**Estimating the Effect of Medicaid**

**Expansion on the Opioid Crisis**

Marcus Ferrara

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*Department of Economics*

University of Colorado Boulder

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**Primary Advisor:**

Shuang Zhang

*Department of Economics*

**Committee Members:**

Brian Cadena

*Department of Economics*

Jason Boardman

*Department of Sociology*

**Abstract**

The question I am examining in this paper is, “What is the effect of Medicaid Expansion on the opioid crisis”. Specifically, I am looking at whether increased access to prescription opioids as a result of expanded medical coverage has had a significant effect on opioid-related emergency department visits. To answer this question, I used a difference-in-differences model, which highlights whether Medicaid expansion led to a greater increase in opioid-related emergency department visits for States that expanded Medicaid compared to non-expansion States. My analysis found opioid-related emergency department visits increased significantly more in States that chose to expand Medicaid compared to States that did not. This suggests that the Medicaid expansion portion of the ACA has had a negative effect on combating the opioid crisis.

**1 INTRODUCTION**

 Over the last two decades, overdose deaths in the United States have been steadily rising. Within the last 10 years, opioids have been the leading cause of overdoses by a large margin, with estimates suggesting that 130 Americans die each day from opioid overdoses. In fact, data from 2016 show there were more opioid-related overdoses than all other drug overdoses combined (National Institute on Drug Abuse). The rise in opioid overdoses coupled with high profile events such as the thousands of lawsuits against Purdue Pharma, the pharmaceutical company responsible for the creation of OxyContin, have catapulted the “Opioid Crisis” into the forefront of national debate.

 This paper estimates how Medicaid expansion has affected the opioid crisis. Specifically, I examined the effect of Medicaid expansion in 2014, when the ACA expanded Medicaid eligibility limits from 100% of the Federal Poverty Line (FPL) to 138% of the FPL. This is an interesting comparison because not all States have expanded Medicaid, which allowed for a natural treatment and control group for this study. In 2012, the Supreme Court ruled that the required expansion of Medicaid for all States in the Affordable Care Act was unconstitutionally coercive, which allowed States to decide whether or not they wanted to opt-in to the aforementioned expansion or opt-out. This allowed me to measure the impact of Medicaid expansion by comparing Medicaid expansion States to non-expansion States. One reason opioid-related emergency department visits may differ between Medicaid expansion and non-expansion States is that Medicaid expansion States have increased access to prescription opioids compared to non-expansion States. I answered this with a model that I believe is the first to provide quantitative estimates of the effect of Medicaid expansion on the opioid crisis, with results showing that opioid-related emergency department (ORED) visits increased more for States that chose to expand Medicaid than States that did not expand Medicaid.

The model I used to answer this question was a difference-in-differences model. The difference -in-differences model was used to estimate the effect of Medicaid expansion on opioid overdoses. To do this, I compared overdoses in expansion versus non-expansion States, both before and after Medicaid expansion took effect. First, I examined the change in overdoses in expansion States and non-expansion States, both before Medicaid expansion and after expansion. Then, my key analysis was examining whether opioid overdoses increased more in expansion states vs. non-expansion States. **Figure 1** below illustrates this concept. Rows 1 and 2 in the difference column show the increase in opioid-related emergency department visits per 100k (ORED) from before Medicaid expansion and after Medicaid expansion for States that chose to expand Medicaid and for States that did not expand Medicaid. States that expanded Medicaid saw their ORED increase by 113.9 after Medicaid Expansion took effect. States that did not expand Medicaid saw their ORED increase by 69.17 after Medicaid Expansion took effect. Thus, ORED increased by 44.19 more for Expansion States than for Non-Expansion States. My regression examined this relationship further by analyzing how much of this difference can be attributed to Medicaid Expansion and how other variables may have played a role in the differences observed.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2008-2013** | **2014-2016** | **Difference** |
| **Expansion** | 154.06 | 267.96 | 113.90 |
| **Non-expansion** | 111.98 | 181.69 | 69.71 |
| **Difference** | 42.08 | 86.27 | **44.19** |

**Figure 1.** Rows 1 and 2 represent States that expanded Medicaid and States that did not expand Medicaid. Column 1 represents the time period before Medicaid expansion, while Column 2 represents the time period after Medicaid expansion. The values in each cell represent opioid-related emergency department visits per 100,000 population.

**2 LITERATURE REVIEW**

Previous papers such as Kowalski (2014)have quantified increases in insurance coverage between Medicaid expansion and non-Medicaid expansion states. In the Kowalski model, and using data from the National Association of Insurance Commissioners, the author found that states that expanded Medicaid have increased rates of insurance coverage compared to non-expansion states. My paper builds off of Kowalski’s work by examining whether or not states with increased coverage also showed increases in opioid related emergency department visits.

 In a separate study, Courtemanche (2017) examined the effect of the Affordable Care Act on ambulance response times. Using a difference in differences model similar to mine, and data from the Small Area Health Insurance Estimates Program and the Fatality Analysis Reporting System, a yearly nationwide census regarding fatal injuries suffered in motor vehicle traffic crashes, Courtemanche et al. found there was a negative correlation between increases in insurance coverage and ambulance response times, with each percentage point increase in insurance coverage slowing response time by 24 seconds. My paper uses a similar methodology for examining the effect of the Affordable Care Act, but I examine the effect on opioid-related emergency department visits instead of ambulance response times.

 Two additional studies, Ghosh (2017) and Buckley (2012), also compare outcomes between Medicaid expansion and non-expansion states. These studies found that people in Medicaid expansion states had higher rates of opioid prescription utilization, but lower estimated possible opioid m­­­isuse. My work contributes to the small but growing literature surrounding opioid use and misuse in Medicaid expansion vs non-expansion States, using a different dataset and measuring different outcomes.

**3 Data Sources**

 The main data source I used comes from the Agency for Health Research and Quality (AHRQ). The data set that I will be using from AHRQ is a count of opioid-related emergency department (ORED) visits per 100,000 population, by state, by year, from 2008 to 2016.

 State-level controls came from the Occupation Employment Statistics Survey (OES) via the Bureau of Labor Statistics (BLS). The specific variables that I was interested in from the OES were state-year measures of total employment, mean hourly wage, mean annual wage, and percentile wage statistics. The second dataset I will be using from the BLS is the Local Area Unemployment Statistics dataset. This dataset contains state-level unemployment rates by month. State GPD per capita data was also collected from the BLS. I believe that accounting for these state control variables allowed me to reduce the chance of my study suffering from omitted variable bias.

 States that did not have complete opioid-related emergency department visits data from 2008 to 2016 were excluded from my sample. This left me with the following 26 states: Arizona, California, Connecticut, Florida, Hawaii, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, and Wisconsin.

**4 Planned Methodology**

 Regression (1) is a basic difference in differences regression that was the base for my analysis:

(1) ORED = B1*Expansion* + B2*After2014* + B3(*Expansion* \* *After2014*)

The key dependent variable that is opioid-related emergency department visits (ORED), and the key independent variables are *Expanded* and *After2014*. In this regression, B1 represents the effect on ORED of a state choosing to expand Medicaid. B2 represents the effect on ORED if the time period being looked at is post 2014, when Medicaid Expansion policy took effect. B3 shows the additional effect on ORED if a State has chosen to expand Medicaid and Medicaid Expansion policies have taken effect.

 Regression (2) is the same regression as before, but with added State fixed effects, time fixed effects, and control variables.

(2) OREDst=B1(*Expansion \* After2014*)st+ **X**st + Γt + FEs +$ \in $st

Notice that B1 and B2 are no longer explicitly shown in the regression model. This is because the *Expansion* term, whether or not a State decided to expand Medicaid, is included in State fixed effects; State fixed effects control for all variables within a State that remain constant, thus, a State’s decision whether to expand Medicaid does not change, so it is considered a fixed effect. Likewise, *After2014* is included in time fixed effects; Time fixed effects control for all variables that remain constant over time. **X** is a placeholder for my list of controls, which includes GDP per capita, median hourly wage, and unemployment rate. Γ is a set of binary time (year) variables, one for each year between 2008-2016. FE represents fixed effects. $\in $ is my error term. The subscript “s” is for states, and the subscript “t” is time in years.

**5 Descriptive Statistics**

 As mentioned earlier, **Figure 1** showed that ORED increased by 44.19 more from before Medicaid expansion to after expansion in expansion States vs non-expansion States. **Figure 2** shows these changes from a year to year perspective.

**Figure 2.** A graph of opioid related emergency department visits (ORED) over time. The blue data points represent Medicaid Expansion States. The orange data points represent States that did not expand Medicaid.

A key assumption in my difference in differences regression is that there are no trend differences between Expansion States and non-expansion States before Medicaid Expansion took effect in 2014. Figure 2 shows that the pre-Medicaid expansion trends for both groups of States appear to be similar, thus verifying the assumption that there are no pre-trend differences. Due to time constraints, I was not able to run a pre-trend analysis to confirm that there were no significant differences between both groups of States before 2014. However, if I were to run a pre-trend analysis, I would use a difference in differences model similar to the current model. Instead of looking at data from 2008 – 2016, I would narrow my data to 2008 – 2013. I would use a midway point, such as 2011, to be my “treatment” year. I could then use this regression to determine if the change from 2008 to 2013 for Medicaid expansion States was significantly different from the 2008 – 2013 change for non-expansion States.

**6 Results**

The following table is a summary of the results for my simplified regression and regression with fixed effects and controls (**Figure 3**).

|  |  |  |
| --- | --- | --- |
| **Model** | **Independent Variables** | **Dependent Variable****ORED Visits per 100k pop.** |
| **Model 1***Simple Difference in**Difference Model* | Expansion | 42.09\*(13.33) |
| After 2014 | 69.71\*(16.95) |
| Expansion\* after 2014 | 44.19(23.10) |
| **Model 2***Difference in Difference Model**w/ added Fixed Effects**& Control Variables* | Expansion\* after 2014 | 43.27\*(8.70) |
| GDPpc | 0.00(0.002) |
| Median Hourly Wage | 13.06(13.05) |
| Unemployment | -11.62\*(3.67) |

**Figure 3. A summary table of regression results. Model 1 represents simplified difference in differences model with no controls. Model 2 represents a difference in differences model with added fixed effects and controls. \* indicates statistical significance at the .05 level. Standard errors are in parentheses.**

Model 1 corresponds to regression 1 discussed in the methodology section of the paper, while

model 2 corresponds to regression 2.

Looking at model 1 first, we see that the betas on *Expansion* and *After2014* are both

significant at the .05 level.

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| --- | --- | --- |
| **Model** | **Independent Variables** | **Dependent Variable****ORED Visits per 100k pop.** |
| **Model 1***Simple Difference in**Difference Model* | Expansion | 42.09\*(13.33) |
| After2014 | 69.71\*(16.95) |
| Expansion\*After2014 | 44.19(23.10) |

The *Expansion* variable indicates that before Medicaid expansion policy took effect (2008-2013), Medicaid expansion States had on average 42.09 more ORED than States that did not expand Medicaid. The *After2014* variable indicates that non-expansion States had on average 69.71 more ORED after Medicaid expansion policy took effect, compared to the time period before Medicaid expansion policy took effect. However, the lack of significance on the interaction term indicates that ORED did not significantly increase more for expansion States than it did for non-expansion States when looking at the before and after effects of Medicaid expansion.

 When looking at Model 2, the results paint a different picture. There are two main differences between Model 1 and Model 2. The first main difference is that when State fixed effects, time fixed effects, and control variables are included, the interaction term, *Expansion\*After2014*, becomes significant. This indicates that ORED increased by 43.27 more for Medicaid expansion States than it did for non-expansion States. The second main difference between the two models is that the standard error on the interaction term is much smaller in Model 2 than it is in Model 1, indicating that the estimate in Model 2 is more precise than the estimate in Model 1. In regard to the control variables added to Model 2, the only control variable that appeared to be significant was unemployment rate.

|  |  |  |
| --- | --- | --- |
| **Model** | **Independent Variables** | **Dependent Variable****ORED Visits per 100k pop.** |
| **Model 2***Difference in Difference Model**w/ added Fixed Effects**& Control Variables* | Expansion\*After2014 | 43.27\*(8.70) |
| GDPpc | 0.00(0.002) |
| Median Hourly Wage | 13.06(13.05) |
| Unemployment | -11.62\*(3.67) |

Surprisingly, a one unit increase in unemployment rate led to a decrease of 11.62 in ORED. This relationship is surprising because substance abuse is typically positively correlated with higher unemployment rates.

**7 Discussion and Conclusion**

 When looking at the regression results, it is important to remember that the main outcome variable is being measured in units of per 100,000 people, meaning that ORED in expansion States increased by thousands more than non-expansion States. These results suggest that current Medicaid policy is having a negative impact on the current opioid crisis. While this regression does not specifically answer what about Medicaid expansion is causing higher ORED, the results do allow for speculation. One possible reason for higher ORED in Medicaid expansion States could be that current Medicaid policies allow for easier access to prescription opioids, and that expanded coverage is simply expanding that ease of access to more people. A possible solution to this issue could involve new legislature to limit the treatment of certain conditions with opioids, such as chronic pain. One issue that may arise from a solution such as this one is that legislators would need to decide whether the benefits of being able to treat more patients in pain with opioids at an affordable cost outweighs the cost of higher ORED.

 Although the results of my regression are significant, this study does contain some limitations. The main limitation of this study is that it only looks at half of the States in the U.S due to incomplete ORED data. It is possible that States suffering more from the opioid crisis have more data than States that are not as impacted, which would have a positive bias effect on my results and make my results appear larger than they really are. Additionally, this paper does not include a full pre-trends analysis. Although the data appear to have similar pre-trends, there are some slight differences in the outcome data before Medicaid expansion policies took effect, which if significant, would not allow us to determine whether Medicaid expansion had any effect on ORED.

 The aim of this paper was to determine whether Medicaid expansion had a significant impact on opioid-related emergency department deaths and the opioid crisis as a whole. The results within suggest there is some aspect of Medicaid expansion which is in fact contributing to higher rates of opioid-related emergency department visits. My hope is that these results shed light on some of the contributing factors to the opioid crisis, and that these results are another step closer to solving an issue that has impacted the lives of millions of Americans.

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