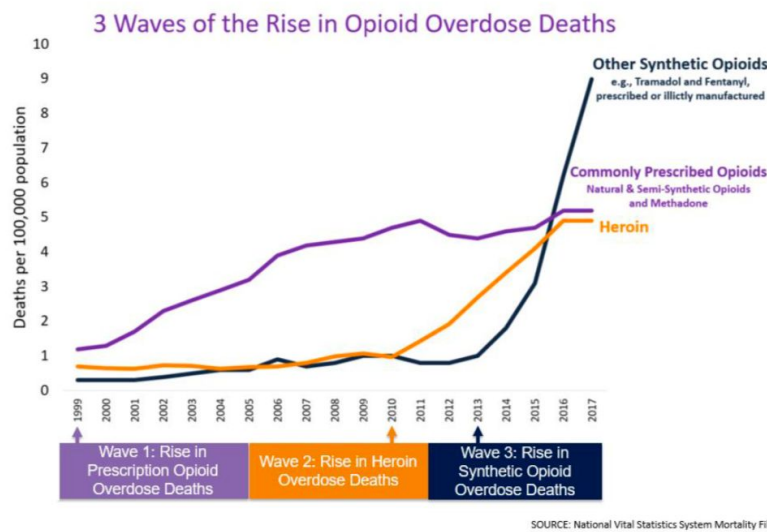# Estimate the Impact of Opioid Control Policies

Motivation for the project :

Over the past two decades, the United States has seen a tremendous increase in the use and abuse of prescription opioids. As a result, there has been a rise in drug overdose deaths from prescription as well as non-prescription opioids like heroin and fentanyl.

Figure 1: Opioid Epidemic

Source: US Centers for Disease Control

Owing to this, several states such as Florida (in 2010) , Texas (in 2007) and Washington (in 2011) have passed laws to make the prescription of opioid drugs more stringent.

Assess the effectiveness of these policy changes can be of vital importance for the respective states for course correction in this area as well as serve as guidelines for other states who may want to act on the issue of opioid regulation.

To get a good understanding of the impact of the policy change, we would want to observe the patterns in opioid prescriptions as well as mortality in regards to drug overdoses.

Our interest in examining mortality as well as opioid prescriptions comes from the fact that while restricting access to opioids may reduce the likelihood that future patients will end up addicted to opioids, it may drive already addicted patients to turn to alternative forms of opioids, be those illegally purchased prescription drugs, heroin, or fentanyl. This possibility is deeply troubling because the likelihood of overdosing on these illegal drugs is much higher than on (monitored) prescription drugs.

Motivation for the design of the project :

This project aims to answer a causal question, and the most standardised approach to study the effect of policy change is a 'pre-post analysis'. Also, something that builds on it is a 'difference-in-difference analysis. Hence, the final product of this project are the results of a pre-post analysis and a difference-in-difference analysis, estimating the impact of opioid control policies in the 3 different states.

The neighbouring states will be considered as a control for the 'difference-in-difference' analysis as multiple states would give more statistical power and trends in the neighbouring states could more easily assumed to be the similar leading to the right kind of control that we need to establish for the study.

The impact of policy change will be measured in terms of the following:
1.   The volume of drugs prescribed: The details on basic considerations are mentioned in the below table:

State	Policy change year	Time period of analysis	Yearly/Monthly level
Florida	2010	2008 - 2012	Yearly
Texas	2007	2006 - 2008	Monthly
Washington	2011	2010 - 2012	Monthly

2.   Drug overdose deaths: The details on basic considerations are mentioned in the below table

State	Policy change year	Time period of analysis	Yearly/Monthly level
Florida	2010	2006 - 2014	Yearly
Texas	2007	2003 - 2011	Yearly
Washington	2011	2007 - 2015	Yearly

Data :

The datasets being considered for this analysis are:

Dataset on Reporting to the US Drug Enforcement Agency (DEA):
(https://www.washingtonpost.com/national/2019/07/18/how-download-use-dea-pain-pills-database/?arc404=true)
> This dataset has details regarding the shipments of two opioids – Hydrocodone & Oxycodone (These opioids account for more than 75% of opioid shipments). Shipment to a particular county is being used as a proxy to infer prescription made in that county.

Population Data from the US Census – POPULATION:
(https://data.ers.usda.gov/reports.aspx?ID=17827&AspxAutoDetectCookieSupport=1)
> This dataset has data of the population at a county level of the census conducted in 2010. The data of the year 2010 is being used for all years of analysis as it is.

US Vital Statistics records: for data on drug overdoses
https://www.dropbox.com/s/kad4dwebr88l3ud/US_VitalStatistics.zip?dl=0

> This dataset has data related to drug overdose related deaths. The exact drug involved in the incident is unknown. Hence, this data is just a proxy to measure the opioid drug related deaths.

Data Wrangling

As 2006-2015 US Vital Statistics data sets (.txt) were separated by year, we combined all the data sets into one file. After concatenating 10 txt files, we split the name of 'County' into 'County' and 'State' (e.g. Autauga County, AL->AL Baldwin County). Then, we removed useless columns and rows with missing values and change the data types (e.g. string data to numeric data). Also we focused on number death by 'Drug poisonings (overdose) Unintentional (X40-X44)', 'Drug poisonings (overdose) Undetermined (Y10-Y14)', 'Drug poisonings (overdose) Suicide (X60-X64)'.

We were trying to find every year population data, but we could find only partial population data. So, we decided to use 2010 population data for 50 states and apply to 2006-2015 US Vital Statistics data sets, because the population for the year 2010 will be the most relevant to this analysis as it is the closest to the years under consideration.

We merged two cleaned data sets with inner join on 'State' and 'Year'. With new data set, we recreated another table showing 'Total Death' and 'Total Population' group by State and Year to compare 'Death Rate' by State and Year
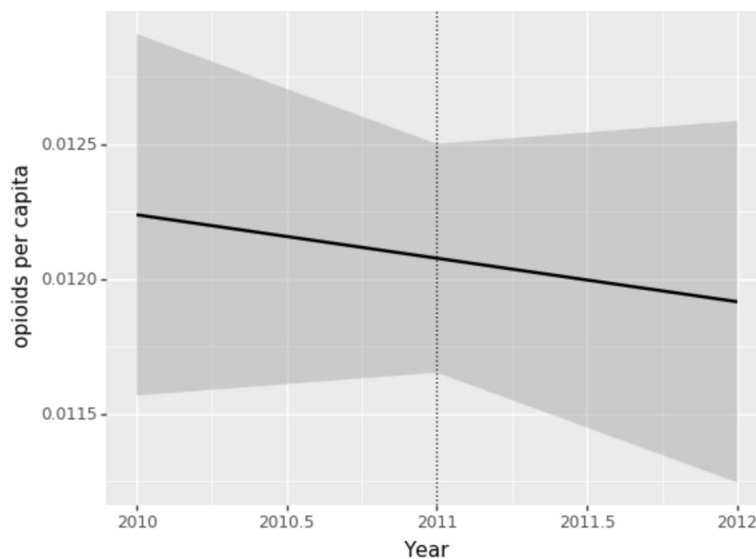
Analysis of Opioid Prescriptions

- ❏ <u>Florida, Effective February, 2010</u>
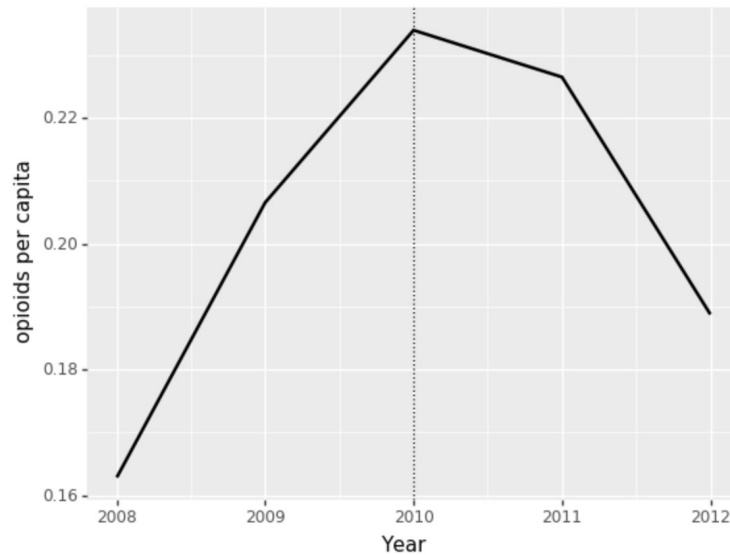
As you can see there seems to be a significant change in the trend of opioid prescriptions after the policy year 2010. However, we will need to conduct the DID analysis on the same to reconfirm the change.

- ❏ <u>Washington, Effective January, 2011</u>

There seems to be a decreasing trend and the policy change doesn't seem to have an effect. There is a need to conduct this analysis at a monthly level in order deep-dive and then do a DID with the neighbouring states.

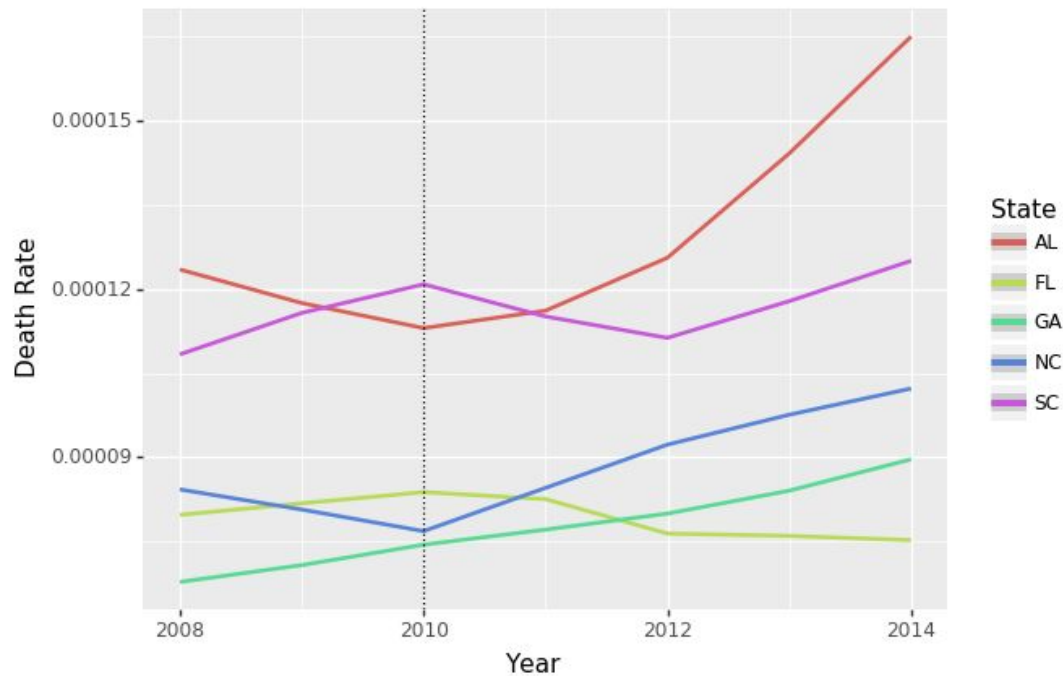❏ <u>Texas, Effective January, 2007</u>
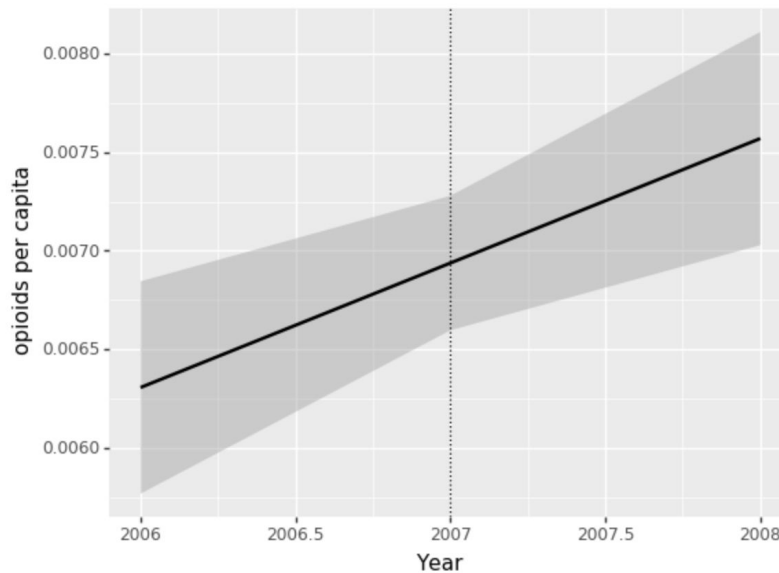
There seems to be a increasing trend and the policy change doesn't seem to have an effect. There is a need to conduct this analysis at a monthly level in order deep-dive and then do a DID with the neighbouring states.

Analysis of Drug Related Deaths

❏ <u>Florida, Effective February, 2010</u>

Florida state is compared with Alabama, Georgia, South Carolina and North Carolina. Death rate by drug overdose of Florida is on a downward trend since 2010 and South Carolina also shows downward slope by 2012. However, other three states don't seem to be affected by the new policy and death rates keep on increasing.

❏ <u>Washington, Effective January, 2011</u>

Washington state is compared with California, Oregon, Idaho, and Montana. In Washington state, death rate shows upward trend after the policy in effective and most of states don't seem to be affected by the new policy and death rates are modestly increasing.
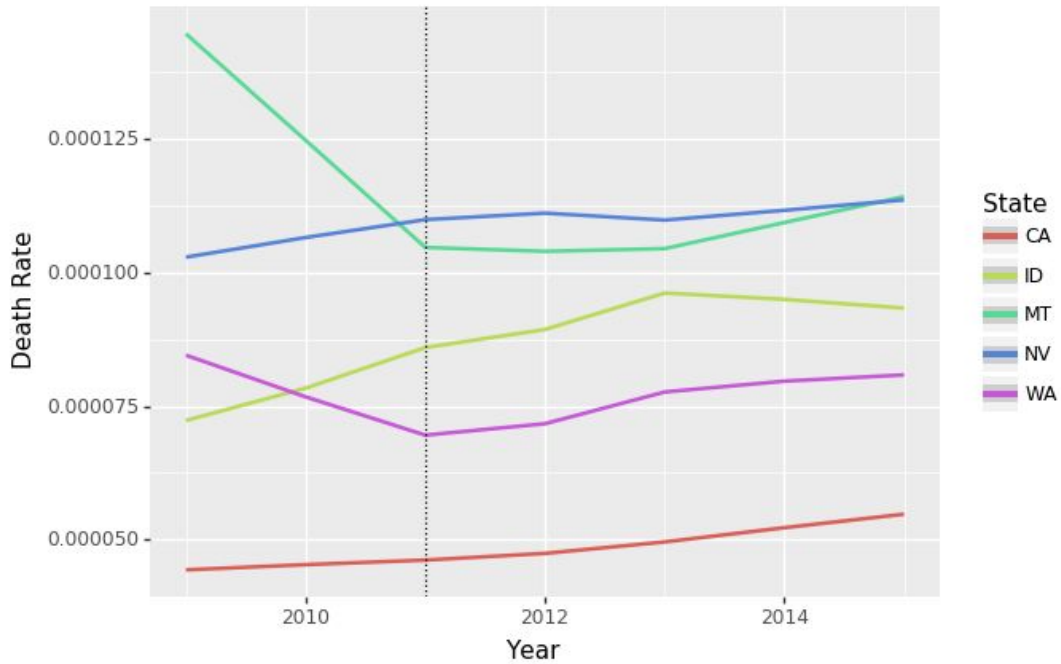
❏ Texas, Effective January, 2007

Texas state is compared with Oklahoma, New Mexico, Louisiana, and Arkansa. All of the states except Louisiana, the death rates don't seem to be affected by the new policy. Death rate is decreasing in Louisiana.
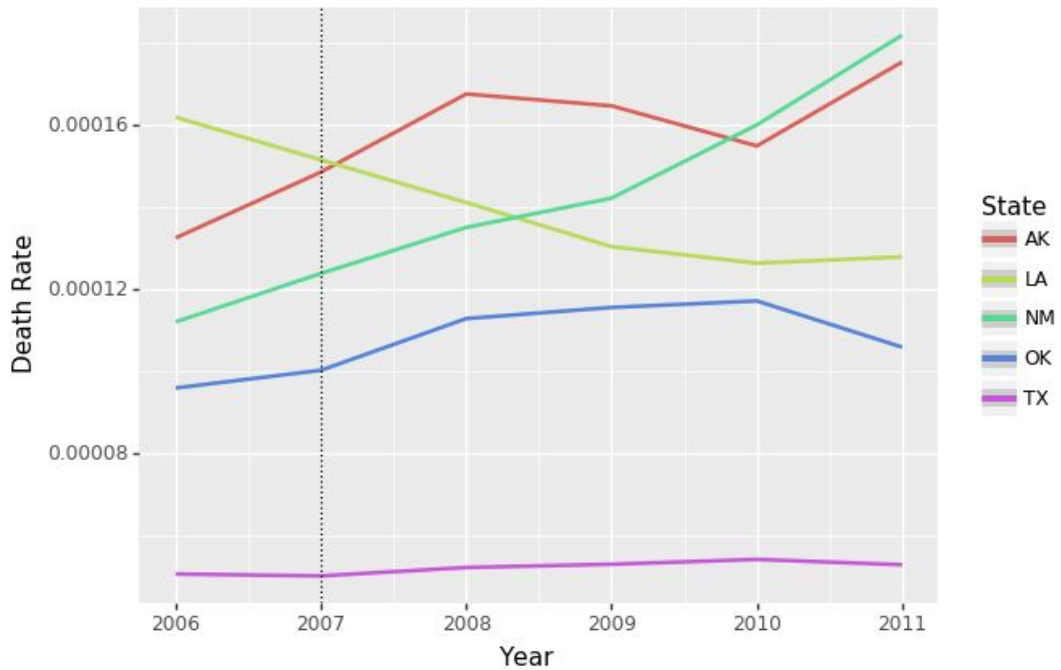
- Conclusion

  From the above comparison plots, we could see some trends in effect of policy, in terms of 'Death Rate' caused by drug overdose. Except Florida, Texas and Washington states don't tend to be affected by the policy. In only a few states, death rates are decreasing gradually.

  As we think that we could not make a big distinction, we will conduct a pre-post analysis and a difference-in-difference analysis to estimate the impact of opioid control policies in 3 different states by fitting the data into a linear model.