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**Economic Model/Theory**

PDMPs provide opioid prescribers with more information on the patients they are prescribing to and PDMPs improve prescribers’ ability to identify patients who are more at risk of abusing or overdosing on opioids. The supply of prescription opioids is influenced by the cost of production, regulations, and government policies. PDMPs may limit the number of prescriptions that can be written for certain drugs or require doctors to follow stricter guidelines when prescribing. The theoretical purpose of PDMPs is to regulate the distribution of opioids and to reduce drug diversion, which would lead to a lower supply of prescription drugs overall, and specifically to those most at risk of abusing them. Economic theory suggests that having a lower supply of these drugs, as well as having fewer people exposed to the drugs in the first place, should lead to lower levels of opioid use and as a result, opioid overdoses. If people generally have less access to the drugs, they are less likely to become addicted to them, so the overall demand for opioids should decrease as well over time, which will ultimately result in a reduction in the number of opioid overdose deaths.

PDMPs may take time after their legalization and implementation before they start to influence the opioid overdose death rate. PDMPs may not be effective at reducing the overdose rates for those already abusing opioids before implementation, but they may lead to fewer people being exposed to the drugs in the future and may prevent many people who use the drugs from developing addictions. The assumptions of this model are that prescribers consider information from the PDMPs before prescribing opioids and that a significant amount of the opioids being used by the population come from prescriptions.

Based on the theory of supply and demand, it is expected that the opioid overdose death rates in a state should decrease after some period after the implementation of a PDMP in that given state. The time effect of the implementation of the PDMP on reducing the overdose death rate is unclear and may differ between states depending upon certain factors of the PDMPs.

**Data Source**

This analysis uses state-year-level data on the opioid death rate per 100,000 people from 2000 to 2020, which was obtained from the CDC Wonder Database. The opioid death rate will be the outcome variable in the model, and it will measure the level of opioid abuse in each state and year. From the CDC Wonder Database, the ICD-10 Codes that were selected as the multiple causes of death were T40.0-T40.4 and T40.6. We would expect there to be 21 years of data for the 50 states and the District of Columbia, resulting in 1,071 observations. However, there are some state-year combinations where there are not enough overdose deaths to find a reliable death rate, so there are 1,035 observations in the final dataset.

Using information from the Prescription Drug Abuse Policy System (PDAPS), an indicator variable was created to indicate whether or not there was an operational PDMP in place in a given state and year.

To control for covariates in the panel data, I obtained data on the median incomes and poverty rates in each state and year. This data was obtained from the United States Census Bureau. Data were also obtained on the percentage of white people, the unemployment rate, the percentage of people with a bachelor’s degree or higher, and the average age for each state from 2000 to 2020. This data was all obtained from the IPUMS USA community survey. The percentages and estimates were calculated using the person weight variable, which indicates how many people in the US population are represented by a given person in the IPUMS sample.

Figure 1 shows the average overall opioid death rate across all 50 states and the District of Columbia each year. Figure 2 shows the quantiles of the opioid overdose death rates in selected years. In both figures, we can see that opioid death rates have rapidly increased over this time horizon.

**Empirical Regression**

The goal of this research paper is to estimate the effect that implementing PDMPs has on the opioid overdose death rate and to see how that effect may differ depending on the number of years after the PDMP was implemented. Given the differential timing in PDMP implementation, and that by 2013, Missouri was the only state without a PDMP, we will use a panel data model with state-year fixed effects to examine the effect of the implementation of a PDMP in a given state and year on the opioid overdose death rate. I use the panel data regression equation:

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Where Ys, t is the opioid death rate for state *s* in time *t*, αs are state-fixed effects, and γt are year-fixed effects. *PDMP* is a binary variable equal to 1 for a state in years after PDMP implementation and 0 otherwise. The vector of the covariates is included and contains the following variables: the median income, the poverty rate, the percentage of the population that is white, the unemployment rate, the percentage of the population with a bachelor’s degree or higher, and the average age for each state from 2000 to 2020.

I expect the opioid overdose death rate to decrease after PDMP implementation. Therefore, I would expect the coefficient of *PDMP* to be negative, indicating a decrease in overdose deaths after PDMP implementation.

By including a fixed effects model with both year and state-fixed effects, the model controls for unobserved time-varying and state-specific confounders that could influence the opioid overdose death rate. The model includes the variable PDMP, which captures the immediate effect of PDMP implementation.

Additional investigation will include the interaction terms of PDMP with the covariates to explore how the effects of PDMP on the overdose death rate are associated with the various covariates. I also plan to investigate any potential leading and lagging impacts that implementing a PDMP may have on the opioid overdose rate. Also, I plan to investigate how other aspects of PDMPs, such as when they receive certain features, may impact the opioid overdose rate. I report the coefficient estimates and the robust standard errors in the panel data model.

Figure 1

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Figure 2

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