The Effects of the Affordable Care Act Medicaid Expansion on the Opioid Epidemic

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Abstract: The opioid epidemic has reached the level of a national emergency. In the past, Medicare and Medicaid public health insurance expansions have been shown to impact drug overdoses both positively and negatively. In 2010, the Obama Administration passed the Affordable Care Act (ACA), which included a provision to expand state Medicaid programs to include low-income childless adults in 2014. The ACA mandated that substance use disorder treatment had to be covered by Medicaid. The ACA Medicaid expansion could reduce the rate of drug overdoses if treatment for substance use disorders is effective and used. There is also the potential that it increases the rate of drug overdoses by providing people with easier access to prescription medications. Because only certain states implemented the ACA Medicaid expansion, this paper relies on a quasi-experimental difference-in-differences design to study the impact of the Medicaid expansion on the rate of drug and opioid overdoses. Based on the difference-in-differences methodology employed here, the ACA Medicaid expansion increases the rate of opioid overdoses by 21.61% and increases the rate of drug overdoses by 17.47%.

I. Introduction and Background:

The opioid epidemic has reached the level of a national emergency. Last year alone, the CDC found that in 2017 more than 70,000 people died of drug overdoses in the United States, the majority of which are attributed to fentanyl (Lopez, 2018).[1] This is the highest level of drug overdoses that United States has ever experienced (Lopez, 2018). This statistic represents a 10% increase of the rate of drug overdoses per 100,000 people since 2016. Additionally, on a global scale, the United States uses 80% of the world's opioids (Rummans, Burton, Dawson, 2018). The number of people dying from overdoses has caused drug overdoses to become the number one cause of death in people under the age of 50 (Rummans, Burton, Dawson, 2018). To make matters even worse, the growth of the opioid epidemic has actually caused a reduction in the life expectancy of Americans (Lopez, 2018). In this respect, the opioid epidemic has become an endemic problem in the United States. In order to understand how to move forward from the opioid epidemic we need to understand how we got here.

America first began using opioids to treat pain following the Civil War where opioids were used as a treatment for veterans (Rummans, Burton, Dawson, 2018). In the early 1900s, once people began to understand that byproducts of opium were addictive opium began to be regulated by limiting imports and preventing the use of heroin altogether (Rummans, Burton, Dawson, 2018). Later in the 1970s, other opioids that people are familiar with today, oxycodone and hydrocodone, were created for cancer patients to treat their chronic pain (Rummans, Burton, Dawson, 2018). Additionally, in the 1980s physicians' approach to prescribing opioids changed in that they were now prescribing them to chronic pain patients instead of exclusively terminal patients (Rummans, Burton, Dawson, 2018). This changed occurred because doctors viewed

[1] Fentanyl is an opioid that was created to treat the pain of terminally ill cancer patients. Recently, it has become very popular amongst recreational users.

opioids as a safer option than surgery and believed that opioids were non-addictive (Rummans, Burton, Dawson, 2018). In the 1990s, drug companies began to advertise opioids as an innocuous way to treat chronic pain, which caused an exponential increase in the number of opioids prescribed (Rummans, Burton, Dawson, 2018). Recently, insurance companies have contributed to the crisis by refusing to cover alternative pain treatment options to opioids that are more expensive and by charging patients less money for prescriptions with a higher number of doses than necessary (Rummans, Burton, Dawson, 2018). As a result of these trends, from the mid-1990s through 2012 the number of opioids prescribed continued to exponentially increase (Rummans, Burton, Dawson, 2018). America's history with opioids demonstrates the difficulties of solving the opioid epidemic, however, public insurance expansions like the Affordable Care Act (ACA) Medicaid expansion could help be a part of the solution to this problem.

In 2010, President Obama signed the ACA into law, which provided for a Medicaid expansion to extend coverage to more low-income populations. The Medicaid expansion was an optional provision of the ACA that provided states with federal funding to expand their Medicaid programs in 2014 (Maclean and Saloner, 2017).[2] Traditionally, Medicaid has been a public insurance program for low-income, parents, pregnant women, children, elderly, and disabled, however, the ACA Medicaid expansion extends health insurance coverage to low-income childless adults below 138% of the Federal Poverty Line (FPL). This is a segment of the population that previously has not had access to public health insurance. Currently, 37 states including the District of Columbia have adopted the Medicaid expansion and it has been

[2] Initially, the Medicaid Expansion was a mandatory provision of the ACA. This was challenged in the Supreme Court (National Federation of Independent Business v. Sebelius, 567 U.S. 519 (2012)) and the Court found that mandating that states expand their Medicaid program was unconstitutional. For more information please see: https://kaiserfamilyfoundation.files.wordpress.com/2013/01/8347.pdf.

implemented in 32 states (The Henry J. Kaiser Family Foundation).[3] Based on the number of states that have expanded their Medicaid program, the Medicaid expansion has the potential to greatly impact the lives of low-income childless adults.

The Medicaid expansion itself can further help us understand the crisis that America is facing with drug overdoses. The population covered by the Medicaid expansion, low-income childless adults, has a higher incidence of substance use disorders than the rest of the population (Maclean and Saloner, 2017). Concurrently, adults with mental illness and substance use disorders are more likely than the general population to not have insurance (Saloner, Bandara, Bachhuber, and Barry, 2017). Substance use disorders also have various public costs such as increased utilization of healthcare, increased amounts of crime and traffic accidents, as well as increased utilization of social services (Maclean and Saloner, 2017). Collectively, it is estimated that substance use disorders cost the United States $519 billion a year (Maclean and Saloner, 2017).

Not only does the ACA extend health insurance coverage to low-income childless adults, but there is also a provision in the ACA that makes it mandatory for Medicaid to cover treatments for substance use disorders (Maclean and Saloner, 2017). Because of this connection, this paper will test the relationship between the Medicaid expansion and the rate of opioid and drug overdoses in order to see if the Medicaid expansion causes a reduction or an increase in the rate of drug and opioid overdoses.

[3] Currently, the states that have adopted the ACA Medicaid Expansion are: Alaska, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, District of Columbia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, Utah, Vermont, Virginia, Washington, and West Virginia. However, Virginia, Idaho, Maine, Nebraska, and Utah, have yet to have implement the expansion.

The Medicaid expansion can impact the rate of drug overdoses negatively or positively. The provision in the ACA that mandates coverage of substance use disorders has the potential to increase the utilization of substance use disorder treatments, which should cause a decrease in the rate of drug overdoses. Through the ACA Medicaid expansion low-income childless adults that are newly insured now have access to prescription treatments for opioid addiction, like buprenorphine. If this is prescribed at higher rates after the ACA Medicaid expansion, then this could reduce the rate of drug overdoses. At the same time, having access to other prescription medications that reverse the effects of an overdose, like naloxone, could lower the opportunity cost of abusing drugs, which could positively impact the rate of drug overdoses. The ACA Medicaid expansion could also increase the rate of drug overdoses simply by increasing the supply of opioids, which increases access to opioids for all populations through spillover effects.[4] Based on the fact that the ACA Medicaid expansion has various impacts on access to health care, insurance coverage, treatments for substance use disorders, and increasing access to prescription drugs it has the potential to increase or decrease the rate of drug and opioid overdoses in this country.

As the opioid epidemic escalates, it is important to learn if the Medicaid expansion is part of the solution or part of the problem. If the Medicaid expansion is part of the problem, then the policy can be restructured to limit its effects on drug overdoses. Conversely, if the Medicaid expansion is part of the solution then that suggests that the federal government should expand the program even more. As the opioid epidemic is becoming one of the greatest challenges facing our nation today, addressing this question could allow politicians to alter policy in order to try to reduce the amount of drug overdoses.

[4] Powell, Pacula, and Taylor (2016) found that the implementation of the Medicare Part D public insurance expansion, had this effect, which increased the rate of drug overdoses in the non-Medicare eligible population.

II. Literature Review:

i. Medicaid

Since its inception in 1965, Medicaid has expanded its covered population multiple times. Similarly, several states have experimented with expansions to their own Medicaid programs. Medicaid expansions have many positive effects such as improved access to healthcare, better health outcomes, and greater financial stability. The main non-medical benefit of having insurance is that it can improve people's financial stability. For instance, Finkelstein et al. (2012) report on the Oregon Health Study, in which the state of Oregon voluntarily expanded its Medicaid program by 10,000 spots through a lottery system for previously ineligible adults with incomes below 100% of the FPL. Based on their study, they find that receiving insurance through this program caused a 4.8 percentage point decrease in the odds of having a bill sent to collections, and a 6.4 percentage point decrease in the odds of having a bill sent to medical collections. Finkelstein et al. (2012) also discover that there was a 35% decrease in out-of-pocket medical costs due to receiving insurance through Oregon's Medicaid expansion. Lastly, they find that Oregon's Medicaid expansion reduced the likelihood of needing to borrow money in order to pay for medical expenses by 40% (Finkelstein et al., 2012). In contrast to Finkelstein et al. (2012), Gruber and Yelowitz (1999) argue that Medicaid has the potential to reduce financial security through limiting the need for "precautionary savings" for medical care. If people save less because they are no longer saving for the potential of healthcare costs then they may spend this money on consumption, which will lower their savings (Gruber and Yelowitz, 1999). Through a societal model, Kotlikoff (1988) finds that people will save less over their lifetime in the presence of public insurance. However, Gruber and Yelowitz (1999) also assert that

Medicaid has the potentiality to increase wealth, because it lowers out of pocket medical costs and insurance costs for people who previously held private insurance.

Medicaid can increase access to healthcare as well. For instance, Simon, Soni, and Cawley (2016) find that the ACA Medicaid expansion increased the likelihood that low-income childless adults had a personal doctor by 7%. Also, Finkelstein et al. (2012) find that Oregon's Medicaid expansion caused an increase in the use of preventative care, such as, mammograms, cholesterol checks, and more. Similarly, Simon, Soni, and Cawley (2016) find that the ACA Medicaid expansion caused an increase in the use of preventative care, as well. Both of these studies demonstrate that their respective Medicaid expansions make it easier for low-income childless adults to gain access to healthcare. Piper et al. (1990), Hass et al. (1993), and Epstein and Newhouse (1998) all look at how giving pregnant women Medicaid impacts birth outcomes. These studies all find that Medicaid expansions to women, in a given state, did not increase the likelihood of women receiving prenatal care or change the health outcomes of babies. However, Currie and Gruber (1996) study the effects of Medicaid on all fifty states and not just states that expanded more coverage to women and find that Medicaid increases the likelihood of women using prenatal care. The literature comes to an ambiguous conclusion of how Medicaid impacts healthcare utilization.

Additionally, the literature tends to find that Medicaid expansions increase insurance coverage. For instance, Finkelstein et al. (2012) find that individuals who were chosen through the aforementioned Oregon insurance lottery were 25 percentage points more likely to have insurance coverage compared to the people who were not selected. Similarly, Simon, Soni, and Cawley (2016) find that the ACA Medicaid expansion increased the likelihood of low-income adults having insurance by 9% and childless adults having insurance by 17%. Lastly, after the

introduction of the ACA Medicaid expansion, the number of people uninsured with mental illnesses and substance use disorders declined and Saloner, Bandara, Bachhuber, and Barry (2017) find that the ACA Medicaid expansion caused the majority of the decline in the uninsurance rate for this population.

While the literature finds that Medicaid expansions increase insurance coverage it also finds that Medicaid expansions that target low-income childless adults do not crowd-out private insurance (Maclean and Saloner, 2017; Finkelstein et al., 2012). Maclean and Saloner (2017) find that the ACA Medicaid expansion does not crowd-out private insurance. Comparably, Finkelstein et al. (2012) find that Oregon's Medicaid expansion did not crowd out private insurance. These studies demonstrate that the populations receiving insurance through these Medicaid expansions were not previously insured through private insurance, which means that analyzing the effects of Medicaid expansions on these populations measures what happens when people are newly insured.

Both the ACA Medicaid expansion as well as Oregon's Medicaid expansion have been found to improve people's health. For example, Finkelstein et al. (2012) find that 13 months after the insurance expansion, people who received insurance reported an increase in both self-reported health and self-reported happiness. Similarly, Simon, Soni, and Cawley (2016) discover that the ACA Medicaid expansion decreased the probability of childless adults smoking, as well as caused an increase in their self-reported health. Gruber (2000) reports on a study conducted by Kaestner, Joyce, and Racine (1999), which looks at states that have expanded their Medicaid programs and compares groups who are likely eligible to receive Medicaid under the new program based on their position in the income distribution to those who are not. This study found that Medicaid does not affect people's self-reported health or the amount of days they stay in

bed. Additionally, Dubay et al. (2001) finds that Medicaid does not impact the birthweight of low-birthweight infants, even though Medicaid gives pregnant women access to prenatal care. In another study, Currie and Gruber (1996) examine the effects of Medicaid expansions that occurred between 1984 and 1992 in which states were ultimately forced to expand their Medicaid programs to cover children under the age of 6 whose family's earnings were up to 133% of the FPL. Before this time period Medicaid coverage for children was typically tied to Aid to Families with Dependent Children (AFDC) (Currie and Gruber, 1996). Using data from 1984-1992, Currie and Gruber (1996) find that expanding Medicaid coverage to these children reduced child mortality by a significant amount, which suggests that the health of children improved as a result of receiving insurance coverage.

The Medicaid expansion provides people with increased access to healthcare and physicians, which allows them greater access to prescription drugs. Ghosh, Simons, and Sommers (2017) find that 15 months after states implemented the ACA Medicaid expansion that the states that expanded their Medicaid programs saw a 19% increase in the consumption of prescription drugs, relative to states that did not expand their Medicaid program. Additionally, Ghosh, Simons, and Sommers (2017) report that the ACA Medicaid expansion caused the greatest increase in prescriptions for drugs that treat diabetes, contraceptives, and drugs that treat cardiovascular problems, like high blood pressure and hypertension, respectively. This study is important because it demonstrates that the largest increases in prescription drugs due to the Medicaid expansion are used to treat chronic illnesses as opposed to the largest increases in prescriptions being attributed to opioids or treatments for substance use disorders.

Most of the research done on the ACA Medicaid expansion focuses primarily on general findings such as how the Medicaid expansion effects insurance coverage, access to healthcare,

and health outcomes, as mentioned above. In contrast, very few researchers focus on how the ACA Medicaid expansion has the potential to impact substance use disorders, and none focus specifically on drug overdoses. The limited literature demonstrates that the ACA Medicaid expansion could have a positive or negative effect on the rate of drug overdoses.

ii. Addressing the Opioid Epidemic

The ACA Medicaid expansion has the potential to increase the number of opioids prescribed. Sharp et al. (2018) look at how the ACA Medicaid expansion impacts prescriptions for opioids. They find that while the number of opioid prescriptions per Medicaid enrollee increased in aggregate, that there was not a statistically significant difference between states that expanded their Medicaid programs and those that did not (Sharp et al., 2018). Based on Sharp et al.'s (2018) and Ghosh, Simons, and Sommers' (2017) findings (describe above) it appears that the ACA Medicaid expansion increased access to prescription drugs that treat chronic conditions the most.

At the same time, the ACA Medicaid expansion did cause an increase in prescription drugs that are used to treat substance use disorders. For example, Maclean and Saloner (2017) find that the ACA Medicaid expansion caused the amount of prescriptions used to treat substance use disorders to increase by 356 for every 100,000 adults. In addition, Maclean and Saloner (2017) report that the ACA Medicaid expansion caused a 43% increase in Medicaid-financed prescriptions for substance use disorders, which is significant, because this population had no prior access to insurance.

One specific case of how the Medicaid expansion effects the treatment of substance use disorders is illustrated with the drug buprenorphine. Buprenorphine is a drug used to treat addiction to opioids. Based on their research, Hefei, Hockenberry, Borders, and Druss (2017)

suggest that the ACA Medicaid expansion resulted in a 70% increase in buprenorphine prescriptions paid for by Medicaid. Their research is very important, because buprenorphine costs 6000 dollars per year which is a prohibitive out-of-pocket-cost for low-income populations (Hefei, Hockenberry, Borders, and Druss, 2017). Similarly, using data from 2011-2016, Sharp et al. (2018) look to see how buprenorphine prescriptions were affected by the ACA Medicaid expansion and find that the amount of buprenorphine prescriptions increased by 1211 for every 100,000 people in states that expanded their Medicaid program compared to 214 for every 100,000 people in states that did not expand their Medicaid program. Consequently, the Medicaid expansion has the potential to increase access to prescription treatments for substance use disorders by lowering costs.

Some treatments for substance use disorders, like naloxone, reduce the opportunity cost of abusing drugs. Naloxone (sometimes referred to by the brand-name Narcan) is a drug that is used to reverse the effects of opioid overdoses (Doleac and Mukhergee, 2018). Doleac and Mukhergee (2018) test the impact of increasing naloxone access on drug overdoses. Ultimately, they find that increasing access to naloxone increases ER visits for opioid use, causes more stealing of opioids, and causes an increase in drug overdoses from opioids in some areas (Doleac and Mukhergee, 2018). Doleac and Mukhergee's (2018) research suggests that increasing access to certain types of substance use disorder treatments has the potential to increase drug overdoses by reducing the opportunity cost of using drugs.

The literature on Medicaid's effect on the use of substance use disorder facilities come to different conclusions. Maclean and Saloner (2017) report that the ACA Medicaid expansion causes no change in the use of specialty treatment facilities, which are hospitals, residential facilities, as well as any facilities that offer detoxification programs, outpatient or inpatient

rehab, and medical detoxification programs through the use of prescription drugs (Maclean and Saloner, 2017). Comparably, Saloner, Bandara, Bachhuber, and Barry (2017) find that the ACA Medicaid expansion did not cause an increase in any form of substance use disorder treatment. However, Saloner, Bandara, Bachhuber, and Barry (2017) do not look at the prescriptions used to treat substance use disorders and they only report on the results from 2014, the year that the ACA Medicaid expansion went into effect. Both studies explain these results by asserting that there are complicated reasons behind choosing to enter substance use disorder treatment facilities and that gaining insurance might not immediately cause someone to decide to get help. In addition, using data from 2007-2015, Meinholfer and Witman (2018) find that treatment for opioid addiction at specialty treatment facilities went up by 18% in states that expanded their Medicaid programs through the ACA compared to states that did not. However, as in the other studies mentioned above they find that the ACA Medicaid expansion did not affect the amount of people seeking more rigorous forms of treatment, such as in residential and inpatient programs, which can be costlier (Meinholfer and Witman, 2018). These studies come to ambiguous conclusions with respect to how the ACA Medicaid expansion affects the use of substance use disorders treatment facilities.

iii. Previous Public Insurance Expansions and Drug Overdoses

Several other studies have investigated the impact of public insurance on drug overdoses. Powell, Pacula, and Taylor (2016) analyze the impact of the Medicare Part D expansion in 2006 on the opioid epidemic.[5] In order to look at how the Medicare Part D expansion influenced drug overdoses, the researchers exploit different geographical variations in the share of the population over 65 in each state in order to determine if there are any spillover effects from the Medicare

[5] Medicare is the public health insurance program for adults over 65. Medicare Part D expanded Medicare coverage to include prescription drugs.

Part D insurance expansion into the Medicare-ineligible population (Powell, Pacula, and Taylor, 2016). Spillover effects would suggest that the non-Medicare eligible population has increased access to opioids, because the Medicare population has easier access to opioids through this new program. For instance, this would be as simple as a family member taking opioids from their grandmother's medicine cabinet. The authors conclude that when the medical distribution of opioids increases by 10% that it causes a 7.4% increase in deaths due to opioids for the Medicare ineligible population, as well as causing a 14.1% increase in adults that are not eligible for Medicare entering substance use disorder treatment facilities (Powell, Pacula, and Taylor, 2016). In addition, Powell, Pacula, and Taylor (2016) find that 73% of the growth in deaths due to opioids can be ascribed to spillovers that were caused by increased access to opioids. Ultimately, these researchers find that Medicare Part D has had a significant impact on the opioid epidemic.

Using data from 1999-2008, Venkataramani and Chatterjee (2018) use a difference-in-differences approach to examine how early Medicaid expansions in 2001 and 2002 in Arizona, New York, and Maine impacted the rate of people dying from drug overdoses. These Medicaid expansions were similar to the ones that occurred under the ACA in 2014, because Medicaid coverage was extended to childless adults at or below 100% of the FPL (Venkataramani and Chatterjee, 2018). New York and Arizona also extended coverage more generously to parents with greater levels of poverty (Venkataramani and Chatterjee, 2018). Venkataramani and Chatterjee (2018) find that fewer people died of drug overdoses in states that expanded their Medicaid programs. The expansion itself reduced the rate of drug overdose deaths by 3.7 people for every 100,000 people each subsequent year (Venkataramani and Chatterjee, 2018). The authors do note that their results are limited because the size of their treatment group is only 3 states (Venkataramani and Chatterjee, 2018). Nevertheless, their results suggest that there is a

potential for the ACA Medicaid expansion to reduce the number of deaths related to drug overdoses or prevent the death rate from rising as quickly.

Wen, Hockenberry, and Cummings (2017) study the effect of the Health Insurance Flexibility and Accountability (HIFA) waivers on the use of substance use disorder treatment and crime. The George W. Bush Administration used HIFA waivers to provide states with federal funding to expand their Medicaid programs. In order to estimate the effects of the HIFA waiver expansion on the use of substance use disorder treatment they use a difference-in-differences design (Wen, Hockenberry, and Cummings, 2017). Their results indicate that increased access to substance use disorder treatment facilities as a result of the HIFA waiver expansion caused a decline in crime and substance use (Wen, Hockenberry, and Cummings, 2017). Wen, Hockenberry, and Cummings (2017) look at the connection between insurance and crime because research suggests that some crime is caused by substance use. Additionally, in 2010, only 11% of the 23 million Americans who had substance use disorders received treatment for their addiction (Wen, Hockenberry, and Cummings, 2017). The primary reasons that people gave for not receiving substance use disorder treatment are that they did not have insurance or that their insurance did not cover substance use disorders (Wen, Hockenberry, and Cummings, 2017). Thus, by reducing financial obstacles the HIFA Medicaid expansion increased the use of substance use disorder treatments (Wen, Hockenberry, and Cummings, 2017).

III. Data and Methodology

This analysis utilizes state-level data for the years 2010-2016. Data on age, gender, race, population, land area, and health insurance status are from the U.S. Census Bureau. Data on substance use disorder facilities and opioid treatment programs are from the National Survey of

Substance Abuse Treatment Services conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA). Data on political affiliation is from Electoral College maps for both the 2012 and 2016 presidential elections from the *New York Times*. Unemployment rates are from the National Bureau of Labor Statistics and state GDP per capita measures (in 2009 dollars) are from the Bureau of Economic Analysis. Lastly, my data on which states have expanded their Medicaid programs as well as the rate of opioid and drug overdose deaths are from the Henry Kaiser Family Foundation's website and they gathered their data from the CDC.

I utilize a difference-in-differences estimation strategy to isolate the impact of the ACA Medicaid expansion on opioid and drug overdoses as well as treatment outcomes in expansion states. Due to the Supreme Court decision that found that the federal government could not force states to expand their Medicaid programs, the ACA Medicaid expansion was only adopted in certain states, which creates a good quasi-experimental design that is ideal for a difference-in-differences approach. As a result, states that adopted the ACA Medicaid expansion in 2014 and in subsequent years are the treatment group, while states that did not adopt the ACA Medicaid expansion are the control group.[6] In order for this approach to work, both expansion and non-expansion states should have similar (close to identical) characteristics in the pre-period.

Table 1 displays the summary statistics for expansion and non-expansion states in the pre- and post-periods. The average rate of drug overdoses in the pre-period for non-expansion states is 12.855 people per every 100,000 people and the average rate of opioid overdoses for non-expansion states is 7.154 people per every 100,000 people, while the average rate of drug overdoses in the pre-period for expansion states is 14.911 people per every 100,000 people and the average rate of opioid overdoses for expansion states is 9.16 people per every 100,000

[6] While Virginia, Maine, Idaho, Nebraska, and Utah have expanded their Medicaid programs, they are coded as non-expansion states because they either adopted or implemented the ACA Medicaid expansion after 2016.

people. The mean of the rate of drug and opioid overdoses is therefore very similar in both the treatment and the control group in the pre-period, which is important as the rate of drug overdoses and opioid overdoses are the predominant variables of interest. Additionally, the average number of substance use disorder treatment facilities in the pre-period for every 100,000 people is 5.73 for non-expansion states and 5.967 for expansion states, which is only approximately a 4% difference. Also, the unemployment rate and the percent of the population that is female are almost identical in expansion states (0.0788;0.5082) and non-expansion states (0.0744;0.5083) in the pre-period. Lastly, the average rate of people with private insurance as well as the average rate of people with Medicaid is very similar for expansion states (0.68;0 .175) relative to non-expansion states (0.663; 0.163) in the pre-period. While not all of the variables are identical in the pre-period the variables of most interest are similar in the pre-period for both expansion and non-expansion states.

Some of the characteristics that are less similar in the pre-period in expansion states versus non-expansion states are GDP per capita, the number of opioid treatment programs per every 100,000 people, and the variable that controls for political partisanship. GDP per capita is approximately $10,000 higher in expansion states than in non-expansion states in the pre-period. In addition, expansion states had approximately 0.2 more opioid treatment programs for every 100,000 people on average. This is significant because this means that there are approximately 75% more opioid treatment programs per 100,000 people in expansion states relative to non-expansion states in the pre-period. The expansion states were also more likely than the non-expansion states to vote for the Democratic presidential candidate in 2012 and 2016. In addition,

population density is higher by over 400 people per square mile in expansion states relative to non-expansion states in the pre-period.[7]

Figure 1 shows that expansion and non-expansion states had similar percentages of people on Medicaid before the ACA Medicaid expansion in 2014. After the ACA Medicaid expansion goes into effect, the rate of people with Medicaid in expansion states increases, while it remains consistent in states that did not expand its Medicaid programs. Figures 2 and 3 demonstrate that the rate of drug and opioid overdoses were on a similar trajectory in the pre-period but appear to rise faster in expansion states in the post-period.

Table 2 illustrates how a difference-in-differences approach works to isolate the effect of the treatment by using the example of how the ACA Medicaid expansion effects the rate of drug overdoses. The difference-in-differences estimator is calculated by comparing the average drug overdose rate before and after the ACA Medicaid expansion in treatment group versus control group states: (Expansion States$_{post}$ –Expansion States$_{pre}$) – (Non-Expansion States$_{post}$ – Non-Expansion States$_{pre}$).[8] This isolates the impact of the treatment because (Expansion States$_{post}$ – Expansion States$_{pre}$) determines the change in overdoses in treated states, while (Non-Expansion States$_{post}$ – Non-Expansion States$_{pre}$) nets out any differential trends other than the ACA Medicaid expansion that affect the rate of drug overdoses. Table 2 uses the means from the data set to illustrate how this works. Based on this analysis the ACA Medicaid expansion caused the rate of drug overdoses to increase by 2.554 people for every 100,000 people in expansion states

[7] In order to check to see if these differences had an effect I removed the District of Columbia, Connecticut, Rhode Island, New York, Massachusetts, and New Jersey from the data set, because these states were outliers for population density, GDP per capita, or both. Ultimately, removing these states from the data set did not impact the results in any meaningful way.

[8] The difference-in-differences estimator can equivalently be calculated by subtracting: (Expansion States$_{post}$ – Non-Expansion States$_{post}$) – (Expansion States$_{pre}$ – Non-Expansion States$_{pre}$).

relative to non-expansion states. However, this is not a sufficient test because it does not include demographic and other controls to determine this simple difference.

The difference-in-differences estimator is calculated in a controlled regression framework by estimating Equation 1 by Ordinary Least Squares (OLS).

$$(1)\ Y = \beta_0 + \beta_1 Post + \beta_2 Medicaid\ Expansion + \beta_3(Post * Medicaid\ Expansion) + \beta_4 \boldsymbol{X} + \beta_5 dyear + \beta_6 dstate + \varepsilon$$

In Equation 1, *Post* is a dummy variable that is equal to 1 in the years after the ACA Medicaid expansion and 0 before the ACA Medicaid expansion, for all states. *Medicaid Expansion* is a dummy variable that is equal to 1 if the state expanded its Medicaid program (for all years) and 0 if the state did not expand their Medicaid program (for all years). The variable *Post*Medicaid Expansion* is therefore equal to 1 in expansions states in the post-period and is equal to 0 otherwise. The coefficient of interest β_3 therefore measures the marginal impact of being in an expansion state in the post period.

In addition, the $\boldsymbol{X}$ in Equation 1 represents a vector of controls. These include the number of opioid treatment programs per 100,000 people in a given state, the number of substance use disorder treatment facilities per 100,000 people in a given state, a measure of political partisanship, the percent of people in a state that are white, the GDP per capita in each state, the percent female in each state, the unemployment rate in each state, the percent of people with private insurance in each state, and the percent of people with Medicaid in each state. The variable that looks at political partisanship is a dummy variable equal to 1 for the years 2010-2013 if the state voted Democrat in the 2012 presidential election for years 2010-2013 and is also equal to 1 for the years 2014-2016 if the state voted Democrat in 2016. In contrast, the political partisanship variable is equal to 0 if a state voted for the Republican candidate in the 2012 and

2016 presidential elections for the same time measurements as listed above. The equation also contains a full set of state and year dummies. This equation is estimated for a variety of different dependent variables (*Y*): the rate of drug overdoses, the rate of opioid overdoses, the number of substance use disorder treatment facilities, and the number of opioid treatment programs.[9]

IV. Results

Table 3 reports the results from estimating Equation 1, with substance use disorder treatment facilities per 100,000 people and opioid treatment programs per 100,000 people as the dependent variables. These regressions function as a "gut check" for my main set of regressions where *Y* is either the rate of drug overdoses or the rate of opioid overdoses for every 100,000 people. For example, if the number of substance use disorder treatment facilities is increasing due to the ACA Medicaid expansion then we would expect that substance use disorder treatment increases logically as well. This set of regressions also demonstrates how the public and the private sectors are responding to the opioid crisis and a newly insured population.

Results are reported with the full set of controls described above, as well as with a more limited set of demographic controls. The set of regressions with substance use disorder treatment facilities per every 100,000 people reveals interesting patterns. For instance, across all regressions with both narrow and broad sets of controls the ACA Medicaid expansion does not have a statistically significant effect on the total number of substance use disorder treatment facilities. This is surprising given that the rate of drug overdoses has been increasing, because this should hypothetically induce people to open up more treatment facilities. Additionally, the rate of drug overdoses and the rate of opioid overdoses do not have a statistically significant

[9] All dependent variables are measured in per every 100,000 people.

impact on the amount of substance use disorder treatment facilities. Although these results are not statistically significant, it is interesting that the rate of opioid overdoses negatively impacts the number of substance use disorder treatment facilities. This is because we would expect that the rate of opioid overdoses has a positive effect on the number of substance use disorder treatment facilities, however, for some reason this is not the case. One reason this may be happening is if these facilities are underutilized. In addition, the percent of people on Medicaid decreases the number of substance use disorder treatment facilities by -12.207 per every 100,000 people and this is statistically significant at the 5% level. This suggests that substance use disorder treatment facilities do not open in areas where a large percentage of the population is on Medicaid, perhaps because Medicaid reimburses less than private insurance. Lastly, the R^2 statistics for these regressions are 0.964 for the full set of controls and 0.963 for the demographic controls, which means that there is very strong relationship between the data and the dependent variable.

The results of the regressions with the number of opioid treatment programs per 100,000 as the dependent variable come to different conclusions than that of the regressions with substance use disorders per 100,000 people as the dependent variable. Most notably, the regression with the full set of controls finds that the ACA Medicaid expansion increases the number of opioid treatment programs by 0.0493 per 100,000 people and that this is significant at the 1% level. Similarly, the regression with the demographic controls finds that the Medicaid expansion increases the number of opioid treatment programs by 0.0387 per 100,000 people (significant at the 5% level). This suggests that society's primary focus on the opioid epidemic following the ACA Medicaid expansion is increasing the number of opioid treatment programs. These coefficients may seem very small, however, in the pre-period expansion states averaged

0.4643 opioid treatment programs per 100,000 people, so the ACA Medicaid expansion results in a 10.62% increase in the number of opioid treatment programs per 100,000 people with full controls and an 8.34% increase with demographic controls. While not statistically significant, these regressions find that the number of opioid overdoses increases the number of opioid treatment programs, which makes sense. Although the rate of opioid overdoses has a negative effect on the aggregate number of substance use disorder treatment facilities, the rate of opioid overdoses could be increasing the number of opioid treatment programs, because there is a larger focus on opioids right now than substance use disorders in general. The R^2 statistics for this set of regressions are 0.957 for both the demographic controls and full set of controls. This means that the regressions with the number of opioid treatment programs per 100,000 people are an excellent fit for this set of data.

Table 4 reports results from estimating Equation 1 with the rate of drug overdoses and the rate of opioid overdoses as the dependent variables. The results suggest that the ACA Medicaid expansion increases the rate of drug overdoses and opioid overdoses. The regressions with the full set of controls find that the ACA Medicaid expansion increases the rate of drug overdoses by 2.605 people for every 100,000 people and is statistically significant at the 1% level. The ACA Medicaid expansion also increases the rate of opioid overdoses by 1.979 people for every 100,000 people and is statistically significant at the 5% level. This represents a 17.47% increase in the rate of drug overdoses and a 21.61% increase in the rate of opioid overdoses. The regressions with the more limited set of demographic controls find that the ACA Medicaid expansion increases the rate of drug overdoses by 2.3 people for every 100,000 people and increases the rate of opioid overdoses by 1.942 people for every 100,000 people both findings are statistically significant at the 1% level. Thus, all regressions consistently find that the ACA

Medicaid expansion causes statistically significant increases in the rate of drug overdoses and opioid overdoses.

There are other interesting results from these regressions besides the fact that the Medicaid expansion actually leads to an increase in the rate of overdoses. For example, an increase in the percent of people with Medicaid as well as the percent of people with private insurance causes a decrease in the rate of drug overdoses and opioid overdoses, both findings are statistically significant at the 1% level. It is important to note that having Medicaid is different than getting Medicaid through the ACA Medicaid expansion, because the ACA Medicaid expansion covers low-income childless adults, while Medicaid traditionally covers low-income adults with children, children, disabled populations, and elderly populations. In this way, the traditional Medicaid population is not predisposed to substance use disorders as low-income childless adults are, which is why the percent of people with Medicaid in a given state reduces the rate of drug overdoses. Over time as more and more states adopt and implement the Medicaid expansion it will be interesting to see if Medicaid continues to reduce the rate of drug and opioid overdoses, with low-income childless adults as a core Medicaid bloc. If this continues to be the case, then it suggests that there are positive externalities to having insurance.

For the regressions where the rate of opioid overdoses is the dependent variable the R^2 statistics are 0.853 for the regression with the full set of controls and 0.829 for the regression that uses demographic controls. This suggests that the model is a very good fit for the data. Additionally, when the rate of drug overdoses is the dependent variable the R^2 statistics are 0.87 and 0.842 for the regression with the full set of controls and the one that uses demographic controls, respectively. Again, this suggests that there is a tight relationship between the dependent variable and the controls and that the controls explain most of the variation in the

dependent variable. Based on both sets of R^2 statistics, this estimated model does a very good job of predicting the rate of drug and opioid overdoses.

V. Robustness Checks

I conduct two separate robustness checks to reinforce the validity of my main results. First, in order to check that the results from the above regressions are not driven by pre-existing trends, I run regressions on the pre-period sample only, removing all observations where the year is greater than or equal to 2014. I estimate the following equation using OLS:

$$(2)\ Y = \beta_0 + \beta_1 Fake\ Post + \beta_2 Medicaid\ Expansion + \beta_3 (Fake\ Post * Medicaid\ Expansion) + \beta_4 \boldsymbol{X} + \beta_5 dyear + \beta_6 dstate + \varepsilon$$

Fake Post is equal to 1 in 2012 and 2013 and 0 in 2010 and 2011, and the variable of interest, *Fake Post*Medicaid Expansion* is therefore equal to 1 in expansion states in 2012 and 2013 and 0 otherwise. This is a check on my above regressions, because I am now running a set of regressions with an artificial post- and pre-period completely prior to the ACA Medicaid expansion (2010-2013). Consequently, in these regressions if coefficient on the interaction term is not statistically or economically significant, then this suggests that the effects of the ACA Medicaid expansion described in the core regressions above are indeed a result of the Medicaid expansion and not some unaccounted-for differential pre-period trend.

The results of this exercise are reported in Table 5. The coefficient on the interaction term is not statistically significant and is much smaller than in the main regressions in Table 4, with both the rate of opioid overdoses and drug overdoses as the dependent variables, and with both the full set of controls as well as the demographic controls. This suggests that the results from the regressions that use the real ACA Medicaid expansion above can be attributed to the ACA

Medicaid expansion and are not attributable to pre-existing differential trends across treatment and control states.

In a second set of robustness checks, I test whether outliers in this data set are impacting the results. I do this by re-estimating Equation 1, after removing outliers from the data set. For this set of robustness checks, I run regressions with the full set of controls and demographic controls with the rate of opioid overdoses and the rate of drug overdoses as the dependent variables.

Connecticut, the District of Columbia, New York, New Jersey, Massachusetts, and Rhode Island are outliers with respect to GDP per capita, population density, or both. Connecticut had an average population density of 740.42 people per square mile in the pre-period and the average population density in the pre-period for expansion states is 549.741 people per square mile and the average population density in non-expansion states in the pre-period is 100.775 people per square mile. Similarly, in the District of Columbia the average population density is 10,240.255 people per square mile in the pre-period. New Jersey's average population density in the pre-period is 1203.663 people per square mile and the average population density in Rhode Island in the pre-period is 1014.13. The average population density in Massachusetts in the pre-period is 850.045. These states are outliers with respect to population density as compared to the average population density in the pre-period for expansion and non-expansion states in Table 1. Connecticut, the District of Columbia, Massachusetts, and New York are also outliers with respect to GDP per capita. The average GDP per capita in the pre-period for Connecticut, the District of Columbia, Massachusetts, and New York are $63,593.5, $164,359.5, $61,715.75, and $61,877.75, respectively. These measures of GDP per capita are outliers because the average GDP per capita in expansion states in the pre-period is $ 52,582.38 and the average GDP per

capita in non-expansion states in the pre-period is $42,948.66. Table 6 illustrates that by dropping these “outlier states” that the population density in the pre-period for expansion states falls to 140.026 people per square mile from 549.741. Similarly, average GDP per capita for expansion states in the pre-period falls to $ 47,543.84. Therefore, removing these outliers makes the expansion states and non-expansion states much more similar in the pre-period.

As shown in Table 7, removing these outlier states from the data set does not significantly affect the above results. For instance, with the full set of controls the ACA Medicaid expansion increases the rate of opioid overdoses by 1.925 people per every 100,000 people and with the demographic set of controls it increases the rate of opioid overdoses by 1.699 people per every 100,000 people and both findings are significant at the 5% level. These coefficients are only marginally different than the coefficients from the regressions that left these states in the data set, which suggests that these outliers do not significantly impact my results. With the rate of drug overdoses as my dependent variable, the Medicaid expansion causes the rate of drug overdoses to increase by 2.908 people per every 100,000 people with the full set of controls and 2.208 people per every 100,000 people with the demographic controls. These coefficients are almost identical in size to those in the regressions that kept the outlier states in the data set. These findings are both significant at the 1% level as they also were when the outlier states were included in the data set. This robustness check further verifies the validity of my results.

VI. Discussion and Conclusion

While my results indicate that the ACA Medicaid expansion increases the rate of drug overdoses this does not suggest that the ACA Medicaid expansion is a bad thing. Rather it

suggests that there are other confounding factors from having insurance that increase the rate of drug overdoses. For instance, the ACA Medicaid expansion could be increasing the overall supply and access to opioids. The ACA Medicaid expansion could also increase moral hazard by reducing the opportunity cost of abusing drugs by giving people easier access to certain treatment options. Although these results seem to negate the positive aspects of the ACA Medicaid expansion this is not the case even if the rate of drug overdoses is increasing. The Medicaid expansion provides people with access to lifesaving prescriptions through insurance, doctors, and preventative treatments (Finkelstein et al, 2012; Simon, Soni, and Cawley, 2016; Ghosh, Simon, and Sommers, 2017). The ACA Medicaid expansion also improves people's health (Simon, Soni, and Cawley, 2016). In this way, the Medicaid expansion is not the root cause of the opioid epidemic and states that have yet to should still undergo the ACA Medicaid expansion. Ultimately, these results simply suggest that the ACA Medicaid expansion cannot currently be used to help end the opioid epidemic.

One explanation for the opioid epidemic here in America may be that our approaches to treating substance use disorders do not work in the long run. For instance, while having access to these treatment programs through Medicaid is a positive thing it does not mean that these facilities are effective or that people use them. In this respect, we may need to look at what other countries do right and wrong when treating substance use disorders. This will help our treatment of substance use disorders be more effective. Additionally, addiction of any kind is a life-long struggle people can relapse and overdose at any point in their life. In this way, there is no short-term solution to addiction and the best way to end the opioid epidemic may be to ensure that future generations do not become addicted or exposed to opioids. While insurance is not a big

enough tool to stop drug and opioid overdoses it may be the beginning of people living healthier lives.

One way to reduce the rate of substance use disorders and subsequent overdoses may be to change our prescribing practices. For instance, the United States may simply have an oversupply of opioids. Even if the person prescribed the opioids does not take them having them in your home poses a problem as they can be stolen or used in the future (Powell, Pacula, and Taylor, 2016). Additionally, European countries have regulations in place that limit the ability of physicians to prescribe opioids. For example, in Europe there are regulations in place that prevent pharmaceutical companies from advertising the ways that they do in the United States (Nilsen, 2017). One difference in advertising practices is that European countries do not allow pharmaceutical companies to advertise to consumers (Nilsen, 2017). Another example in how European countries and the United States prescribe opioids differently, is that in Europe they usually need to be prescribed by a specialist, whereas in the United States they can be prescribed by a primary care physician (Nilsen, 2017). In fact, 50% of all opioids are prescribed by a primary care physician in the United States (Nilsen, 2017). In this respect, we need to find better ways of prescribing opioids so that fewer are in circulation.

Lastly, the ACA Medicaid expansion could be altered so that people have to seek certain measures of preventative care to keep their insurance. This may be beneficial because if people are monitored more closely by doctors routinely then they may be more likely to seek treatment for a substance use disorder. In doing so, preventative care may limit the severity of substance use disorders. Thus, requiring people to seek preventative care in order to keep their Medicaid may begin to curb the opioid epidemic.

Ultimately, the crisis this country is facing with overdoses is a complex issue that cannot be solved merely by giving people insurance. For instance, the ACA Medicaid expansion provides childless adults in poverty with insurance, and this population has a higher likelihood of contracting a substance use disorder. Giving them insurance, however, does not simply fix their predisposition to substance use disorders. Although it appears like the ACA Medicaid expansion increases the rate of drug overdoses and opioid overdoses what is really going on is that certain byproducts of having insurance increases overdoses. There are other confounding factors that could be making the opioid epidemic worse, like the increase in supply of opioids and prescriptions, prescribing practices for opioids, moral hazard with prescribing drugs like naloxone to treat overdoses, and more. Therefore, the ACA Medicaid expansion and giving people health insurance is not the problem, rather, there are certain byproducts of having insurance that can explain this increase in overdoses. In the future, more research needs to be done to determine how to better address the opioid epidemic.

Table 1				
	Expansion States		Non-Expansion States	
VARIABLES	Pre	Post	Pre	Post
Drug Overdoses	14.9106	20.2121	12.8553	15.6018
Opioid Overdoses	9.1597	14.2187	7.1539	9.8088
Political Partisanship	0.6917	0.6264	0.2105	0.1053
Substance Use Disorder Treatment Facilities	5.9672	6.1265	5.7299	6.1011
Opioid Treatment Programs	0.4643	0.5399	0.2641	0.2918
Percent White	0.6933	0.6753	0.7202	0.7094
Population Density	549.7408	618.9232	100.7750	104.1074
Unemployment Rate	0.0788	0.0529	0.0744	0.0490
GDP per Capita	52582.38	54310.21	42948.66	44384.21
Private Insurance Rate	0.68	0.6922	0.6631	0.6888
Medicaid Rate	0.1754	0.2105	0.1632	0.1689
Percent Female	0.5082	0.5078	0.5083	0.5078
Observations	133	91	76	57

Note: Universe is state-level data for the years 2010-2016. The pre-period includes years 2010-2013 for most states. Some states expanded their Medicaid programs after 2014, which is accounted for in the data set. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars.

Table 2: Difference-in-Differences Design			
	Expansion States	Non-Expansion States	Difference
Post: Rate of Drug Overdoses (after Medicaid expansion)	20.212	15.602	4.61
Pre: Rate of Drug Overdoses (before Medicaid expansion)	14.911	12.855	2.056
Difference	5.301	2.747	2.554
Note: This table calculates the simple difference in means between expansion states and non-expansion states.			

Table 3				
	Substance Use Disorder Treatment Facilities		Opioid Treatment Programs	
VARIABLES	Demographic Controls	Full Controls	Demographic Controls	Full Controls
Medicaid Expansion	39.3375*	43.2369**	2.5466+	2.9449+
	(16.652)	(16.366)	(1.472)	(1.524)
Post	-0.0705	-0.1722	-0.0398	-0.0429
	(0.208)	(0.214)	(0.033)	(0.034)
Post*Medicaid Expansion	0.0103	0.2759	0.0387*	0.0493**
	(0.178)	(0.191)	(0.015)	(0.019)
Rate of Drug Overdoses	0.0390	0.0259	-0.0061	-0.0072
	(0.027)	(0.029)	(0.005)	(0.005)
Rate of Opioid Overdoses	-0.0174	-0.0159	0.0064	0.0065
	(0.033)	(0.035)	(0.005)	(0.005)
Percent Female	199.5374+	207.1944+	0.4454	2.0372
	(107.672)	(113.194)	(13.474)	(14.015)
Percent White	42.1996**	41.3689**	0.1804	0.2787
	(15.334)	(13.585)	(1.493)	(1.451)
Population Density	-0.0029**	-0.0033**	-0.0001	-0.0002+
	(0.001)	(0.001)	(0.000)	(0.000)
Unemployment Rate	14.9378**	9.2883	1.8188*	1.4821
	(5.697)	(6.563)	(0.916)	(0.969)
GDP per Capita	0.0000044	0.00000501	-0.00000624+	-0.00000656+
	(0.0000349)	(0.0000346)	(0.00000335)	(0.00000341)
Political Partisanship		0.2576		0.0011
		(0.158)		(0.016)
Private Insurance Rate		-8.0069		-0.8320
		(6.596)		(0.860)
Medicaid Rate		-12.2065*		-0.6901
		(5.885)		(0.465)
Observations	353	353	353	353
R-squared	0.963	0.964	0.957	0.957

Note: Universe is state-level data years for the years 2010-2016. Coefficients are from estimating Equation 1 as an OLS regression. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars. All regressions include state and year fixed effects.

Robust standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Table 4				
	Rate of Opioid Overdoses		Rate of Drug Overdoses	
VARIABLES	Demographic Controls	Full Controls	Demographic Controls	Full Controls
Medicaid Expansion	-37.2611	21.7830	24.0345**	7.4136
	(88.056)	(77.980)	(6.696)	(34.668)
Post	-0.9708	-0.6595	-1.7215+	-1.4267
	(0.742)	(0.784)	(0.898)	(1.000)
Post*Medicaid Expansion	1.9421**	1.9790*	2.3001**	2.6051**
	(0.629)	(0.784)	(0.662)	(0.811)
Percent Female	-798.2863+	-443.0818	-460.9408	-209.7821
	(438.778)	(451.365)	(345.087)	(324.504)
Percent White	26.5085	48.4760	19.3379	32.9187
	(74.868)	(69.945)	(73.718)	(71.192)
Population Density	0.0078	0.0030	0.0075	0.0027
	(0.005)	(0.005)	(0.007)	(0.006)
Unemployment Rate	-37.5182	-74.0481*	-17.3683	-54.3711
	(31.267)	(33.770)	(31.861)	(33.623)
GDP per Capita	0.00000581	-0.0000715	-0.0000115	-0.0000604
	(0.0001537)	(0.0001281)	(0.0001423)	(0.0001108)
Political Partisanship		-1.1076		-1.8367+
		(1.033)		(1.112)
Substance Use Disorder Treatment Facilities		0.1552		0.2172
		(0.396)		(0.357)
Opioid Treatment Programs		-0.2129		-1.6554
		(2.034)		(2.108)
Private Insurance Rate		-132.3823**		-140.9818**
		(24.485)		(25.064)
Medicaid Rate		-65.6705**		-78.5799**
		(20.243)		(22.301)
Observations	353	353	356	356
R-squared	0.829	0.853	0.842	0.870

Note:Universe is state-level data for the years 2010-2016. Coefficients are from estimating Equation 1 as an OLS regression. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars. All regressions include state and year fixed effects.

Robust standard errors in parentheses
** p<0.01, * p<0.05, + p<0.1

Table 5

	Rate of Opioid Overdoses		Rate of Drug Overdoses	
VARIABLES	Demographic Controls	Full Controls	Demographic Controls	Full Controls
Medicaid Expansion	31.9967	-8.6832	34.1613	10.0802
	(23.262)	(60.169)	(24.795)	(13.348)
Fake Post	1.7972+	1.9916*	1.1267	2.0220+
	(0.940)	(0.943)	(0.723)	(1.070)
Fake Post*Medicaid Expansion	0.4503	0.4720	0.1938	0.1512
	(0.324)	(0.333)	(0.353)	(0.362)
Percent Female	-356.1523	-377.2491	-345.2909	-319.1633
	(341.200)	(344.580)	(335.112)	(327.044)
Percent White	-28.9551	3.7070	-42.1547	-43.5625
	(63.853)	(55.168)	(68.439)	(63.854)
Population Density	0.0012	0.0004	-0.0020	-0.0017
	(0.002)	(0.002)	(0.003)	(0.003)
Unemployment Rate	55.2601*	57.4465*	39.3604	38.3675
	(25.596)	(25.179)	(29.482)	(30.209)
GDP per Capita	0.000058	0.0001	-0.0001	-0.0001
	(0.0001201)	(0.0001193)	(0.0000982)	(0.0000945)
Political Partisanship		-0.3088		34.2639
		(48.401)		(49.991)
Substance Use Disorder Treatment Facilities		-0.1653		0.1048
		(0.212)		(0.240)
Opioid Treatment Programs		4.8372*		1.1221
		(2.188)		(1.962)
Private Insurance Rate		-16.3243		-31.5253
		(23.504)		(23.260)
Medicaid Rate		-11.4847		-46.5518+
		(25.977)		(25.099)
Observations	203	200	203	200
R-squared	0.951	0.954	0.956	0.958

Note: Universe is state-level data years for the years 2010-2013. Coefficients are from estimating Equation 2 as an OLS regression. Fake post is a variable that creates a fake treatment in 2012 and 2013. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars. All regressions include state and year fixed effects.

Robust standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Table 6				
	Expansion States		Non-Expansion States	
VARIABLES	Pre	Post	Pre	Post
Drug Overdoses	15.27407	19.78219	12.85526	15.60175
Opioid Overdoses	9.264762	13.32329	7.153947	9.808772
Political Partisanship	0.6238532	0.5342466	0.2105263	0.1052632
Substance Use Disorder Treatment Facilities	6.05849	6.319748	5.729915	6.101069
Opioid Treatment Programs	0.379849	0.457793	0.2640613	0.2918149
Percent White	0.7087954	0.6921959	0.7202487	0.7093526
Population Density	140.0263	145.6085	100.775	104.1074
Unemployment Rate	0.0767706	0.0515479	0.0744342	0.0489649
GDP per Capita	47543.84	49072	42948.66	44384.21
Private Insurance Rate	0.6742303	0.6894753	0.6630632	0.688814
Medicaid Rate	0.1711404	0.2071589	0.1632382	0.1689123
Percent Female	0.5062	0.505611	0.5083461	0.5078491
Observations	109	73	76	57

Note: Universe is state-level data for the years 2010-2016. The pre-period includes years 2010-2013 for most states. Some states expanded their Medicaid programs after 2014, which is accounted for in the data set. This set of summary statistics removes Connecticut, Massachusetts, New York, New Jersey, and the District of Columbia from the data set. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars.

Table 7				
	Rate of Opioid Overdoses		Rate of Drug Overdoses	
VARIABLES	Demographic Controls	Full Controls	Demographic Controls	Full Controls
Medicaid Expansion	148.1895**	34.3200	115.0138*	114.3982*
	(46.382)	(48.749)	(48.223)	(54.534)
Post	-0.8958	-0.6768	-1.4905	-1.4269
	(0.716)	(0.790)	(0.905)	(0.957)
Post*Medicaid Expansion	1.6987*	1.9252*	2.2083**	2.9075**
	(0.660)	(0.854)	(0.685)	(0.853)
Percent Female	-647.0396+	-317.5042	-737.5324*	-426.6766
	(380.627)	(380.616)	(292.664)	(291.971)
Percent White	281.7284**	253.5586**	248.0860**	206.9713**
	(70.658)	(73.923)	(73.536)	(77.981)
Population Density	0.1696*	0.1401+	0.2246**	0.2012*
	(0.076)	(0.080)	(0.082)	(0.079)
Unemployment Rate	-1.3754	-19.3443	11.8869	-7.9455
	(31.897)	(33.808)	(31.371)	(33.770)
GDP per Capita	0.0000158	-0.0000677	-0.000035	-0.0001
	(0.0001158)	(0.000107)	(0.000118)	(0.0001035)
Political Partisanship		-2.0326+		-2.2449*
		(1.066)		(1.124)
Substance Use Disorder Treatment Facilities		0.1670		0.2577
		(0.409)		(0.376)
Opioid Treatment Programs		-0.7379		-4.6057+
		(3.033)		(2.708)
Private Insurance Rate		-74.0793**		-97.7189**
		(27.143)		(27.864)
Medicaid Rate		-40.1114+		-60.5417**
		(21.451)		(23.303)
Observations	311	311	314	314
R-squared	0.851	0.862	0.865	0.882

Note: Universe is state-level data years for the years 2010-2016. Coefficients are from estimating Equation 1 as an OLS regression. This set of regressions removes Connecticut, Massachusetts, New York, New Jersey, and the District of Columbia from the data set. The rate of drug overdoses also includes opioid overdoses. Rate of Drug Overdoses, Rate of Opioid Overdoses, Substance Use Disorder Treatment Facilities, and Opioid Treatment Programs, are measured per 100,000 people. Population Density is measured in people per square mile. GDP per Capita is calculated in 2009 dollars. All regressions include state and year fixed effects.

Robust standard errors in parentheses

** p<0.01, * p<0.05, + p<0.1

Figure 1:

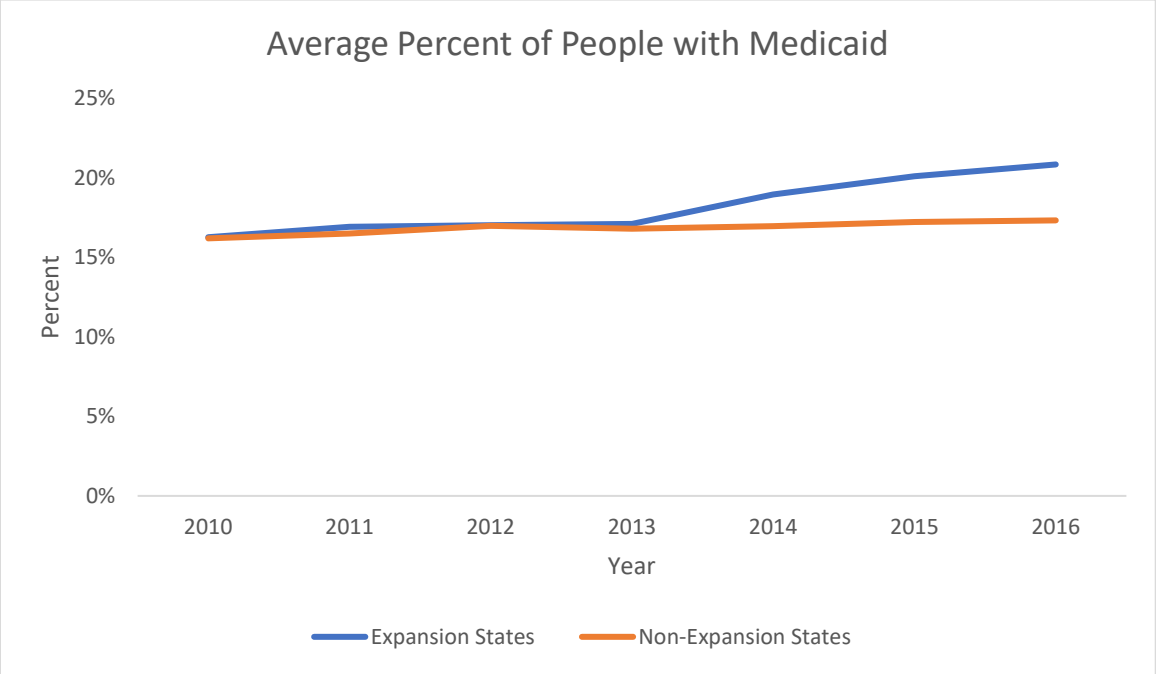


Figure 2:

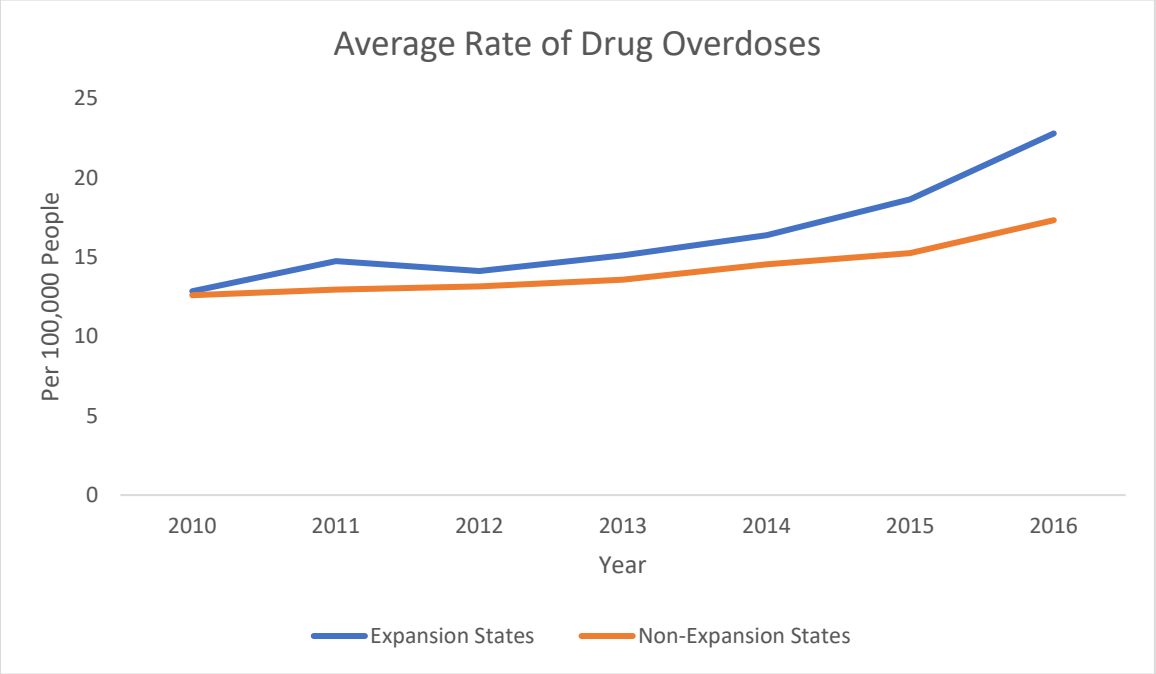
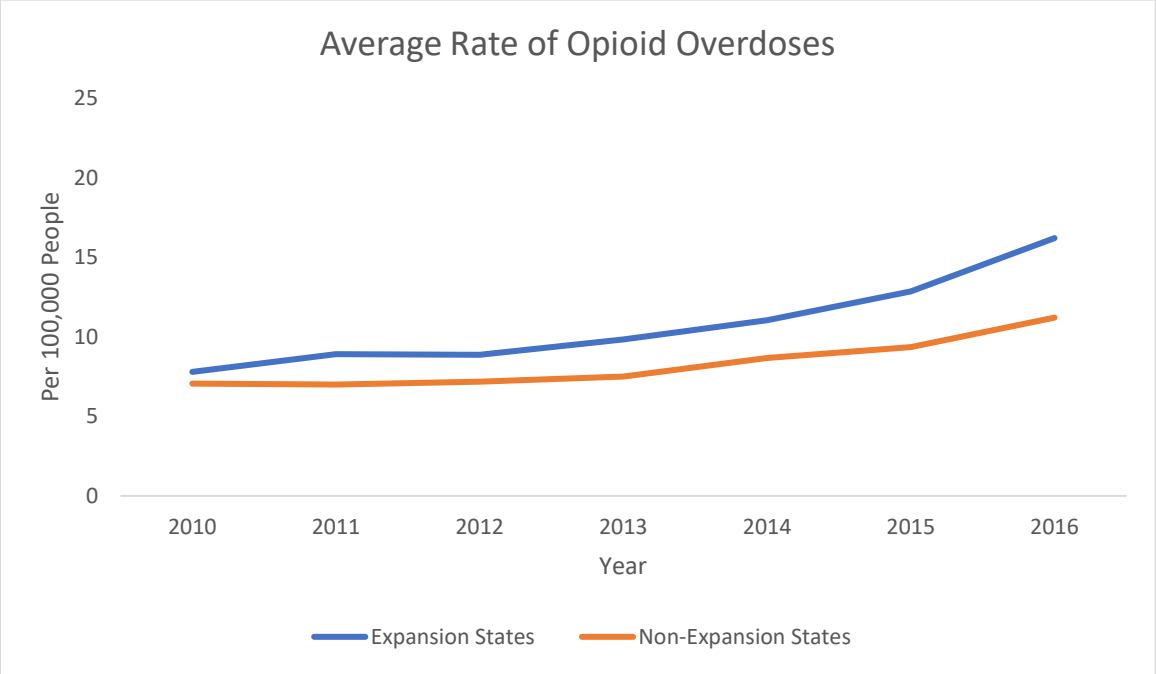


Figure 3:


Average Rate of Opioid Overdoses
Per 100,000 People
25
20
15
10
5
0
2010
2011
2012
2013
2014
2015
2016
Year
Expansion States
Non-Expansion States

References

Currie, J., and J. Gruber. 1996. "Health Insurance Eligibility, Utilization of Medical Care, and Child Health," *The Quarterly Journal of Economics*. 111(2), pp. 431-466.

Doleac, J.L., and A. Mukherjee. 2018. "The Moral Hazard of Lifesaving Innovations: Naloxone Access, Opioid Abuse, and Crime," *SSRN*. pp. 1-66.

Dubay, L., T. Joyce, R. Kaestner, and G. Kenney. 2001. "Changes in Prenatal Care Timing and Low Birth Weight by Race and Socioeconomic Status: Implications for Medicaid Expansions for Pregnant Women," *Health Services Research*. 36(2), pp. 373-398.

Epstein, A., and J. Newhouse. 1998. "Impact of Medicaid Expansion on Early Prenatal Care and Health Outcomes," *Health Care Financing Review*. 19(4), pp.85-99.

Finkelstein, A., S. Taubman, B. Wright, M. Bernstein, J. Gruber, J.P. Newhouse, H. Allen, and K. Baicker. 2012. "The Oregon Health Insurance Experiment: Evidence from the First Year," *The Quarterly Journal of Economics*. 127(3), pp. 1057-1106.

Ghosh, A., K. Simon, and B.D. Sommers. 2017. "The Effect of State Medicaid Expansions on Prescription Drug Use: Evidence from the Affordable Care Act," *National Bureau of Economic Research Working Papers Series*. No. 23044, pp. 1-35.

Gruber, J. 2000. "Medicaid," *National Bureau of Economic Research Working Papers Series*. No. 7829, pp. 1-101.

Gruber, J., and A. Yelowitz. 1999. "Public Health Insurance and Private Savings," *Journal of Political Economy*. 107(6), 1249-1274.

Hass, J.S., S. Udarhelyi, C.N.Morris, and A.M. Epstein. 1993. "The Effect of Providing Health Coverage to Poor Uninsured Pregnant Women in Massachusetts," *Journal of the American Medical Association*. 269(1), pp.87-91.

Hefei, W., J.M. Hockenberry, T.F. Borders, and B.G. Druss. 2017. "Impact of Medicaid Expansion on Medicaid-covered Utilization of Buprenorphine for Opioid Use Disorder Treatment," *Medical Care*. 55(4), pp. 336-341.

Kaestner, R., T. Joyce, and A. Racine. 1999. "Does Publicly Provided Health Insurance Improve the Health of Low Income Children in the United States?," *National Bureau of Economic Research Working Papers Series*. No. 6887 pp. 1-27.

Kotlikoff, L.J. 1988. "Health Expenditures and Precautionary Saving," in L. Kotlikoff, ed., *What Determines Saving?* Cambridge: MIT Press.

Lopez, G. November 29, 2018. "Drug overdose deaths were so bad in 2017, they reduced overall life expectancy," *Vox*. Retrieved from: https://www.vox.com/science-and-

health/2018/11/29/18117906/opioid-epidemic-drug-overdose-deaths-2017-life-expectancy.

Maclean, J.C., and B. Saloner. 2017. "The Effect of Public Insurance Expansions on Substance Use Disorder Treatment: Evidence from the Affordable Care Act," *National Bureau of Economic Research Working Papers Series*. No. 23342, pp. 1-61.

Meinhofer, A., and A.E. Witman. 2018. "The role of health insurance on treatment for opioid use disorders: Evidence from the Affordable Care Act Medicaid expansion," *Journal of Health Economics*. 60, pp. 177-197.

Nilsen, E. August 8, 2017. "Why it's so much easier to get an opioid prescription in the US than in Europe or Japan," *Vox*. Retrieved from: https://www.vox.com/policy-and-politics/2017/8/8/16049952/opioid-prescription-us-europe-japan.

Piper, J., W. Riley, and M. Griffin. 1990. "The Effects of Medicaid Eligibility Expansion on Prenatal Care and Pregnancy Outcomes in Tennessee," *Journal of the American Medical Association*. 264, pp.2219-2223.

Powell, D. R.L. Pacula, and E.A. Taylor. 2017. "How Increasing Medical Access to Opioids Contributes to the Opioid Epidemic: Evidence from Medicare Part D," *Rand Working Paper Series*. No. 21072, pp. 1-50.

Rummans, T.A., M.C. Burton, and N.L. Dawson. 2018. "How Good Intentions Contributed to Bad Outcomes: The Opioid Crisis," *Mayo Clinic Proceedings*. 93(3), pp. 344-350.

Saloner, B., S. Bandara, M. Bachhuber, C.L. Barry. 2017. "Insurance Coverage and Treatment Use Under the Affordable Care Act Among Adults with Mental and Substance Use Disorders," *Psychiatric Services*. 68(6), pp. 542-548.

Sharp, A, A. Jones, J. Sherwood, O. Kutsa, B. Honermann, and G. Millett. 2018. "Impact of Medicaid Expansion on Access to Opioid Analgesic Medications and Medication-Assisted Treatment," *American Journal of Public Health*. 108(5), pp. 642-648.

Simon, K., A. Soni, J. Cawley. 2016. "The Impact of Health Insurance on Preventive Care and Health Behaviors: Evidence from the First Two Years of the ACA Medicaid Expansions," *Journal of Policy Analysis and Management*. 36(2), pp. 390-417.

The Henry J. Kaiser Family Foundation. Status of State Action on the Medicaid Expansion Decision. Retrieved on February 21, 2018, from: https://www.kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.

Venkataramani, A.S., and P. Chatterjee. 2018. “Early Medicaid Expansions and Drug Overdose Mortality in the USA: a Quasi-experimental Analysis,” *Journal of Internal Medicine*. pp. 1-3.

Wen, H., J.M. Hockenberry, and J.R. Cummings. 2017. “The effect of Medicaid expansion on crime reduction: Evidence from HIFA-waiver expansions,” *Journal of Public Economics*. 154, pp. 67-94.