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## Drug Abuse: Is Number of Breweries Playing a Role?

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#SASGF



# Drug Abuse: Is Number of Breweries Playing a Role?

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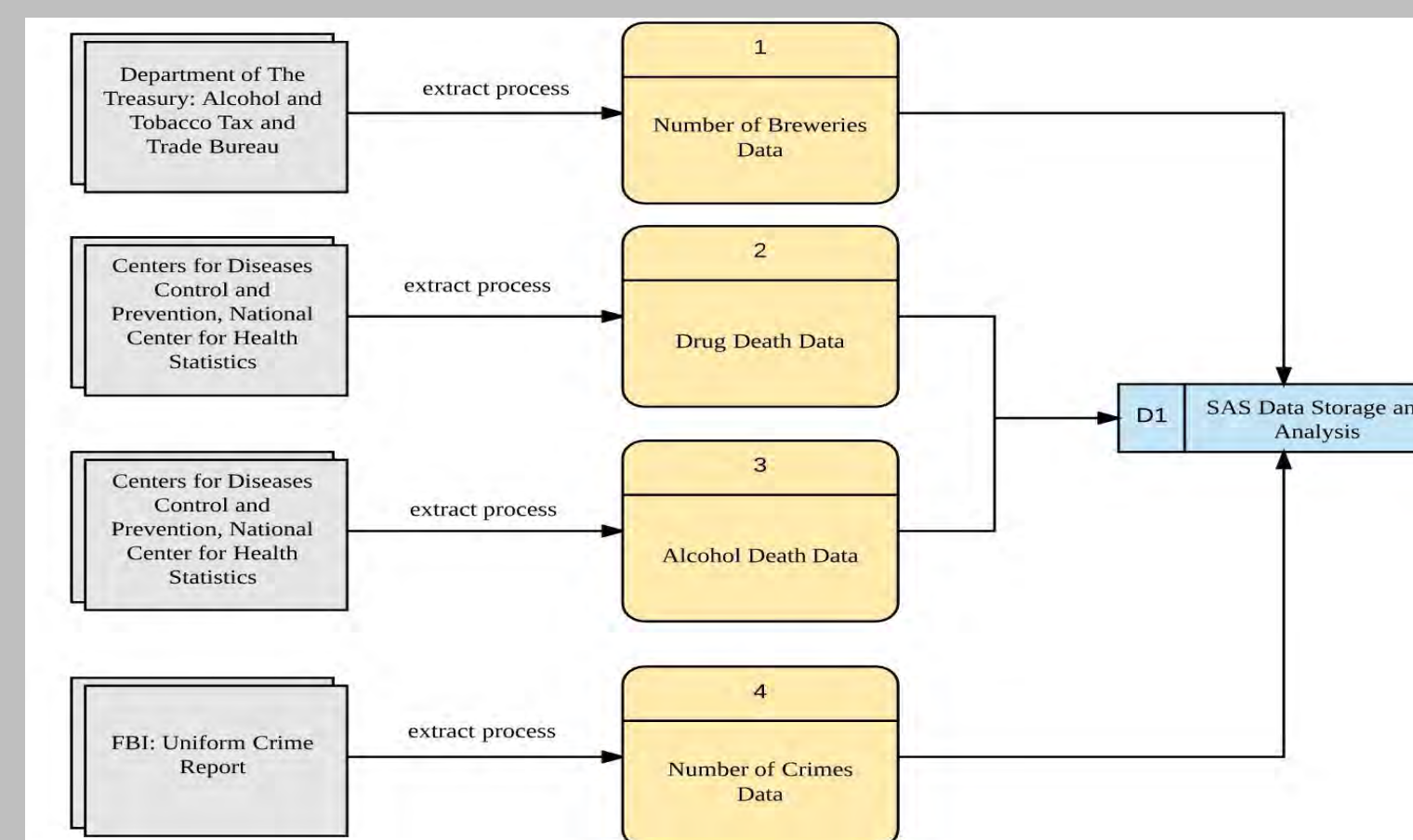


## Introduction/Abstract

- Problem:** drug abuse causes severe health risks, impacting almost every organ and can be fatal. Apart from destroying an individual life, it also deteriorates the well-being of a family, status of a community and severely affects the economy of a country.
- Purpose:** to analyze patterns of population on drug abusive behavior.
- Tool:** SAS was used to build a model to understand the effects of unprecedented factors – political influence, number of breweries, crime rates and alcohol-induced deaths on drug-induced deaths.
- Application:** the model that is developed can help establish multiple criteria to target certain population before drug abusive behaviors are reported and make early intervention if possible.

## Methods

**Step I** - Data flow diagram of extracting data from multiple sources:



**Step II** – Classify each variable based on frequencies and ranges

Number of crimes:

Classification	Range	Frequency
Low	<50,000	14
Moderate	50,000 – 150,000	16
High	150,000 – 300,000	16
Very high	>300,000	25

Number of breweries:

Classification	Range	Frequency
Low	<50	19
Moderate	50-80	11
High	80-300	16
Very high	>300	5

Number of alcohol-induced deaths:

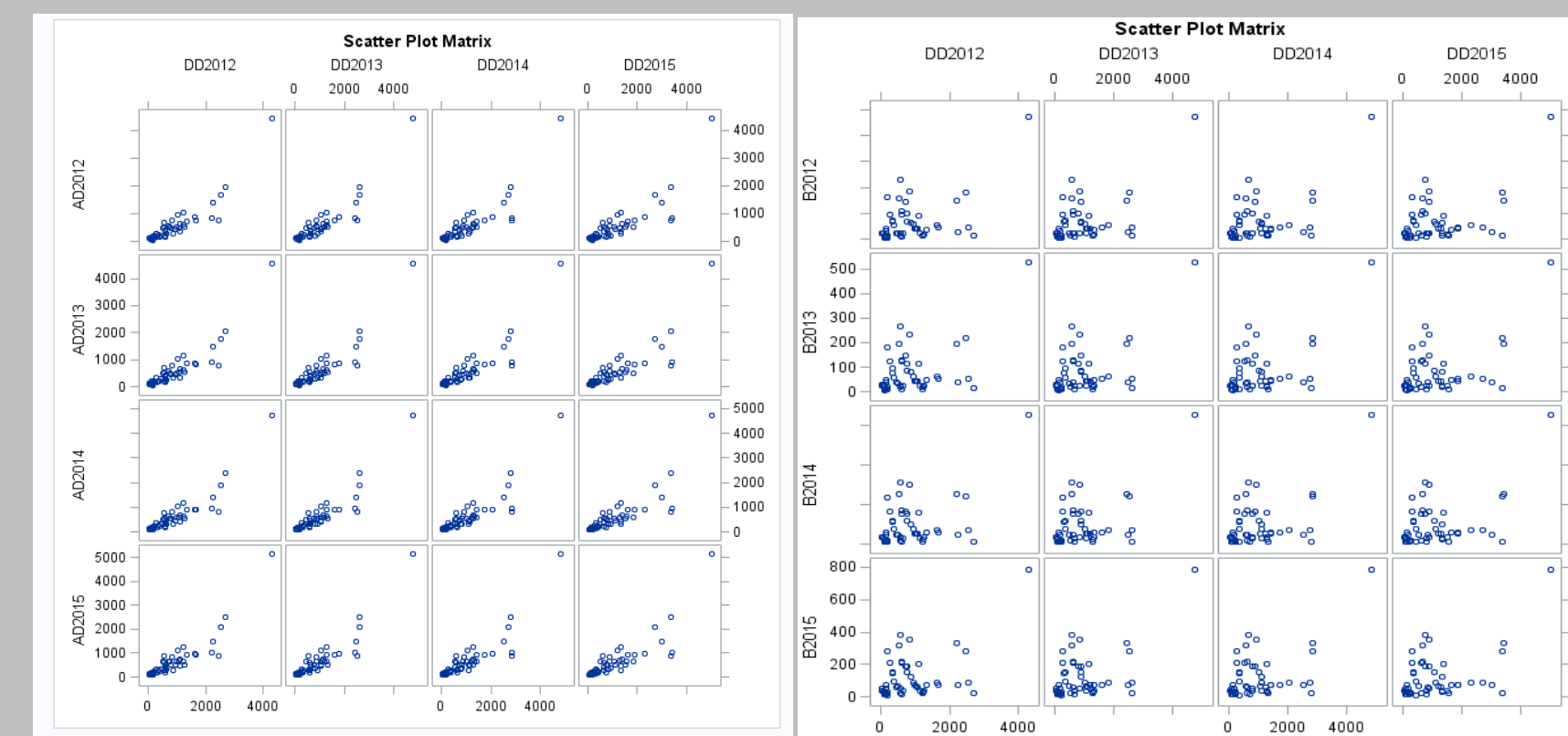
Classification	Range	Frequency
Low	<250	17
Moderate	250-600	14
High	600-1,200	15
Very high	>1,200	5

Number of drug-induced deaths:

Classification	Range	Frequency
Low	<300	12
Moderate	300-1,000	19
High	1,000-3,000	15
Very high	>3,000	5

## Results

- Correlation Analysis:**
  - Drug death vs. alcohol death (Left)
  - Drug death vs. number of breweries (Right)



- Table Analysis:**
  - Number of breweries vs. number of crimes

	High number of crimes	Low number of crimes
High number of breweries	37.50%	Outside the scope
Low number of breweries	Abnormality	64.29%

- Number of breweries vs. number of alcohol-induced deaths

	High number of alcohol deaths	Low number of alcohol deaths
High number of breweries	73.30%	Outside the scope
Low number of breweries	Abnormality	58.82%

- Number of breweries vs. number of drug-induced deaths

	High number of drug deaths	Low number of drug deaths
High number of breweries	40%	Outside the scope
Low number of breweries	Abnormality	75%

## Results

- Linear Regression Analysis:**
  - Standard estimates for number of breweries and political inclinations

Std. Est.	2015	2014	2013	2012
Red	0.29	0.27	0.27	0.23
Blue	-0.32	-0.26	-0.24	-0.24

- Robustness of the model – R-square:

R-square	2015	2014	2013	2012
Red	0.8495	0.9126	0.9288	0.9129
Blue	0.7842	0.8006	0.8450	0.8699

## Conclusion

- A positive relationship exists between number of breweries and drug-induced deaths.
- Political inclination affects red states and blue states in the opposite way in terms of number of breweries, number of drug-induced deaths, and number of alcohol-induced deaths.
- Crime rate and alcohol-induced deaths are other factors that are highly correlated with drug-induced deaths

## Acknowledgements

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## **Drug Abuse: Is Number of Breweries Playing a Role?**

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### **ABSTRACT**

The purpose of this article is to help researchers seek for a preventive treatment to predict certain patterns of population on drug abusive behavior. In this study, we use SAS to build a model to understand the effects of the unprecedented factors – political influence and number of breweries – on human mental status and their decision-making process. The number of drug-induced death in our study is used to depict an overall picture of drug abusive behaviors existing in the nation. Crime rates among states and the corresponding number of deaths induced by alcohol are another scope that we consider as an aftermath of drug abusive usage. The model provides us with the probability measure of the correlations among political influence, number of breweries, alcohol-induced deaths and drug-induced deaths. The study constraints political influence, alcohol-induced death and number of breweries as independent variables to correlate with drug-induced death as dependent variable. The model that is developed can help establish multiple criteria to target certain population before drug abusive behaviors are reported and make early intervention if possible.

### **INTRODUCTION**

Drug abuse is one of the most serious problems that United States is grappling with for the last few decades. National Institute on Drug Abuse (NIDA) informs tobacco, alcohol, illicit drugs, and prescription opioids as four types of abuse of drugs in the United States. Drug abuse causes severe health risks, impacting almost every organ and can be fatal. Apart from destroying an individual life, it also deteriorates the well-being of a family, status of a community and severely affects the economy of a country. A report from the Surgeon General claims that although the United States spends approximately \$442 billion annually in dealing with drug and alcohol abusive activities. However, continually growing cases of drug overdoses, drug related crime and several public health issues suggest that the country is far away from finding an effective solution to the drug abuse crisis. Researchers believe that the causes of drug abusive behaviors vary among individuals in terms of gender, age, and health status. Yet, unprecedented factors –

number of crimes, alcohol related deaths, political influence and number of breweries – could breed a unique perspective employing a data analytics approach. We believe that political influence and number of breweries influence human mental status on decision-making process, which affect drug abusive use among the population of the United States. We use SAS Enterprise Guide for visualization and statistical analysis to detect patterns among the variables. Our aim is to build a model to understand probable patterns on drug-induced death and to help researchers uncover preventive treatment approaches.

## **LITERATURE REVIEW**

Among several other factors, alcohol abuse has also been linked with the drug abuse. According to reports, over 20 million people throughout the United States suffer from drug and alcohol abuse. Alcohol and drug abuse have also been simultaneously observed in teenagers. A study by E Y Devkin, J C Levy and V Wells, published in American journal of public health reported that the onset of Major Depressive Disorder (MDD) almost always preceded alcohol or substance abuse. This study was conducted on 424 college students aged 16 to 19 years. According to the study, underage drinking is the major concern that could potentially affect stability of the society due to drug uses after consuming alcohol. However, the primary focuses of the study are not unfolding the relationship rather addressing the severity of the issue.

Furthermore, studies have shown that early use of alcohol makes it likely that the person will experience abuse and addiction problems into the future. Ralph W. Hingson, Timothy Heeren, Erika M. Edwards studied a U.S. national sample of 42,867 people aged 18 and older, the result of which was published on Journal of Studies on Alcohol and Drugs. It showed that the chances of drug dependence or ever using drugs were independently dependent on alcohol dependence and the age when the respondent first started drinking. Even so, no studies have been done to directly link the number of beers sold with the cases of drug abusive activities. On the other hand, research illustrated that a positive linear relationship exists between crime rate and drug abusive activities. However, we rarely see a mixed relationship among crime rate, number of breweries, and drug abusive activities that is closely examined by researchers.

In this paper, we investigate the relationship between the number of breweries and the number of drug abuse cases related to health issues. To the best of our knowledge, we are the first to study this relationship. With more than 7,000 breweries, United States is currently experiencing a record high number of breweries. We plan on using data analysis to study whether there is any link between number of breweries in a place with the number of drug abuse cases. In addition, we expand our scope of research to find relationships among political influence, number of breweries, alcohol-induced deaths and drug-induced deaths.

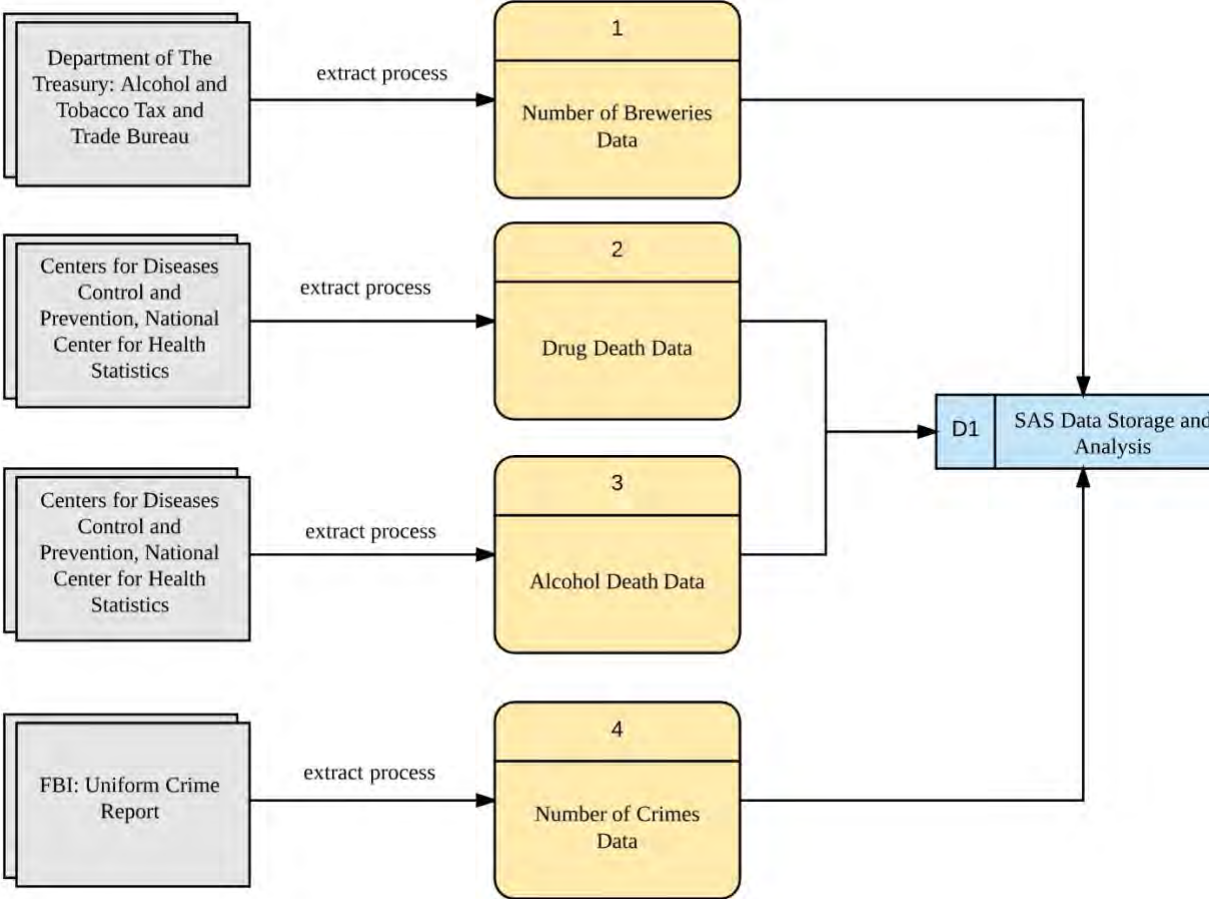
Alcohol content by volume is the lowest in beer when compared to wine, whiskey and other hard liquor. Hence, the possibility of beer addiction is not high. However, we want to study if availability of number of breweries lead to more beer consumption along with political influences, which might in turn lead to abusive behaviors. Moreover, hanging around bars or breweries might lead to greater chances of encountering drug abusers under the influences of alcohol. In conclusion, finding a relationship between number of breweries and drug abuse will help researchers consider effects of unprecedented factors upon abusive behaviors and encourage them to develop new methods to tackle drug abuse issues.

## **METHODOLOGY**

The variables that we are extracted from our study are number of breweries, number of crimes reported, number of alcohol-induced deaths and number of drug-induced deaths for each of 50 states. Detailed description regarding four variables on unit of analysis and level of focus is illustrated on Table 1. The data for number of crimes was extracted from FBI: uniform crime report (retrieved from [ucr.fbi.gov](http://ucr.fbi.gov)), data for number of breweries was extracted from Department of the Treasury: Alcohol and Tobacco Tax and Trade Bureau (retrieved from [www.catalog.gov](http://www.catalog.gov)) and the data for number of alcohol-induced deaths and drug-induced deaths was extracted from Center for Diseases Control and Prevention, National Center for Health Statistics (retrieved from <http://wonder.cdc.gov/wonder/help/ucd.html>). The data flow diagram describes the process to extract data from multiple sources and analyze them through SAS Enterprise Guide for correlations.

Variable Names	Unit of Analysis
Number of breweries - independent variable	Number of breweries per year per state
Crime rate – independent variable	Number of cases per year per state
Alcohol-induced deaths – dependent variable	Number of cases per year per state
Drug-induced deaths – dependent variable	Number of cases per year per state

**Table 1: Detailed Descriptions on Variable Names, Unit of Analysis, and Level of Focus.**



**Diagram 1: Data Flow Diagram of Extracting Data from Multiple Sources.**

- The number of crimes are calculated as the sum of arrests made in each state for crimes related to murder, non-negligent manslaughter, forcible rape, robbery, aggravated assault, burglary, violent crime, property crime, and other types. The missing values for this will

be imputed using single imputation strategy to keep the sample size on the same scale. We will assume that the values will be in proportion to the preceding and following years.

- The number of breweries in each state is complete and has no missing values.
- The mortality data are based on information from all death certificates filed in the 50 states. Deaths of nonresidents (e.g. nonresident aliens, nationals living abroad, residents of Puerto Rico, Guam, the Virgin Islands, and other territories of the U.S.) are excluded.
  - Drug-induced deaths include causes of death attributable to mental and behavioral disorders due to psychoactive substance use. It excludes accidents, homicides, and other causes indirectly related to drug use.
  - Alcohol-induced deaths include causes of death attributable to mental and behavioral disorders due to alcohol use. It excludes accidents, homicides, and other causes indirectly related to alcohol use.

Descriptive methods like correlation, scatter plots, linear regression and table analysis has been employed to understand the data, detect patterns and build analysis models. For table analysis, each of the variables (number of crimes, number of breweries, number of alcohol-induced deaths and number of drug-induced deaths) was classified into four regions of low, moderate, high and very high in accordance to the distribution of the corresponding data. The frequencies of data and the ranges for classification for each variable is listed as follows:

Number of crime

Classification	Range	Frequency
Low	<50,000	14
Moderate	50,000 – 150,000	16
High	150,000 – 300,000	16
Very high	>300,000	25

Number of breweries

Classification	Range	Frequency
Low	<50	19
Moderate	50-80	11
High	80-300	16
Very high	>300	5



## Number of alcohol-induced deaths

Classification	Range	Frequency
Low	<250	17
Moderate	250-600	14
High	600-1,200	15
Very high	>1,200	5

## Number of drug-induced deaths

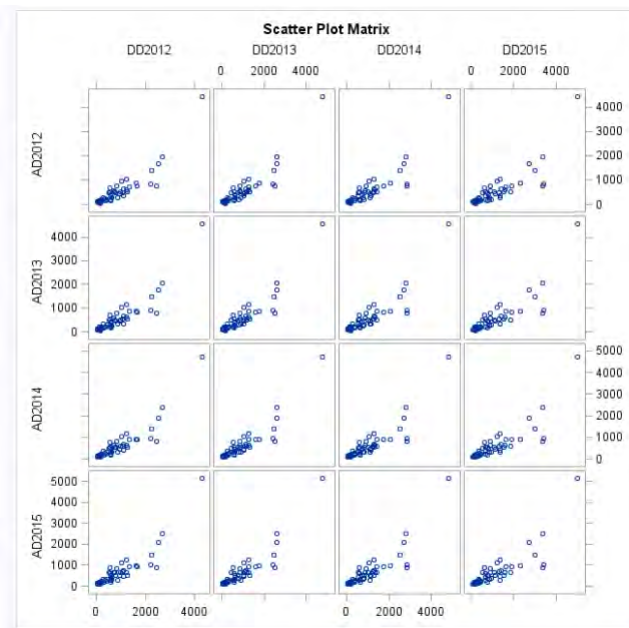
Classification	Range	Frequency
Low	<300	12
Moderate	300-1,000	19
High	1,000-3,000	15
Very high	>3,000	5

## RESULTS

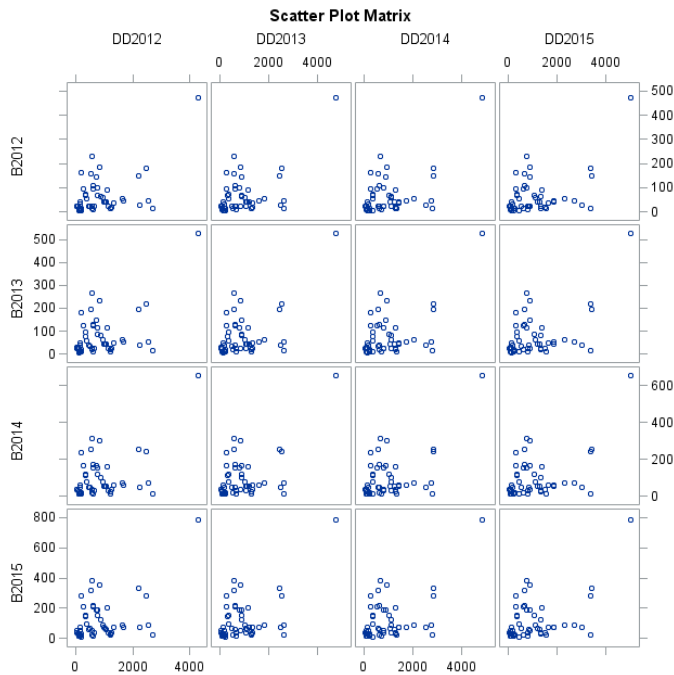
### Correlation Analysis:

Correlation analysis between drug death and alcohol death was performed for the years between 2012 and 2015 to test the direction and strength of the relationship between these variables. The result showed a strong positive correlation for each year. The Pearson correlation coefficient was found to be 0.90, 0.90, 0.88 and 0.84 for year 2012, 2013, 2014 and 2015 accordingly.

Following figure shows the corresponding scatter plot for the analysis:



In addition, correlation analysis between number of drug deaths and number of breweries was also performed for the years between 2012 and 2015 to test the direction and strength of the relationship between these variables. The result showed a moderate positive correlation for each year. The Pearson correlation coefficient was found to be 0.52, 0.53, 0.51 and 0.48 for year 2012, 2013, 2014 and 2015 respectively. Following figure shows the corresponding scatter plot for the analysis:



### **Linear Regression Analysis:**

Linear regression analysis was performed to better understand the effects of political influence in the dynamic of crime rate, number of alcohol-induced deaths and drug-induced deaths. For the analysis, number of alcohol-induced deaths, number of crimes and number of breweries were considered as independent variables while number of drug-induced deaths was treated as the dependent variable. Political inclination was used as classification variable to generate separate models for blue and red states and analyze the difference.

Year of 2015:

- R-Square (blue states): 0.8495; R-Square (red states): 0.7842
- Only number of breweries and alcohol death are significant.
- Number of breweries is positively correlated with number of drug deaths with a standardized estimate of 0.29 for red states but number of breweries is negatively correlated with number of drug deaths with standardized estimate of -0.32 for blue.

Since we are only focused on the data outputs of year 2015 and a strong relationship is established between independent variables and dependent variable, we would like to see a similar

trend in the years of 2014, 2013, and 2012 to satisfy the robustness of our model. The test results are represented as follows in a descending order:

### **Robustness of the Model:**

In order to test the robustness of our model, similar analysis was performed for the years of 2012, 2013 and 2014, the results of which are as follows:

Year of 2014:

- R-Square (blue states): 0.9126; R-Square (red states): 0.8006
- Only number of breweries and alcohol death are significant
- Number of breweries is positively correlated with number of drug deaths with a standardized estimate of 0.27 for red states but number of breweries is negatively correlated with number of drug deaths with standardized estimate of -0.26 for blue.

Year of 2013:

- R-Square (blue states): 0.9288; R-Square (red states): 0.8450
- Only number of breweries and alcohol death are significant
- Number of breweries is positively correlated with number of drug deaths with a standardized estimate of 0.27 for red states but number of breweries is negatively correlated with number of drug deaths with standardized estimate of -0.24 for blue.

Year of 2012:

- R-Square (blue states): 0.9129; R-Square (red states): 0.8699
- Only number of breweries and alcohol death are significant for red states and only number of alcohol death is significant in blue states
- Number of breweries is positively correlated with number of drug deaths with a standardized estimate of 0.23 for red states but number of breweries is negatively correlated with number of drug deaths with standardized estimate of -0.21 for blue.

Std. Est.	2015	2014	2013	2012
Red	0.29	0.27	0.27	0.23
Blue	-0.32	-0.26	-0.24	-0.24

Fig: Standard estimate for number of breweries

### Table Analysis

#### 1. Number of breweries vs. Number of crimes

- a. 64.29% of low number of crimes were reported in areas with low number of breweries while 37.5% of high number of crimes were reported in areas with low number of breweries.
- b. 40% of very high number of crimes were reported in areas with low number of breweries.

	High number of crimes	Low number of crimes
High number of breweries	37.50%	Outside the scope
Low number of breweries	<b>Abnormality</b>	64.29%

#### 2. Number of breweries vs. Number of alcohol-induced deaths

- a. 58.82% of low number of alcohol-induced deaths were reported in areas with low number of breweries while 73.33% of high number of alcohol-induced deaths were reported in areas with low number of breweries.
- b. 40% of very high number of alcohol-induced deaths were reported in areas with low number of breweries.

	High number of alcohol deaths	Low number of alcohol deaths
High number of breweries	73.30%	Outside the scope
Low number of breweries	<b>Abnormality</b>	58.82%

#### 3. Number of breweries vs. Number of drug-induced deaths

- a. 75% of low number of drug-induced deaths were reported in areas with low number of breweries while 40% of high number of drug-induced deaths were reported in areas with low number of breweries.
- b. 20% of very high number of drug-induced deaths were reported in areas with low number of breweries.

	<b>High number of drug deaths</b>	<b>Low number of drug deaths</b>
<b>High number of breweries</b>	40%	Outside the scope
<b>Low number of breweries</b>	<b>Abnormality</b>	75%

## **DISCUSSION:**

As analyses indicated, we witness a strong relationship between number of breweries and drug abusive activities in the nation. Political inclinations somewhat influence the behaviors and act differently between red states and blue states. Red states and blue states are significantly acting on the opposite regarding number of breweries and drug death cases YoY. Based on the results from table analysis, we take a step forward and analyze abnormality of low number of breweries with high number of crimes, high number of alcohol deaths, and high number of drug deaths.

The findings are intuitive:

- Two states – Florida and Tennessee – demonstrate the presence in low number of breweries and high number of crimes category. As research continues, we found out that most southern states incorporate about 41% of total number of crimes in the U.S., which strongly aligns with what our project suggests;
- Two states – Florida and Arizona – demonstrate the presence in low number of breweries and high number of alcohol related death cases. Similarly, Florida remains one of the southern states that involves high number of alcohol death cases. In addition, underage drinking is mutually shared between these two states, which could be used as a reference to prove the theory that is offered by the studies on alcohol and drugs back to 2008.

We believe that our project is a game changer either to law enforcement or researchers regarding the issues on drug abusive activities. The project explicitly provides a new perspective of thinking drug abusive events that are potentially related to number of breweries and bars. Thus,

we recommend a detailed walkthrough within number of bars in each state and take political influences into consideration. Moreover, a practical method to detect drug abusive activities is to search for potential drug selling activities in the bars or near the parameter of 10 miles radius. If this relationship is well established, it offers a new scope to monitor if the crimes are saturated in the areas that are close to high number of breweries or bars.

#### **APPLICATION, IMPLEMENTATION, AND FEASIBILITY:**

As we conclude, the results suggest that the number of breweries and drug related death cases are highly correlated. Hence, in order to control drug abusive activities, we propose to limit the number of bars that can be open in each state per year, which is very likely to be enforced on state level. However, another perspective might not be as applicable as limitation on bars. Federal government is able to update current alcohol laws or replace the current laws with new alcohol laws nationwide. In conclusion, the model is well-explained what actually happens in the real world and offers a feasible solution to the issues that the model unfolded.

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