

# Estimating the Impact of Opioid Control Policies

(Report for Policy Makers)

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## Motivation

This report describes the effect opioids have had on the U.S. population in terms of deaths caused by overdose and analyzes the impact of different states' policies to control opioid shipments in the hopes to decrease mortality rates. Opioids are medically prescribed pain medication that can come in the form of pills, patches, or nasal sprays. Opioid addiction has been a growing cause for concern, and the U.S. Department of Health and Human Services (DHSS) has declared a public health alert on opioid addiction and dependence. Patients who take opioids for an extended period can slowly stop experiencing the pain relief they had prior to taking them. In addition, the body can start to depend on the drug which causes withdrawal symptoms if the patient stops taking them. These factors are what lead to addiction because patients can become heavily dependent on the drug or take more than the prescribed amount. This often results in numerous incidents of overdose and subsequently, death.

Opioids have been a controversial topic that policy makers have been discussing in the last decade. Florida, Washington, and Texas are three states that have implemented policies to combat the opioid overdose epidemic. Texas was the first to regulate opioids in January 2007 which put a few hurdles in place before a practitioner could prescribe any opioid medication. These included patient evaluation, review of medical history, patient consent, periodic patient review, and complete medical records. This was followed by Florida, where, in 2010, a report was published which showed that of the top 100 opioid prescribing practitioners in the country, 98 were conducting practice in Florida. The policy aimed to regulate the many "pain clinics" that had popped up during the 2000's which housed many patients addicted to opioids. Florida saw more regulations in February 2011 when it started to conduct raids of the pain clinics and closed many. The last policy change occurred in 2012 when Florida created a task force specifically devoted to regulating wholesale drug distributors. Finally, Washington's regulation went into effect in January 2012 that added several requirements in place before a practitioner could prescribe opioids. Similar to Texas, these requirements included periodic patient reviews, milligram thresholds, strict documentation guidelines, and consultations with pain management experts.

# Methodology

Throughout the scope of this paper, we performed two types of analysis to evaluate the effect of the opioid regulation in their respective states: pre-post analysis and the difference in difference analysis.

Our pre-post analysis will look at the change over time for all the states to see if policy implementations influenced overdose deaths or opioid shipments. If policy did not have an effect, our plot will show overdose deaths and opioid shipments continuing to increase over time. If policy did have an effect, our plot will show overdose deaths and opioid shipments starting to decrease over time.

However, to effectively analyze the effect of the policy, we need to isolate the causal effect of the policy from other unknown factors that might be affecting our variables of interest simultaneously. These factors in this case could be the U.S. Customs making a policy change that affects imports of opioids in the U.S. This would likely reduce the shipment amount, and therefore, overdose deaths throughout the entire country. If we were just to use our pre-post analysis to compare Florida in 2009 to Florida in 2011, we would see a decline in the shipment amount and overdose deaths and wrongly attribute that to Florida's policy change.

A difference-in-difference approach seeks to answer the question of whether there were bigger changes in overdose deaths or opioid shipments in Florida between 2009 and 2011 than in other states that did not implement any regulations on opioids. To do this, we must look at states that did not implement a policy change in relation to opioids. We will choose three states to serve as our control group (i.e., the ones that did not implement a policy change) corresponding to each treatment state. Then, we will evaluate the effect of policy in that state using a pre-post analysis and compare the control and the treatment groups.

## Data

We used the [Opioid Prescriptions by The Washington Post](#) to obtain the quantity of opioids prescribed, which was available in the data at monthly level for the years 2006 to 2012. [The US Vital Statistics records](#) provided us with the information on deaths caused by opioid overdose for each county within the United States. To account for the population of each county, we combined these datasets with the [County Population Data by The National Historical Geographic Information System \(NHGIS\)](#), which contained the population estimates from 2009 to 2019. From this, we were able to calculate shipments per capita and the deaths per capita for each county for the respective years.

We used the [Income data by IPUMS National Historical Geographic Information System \(NHGIS\)](#) which consisted of the median household income for each county and state in 2010. We chose 2010 because it was relatively centered in relation to the years we had in the other data sets.

# Analysis

## Pre-post and Difference-in-difference analysis

### Florida

#### Effect of regulations on opioid shipments

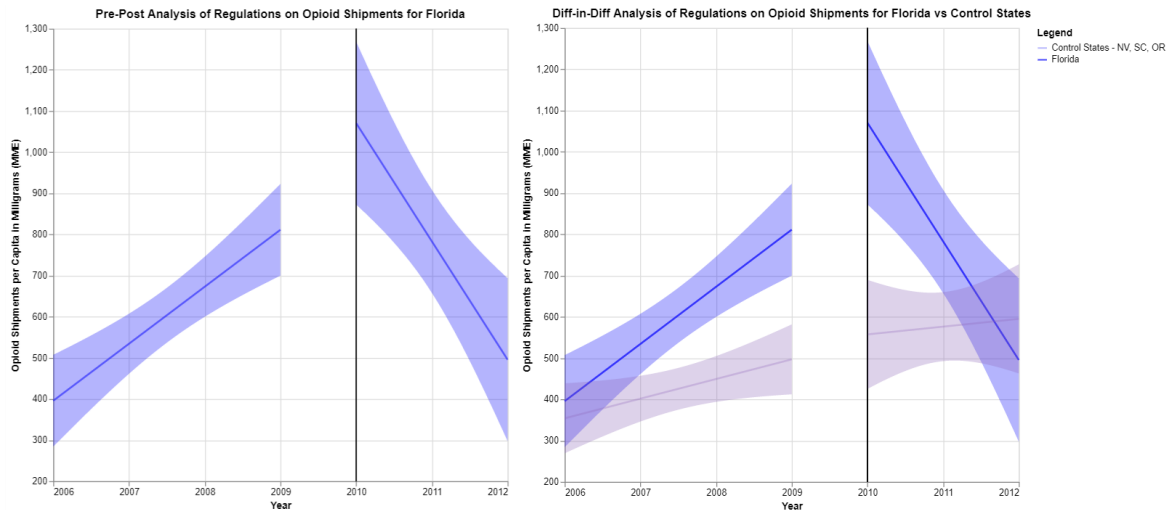


Fig.1.1: Snapshot of opioid shipments, before and after implementation of policy, which came into effect in Florida in February 2010. There is a noticeable decline in the number of shipments, as is evident from the graph on the left. The graph on the right shows the comparison between FL and control states (SC, NV, OR), which did not implement policies. The volumes of opioid shipments for these states post 2010 do not decline.

When looking at the opioid prescriptions per capita before and after the policy was implemented, we note that opioid shipments exhibited an increasing trend before the policy was implemented. However, after the regulation was put into effect, there was a sharp decline in the shipments per capita. This can be clearly seen in the pre – post analysis graph above (left). To understand whether this sharp decline was solely due to the restrictions implemented, we also look at how the shipments per capita changed during the same years for the control states - Nevada, South Carolina, and Oregon. We note that for these states the shipments per capita continued to increase throughout the years after the policy was implemented in Florida in 2010. This indicates that the policy was successful in curbing the shipments per capita influx for Florida.

## Effect of regulations on mortality rate from drug overdose

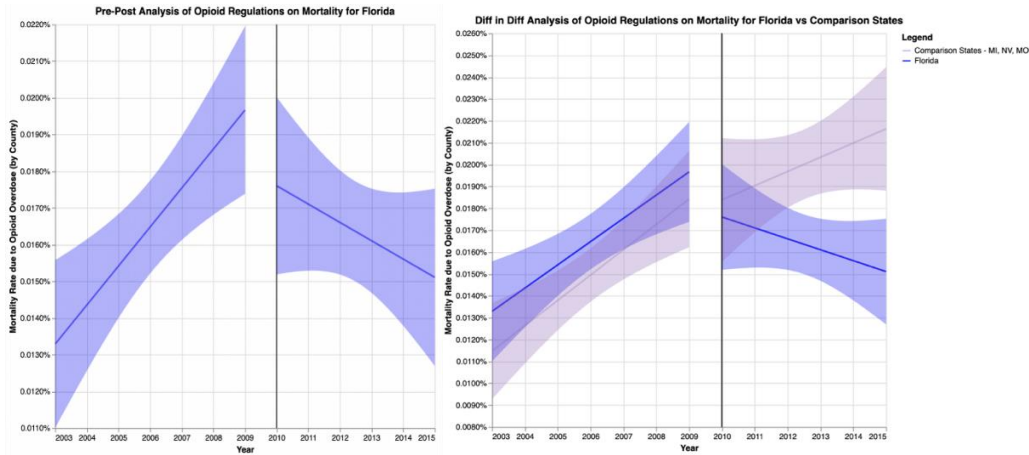


Fig.1.2: Snapshot of mortality rate from drug overdose, before and after implementation of policy, which came into effect in Florida in February 2010. There is a decline in mortality rate, as is evident from the graph on the left. The graph on the right shows the comparison between FL and control states (MI, NV, MO), which did not implement policies. The mortality for these states post 2010 do not decline.

From the graph on the left above, we observe that the average mortality rate due to drug overdose rises until the implementation of the policy year in 2010, peaking at about 0.02% in 2009. The mortality rate drops post the implementation of the policy, and continues a downward trend, which might not have been the case if the policy was not implemented. From the difference-in-difference analysis, we observe that the average mortality rates for the comparison states continue their upward trend, before and after 2010. This suggests that the opioid regulations had a positive impact in reducing the mortality rate in the state of Florida.

## Washington

## Effect of regulations on mortality rate from drug overdose

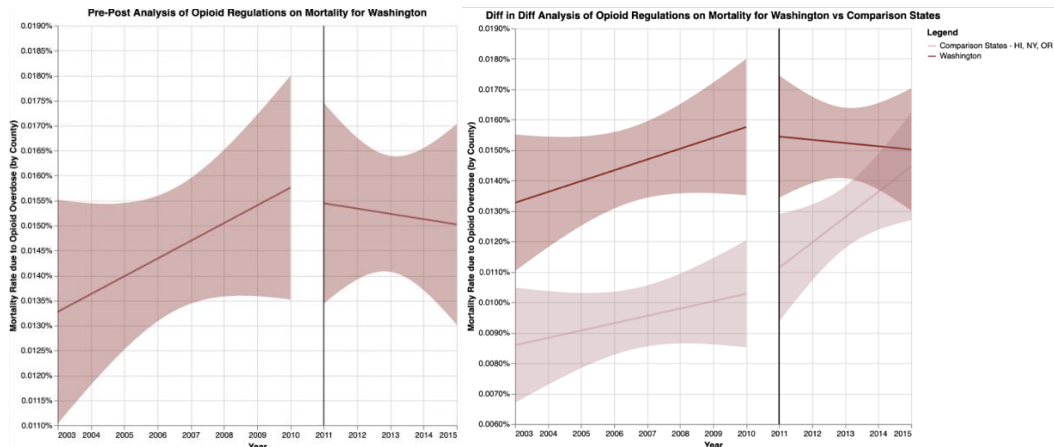


Fig. 2: Snapshot of mortality rate due to drug overdose, before and after implementation of policy, which came into effect in Washington (WA) in 2011. There is a slight decline in mortality rate, as is evident from the graph on the left. The graph on the right shows the comparison between WA and control states (HI, NY, OR), which did not implement policies. The mortality for these states post 2010 show an increasing trend.

From the graph on the left above, we observe that the average mortality rate due to drug overdose rises until the implementation of the policy in Washington in January 2012, peaking at about 0.02% in 2010. The mortality rate drops post the implementation of the policy, although not by a significant amount. From the difference-in-difference analysis, we observe that the average mortality rates for the comparison states, whose rates were lower than Washington, continue their upward trend, before and after the implementation of the policy. This suggests that the opioid regulations had a positive impact in the state of Washington, although the success of the policy would be questionable, given the magnitude of the impact.

## Texas

### Effect of regulations on mortality rate from drug overdose



Fig.3: Snapshot of mortality rate due to drug overdose, before and after implementation of policy, which came into effect in Texas (TX) in 2007. No significant effect of the policy can be observed from the graph on the left. The graph on the right shows the comparison between TX and control states (IL, NY, OR), which did not implement policies. The mortality for these states post 2007 show a sharper increase in comparison to TX.

When looking at the pre-post analysis for Texas, we observe that the trend for mortality rates for drug overdose increases up until the implementation of the regulations in Texas in 2007. The mortality rate rises to close to 0.008% in 2006. However, post the policy implementation, we observe that the trend for mortality continues to rise. If we compare this analysis with the difference-in-difference analysis, we observe that Texas has lower rates than its comparison states, before and after the implementation of the policy. However, even though Texas has lower rates, we cannot conclude that the policy had any effect in this state.

## Insights from Income

We also explore if the household incomes of different counties had an effect of the opioid regulations policies. Specifically, we are interested in how the effect varies for high income and low-

income counties. The counties within each of our treatment states were classified into high and low-income counties based on certain threshold levels specific to our states of interest. We calculated this threshold by considering the average median household income for all the counties within that state. Counties with median household income above the average were classified as high-income counties and the rest were classified as low income.

## Florida

### Effect of regulations on opioid shipments by Income

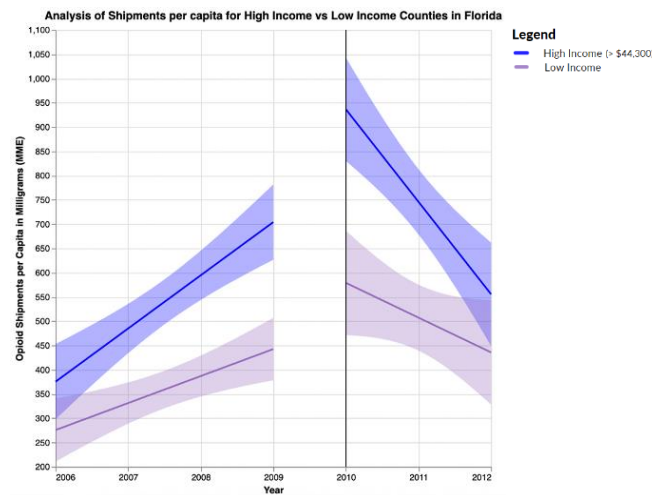


Fig.4.1: We observe that post the policy changes, the higher income counties of Florida witnessed a sharper decline in opioid shipments than the lower income counties.

We see that the high-income counties had higher shipments per capita, and this trend continues to move upward before the policy was implemented. The shipments per capita for lower income counties also increased in the years leading up to the implementation of the policy. However, the slope for this trend does not increase as sharply for the low-income counties, as it does for the high-income counties. After the policy was implemented, there was a greater decline in the shipments per capita for the high-income counties in comparison to low-income counties. This decreasing trend continued successively over the years after the policy was implemented.

## Effect of regulations on mortality rate by Income



Fig.4.2: Shows the pre-post policy comparison on mortality rates at an income level for Florida (FL). We observe a steep rise in the death rates for lower income counties leading up to the policy year. Post policy implementation reflects a steeper decline in mortality rate for lower income households than high income households

When we look at the effect of policy on mortality rates, we notice that before 2010, the mortality rates for both high and low-income counties was increasing steadily. In 2009, the mortality rate for the high and low-income counties was approximately the same. The policy proved to be effective in decreasing the mortality rate for both high and low-income counties. The decline in mortality rate for low-income was sharper as compared to the high-income counties.

## Washington

## Effect of regulations on mortality rate by Income

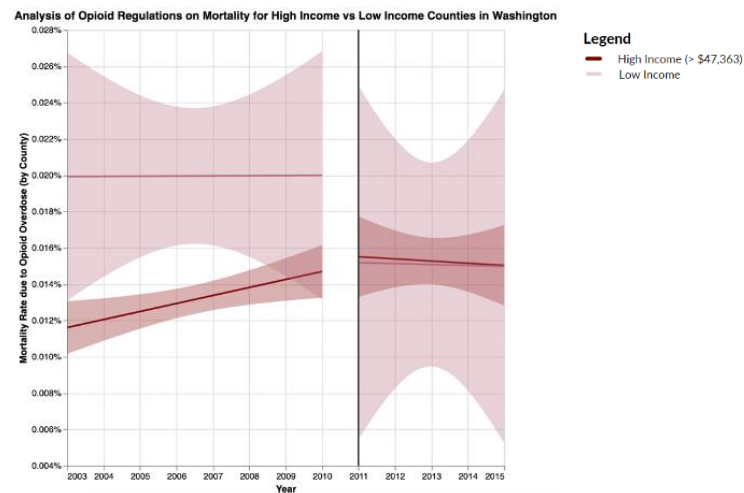


Fig.5: Shows the pre-post policy comparison on mortality rates at an income level for Washington (WA). The low-income households have a constant mortality rate before policy implementation. We observe a decline in the death rates for both low-income and high-income counties post the implementation of the policy. The decline is slow, however its more for high income counties than low-income counties.

When we look at the effect of policy on high and low-income counties in Washington, we see that the mortality rate for low-income counties was unchanging but significantly higher than the high-income counties before the policy was implemented. Although, the high-income counties had a lower mortality rate in comparison to the low-income counties, we observe an increasing trend until the policy was implemented. Post policy implementation, the mortality rate fell significantly for low-income counties. For the high-income counties, the policy was able to control the increasing trend in mortality rate that was observed before 2011. After 2011, we see that the mortality rate for both high and low income counties starts to decrease, however at a very low rate.

## Texas

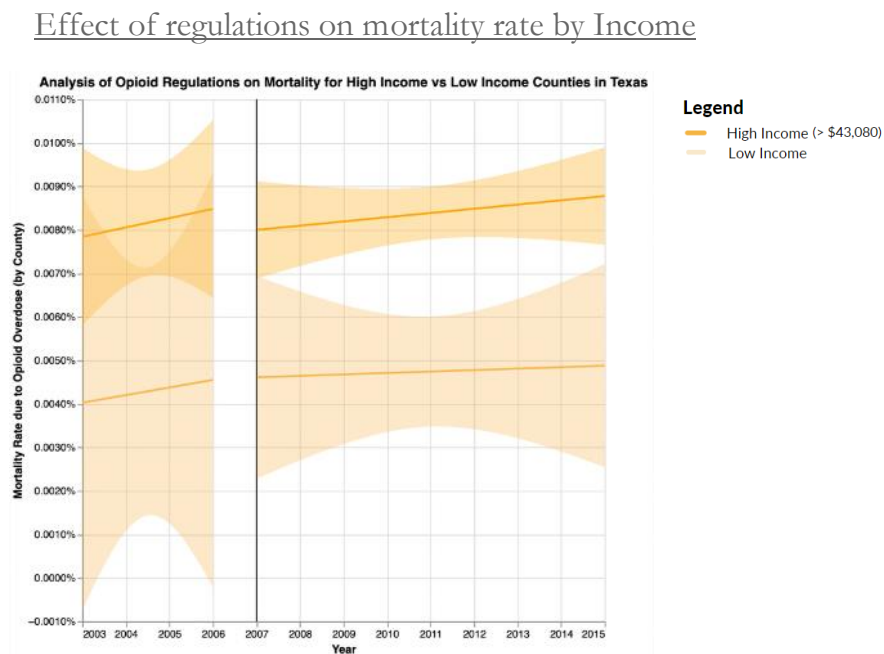


Fig.6: Shows the pre-post policy comparison on mortality rates at an income level for Texas (TX). There policy does not seem to be very effective, since the mortality rate for both high- and low-income households continues to increase post policy implementation. We do observe that rate of increase has reduced.

For Texas, in high income counties, the mortality rate caused by opioid overdose were considerably higher than the low-income counties before and after the policy. The opioid regulation in Texas seems to be quite ineffective as the trend for mortality rates remain unchanged in the periods before and after the policy changes. However, the rate of increase in mortality rates for both high- and low-income counties decreases by a small fraction after the policy was put into effect.

## Limitations

The first limitation of our analysis is that we only included counties with population above 400,000 due to counties with missing mortality rates. Therefore, we can assume the calculations would be higher than they are appearing if we were to include all counties and get the exact number of deaths



per capita. Secondly, while identifying the control states in the analysis, we selected the states where the opioid regulation policies were not implemented by the force of law. However, some of these states had quasi-regulatory guidelines which are enforced through fines and penalties.

## Conclusion

Based on the graphs of our pre-post and difference-in-difference analysis, Florida's drug policy was effective in decreasing the shipments of opioids as well as effective in declining the overall growing trend of its mortality rate. Texas's drug policy was not very successful as the overall trend of the average mortality rate did not decline after the policy went into effect. The increasing slope is not as steep as it was before the policy change, but the rate is still increasing, nonetheless. Washington's drug policy was potentially successful since its average mortality rate declined after the policy was implemented.

Why was Florida so successful and Texas unsuccessful? If we look into these policies, we can see a distinct difference. In Florida, the policies were directed towards the physicians and the pain clinics dispensing the medication. The strategy was to go to the source by conducting raids and closing pain clinics to stop the influx of opioids there. In Texas, the freedom was given to the people. It did not set any thresholds on the number of opioids a patient could receive, but instead only required patient consent to receive opioids. Since addiction is already a key issue with opioids, patients most likely did not change their intake, so it makes sense why Texas did not see a decrease in deaths per capita.

Both the pre-post comparison and difference-in-difference analysis provided straightforward ways for us to see how policies affected the trend on opioid shipments and mortality rate due to drug overdose. However, we must keep in mind that the work is far from over. Even after a successful policy change, there are still opioid overdose deaths occurring. Additionally, a decreasing trend can potentially start to increase again if policies are not adjusted to keep up with societal changes. Policy makers must be vigilant, and the key to that is understanding which policies work and which do not.

## Citations

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