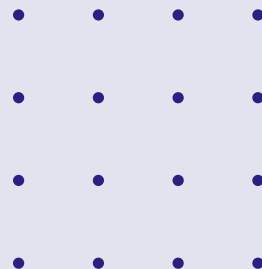


Predictors of Adverse Events from Substance Abuse

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Carnegie Mellon University SURE Program 2023



Substance Abuse is a Growing Problem in the US

Simultaneously the wealth gap since the emergence of the Covid 19 pandemic has grown.

Nearly 110,000 people in the US died of drug overdose in 2022.

Overdose deaths have increased significantly from 17% in 2021 to 30% in 2022.

More than a quarter of all traffic related deaths are due to alcohol use.

At the peak of the pandemic in 2020, the poverty rate increased by a percentage point from 10.5% in 2019 to 11.4%.

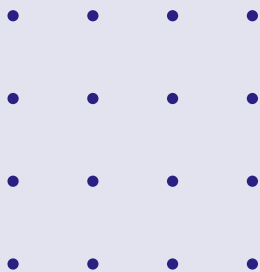
At the same time, there was a significant increase in retail alcohol sales during 2020, representing an increase by 20% from 2019.





Why We Care





Data

County Health Ranking and Data map

University of Wisconsin Population
Health Institute

(<https://www.countyhealthrankings.org/>)

Our Predictors

Predictors:

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

Food Insecurity

Percentage of population who lack adequate access to food

Primary Care Physicians

Number of primary care physicians per 100,000 of the population

Response:

Drug Overdose Deaths

Number of drug poisoning deaths per 100,000 of the population

Alcohol Impaired Driving Deaths

Percentage of driving deaths with alcohol involvement



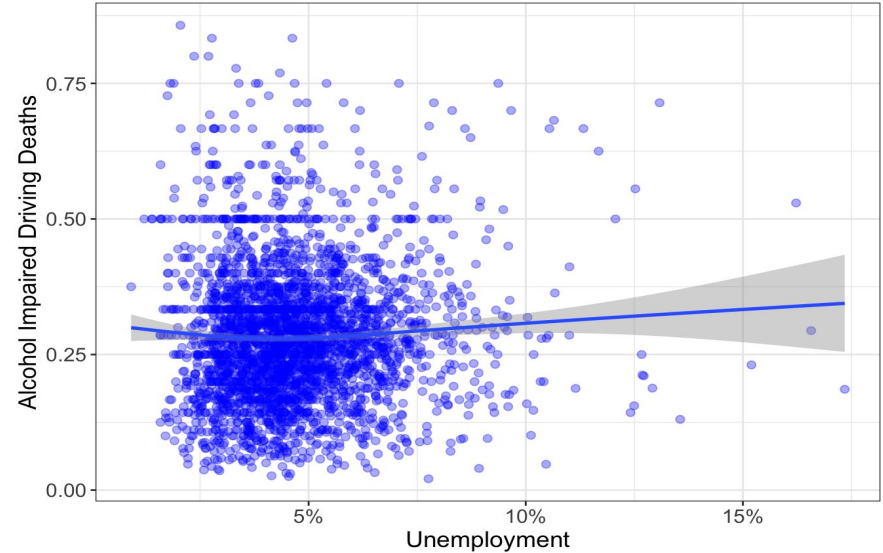
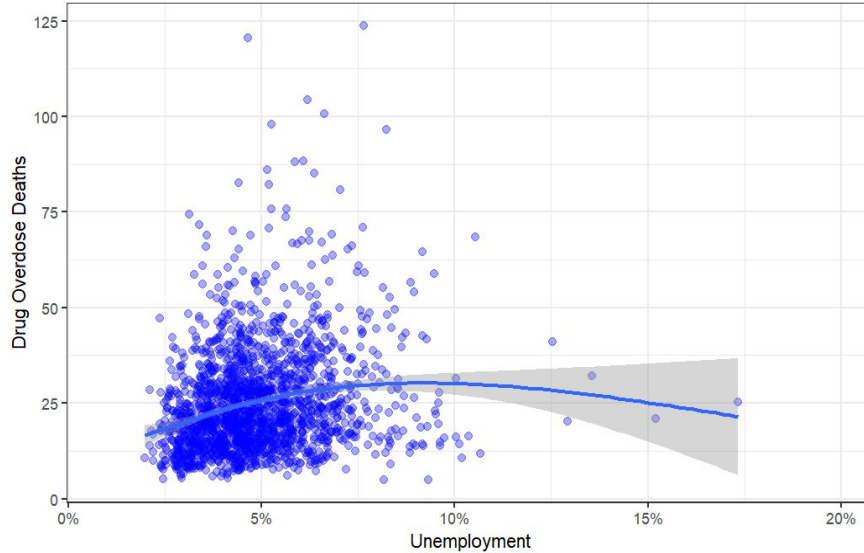
EDA

Exploratory Data Analysis

Hypotheses

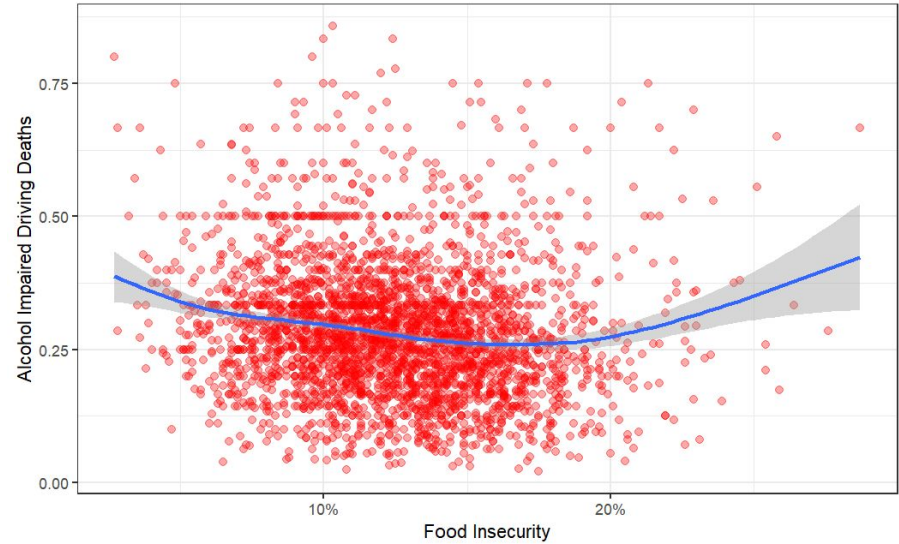
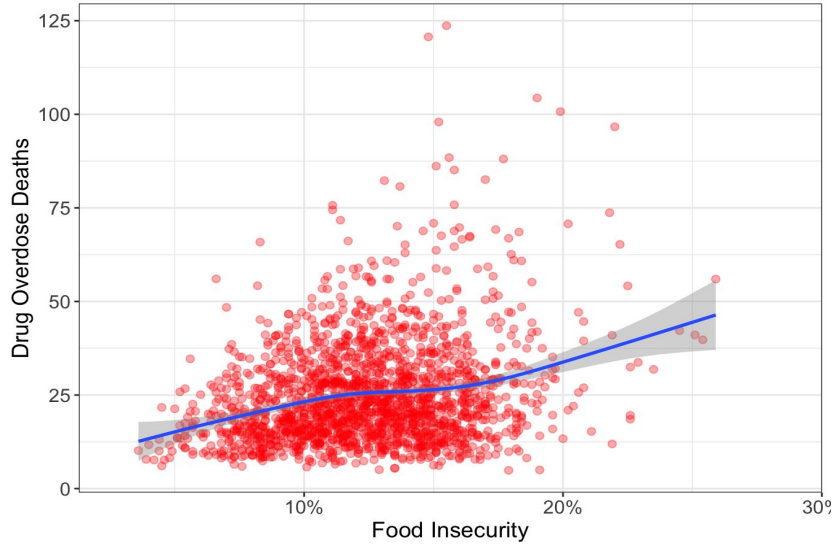
- **Unemployment:** Does an increase in unemployment rates result in an increase in drug overdoses and alcohol-related incidents?
- **Food Insecurity:** Does an increase in food insecurity result in an increase in drug overdoses and alcohol-related incidents?
- **Mental Health Providers:** Does an increase in mental health providers result in a decrease in drug overdose and alcohol-related incidents?
- **Primary Care Physicians:** Does an increase in primary care physicians result in a decrease in drug overdoses and alcohol-related incidents?

Unemployment



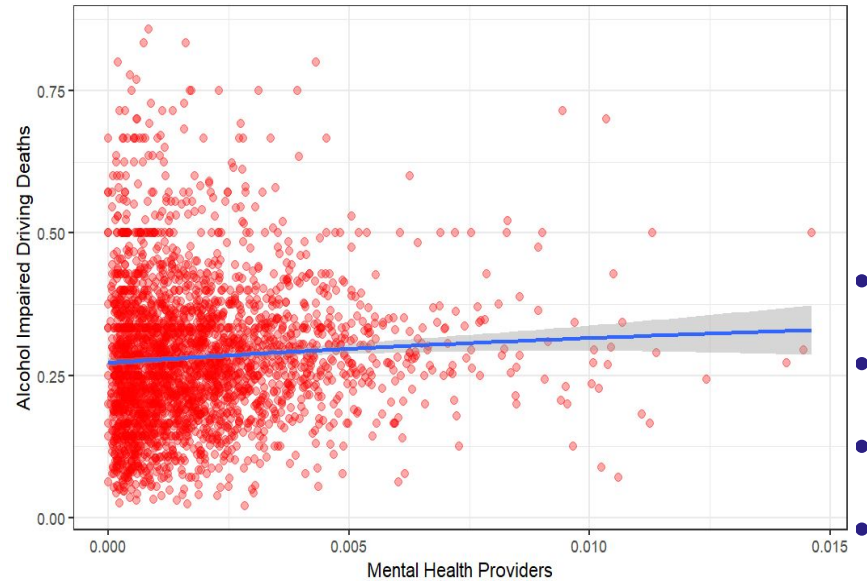
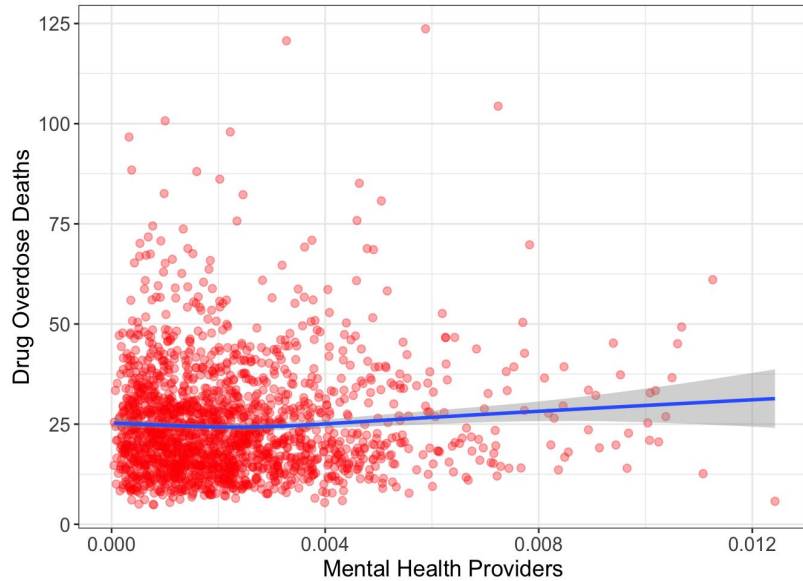
Unemployment: The percentage of the population ages 16 and older unemployed but seeking work.

Food Insecurity



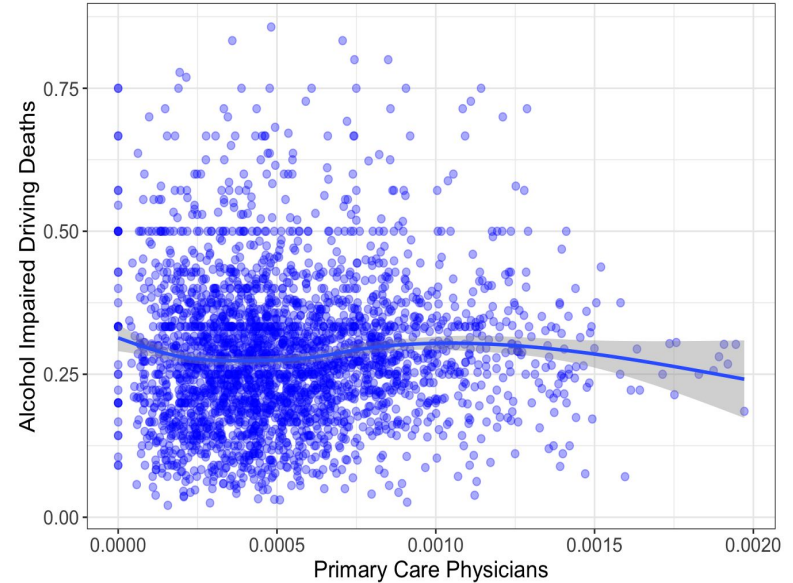
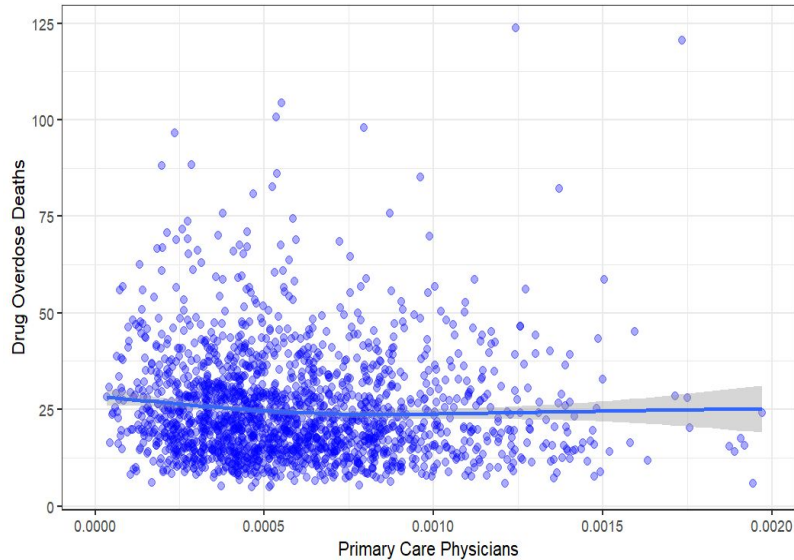
Food Insecurity: The percentage of population who lack adequate access to food.

Mental Health Providers



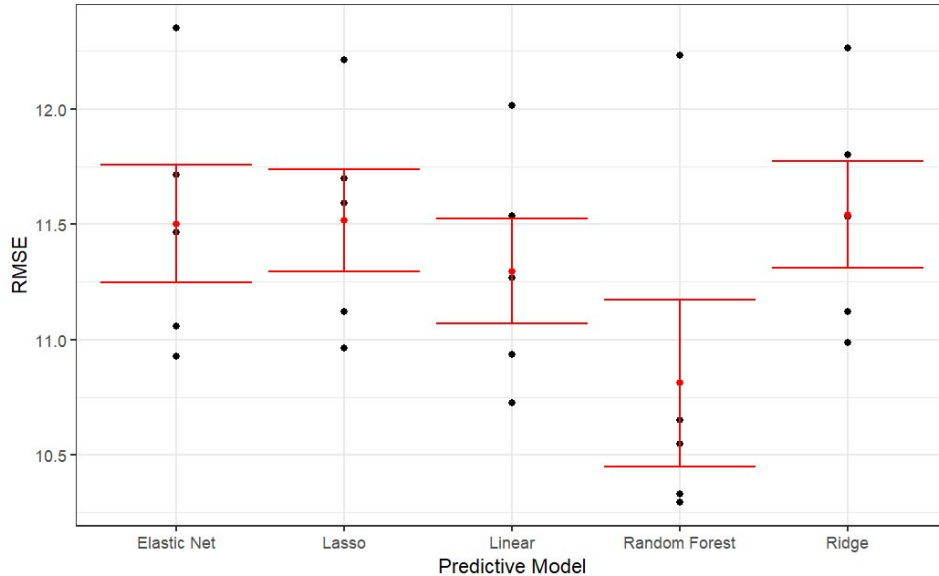
Mental Health Providers: The number of mental health care providers per 100,000 of the population.

Primary Care Physicians



Primary Care Physicians: The number of primary care physicians per 100,000 of the population.

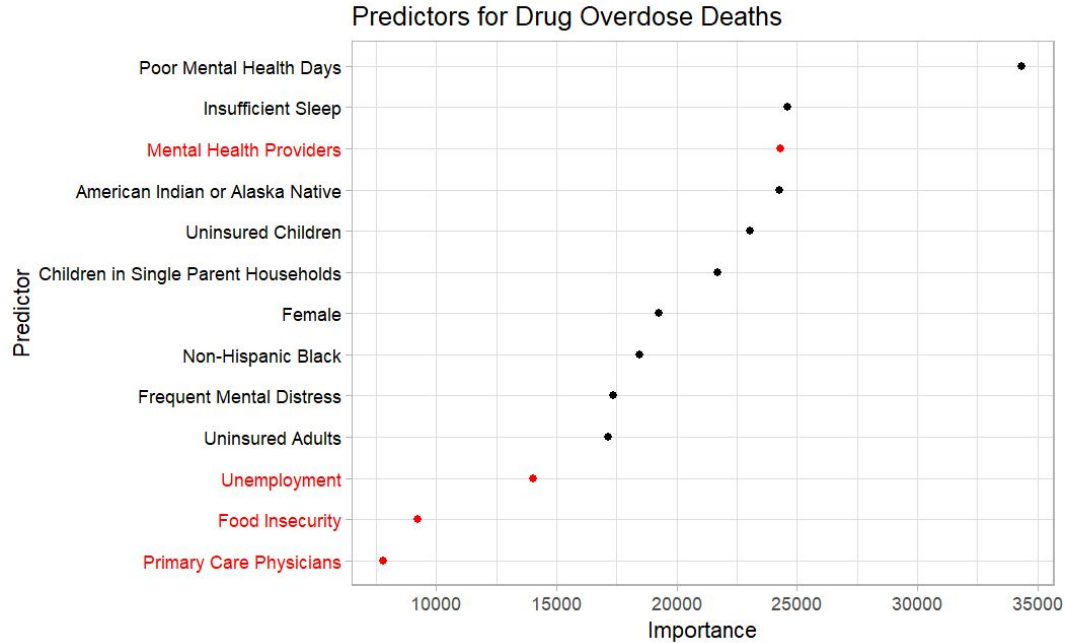
Which predictive model fits the data best?



The random forest model fits the data best compared to regularization techniques and linear regression

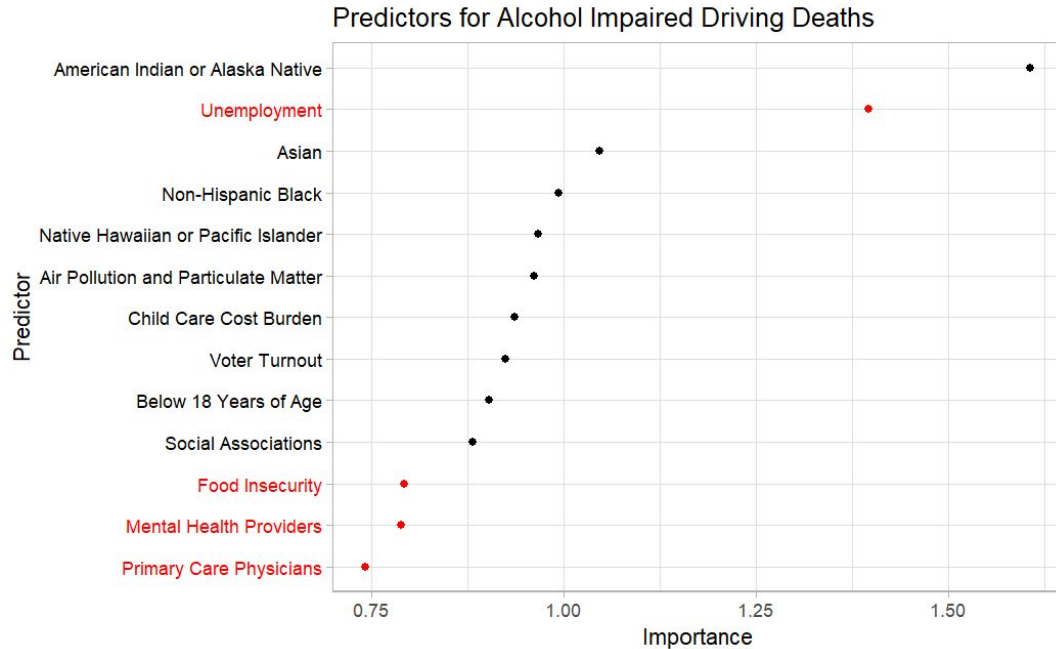


Predicting Drug Overdose Deaths



Poor mental health days, insufficient sleep, and mental health providers are the most important predictors for drug overdose deaths

Predicting Alcohol Impaired Driving Deaths



Controlling for demographic factors, unemployment is the most important predictors for alcohol impaired driving deaths

What We Found

- **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**



What Next?

Demographics

Include along with predictive variables

New Variables

Relating to the wealth gap

State levels

Adjust to county-to-county level comparisons

Individualized Data

Incorporated to expand findings

How might we?

1. Lobby the Department of Labor for mental health day requirement
2. Educational tips on sleeping habits
3. Hire more mental health professionals
4. Partner with hiring companies for job-related resources

