorado and Washington,<sup>2,3</sup> whereas a study including Oregon reported a temporary increase.<sup>4</sup> A more recent study, including 2017 data, found a statistically significant increase in fatal crashes only after commercial stores opened, suggesting that the effect of legalization may take more time to observe.<sup>5</sup>

Following the recent release of 2018 roadway fatality reports by the US Department of Transportation, we analyzed data from more states over a longer period of commercial sales to get a better understanding of the relationship between legalization of recreational marijuana and traffic fatalities.

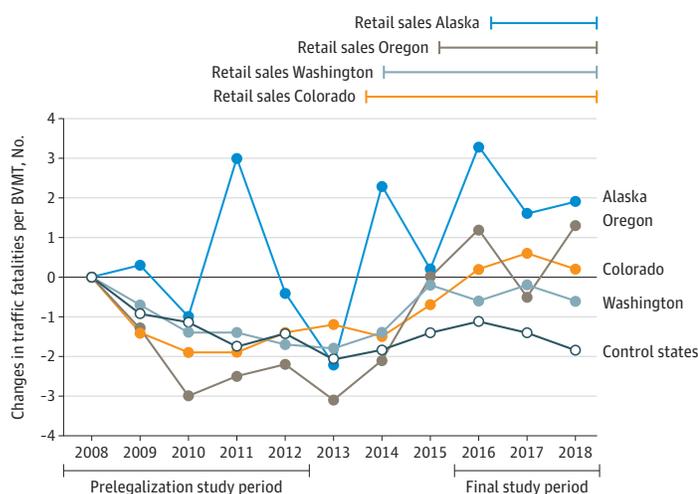
**Methods** | Traffic fatality rates were obtained from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System.<sup>6</sup> The first 4 states to legalize recreational marijuana (Colorado, Washington, Oregon, and Alaska) comprised the experimental group. These states are the only ones for which there are at least 2 full years of traffic fatality data available following the opening of retail stores. All 20 states that did not legalize recreational or medical marijuana as of the beginning of 2018 served as controls.

First, parallel fatality trends in both groups of states during the 18 years preceding legalization were confirmed by graphing and inspecting the data. Then, we performed a difference-in-difference analysis with a random effects model to compare the change in traffic fatality rates between the 2 groups from the prelegalization to the postcommercialization period. The prelegalization panel data were from the 5 years preceding legalization in any state (2008-2012), and the postcommercialization data were from the years that included commercial sales in all 4 experimental states (2016-2018). Unemployment rate, maximum speed limit, and presence of a primary seatbelt law were included as covariates. We calculated our estimates using the xtreg function in Stata MP statistical software (version 16.0, StataCorp). Robust standard errors were used to generate confidence intervals. Data were analyzed from December 22, 2019 to February 29, 2020. Because the study used deidentified publicly available data, no review board approval was needed.

**Results** | The changes in fatality rates for the control group and each experimental state are displayed in the **Figure**. Our unadjusted difference-in-difference analysis showed an increase of 2.1 (95% CI, 1.2-2.9;  $P < .001$ ) traffic fatalities per billion vehicle miles traveled (BVMT) in experimental states relative to control states in the postcommercialization study period. Including covariates, the increase was 2.1 (95% CI, 1.3-3.0;  $P < .001$ ) traffic fatalities per BVMT.

**Discussion** | By analyzing additional experimental states over a more recent time period, we have provided additional data that legalization of recreational marijuana is associated with increased traffic fatality rates. Applying these results to na-

Figure. Change in Traffic Fatality Rate From 2008



BVMT indicates billion vehicle miles traveled. Rates are indexed to 2008. Data points represent the change in the annual traffic fatality rate since 2008 for each experimental state and the 20-state control group mean. Colorado and Washington voted to legalize recreational marijuana in November 2012. Retail stores opened in January and July of 2014, respectively. Oregon and Alaska voted to legalize in November 2014. Retail stores opened in October 2015 and October 2016, respectively.

tional driving statistics, nationwide legalization would be associated with 6800 (95% CI, 4200-9700) excess roadway deaths each year. Despite certain methodological differences, we found an increase similar to that reported by Aydelotte et al.<sup>4</sup> They reported an increase of 1.8 fatal crashes (equivalent to 2.0 fatalities) per BVMT. We concur with their opinion that changes may not be detected immediately after legalization but only after a longer time period or after commercial sales begin.

We chose a control group consisting of all states with neither legal recreational nor medical marijuana to isolate the effects of marijuana. We did not require that control states have baseline attributes similar to the experimental states because the difference-in-difference technique removes biases in comparisons between experimental and control groups that result from permanent differences between those groups. Our conclusions, nonetheless, are limited by adjusting for only 3 state-specific factors that may have changed during the study period. It is possible that another confounder, rather than marijuana legalization and commercialization, caused the observed increase in roadway deaths.

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*Concept and design:* R. Kamer, Warshafsky.

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