

Analyzing the Relationship among Socioeconomic Factors and Drug Overdose Mortality in the United States

Alexandra Dolezal, Lisa McFadden
University of South Dakota



Abstract/Introduction

The drug overdose mortality rate has increased throughout the United States. The purpose of this study was to determine what socioeconomic factors are associated with the overdose rate on a state-by-state basis. Statistical models were created using previously collected survey and epidemiological data. Results revealed the drug overdose mortality rate significantly increased from 2013 to 2015. In 2014, the following six variables were significantly associated with the drug overdose mortality rate: prevalence of any mental illness in the past year, percentage of employees being let go by employers, prevalence of fentanyl positive drug seizures by law enforcement, high school education as highest degree earned, prevalence of cocaine use in the past year, and the Gallop Poll percentage of Obama disapproval. Wastewater epidemiology is underway to assess the geographical differences in drug use in the United States. By improving associated factors, such as mental health, education, and economic stability, and monitoring, the consequences may lead to reductions in drug overdose mortality.

Objectives

- Investigate socioeconomic factors that may be associated with overdoses mortality in the United States
- Utilize wastewater epidemiology in multiple sites to assess the geographical and temporal changes in drug use
- Investigate if changes in socioeconomic factors will be associated in changes in drug use as assessed by wastewater epidemiology

Methods

Previously published survey data on socioeconomic factors were collected via internet research. Statistical modeling was conducted using the program R or SAS. After collecting the data, on a state-by-state basis, eighty-three variables were correlated with the 2014 drug overdose mortality rate.¹ Next, multiple linear regression models were constructed using the 2014 drug overdose mortality rate¹ as the dependent variable. A stepwise selection method was used to determine the best model for each number of independent variables. Wastewater treatment plants were recruited and sampled. Ongoing research will analyze these samples for drugs of abuse and metabolites.

Variables

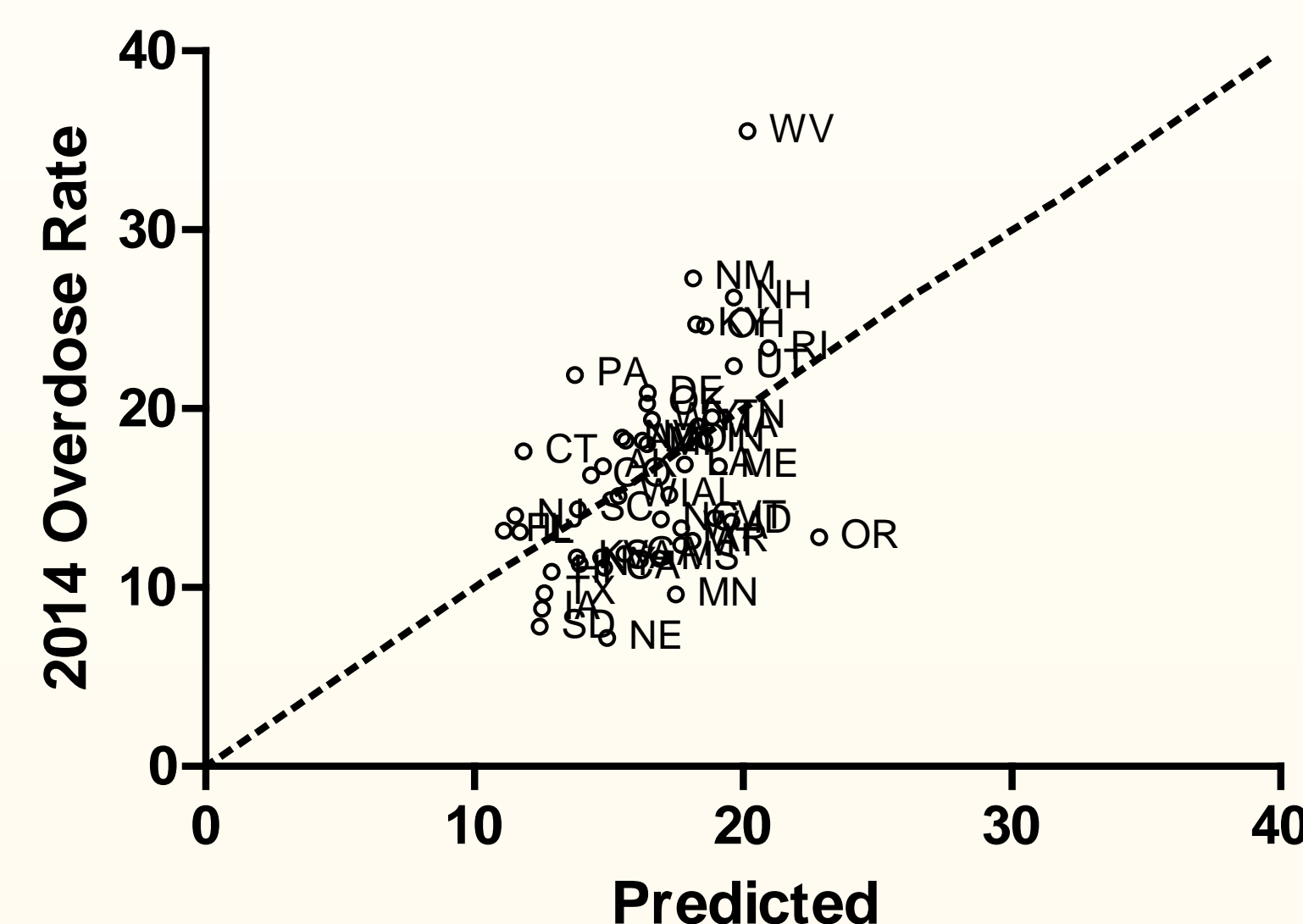
| Independent Variables | | | | | |
|-------------------------------------|--------------------------------------|--|--|--|--|
| Political | Community | Other | Health | Economic | Mental Health |
| % Obama Approval ² | % Community Recognition ² | % Very Religious ² | Overall Well-Being ² | Economic Confidence Index ² | Major Depressive Episode Past Year ³ |
| % Obama Disapproval ² | % Urban ⁵ | % Moderately Religious ² | % Uninsured ² | Job Creation Index ² | Suicidal Thoughts Past Year ³ |
| % Republican ² | Violent Crime Rate ⁶ | % Nonreligious ² | % Exercise Frequently ² | % Hiring ² | Any Mental Illness Past Year ³ |
| % Democrat ² | Property Crime Rate ⁶ | College Degree ⁴ | % Eat Produce Frequently ² | % Letting Go ² | Serious Mental Illness ³ |
| Democratic Advantage ² | % Immigrant ⁵ | Less than High School Education ⁴ | % Feel Active and Productive ² | % Gallup Good Jobs ² | Need but not Receiving Treatment for Alcohol Addiction ³ |
| % Conservative ² | % Volunteering ⁷ | High School only Education ⁴ | Mother's Age at Birth (Teen) ¹ | % Underemployed ² | Need but not Receiving Treatment for Illicit Drug Addiction ³ |
| Conservative Advantage ² | 2010 Median Age ⁵ | | Mother's Age at Birth (20-24) ¹ | % Worried About Money ² | Dependence or Abuse of Illicit Drugs ³ |
| % Liberal ² | | | Mother's Age at Birth (25-29) ¹ | % of All People in Poverty ⁵ | Illicit Drug Dependence Past Year ³ |
| % Moderate ² | | | Mother's Age at Birth (30-34) ¹ | Children in Poverty ⁵ | Illicit Drug Dependence or Abuse ³ |
| Cannabis Status ⁸ | | | Mother's Age at Birth (35-39) ¹ | Unemployment 2014 ⁵ | Alcohol Dependence Past Year ³ |
| | | | Alcohol Mortality Rate ¹ | Median Income ⁵ | Alcohol Dependence or Abuse Past Year ³ |
| | | | Fam.GenPract.100K ⁹ | Median Household Income ⁵ | Tobacco Product Use Past Month ³ |
| | | | Nurse.Pract.100K ⁹ | Median Family Income ⁵ | Binge Alcohol Use Past Month ³ |
| | | | Phy.Assist.100K ⁹ | Per Capita Income ⁵ | Alcohol Use Past Month ³ |
| | | | Psychiatrists.100K ⁹ | Median Earnings for Workers ⁵ | Pain Reliever Misuse ³ |
| | | | Reg.Nurses.100K ⁹ | Median Earnings Male ⁵ | Cocaine Use Past Year ³ |
| | | | Prescription Opioid ¹ | Median Earnings Female ⁵ | Drug Use Past Year (No Marijuana) ³ |
| | | | Fentanyl Seizures ¹ | Alcohol Tax ⁹ | Marijuana Use Past Year ³ |
| | | | | Tobacco Tax ⁹ | Illicit Drug Use Past Month ³ |
| | | | | % Low Food Security ⁹ | ADHD Medication ¹ |

Top Pearson's Correlations

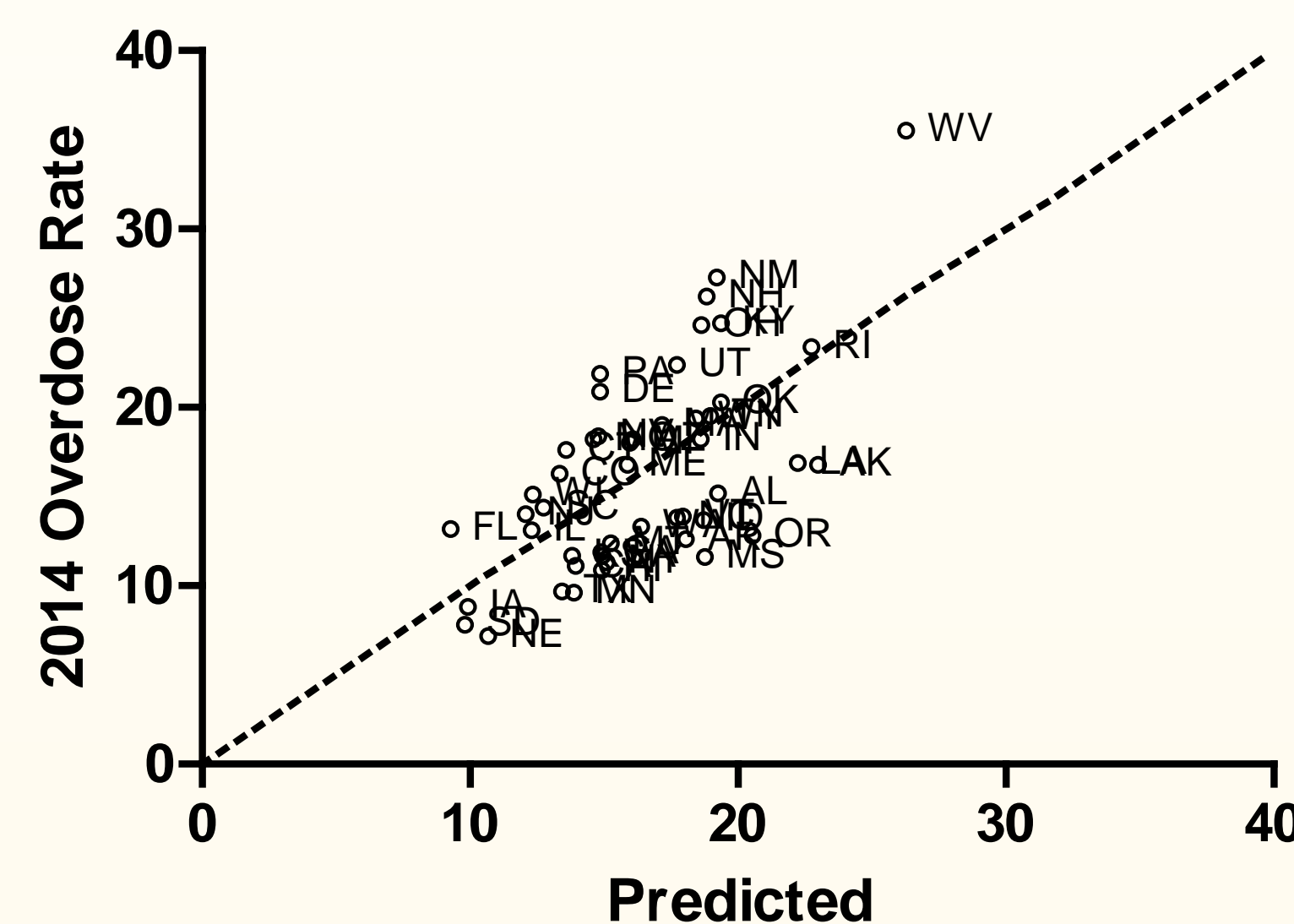
| 2014 DO Rate | Any Mental Illness Past Year | Illicit Drug Dependence or Abuse | Economic Confidence Index | % Feel Active and Productive | Overall Well-Being | Mother's Age at Birth (30-34) | Need but not Receiving Treatment for Illicit Drug Addiction | Illicit Drug Dependence Past Year | Prescription Opioid |
|--------------|------------------------------|----------------------------------|---------------------------|------------------------------|--------------------|-------------------------------|---|-----------------------------------|---------------------|
| | r=-0.497 | r=-0.474 | r=-0.467 | r=-0.456 | r=-0.447 | r=-0.436 | r=-0.424 | r=-0.420 | r=-0.394 |
| | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 | p<0.05 |

Models

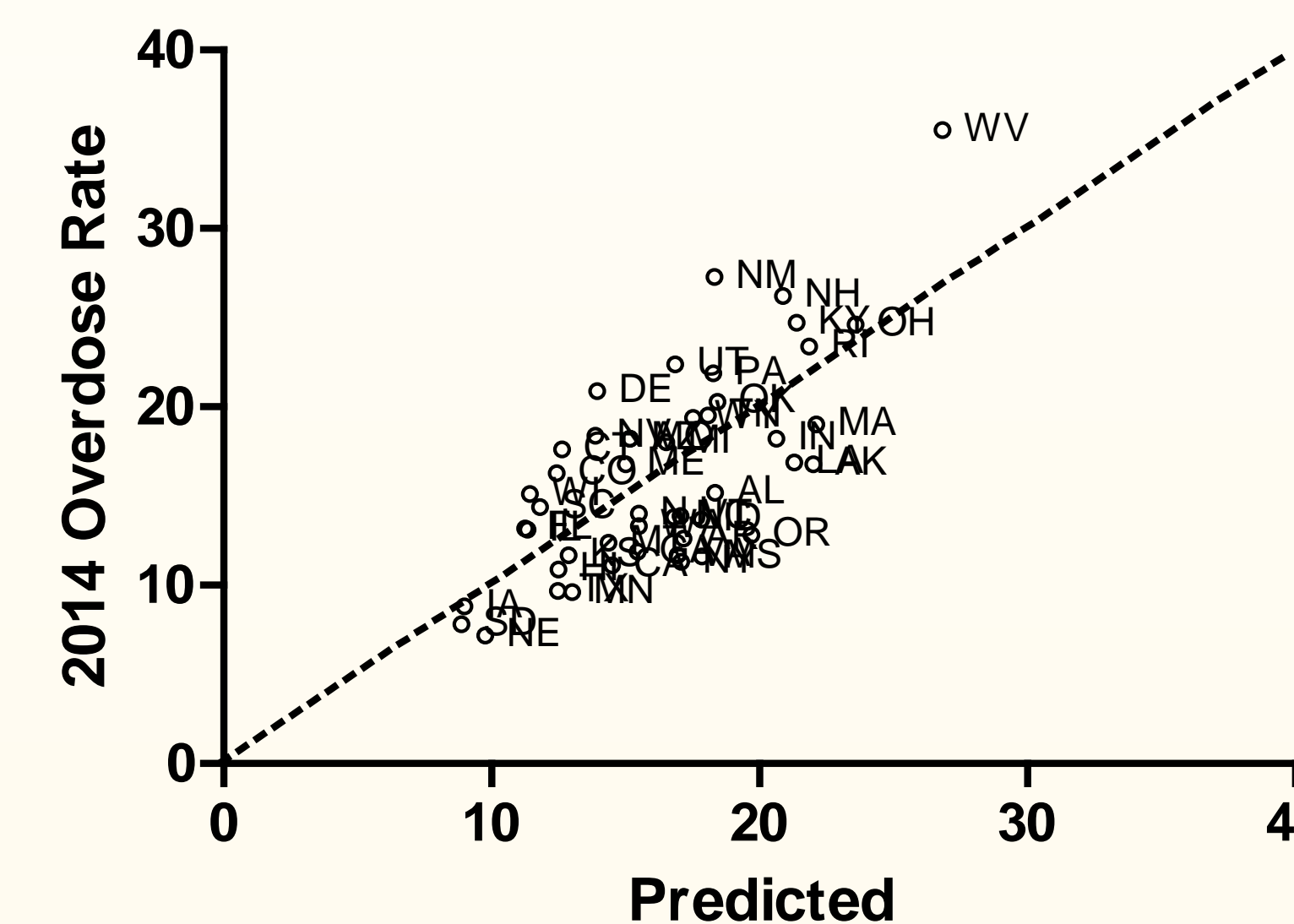
One Variable Model



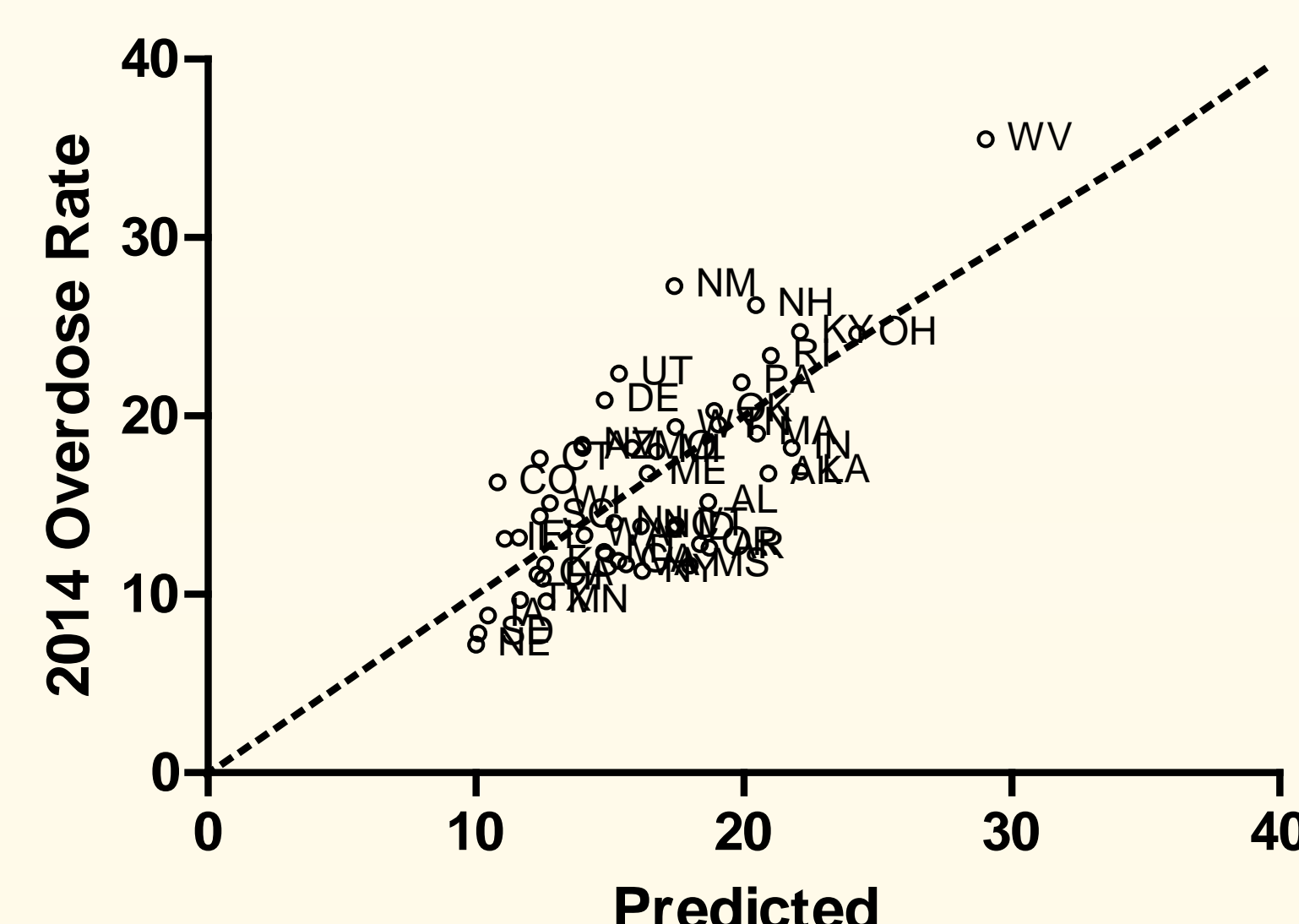
Two Variable Model



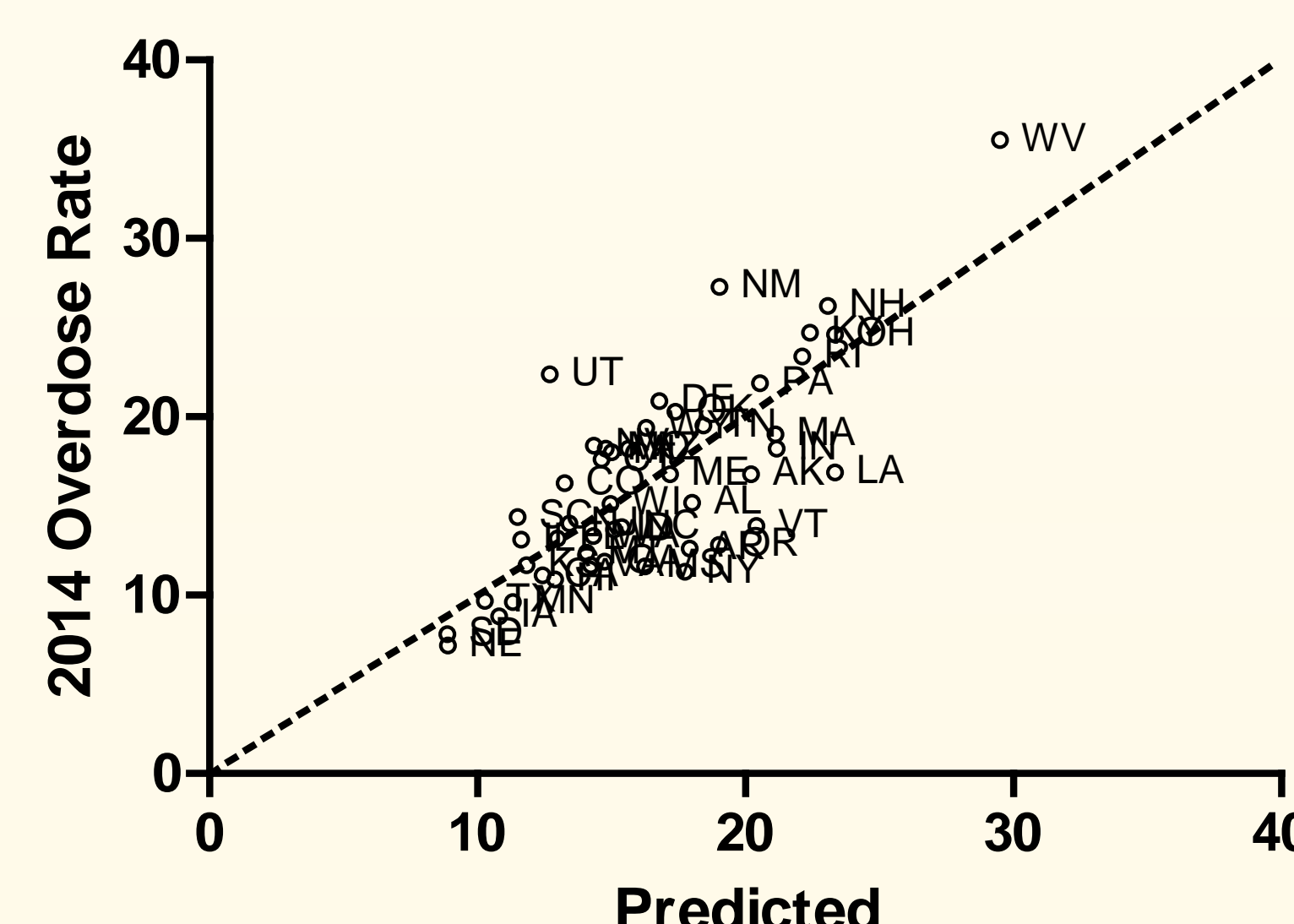
Three Variable Model



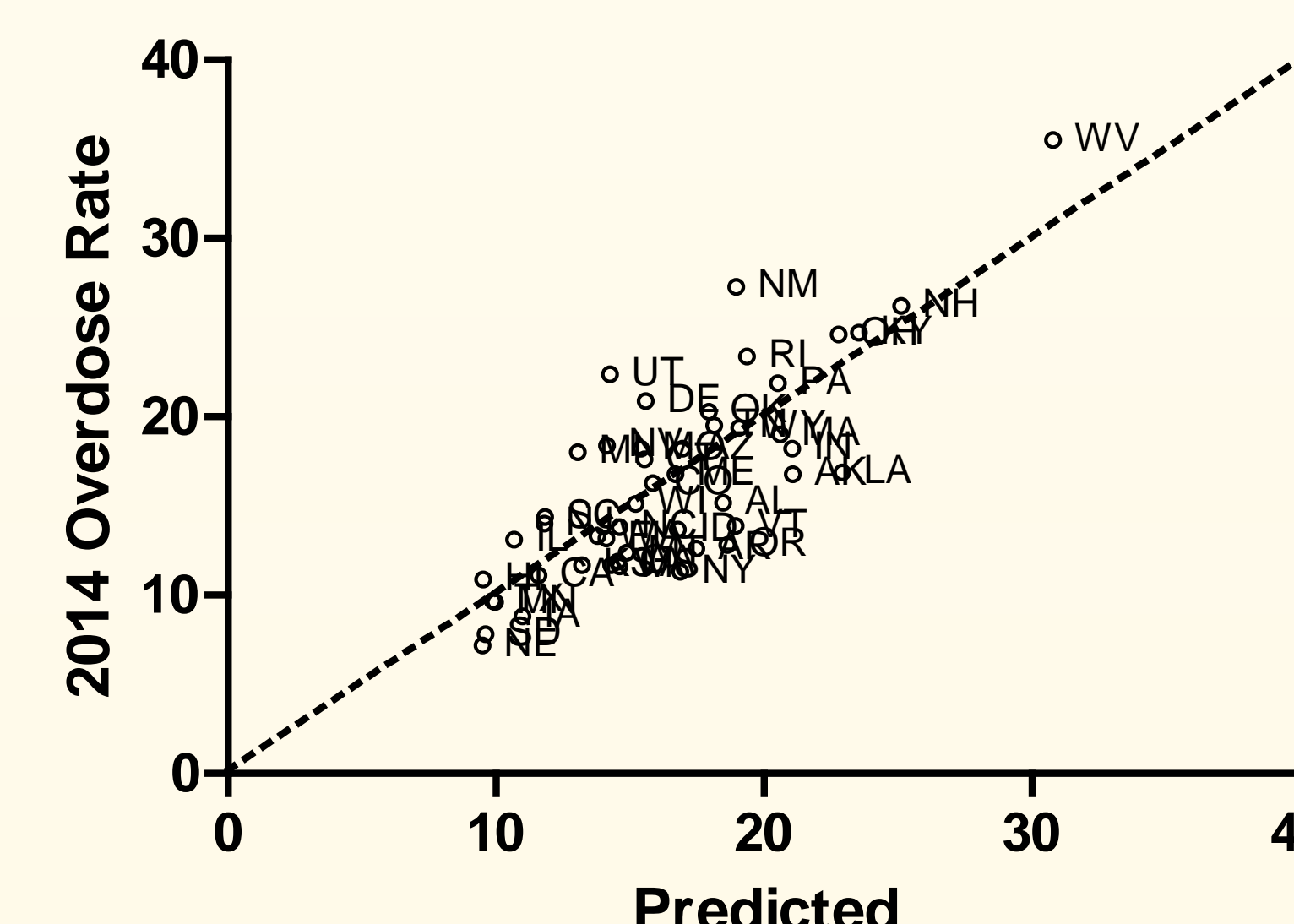
Four Variable Model



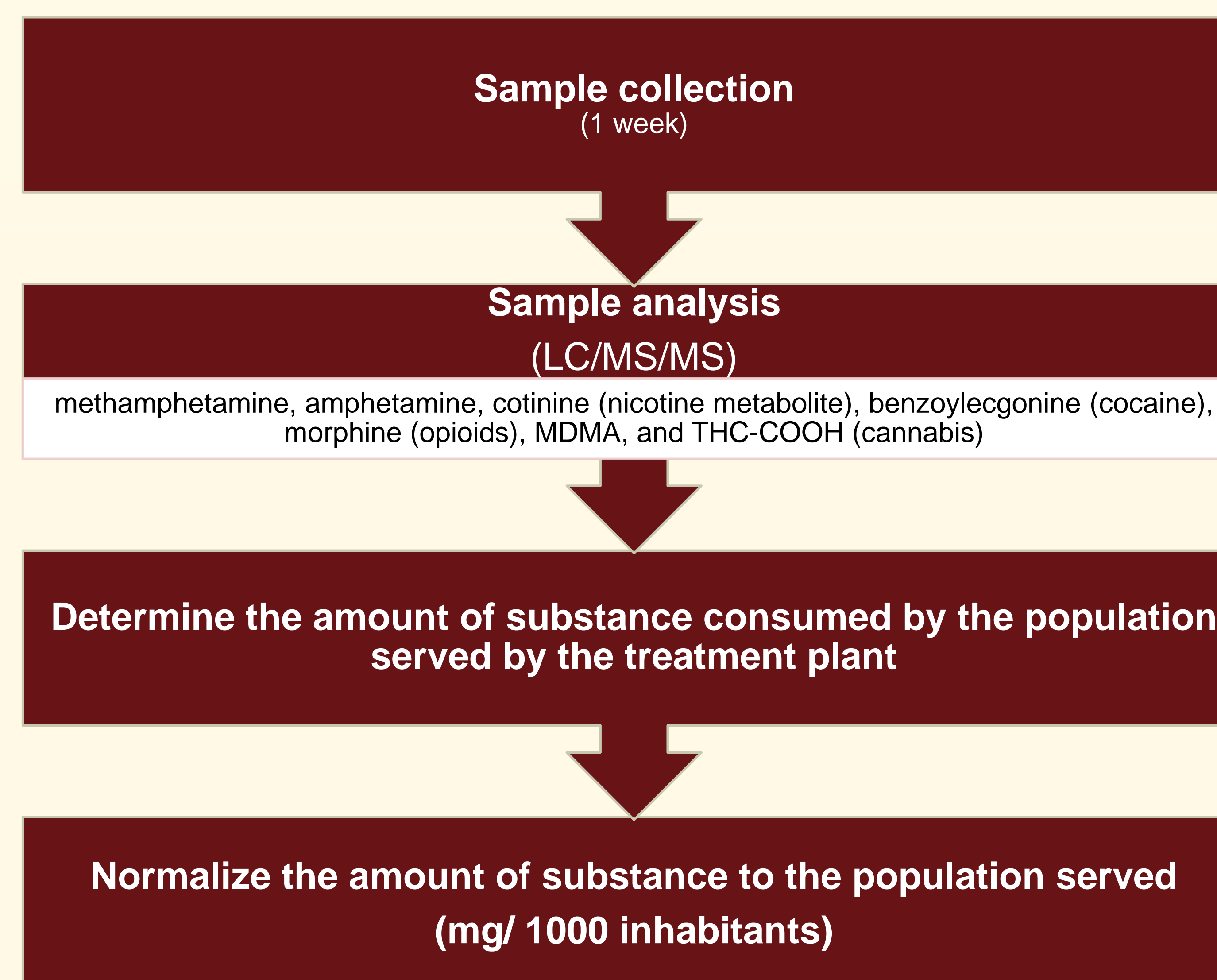
Five Variable Model



Six Variable Model



Wastewater Epidemiology



Progress/Conclusions

- A goal of this project was to determine what socioeconomic factors were associated with the 2014 drug overdose mortality rate in the United States.
- While the one variable model only explained 26% of the variance, the six-variable model explained 64% of the variance suggesting that these factors relate to the 2014 drug overdose mortality rate.
- Using these models, predictions of mortality based on drug overdose can be made for other years. Because we cannot control these variables, we cannot make conclusions on causation. However, consistent patterns in our models over multiple years may suggest a stronger association between these socioeconomic variables and drug overdoses. Ongoing research is investigating if these variables are predictors of drug overdose mortality rates in other years as well.
- With a better understanding of factors consistently associated with drug overdose mortality rates, measures can be taken at the community level, targeting some of these variables to assess if these factors will lead to a decrease in the number of drug related mortalities.
- The goal of the wastewater epidemiology project was to assess the feasibility of this technique in providing large-scale monitoring of drug use/misuse in communities across the United States using cost-efficient, rapid, noninvasive, and unbiased assessments. Samples from various communities have been collected and are awaiting analysis.
- With this study, we hope to provide communities with estimates of community drug use in order to assess changes in drug use, assess types of drugs used, and allow for faster and more accurate results to aid decisions for public policy makers.
- By tracking temporal associations among socioeconomic factors and changes in wastewater results, indicators of changes in drug use may be revealed. With continued sampling, these findings could help further our understanding of warning signs of drug use epidemics.

References

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Contact Information: lisa.mcfadden@usd.edu