



# **Impact of Legalization of Cannabis on Traffic Accidents**

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**Team 20**

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MSBA 6440 Final Project**

# Researchers Have Yet to Reach a Definitive Conclusion on Marijuana’s Role in Car Accidents

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cannabis legalization car crash

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Evaluating the public health impacts of **legalizing** recreational **cannabis** use in the United States

[W Hall](#), [M Lynskey](#) - *Addiction*, 2016 - Wiley Online Library

... The modest impact of medical **cannabis** laws to date cannot be used to predict that the same will be true of **cannabis** outcomes in states that **legalize** retail sales to ... Given our experience with alcohol, **legalization** is likely to reduce the price of **cannabis** substantially, increase ...

☆ 99 Cited by 147 Related articles All 8 versions

Assessing the public health impacts of **legalizing** recreational **cannabis** use in the USA

[W Hall](#), [M Weier](#) - *Clinical pharmacology & therapeutics*, 2015 - Wiley Online Library

... were a consequence of greater social tolerance of **cannabis** use in these states that also explained why their citizens had voted to **legalize** medical **cannabis** use ... They also found that the increase in prevalence occurred shortly after the **legalization** of medical **cannabis** but did ...

☆ 99 Cited by 135 Related articles All 11 versions

The effects of **cannabis** intoxication on motor vehicle collision revisited and revised

[Q Rogeberg](#), R Elvik - *Addiction*, 2016 - Wiley Online Library

... Impaired driving as one of the three 'primary reasons for concern about **legalized cannabis**' 1, and ... a structured search in Google Scholar and Web of Science.4 4 (**cannabis** OR marihuana ... THC OR cannabinoids OR hashish OR ganja OR hemp OR pot)AND (**car** OR automobile ...

☆ 99 Cited by 142 Related articles All 12 versions

Marijuana use and **car crash** injury

S Blows, [RQ Ivers](#), J Connor, S Ameratunga... - ..., 2005 - Wiley Online Library

... From the roadside surveys, 746 **cars** were identified as control vehicles ... The results suggest that habitual users of marijuana have about 10 times the risk of **car crash** injury or death ... which has been achieved by few previous studies [9]. Marijuana use prior to the **crash**/survey was ...

☆ 99 Cited by 173 Related articles All 18 versions

Motor vehicle **crash** fatalities and undercompensated care associated with **legalization** of marijuana

S Steinemann, D Galanis, T Nguyen... - *Journal of trauma and ...*, 2018 - cdn.journals.lww.com

BACKGROUND Half of the US states have legalized medical cannabis (marijuana), some allow recreatio...

☆ 99 Cited by 8 Related articles All 10 versions

## Research Ties Marijuana Legalization to Car Accidents, Injuries

Researchers found that marijuana-related hospitalizations increased in Colorado after the state legalized recreational pot.

SCIENCE / TRANSPORTATION / HEALTH

### Traffic deaths rose, then fell, after three states legalized marijuana

But that's not the entire story

By Angela Chen | @chengela | Feb 5, 2019, 10:52am EST

Wellness

### Car Accidents On The Rise In Legal States - But Marijuana Isn't The Culprit

James McClure

## Data: Cannabis Legalization Does Not Increase Traffic Fatalities



New Frontier Data

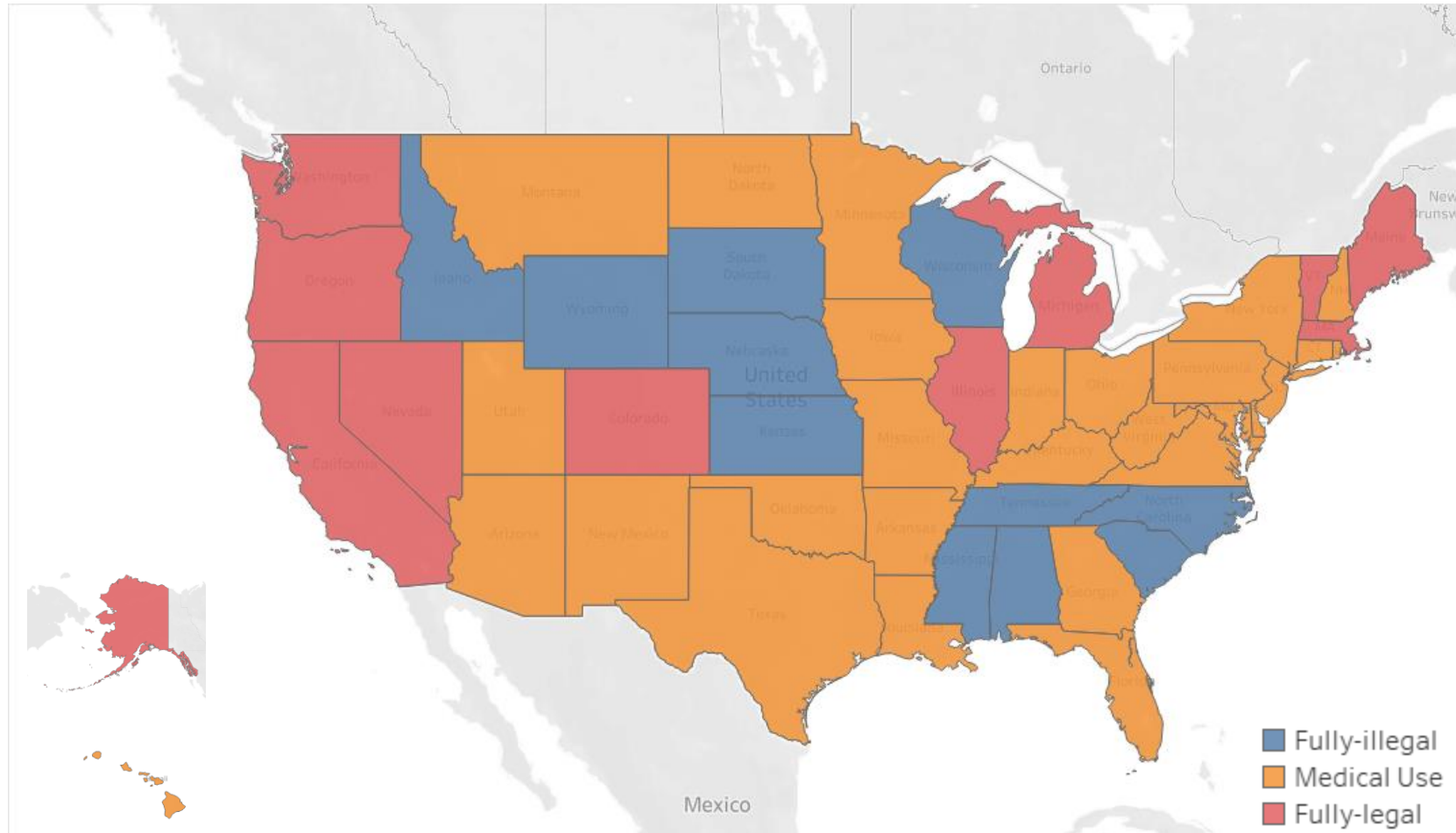
FOLLOW

October 16, 2019 10:45am

3 min read

Comments

# 11 States have Legalized Recreational Cannabis, 28 Allow Medical Use, and 11 States Strictly Prohibit Any Use



*For states that have legalized cannabis, has that decision causally affected the rate of car accidents?*

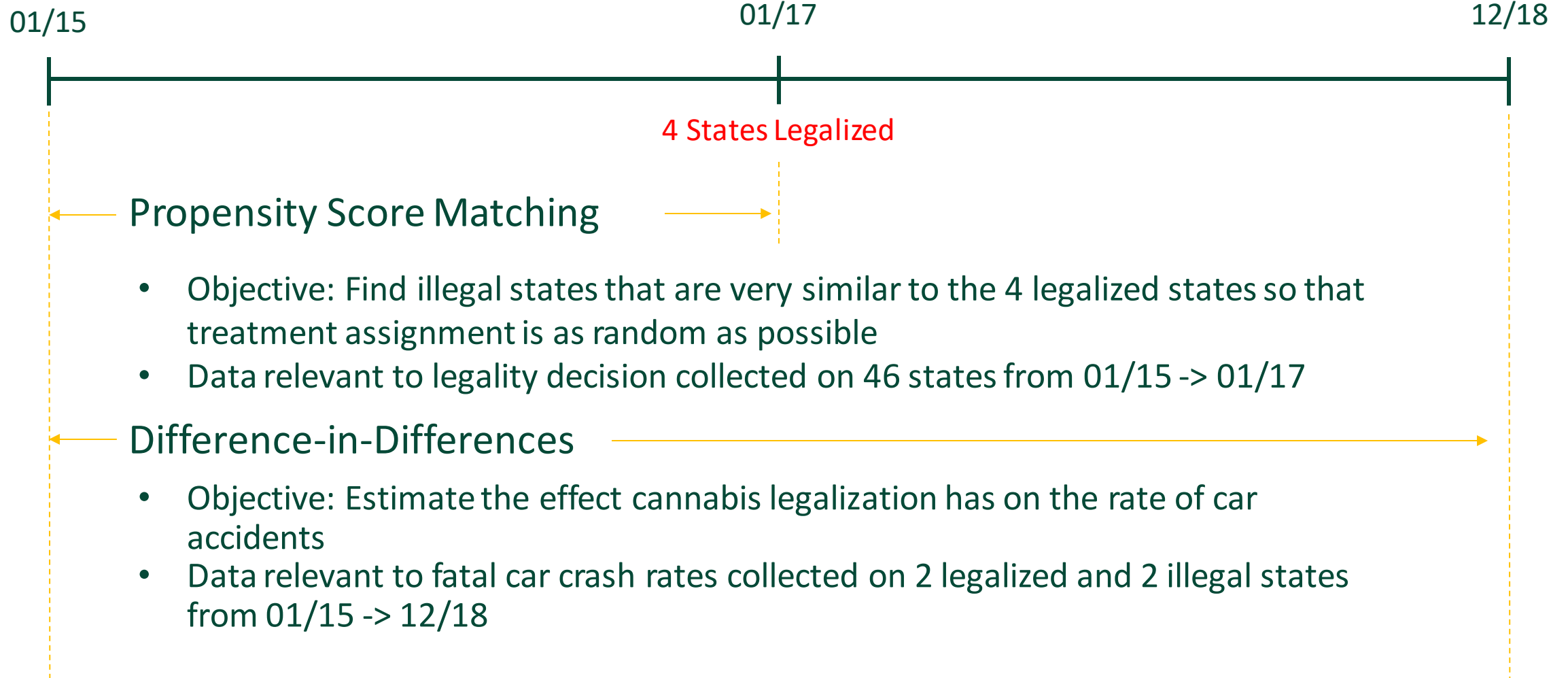




# Agenda

- Experimental Design
- Propensity Score Matching
- Difference-in-Differences
- Threats to Causal Inference
- Future Improvements

# Experimental Design



# Propensity Score Matching

## Dependent Variable

- Legality (1 = legalized, 0 = illegal)

## Independent Variables

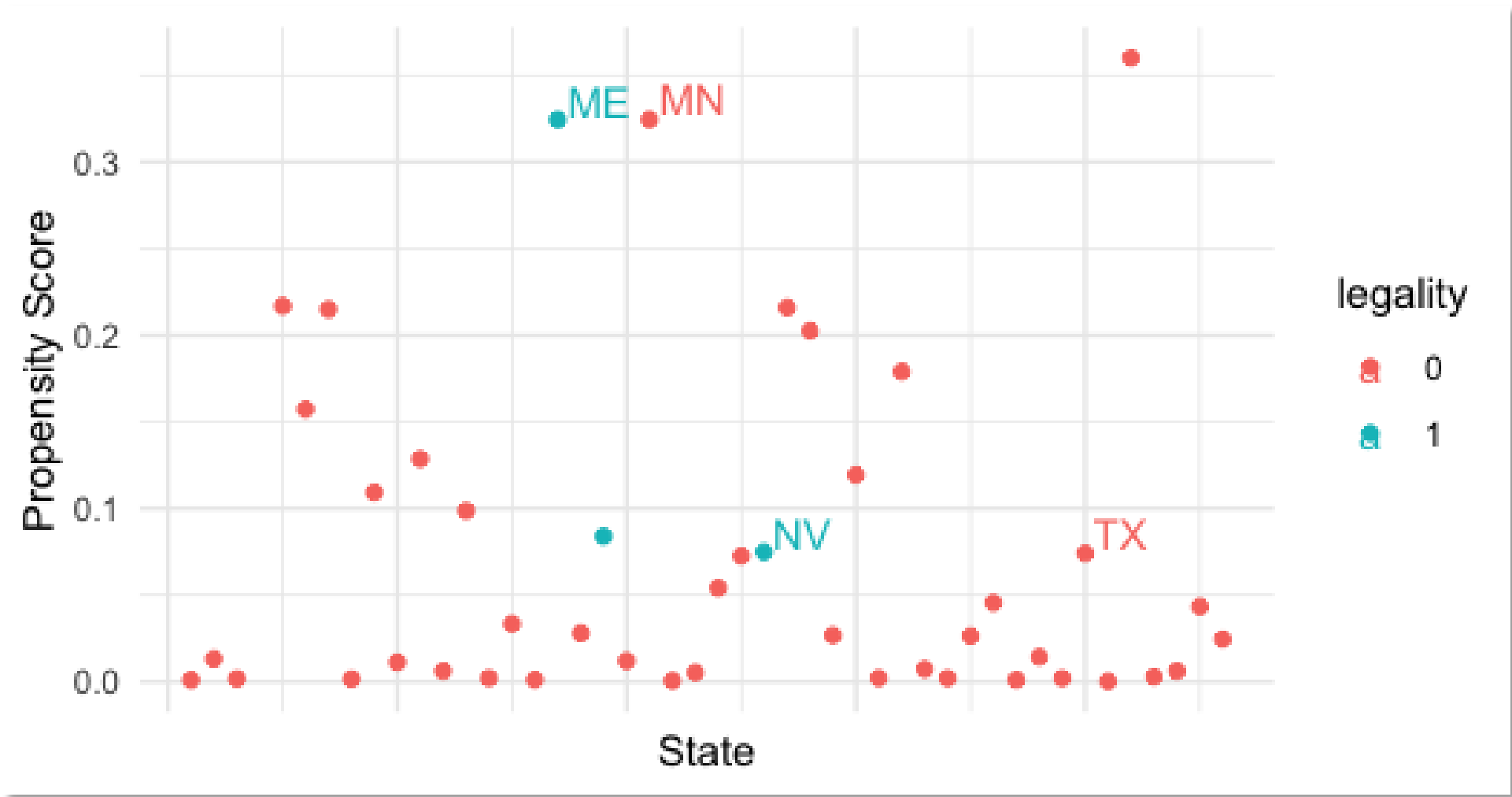
- Average Age
- Political Party
- Proportion of Population - Male
- Number of Prisoners
- Yearly Taxes / Yearly Revenue
- Average Alcohol Consumption Rate
- Population Density

Include all control variables that determine legalization decision

Minimize differences in propensity scores of treatment and control

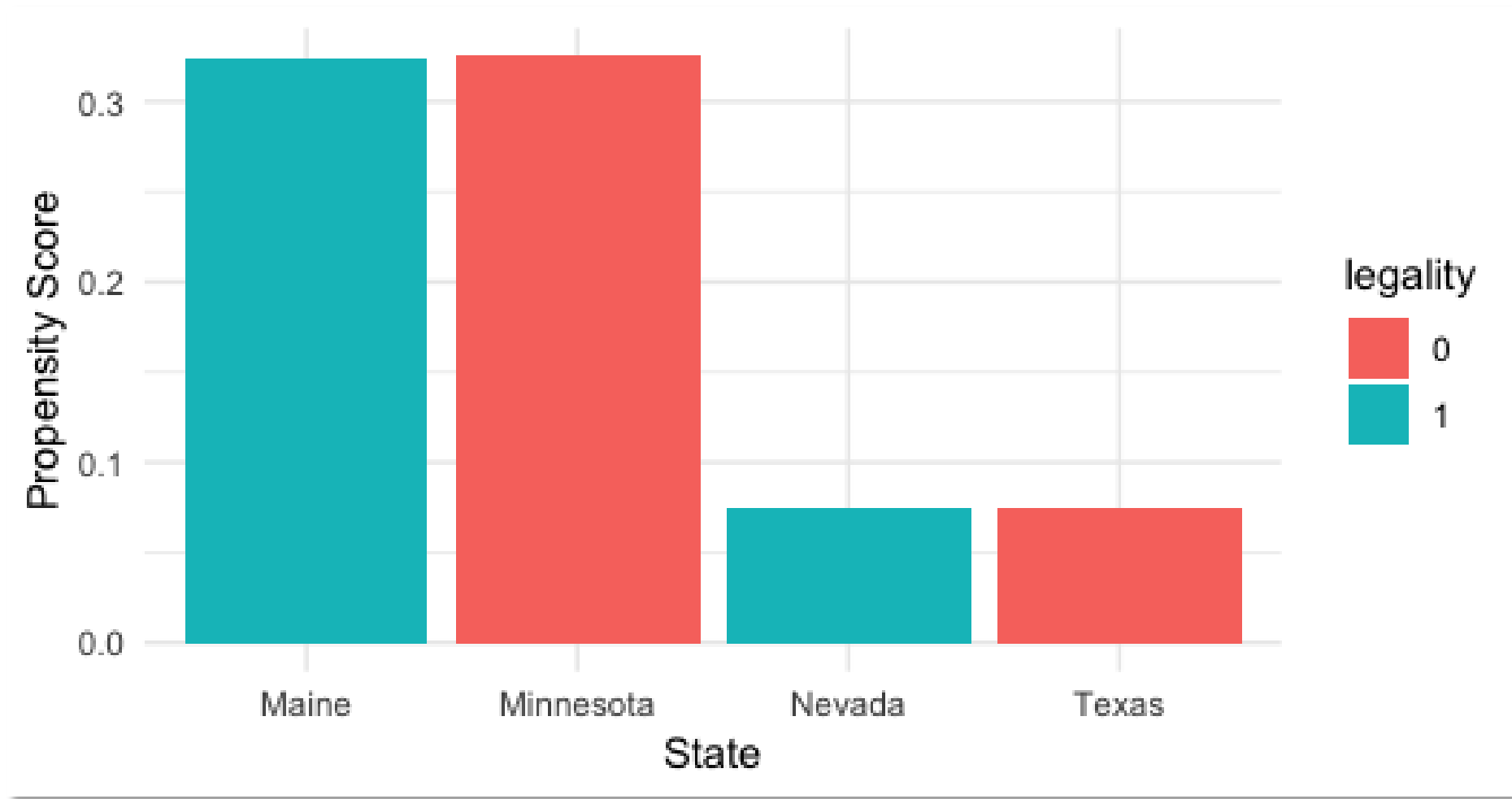
```
matchit(legality ~ age + pp + prop_male + ps + rev_ratio + beverage + population_density,  
        data = master_pre, method = "nearest", distance = "logit",  
        caliper = 0.01, replace = FALSE, ratio = 1)
```

# Before Matching





## After Matching



# Difference-in-Differences

## Assumptions



## Model Specification



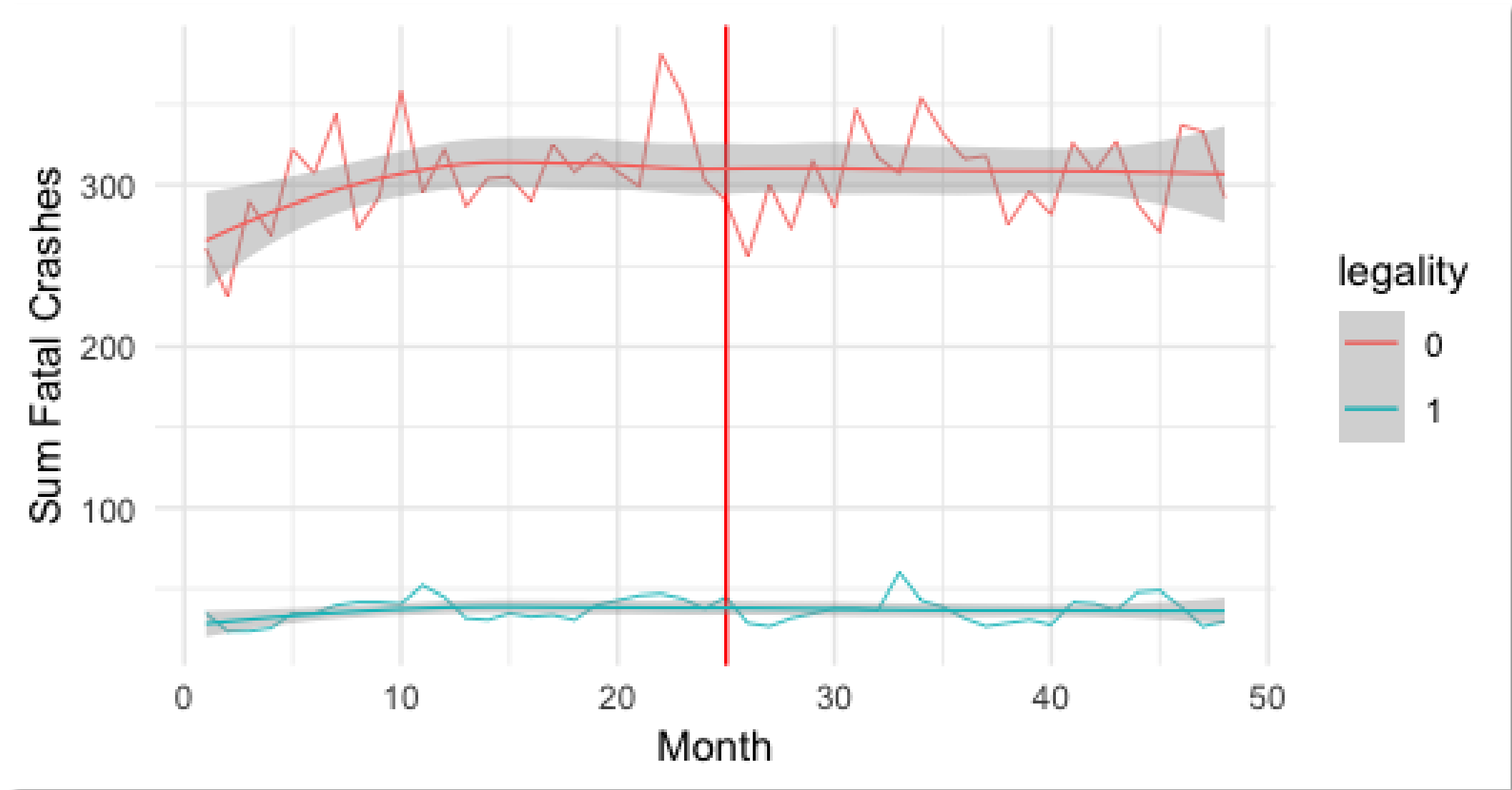
## Results



# Difference-in-Differences: Assumptions

1. Fatal car accident rates across treatment & control states follow a parallel trend
2. After effective date of legalization, there are no unobserved time-variant factors unique to either the control or treatment group
3. Illegal states are not influencing the legalized states

## Differences in Difference: Parallel Trend



# Difference-in-Differences: Model Specification

## Dependent Variable

- Number of Fatal Car Accidents per Month

## Independent Variables

- Legality (1 = legalized, 0 = illegal)
- Before & After Legalization Effective Date (2017 Jan)
- Highway Expenses Ratio (Highway Expense / Total Area)

```
plm(fatal_crashes ~ after + treatment + hw_expense_ratio + after * treatment, data = crashes,  
    effect = 'individual', index = 'state', model = 'within')
```

# Difference-in-Differences: Results

- There is a 50% chance that we would obtain results at least as extreme as what we observed if in fact there is no causal relationship between cannabis legalization and fatal crashes
- We did not obtain evidence to conclude that there is a relationship between cannabis legalization and car crash

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
after1	-0.054309	2.881792	-0.0188	0.9850
hw_expense_ratio	1.175793	0.592803	1.9834	0.0488 *
after1:treatment1	-2.932078	4.300600	-0.6818	0.4962



# Difference-in-Differences: Other Approaches



## 1. Weather (Condition) Data

- Tradeoff between longer and shorter experimental window
- Less accurate estimations because of small dataset with more variables



## 2. Percentage increases in fatal car crashes

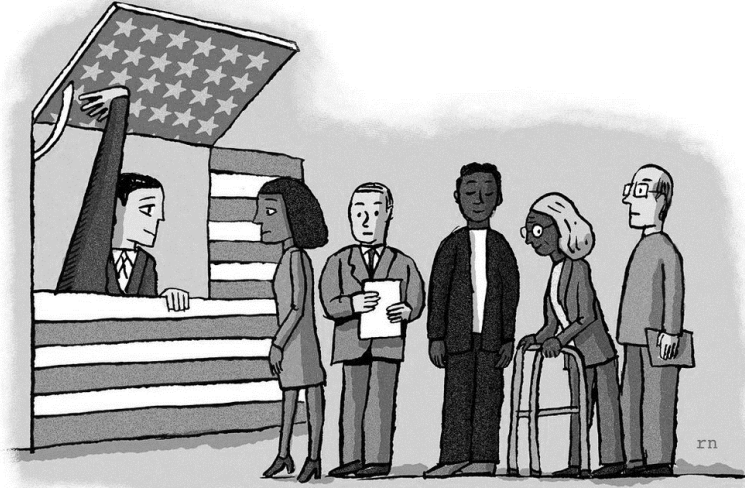
- log transformation
- Making car crashes more comparable, no significant change in results



## 3. Drop Texas and Nevada from dataset

- No significant change in results

# Threats to Causal Inference



## Organic Limitations

- Difficult to predict probability of legality
- Difficult to measure how long it takes for cannabis-impaired driving to manifest after legalization
- Disproportional sample size in treatment & control group



## Data Availability

- Don't have data directly linked to cannabis-impaired driving
- Including more variables limits the time span of experiment e.g. no alcohol consumption data for 2018 to put into DiD



## Interference

- People are likely to travel from other states to buy cannabis, leading to a boost in overall traffic in legalized states

# Future Improvements

## Find a better target variable

- Find total crash data which would detect smaller variation in the treatment effect

## Control for more variables in the Difference-in-Differences regression

- Vehicle registration data to improve upon the population density metric
- Weather data independent of fatal car crashes

## If Future Studies Find Significant Results,



Motivate research on  
effective cannabis  
breathalyzers



Inform policy for non-legalized  
states

The background is a light gray illustration of a city street scene. On the left, there are several multi-story buildings with many windows. A small car is parked on the street in front of one of the buildings. In the center, a large cannabis leaf is superimposed over the scene. The text "Questions? Thank you!" is written in a dark green, sans-serif font, centered over the cannabis leaf.

Questions?  
Thank you!

