Predictors of Adverse Events from Substance Use

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Motivation

- Alcohol and drug sales are following the trends of wealth inequality and poverty started by the COVID-19 pandemic.
- We want to analyze specific factors that influence substance use so that the healthcare system can work to alleviate these issues.
- Addressing these predictors increases quality of life for those that are affected by excessive substance use and their communities.

Our Hypotheses

- All of the data utilized was obtained from a US county-level data set.
- Drug overdoses and alcohol-related driving incidents are positively associated with (1) **unemployment rates** and (2) **food insecurity**.
- Drug overdoses and alcohol-related driving incidents are negatively associated with (3) **the number of mental health providers** and (4) **the number of primary care physicians**.

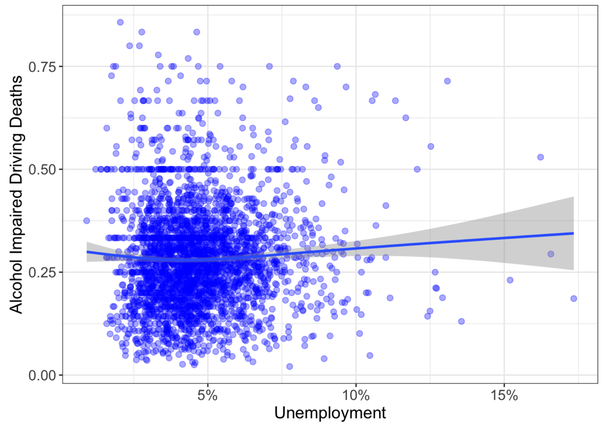
Data

- **Alcohol-Impaired Driving Deaths**: Percentage of driving deaths with alcohol involvement.
- **Drug Overdose Deaths**: Number of drug poisoning deaths per 100,000 population.
- **Unemployment**: Percentage of population ages 16 and older unemployed but seeking work.
- **Mental Health Providers**: Number of mental health care providers per 100,000 of the population.
- **Primary Care Physicians**: Number of primary care physicians per 100,000 of the population.
- **Food Insecurity**: Percentage of population who lack adequate access to food.

Source

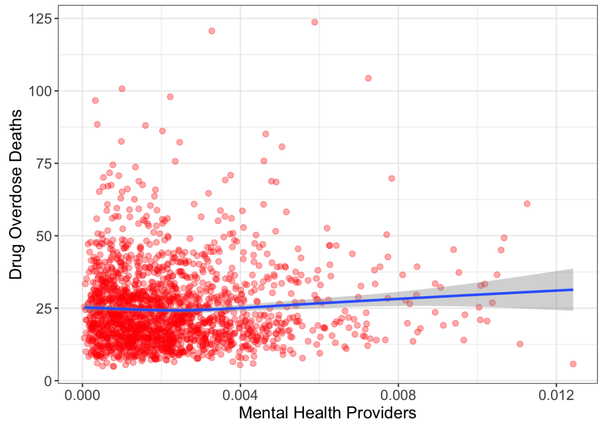
University of Wisconsin Population Health Institute. County Health Rankings & Roadmaps 2023. www.countyhealthrankings.org

Unemployment



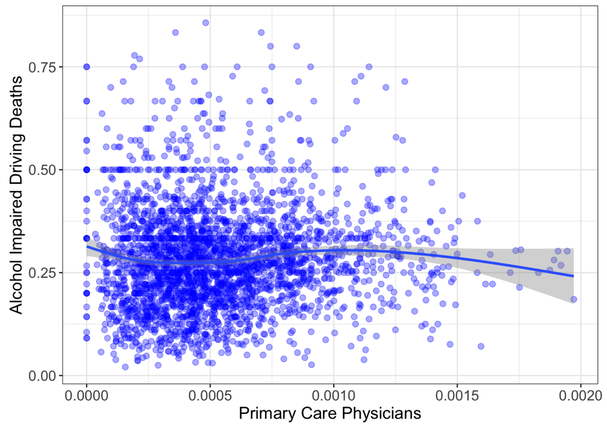
There is a **positive, weak relationship** between **Unemployment** and **Alcohol-Impaired Driving Deaths**.

Mental Health Providers



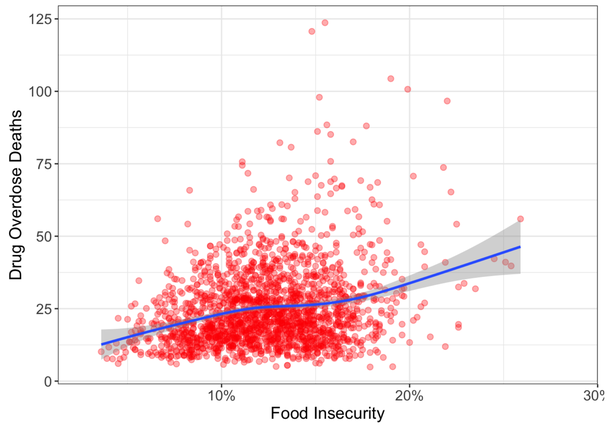
There is a **positive, weak relationship** between **Mental Health Providers** and **Drug Overdose Deaths**.

Primary Care Physicians



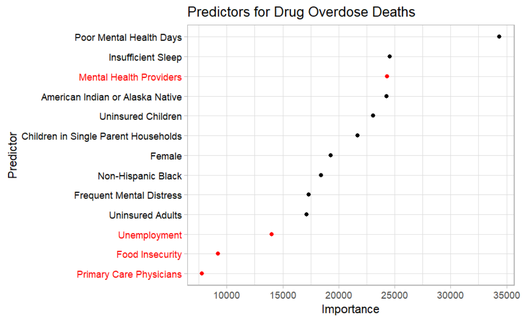
There is a **negative, weak relationship** between **Primary Care Physicians** and **Alcohol-Impaired Driving Deaths**.

Food Insecurity

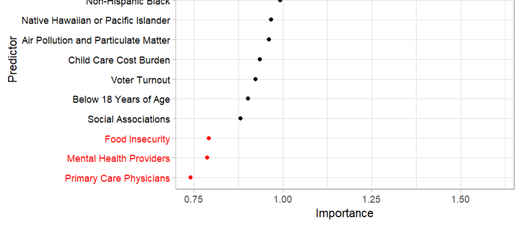


There is a **positive, strong relationship** between **Food Insecurity** and **Drug Overdose Deaths**.

Drug Overdose Deaths



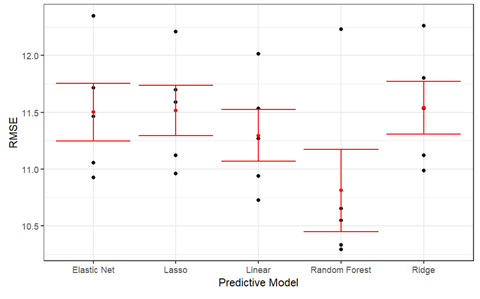
Alcohol Impaired Driving Deaths



Conclusions

- **Random forests** outperformed both linear regression and regularization models
- **Poor mental health days, poor sleep**, and the **number of mental health providers** are the best predictors of **drug overdose deaths**
- Controlling for demographic information, **high unemployment rate** is the best predictor of **alcohol-impaired driving deaths**

Which predictive model should we use? Random Forest!



- The figure shows the **prediction error** for **linear regression, three regularization techniques, and random forests**.
- Using cross-validation with five folds, the point and whiskers show the **average root mean squared error** and 95% confidence interval for each estimator.
- The random forest model produced the **lowest root mean squared error values**, so we will use a random forest as the predictive model.

Future Work

- Incorporate more demographic and socioeconomic information such as marital status, political ideology, completion of higher education, among others.
- Adjust for state level effects to provide better county-to-county level comparisons
- Incorporate individualized data to expand findings