How has COVID-19 affected the US substance abuse crisis?

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Introduction

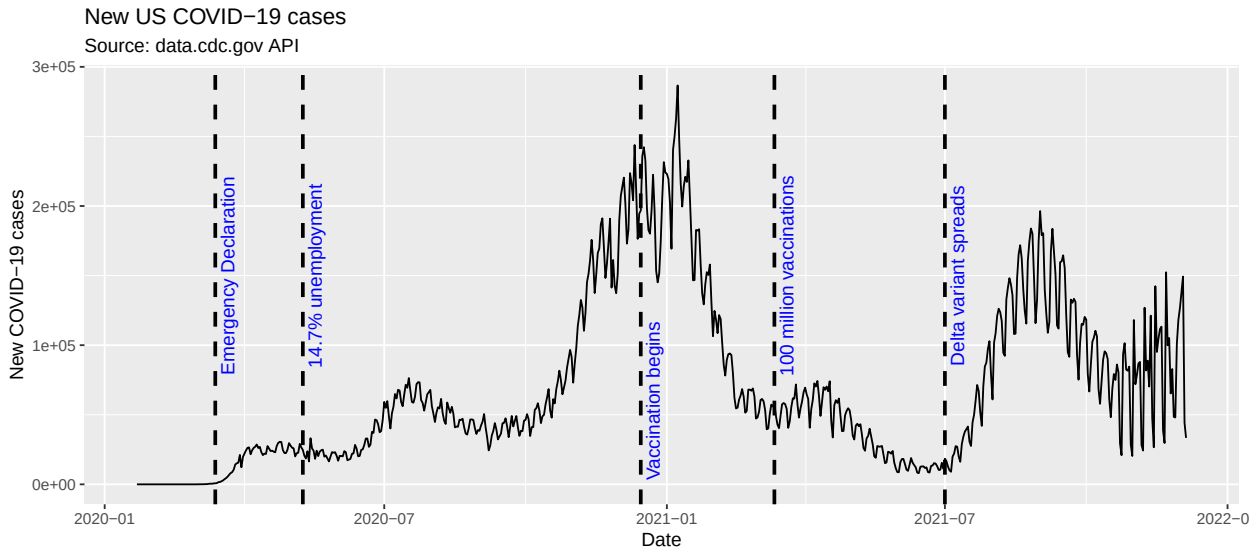
Drug overdose deaths in the United States have been rising steadily since the turn of the century, and a significant increase in this trend has been observed since the mid-2010's. Public discourse around this tragedy led to cultural and political changes which appeared to have slowed the trend around 2018. Then, in March 2020, the COVID-19 pandemic led to an upheaval in nearly every aspect of daily life, resulting in drastic changes to the way we work, socialize, and interact with society at large.

Such a fundamental change in the way we live our lives led to universally destabilizing experiences. To slow the spread of the virus, most public places of congregation were shut down, leading to widespread loss of jobs and a crash of the economy. Those with job security soon found new ways to work through the pandemic, and those without it found themselves without a job and an income.

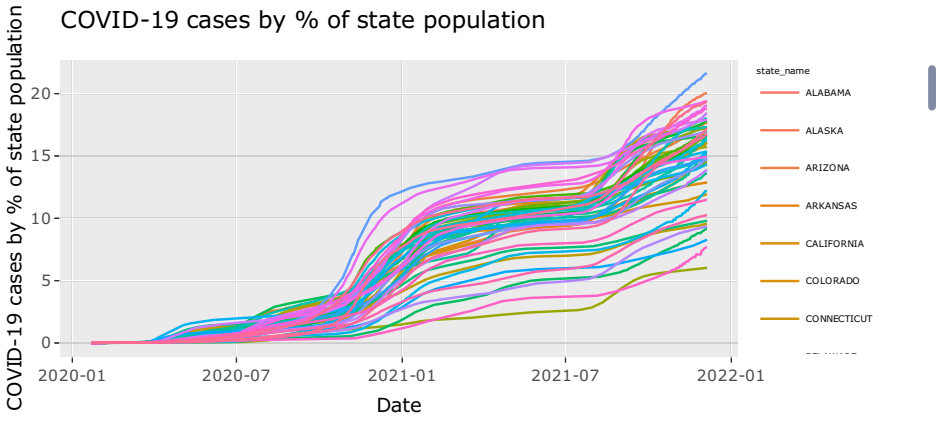
The category of person most likely to be debilitated by the COVID-19 pandemic correlates with the type of person most vulnerable to experiencing drug addiction. Substance abuse is associated with unemployment or underemployment, lack of career opportunities, social isolation, mental health issues, and homelessness. As COVID-19 has undeniably contributed to each of these factors, an investigation into the pandemic's effect on the substance abuse crisis is warranted.

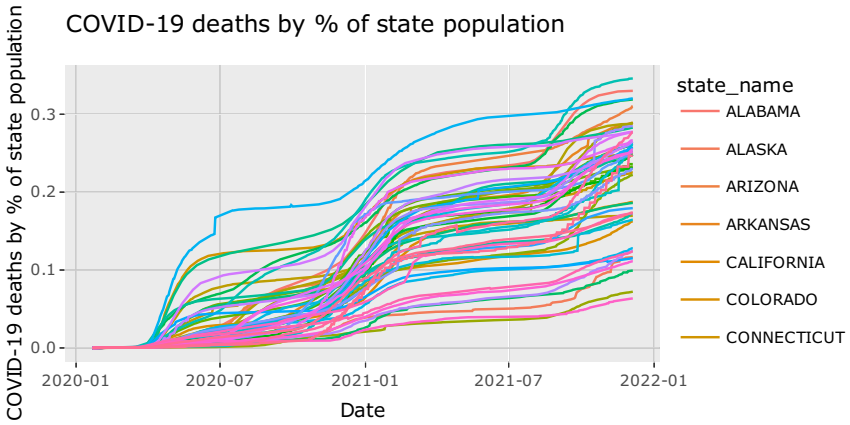
The COVID-19 pandemic in the US

COVID-19 was first detected in the USA on January 17, 2020, in Washington State. By March 13, 2020, President Trump had declared a nationwide emergency, and 2 days later, schools and restaurants began to shut down. By May 9th, 2020, the unemployment rate hit 14.7%, the worst rate since the Great Depression. By September 2020, the US COVID-19 death toll surpassed 200,000, and by January 18, 2021, it had doubled to 400,000. On December 14th, 2020, the initial phase of the vaccination program began, and by March 13, 2021, the US had surpassed 100 million vaccinations administered. By July 1st, 2021, the delta variant had become detected in all 50 US States.



There has been considerable difference between how each of the US States has experienced COVID-19:





The state with the highest number deaths per population, MISSISSIPPI, has experienced per population mortality rates 544% higher than that of the lowest number of deaths per population, VERMONT.

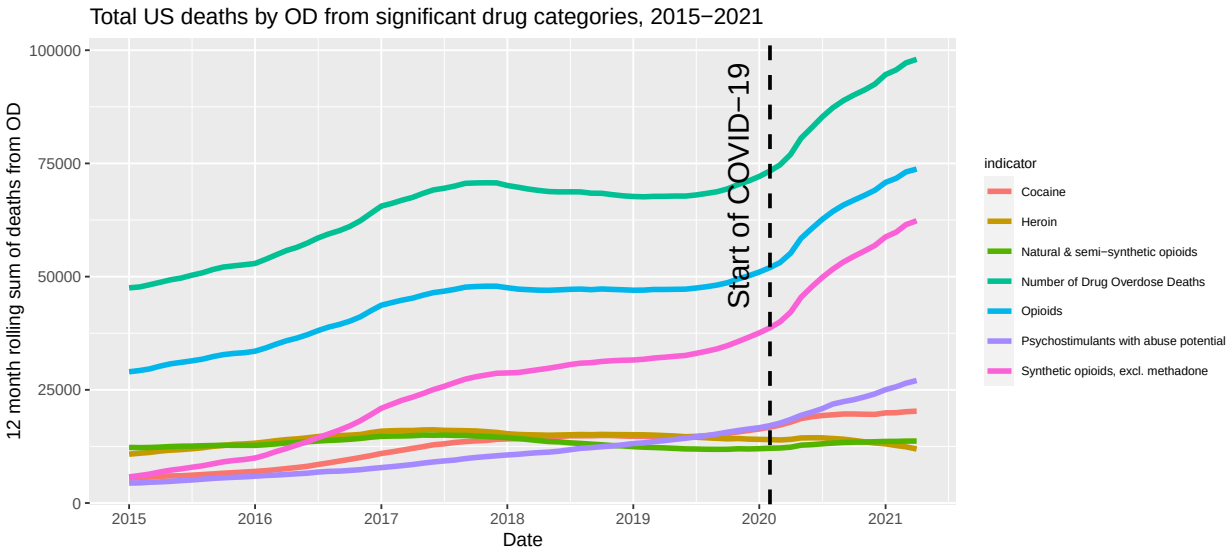
These differences are a result of a complicated web of interconnected variables: geography, viral transmission tendencies, the extent to which the state and local governments enforced lockdown measures, the culture of the communities and how rigorously they practiced social distancing, the types of economies typical of each region, and many more.

Having the above information in hand will help provide perspective as a preliminary investigation into US drug useage patterns is explored.

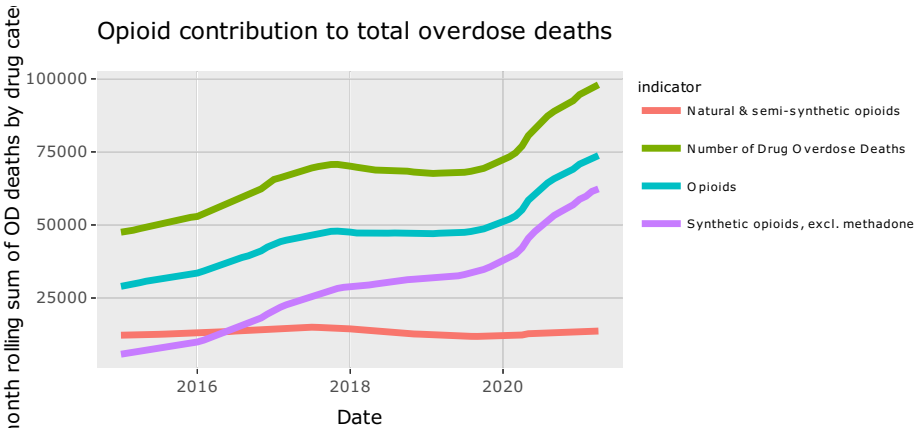
The drug mortality crisis in the US

The CDC provides a vast and thorough dataset giving monthly 12-month rolling summaries of overdose deaths, by state, categorized by drug type (heroin, cocaine, opioids, etc.) as well as drug type subcategories (synthetic opioids, natural & semi-synthetic opioids, etc.).

Shown below is overdoses in the US from 2015-2021, broken down by drug type and sub-type. Some of these are independent of all others: Psychostimulants (methamphedamine) and cocaine have their own categories. Others share data: there is one category for all opioids, another for natural opioids, and another for synthetic opioids.



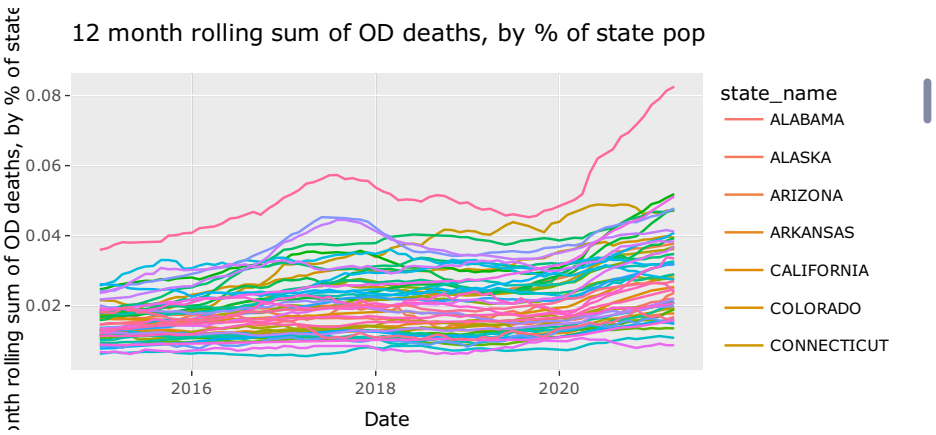
The following graph immediately suggests some insights. For one, there does appear to be a clear acceleration in the rate of drug overdose deaths following the onset of the COVID-19 pandemic. Another is regarding the types of drugs involved: It is opioids that are by far the most implicated drug, and it's the synthetic, not the natural opioids, that are the primary driver. Natural opioids are those such as morphine and codeine; common semi-synthetic opioids are hydrocodone and oxycodone.



The synthetic opioid behind this great increase is fentanyl, which is often illicitly manufactured and commonly used to lace other drugs. There has been considerable media coverage of the rise of fentanyl and the damage it is causing the US, and many government agencies have declared an "opioid epidemic."

In January 2015 - the earliest data provided in this dataset - synthetic opioids accounted for 12% of all overdose deaths. As of March 01, 2021 - the most recent data provided in this dataset - synthetic opioids were responsible for 64% of all drug overdose deaths in the US. During this time, the total number of deaths due to synthetic opioids grew by 1081%.

Similar to the disparity in how each state experienced the COVID-19 pandemic, each state is experiencing the drug epidemic in its own way:



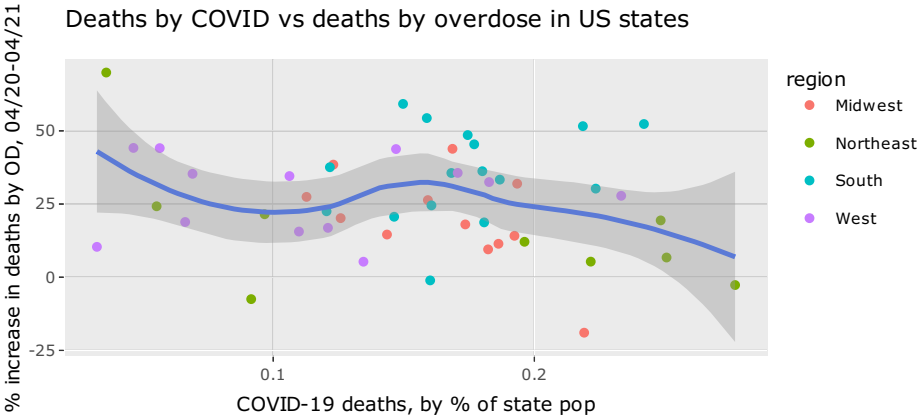
The reasons why states have historically experienced the drug overdose epidemic so differently are numerous and complicated. This analysis is an effort to strip away these variations and determine if there is a relationship with the COVID-19 pandemic.

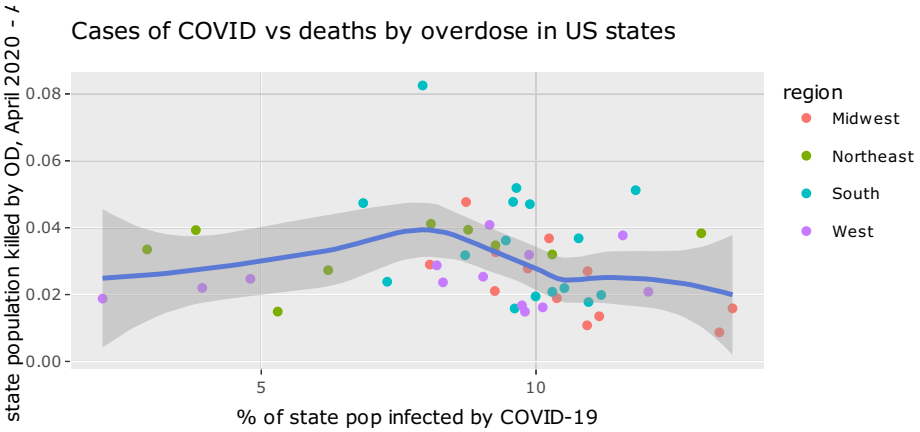
Two different questions are asked below:

Whether statewide COVID-19 *deaths* per capita is correlated with the *percentage increase (over subsequent 12 month periods) in deaths due to overdose* per capita

AND

Whether statewide COVID-19 *cases* per capita is correlated with *non-normalized deaths due to overdose* per capita.





Before drawing any conclusions from these scatter plots, a visualization of the geographical distribution of these factors may uncover some regional trends:

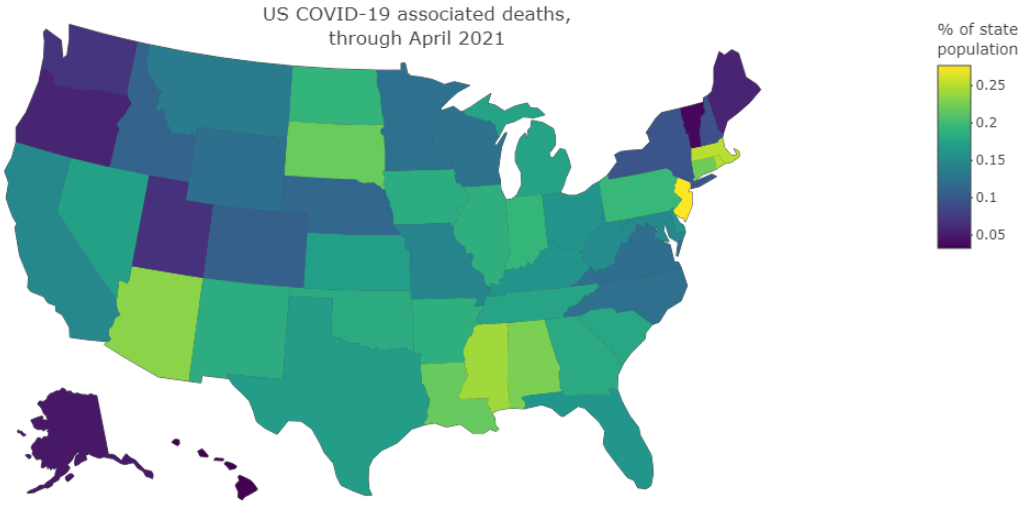


Figure 1: words

The maps highlight a few areas (the southeastern US) where COVID-19 and deaths due to overdose seem to correlate, as well as contrasting areas (the northern midwest, the New England area) where they seem inversely related.

The scatter plots indicate that there is either no relation between the two factors, or there is even a negative correlation.

While this may seem counterintuitive, COVID-19 affected the US in more ways than just the mortalities from the virus itself. The economic shutdown and enforced social distancing changed the way we live our entire lives, and these are the types of disruptions that could lead to increased drug usage: social isolation, joblessness, and the associated mental health effects. One conjecture which might explain the lack of correlation seen above is that those states which experienced the lowest COVID-19 mortalities endured

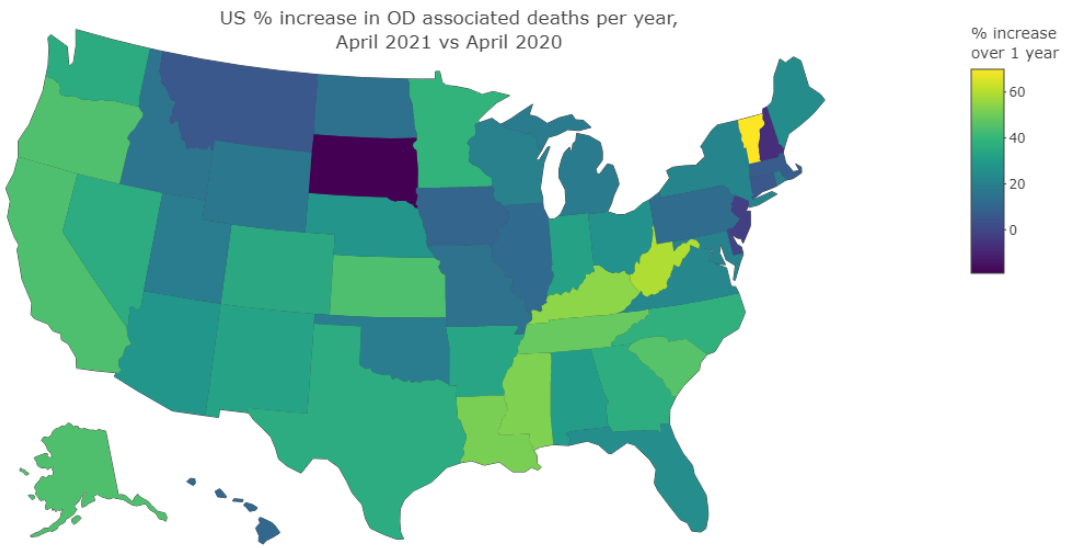
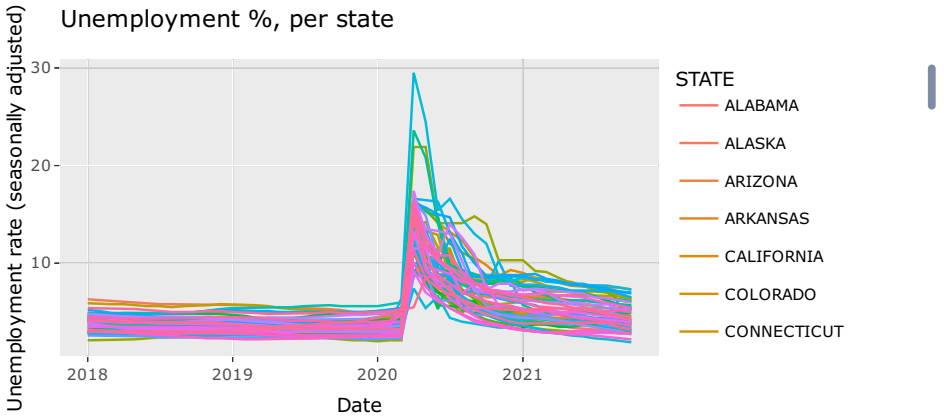


Figure 2: words2

the most severe lockdowns - resulting in lower virus associated deaths but higher social isolation and a more damaged economy.

To investigate this possibility, another dataset will be introduced into this analysis: monthly unemployment data in the 50 US states.

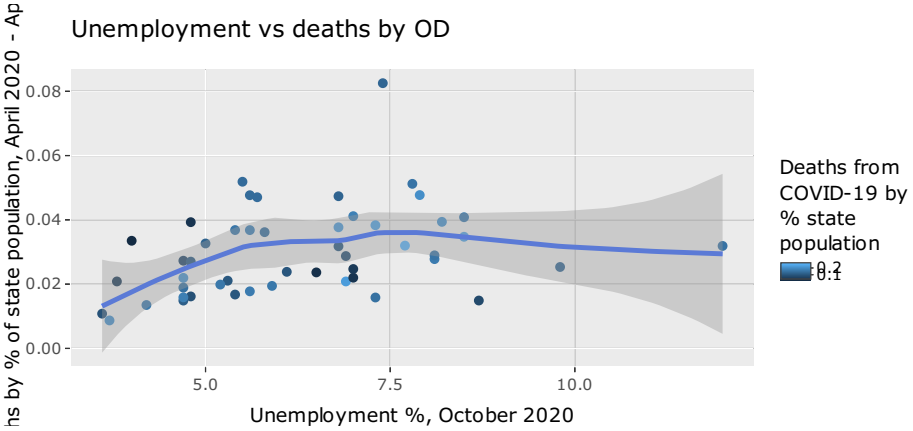
COVID-19 induced unemployment vs deaths by overdose

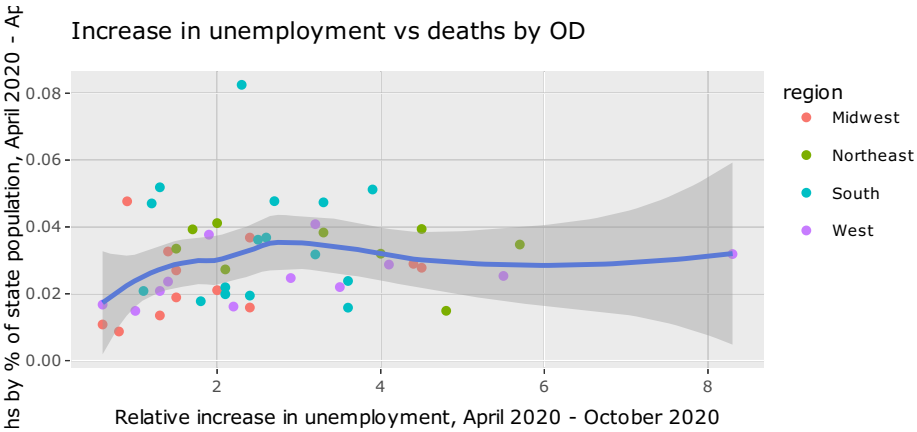


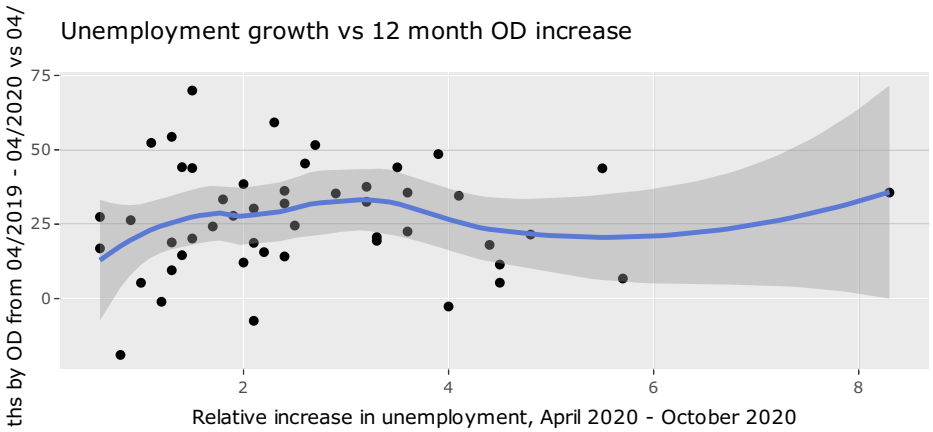
Upon realization of the severity of the pandemic spreading throughout the country, a series of business shutdowns were enforced at each of the county, state, and federal levels. Due to this patchwork approach to shutdown laws as well as the unique nature of the economies of each state, there was marked difference between the way each state experienced unemployment and financial downturn. Hawaii and Nevada stand out in particular, as tourism makes up a large sector of their economies.

To examine the possibility that the unemployment experienced as a result of the COVID-19 lockdowns led to increased drug usage and deaths by overdose, below is a visualization of the relationship between these factors: The *relative increase in the percent of the total state population that died due to drug overdose in the 12 months ending in April 2020 vs April 2021*, compared to the *increase in the percent of the state population experiencing unemployment from February 2020, before the pandemic, to October 2020,* when unemployment began to recede in most states.

(Hawaii is removed from these analyses as its economy is unusually reliant on tourism and because it's geographically isolated from the mainland drug trade routes, making it an outlier.)







The above tabs show a sequence of similar scatterplots, with each subsequent plot eliminating a confounding variable.

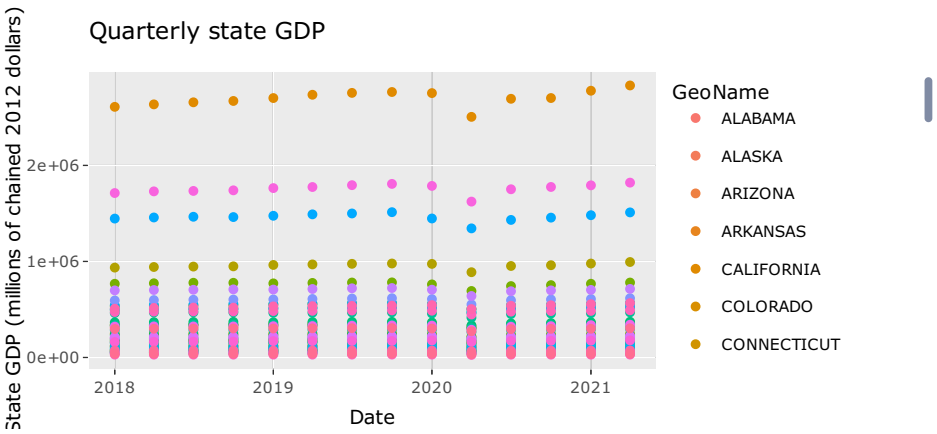
Tab 1 shows raw unemployment numbers compared to raw deaths due to overdose per state, without considering prior unemployment values. Even without the influence of COVID-19, a relationship between these variables is to be expected, and indeed a positive relationship appears to exist.

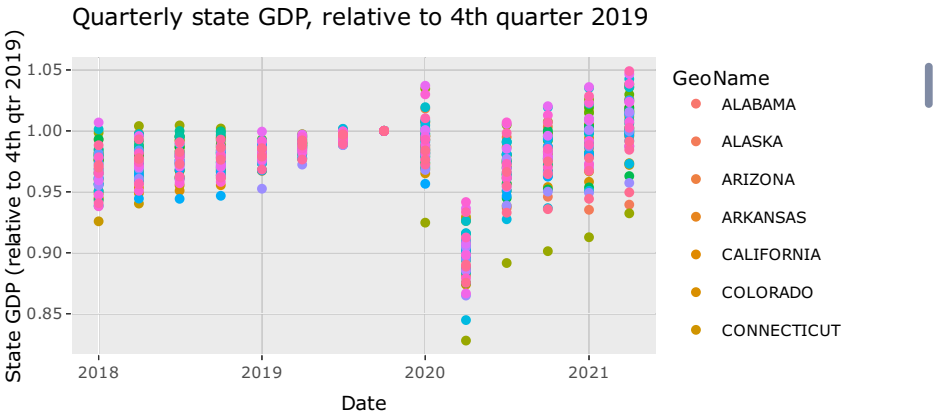
Tab 2 shows the same data, but with unemployment normalized against pre COVID-19 levels. The relationship still appears positively correlated, but with greater variance.

Tab 3 also uses normalized unemployment values, but also considers the percentage increase in drug overdoses per capita for the 12 month period coinciding with COVID-19, compared to the 12 month period immediately prior. By eliminating another confounding factor, an even more accurate picture of the relationship between COVID-19 induced unemployment and drug overdose deaths is shown. A positive correlation is suggested, but is far from certain.

COVID-19 induced economic slowdown vs deaths by overdose

Another way to measure the economic health of a community is to consider the change in state GDP in the period following the COVID lockdown.

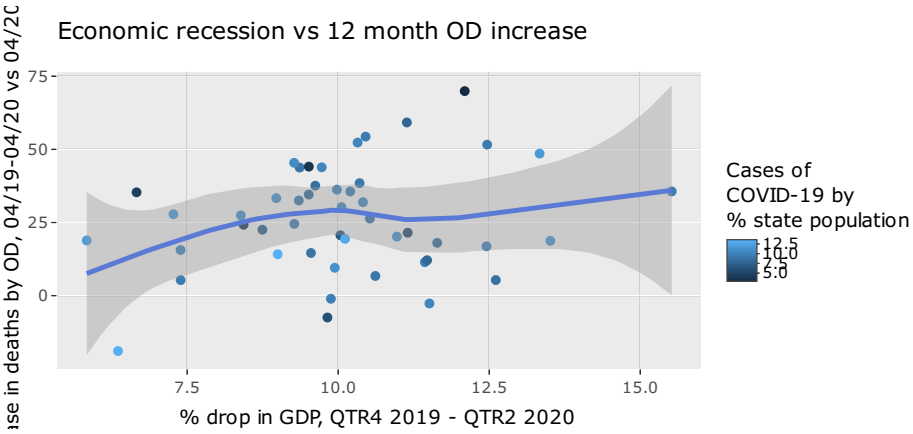




Tab 1 above shows raw quarterly GDP values (in millions of chained 2012 dollars) per state. However, a more telling way of visualizing this data is to normalize these values, so that the relative change in the state GDP immediately after the shutdown becomes more evident, as seen in **Tab 2**.

(This data is provided quarterly, and the shutdown occurred part way through the 1st quarter of 2020, which is represented by the point at 2020-01-01.)

Finally, plotting this normalized percentage drop in GDP vs the normalized percentage increase in deaths due to overdose:



While the data points are very disperse, and it's unclear whether any conclusions should be drawn from this relationship, a positive correlation does appear to exist between the variables.

Conclusion and Summary

Fiddlesticks.

Methods

Data regarding the population of the US and its States was collected from the census.gov's API portal. It was converted to a data.table by the methods instructed in lecture, and associated with other data.tables using the data.table merge method. The COVID-19 data was accessed via the data.cdc.gov API portal. It was merged with census data to calculate COVID-19 infections and deaths as a percentage of the state population. Data regarding drug overdoses in the USA was also accessed through the data.cdc.gov API. It was merged with the census data to be able to calculate overdose percentages by state population. Later, it was merged with the COVID-19 data to investigate the relationship between overdoses and COVID-19 infection rates. Data regarding unemployment was downloaded from the Bureau of Labor Statistics website. Data regarding GDP was received from the Bureau of Economic Analysis API. The data was very reliable, as it was thoroughly gathered by the CDC, and needed very little cleaning or wrangling. Data exploration was mainly done visually using ggplot2 line and scatterplots, most of which are shown in this report.

Sources

https://www.cdc.gov/museum/timeline/covid19.html

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