

# Predicting and preventing US traffic fatalities:

## Final report

Rhiannon Rognstad  
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# Overview of problem:

- Over 35,000 fatalities occurred on US highways in 2015, and increase by 7.2% from 2014.
- The goal of this project is to analyze traffic fatality and supporting data to identify spatial patterns and factors that are related to fatal traffic incidents.
- Factors associated with increased traffic fatalities could be targeted by law enforcement or managers to reduce future crashes.

# Main datasets:

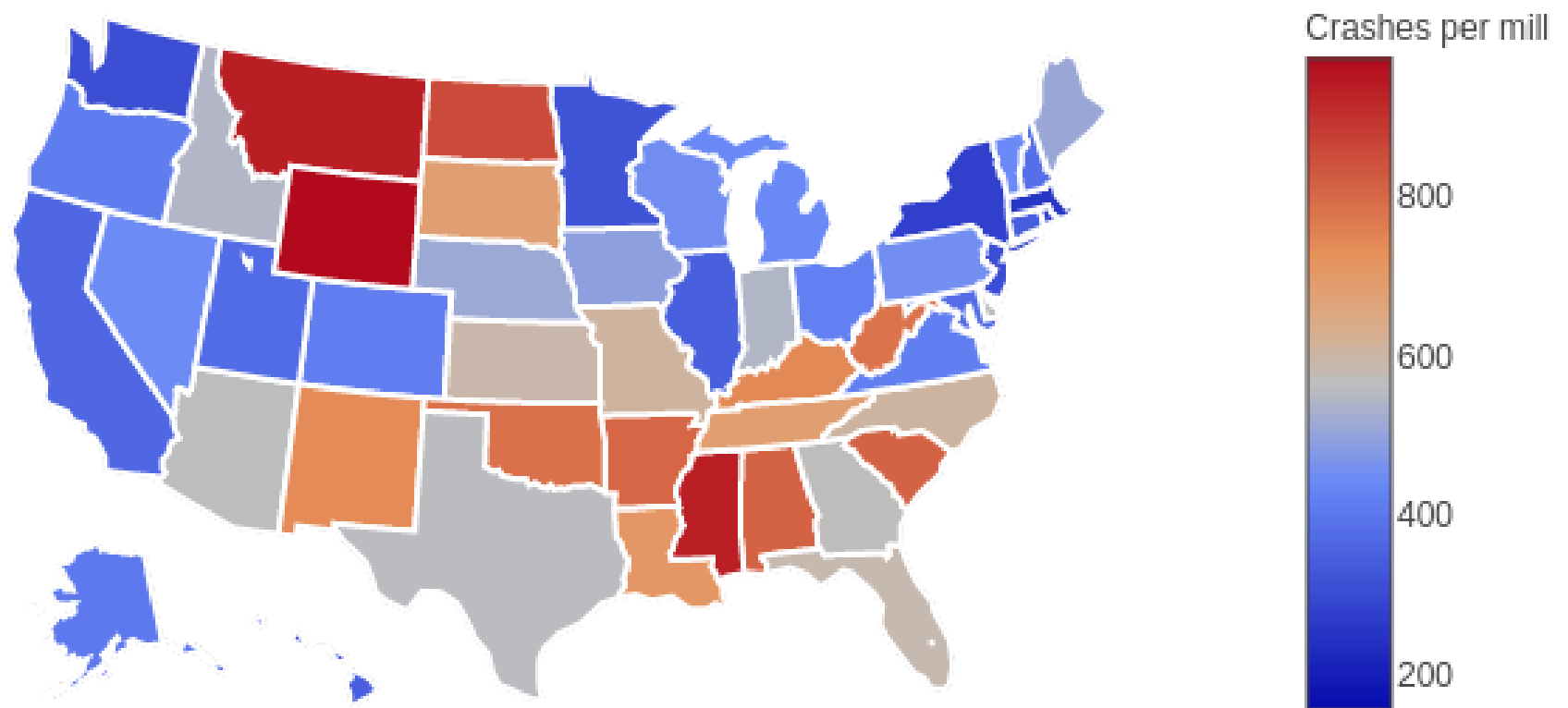
	<b>FARS (Fatality Analysis Reporting System)</b>	<b>GES (General Estimates System)</b>
<b>Temporal coverage:</b>	1975-2015	1988-2015
<b>Spatial coverage:</b>	All 50 US states, DC, Puerto Rico; latitude and longitude reported for each accident	All 50 US states, DC; location reported by region (northeast, south, midwest, west)
<b>Accident coverage:</b>	All accidents with least one fatality	Representative sample of police-reported crashes
<b>Supplementary information:</b>	Conditions of accident (weather, road location, date/time, speeding, alcohol involved), driver and passenger info (age, sex), vehicle (make, model, year)	Conditions of accident (weather, road location, date/time, speeding, alcohol involved), driver and passenger info (age, sex), vehicle (make, model, year)
<b>URL</b>	<a href="ftp://ftp.nhtsa.dot.gov/fars/">ftp://ftp.nhtsa.dot.gov/fars/</a>	<a href="ftp://ftp.nhtsa.dot.gov/GES/">ftp://ftp.nhtsa.dot.gov/GES/</a>

# Supplementary datasets

Dataset	Data	URL
US census	Demographic data on population size, age distribution	<a href="https://www2.census.gov/programs-surveys/popest/datasets/">https://www2.census.gov/programs-surveys/popest/datasets/</a>
State traffic laws	Speed limits, red light/speeding cameras, DUI/DWI laws, cellphone/texting	<a href="http://www.iihs.org/iihs/topics/laws/">http://www.iihs.org/iihs/topics/laws/</a>
Alcohol consumption	State-wide alcohol consumption	<a href="https://pubs.niaaa.nih.gov/publications/surveillance108/pcyr1970-2015.txt">https://pubs.niaaa.nih.gov/publications/surveillance108/pcyr1970-2015.txt</a>
Alcohol tax rate	State-wide taxes on beer, wine, and spirits	<a href="https://alcoholpolicy.niaaa.nih.gov/Taxes_Beer.html">https://alcoholpolicy.niaaa.nih.gov/Taxes_Beer.html</a>
Traffic related laws	State-wide traffic laws, particularly related to alcohol and driving	<a href="http://www.iihs.org/iihs/topics/t/impaired-driving/topicoverview">http://www.iihs.org/iihs/topics/t/impaired-driving/topicoverview</a>

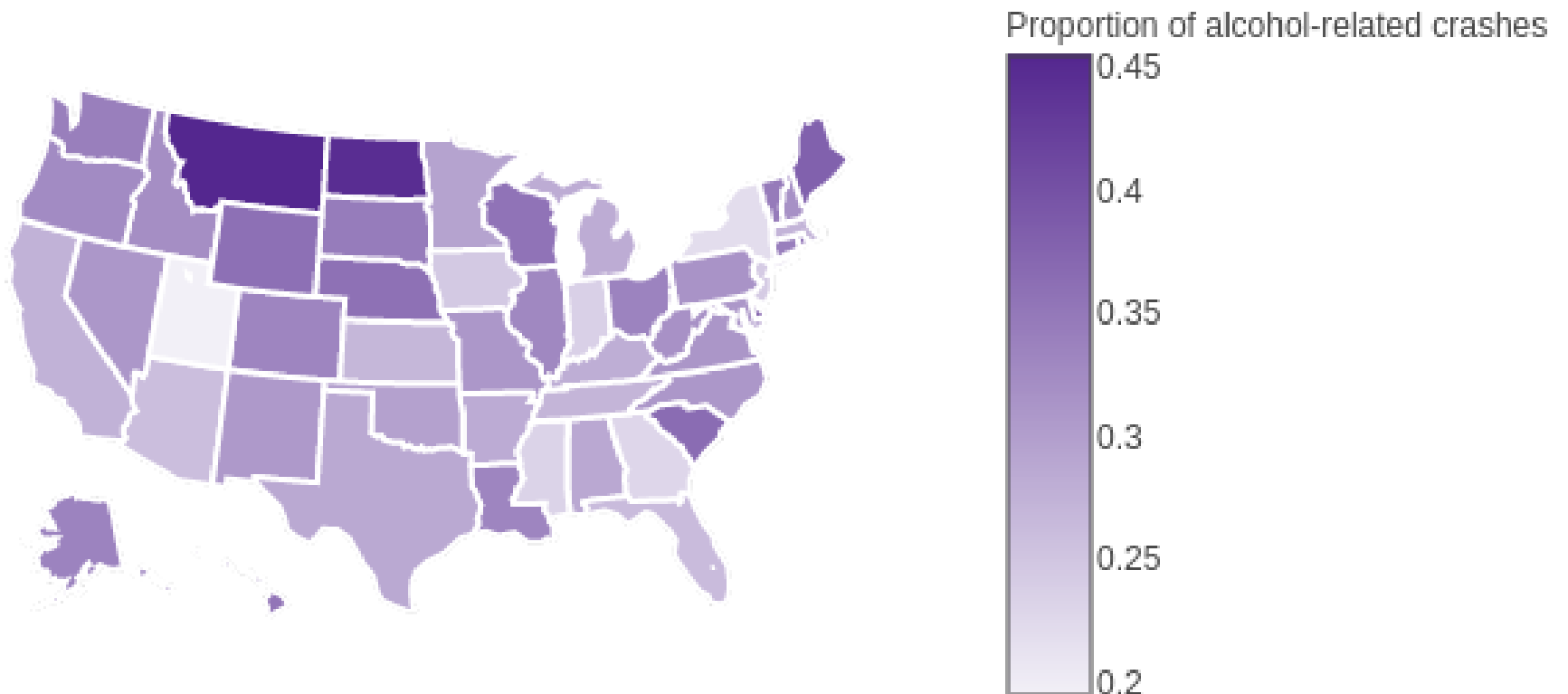
# Where do fatal crashes occur?

Number of fatal crashes per 1 million people (2015)



# What factors cause crashes? proportion of alcohol-related crashes

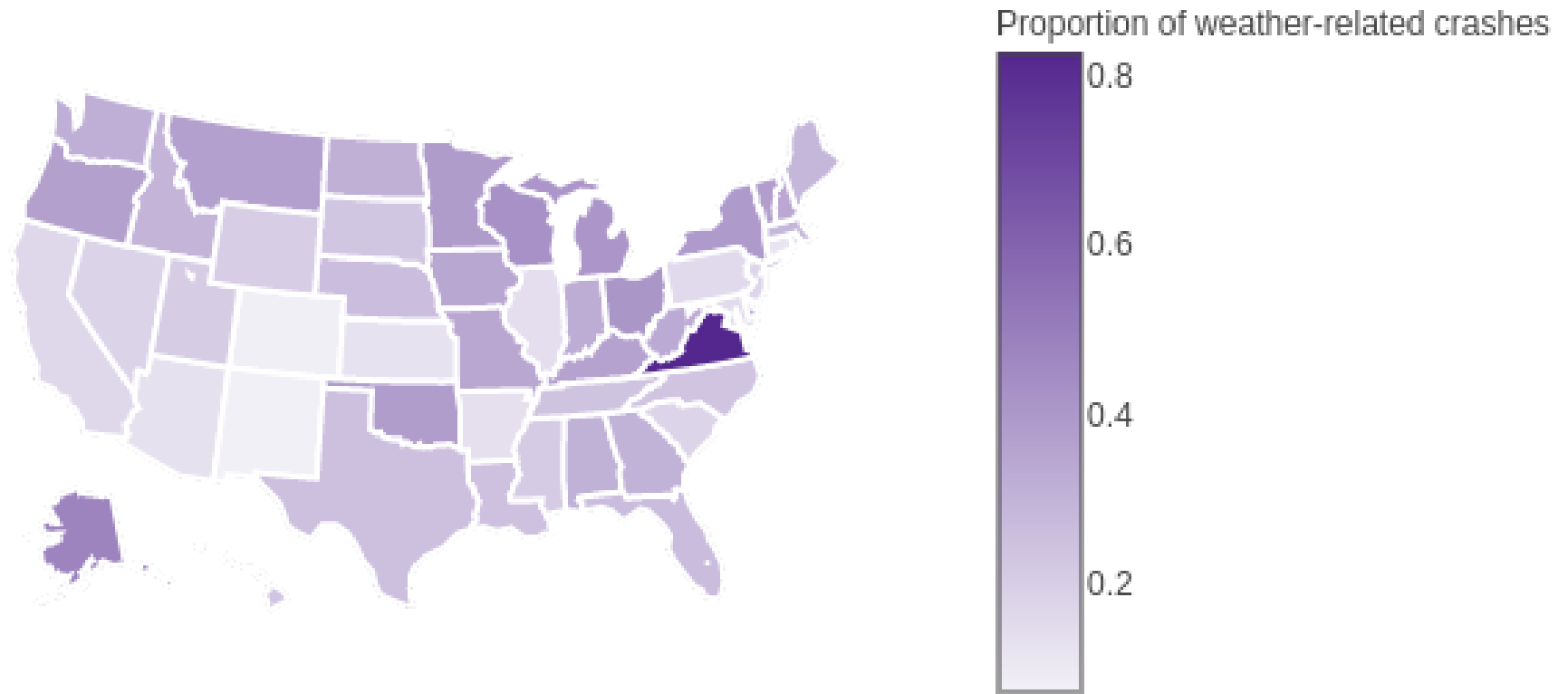
Proportion of alcohol-related fata crashes



# What factors cause crashes?

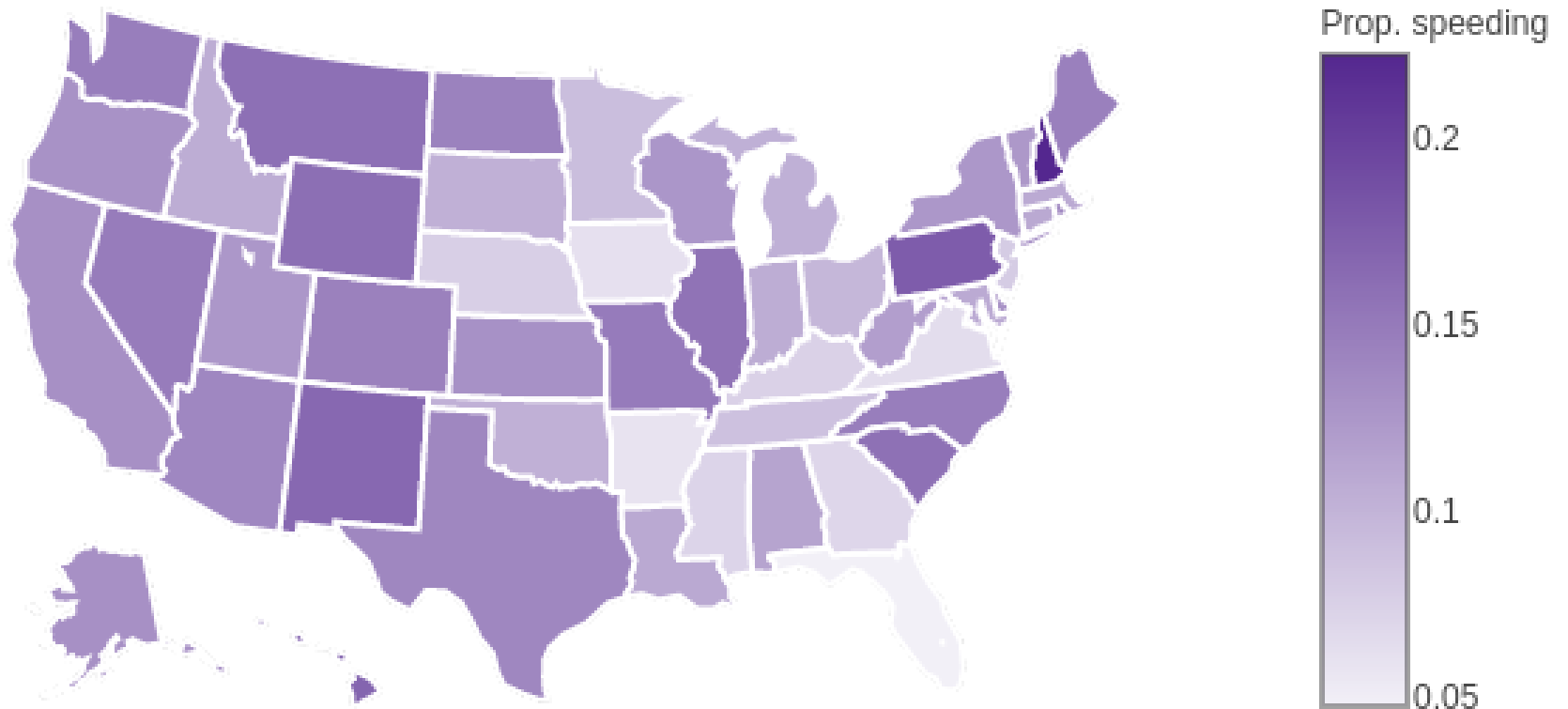
## proportion of weather-related crashes

Proportion of weather-related fatal crashes



# What factors cause crashes? proportion of speeding-related crashes

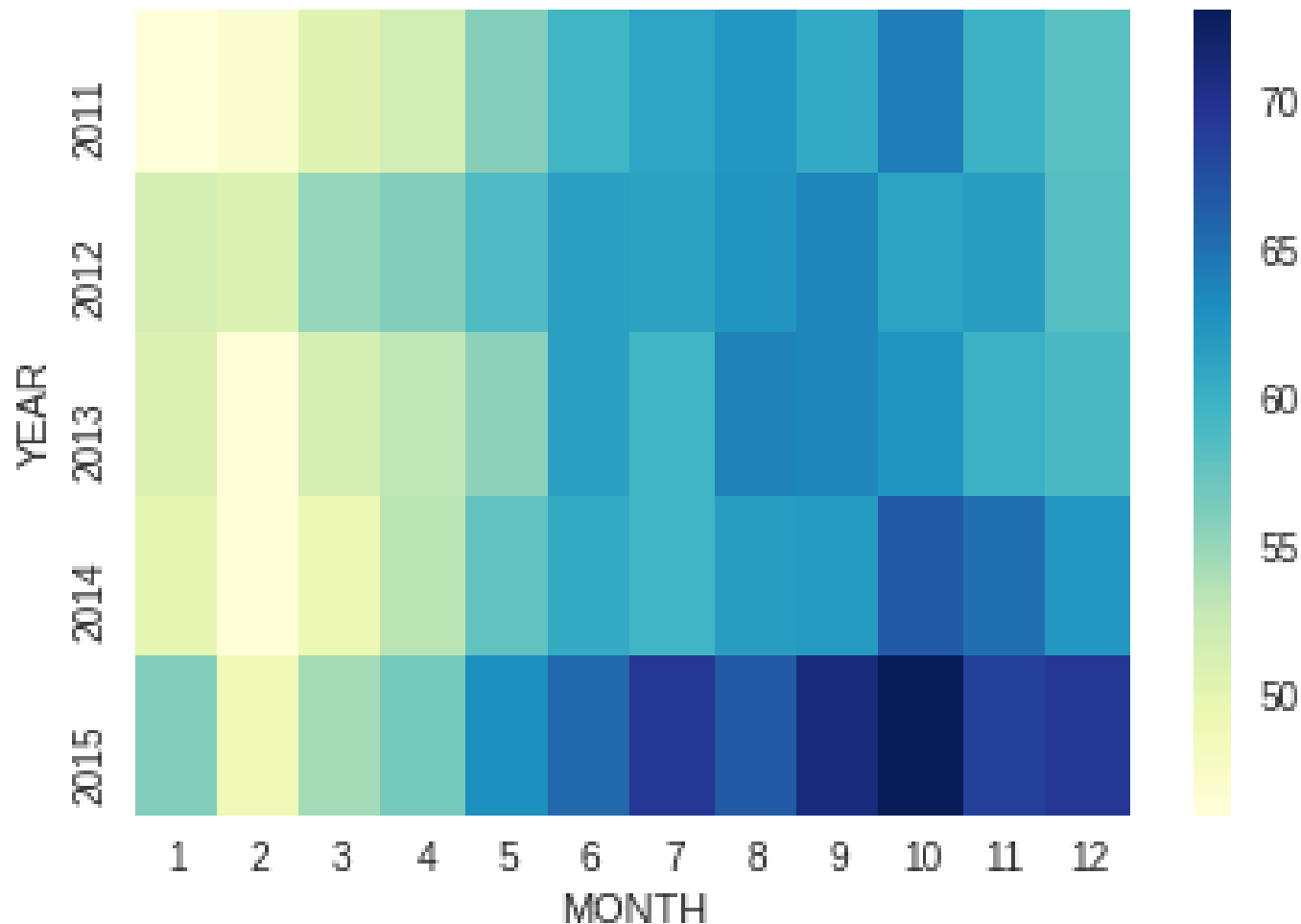
Proportion of speeding-related fatal crashes





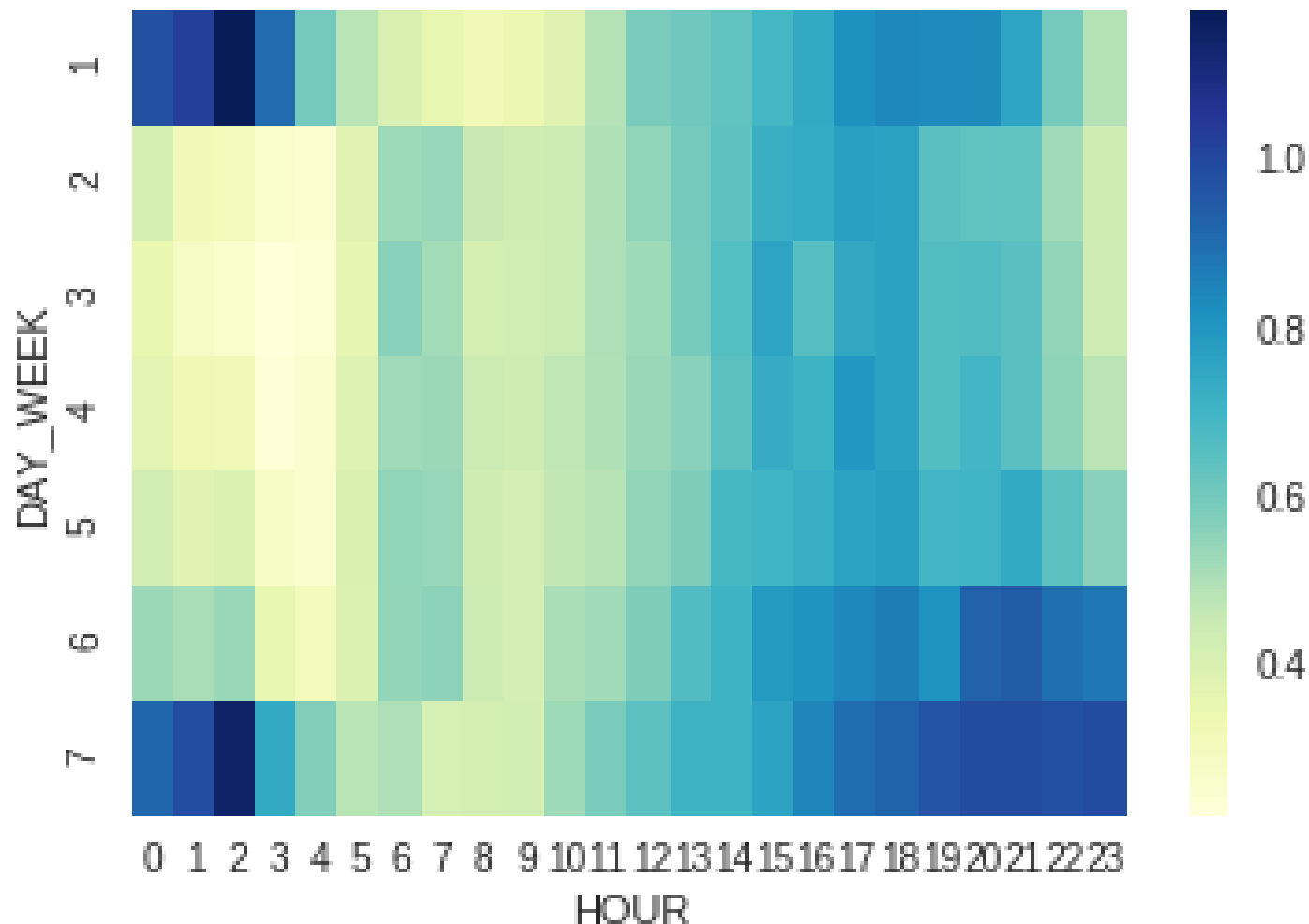
# When do crashes occur?

## Timing of accidents by month, scaled by number of days



# When do crashes occur?

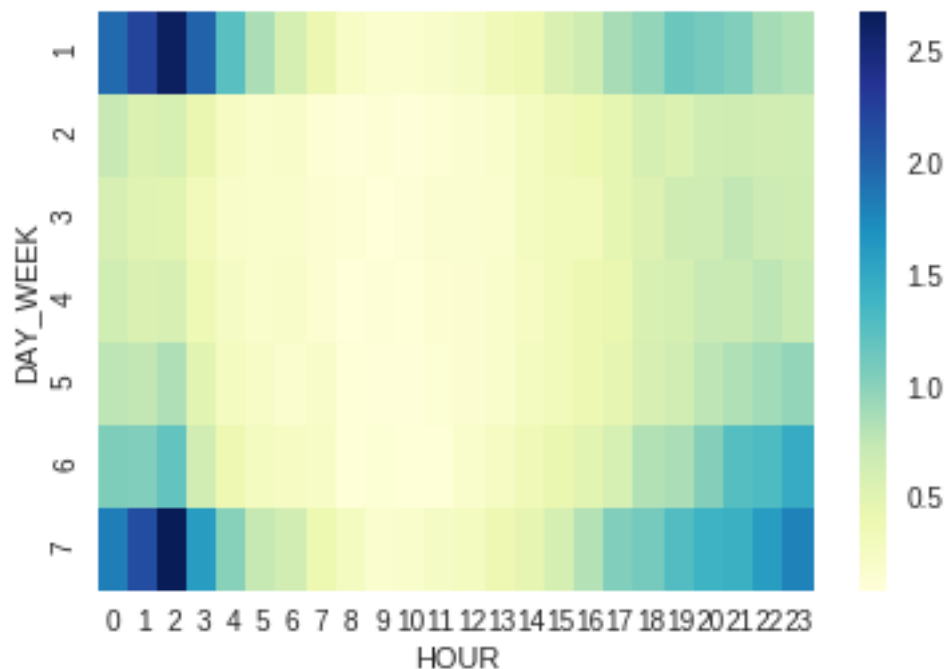
Timing of accidents, all fatal accidents, scaled as % of total



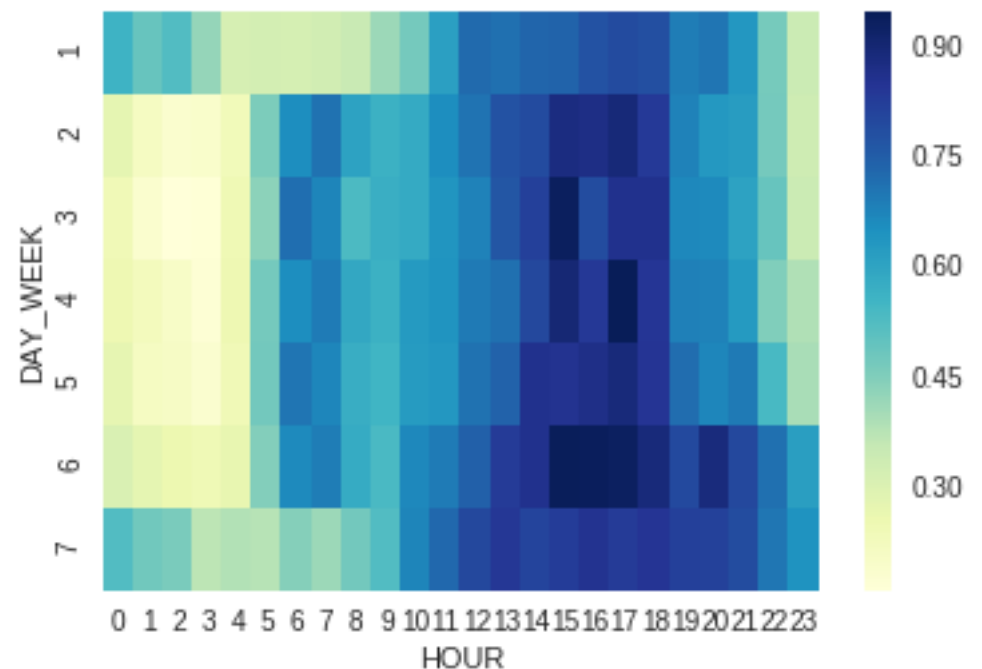
\*Sunday = day 1

# When do crashes occur?

## Timing of accidents, alcohol-involved vs. not, scaled as % of total



**Alcohol-involved**, concentrated late at night and early in the morning on weekends



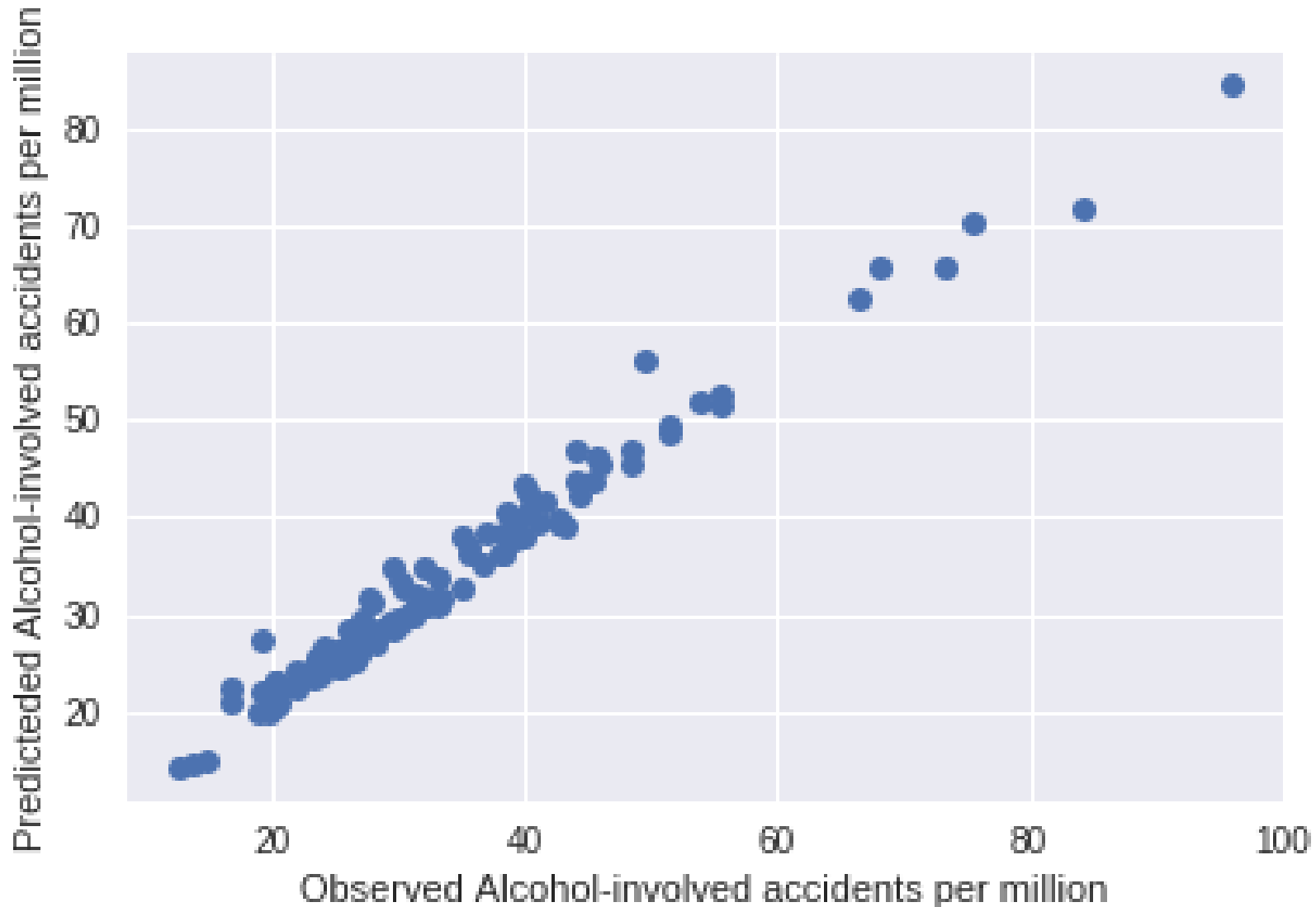
**Non alcohol-involved**, concentrated in afternoon and evening, particularly on weekdays

\*Sunday = day 1

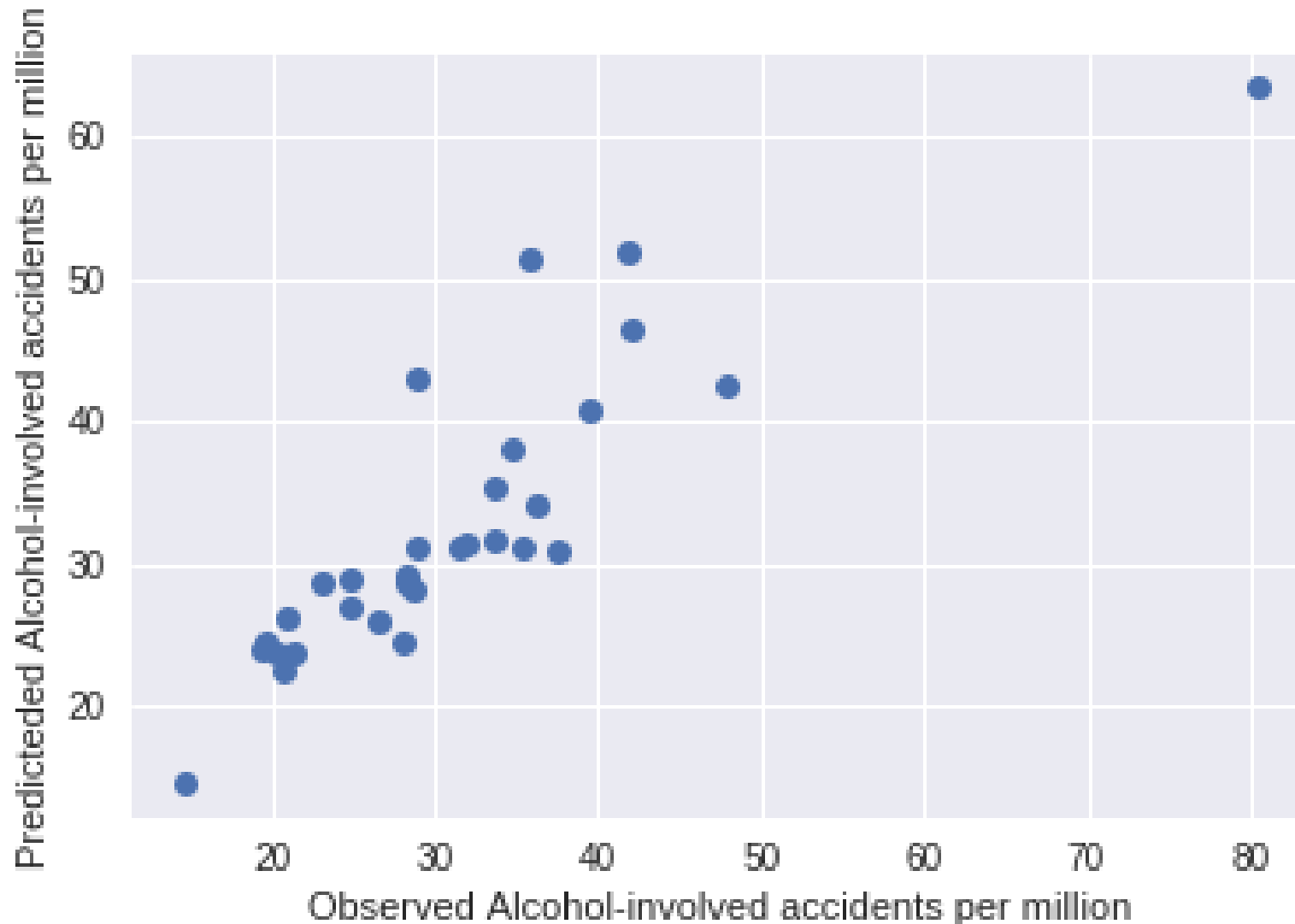
# Random Forest analysis: predictors

- Alcohol consumption per capita
- Alcohol tax rate: beer, wine, spirits
- Alcohol-related traffic laws: license suspension, suspension duration, interlock requirement
- Income

# Random Forest analysis: training data evaluation



# Random Forest analysis: test data evaluation



# Recommendations

- 1) To reduce alcohol-involved fatal crashes, law enforcement efforts should be concentrated between midnight and 3am on Saturday and Sunday mornings.
- 2) Beer tax rate is a key predictor of alcohol-involved crash rate. Increasing the beer tax rate may reduce this group of fatal crashes, likely by reducing consumption.
- 3) Interlock requirement laws are key predictors of alcohol-involved crash rate. Requiring interlocks after alcohol-related offenses may reduce this group of fatal crashes, likely by reducing the prevalence of reoffenders.