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The Effect of the Dependent Coverage Provision of the Affordable Care
Act on Opioid Use and Abuse

by

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of the requirements for the degree of
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Abstract

The non-medical use of prescription opioids has become the fastest growing drug problem in the United States. The economics literature offers little evidence about the causal relationship between extending insurance coverage, which increases access to opioids, and the prevalence of the epidemic. I leverage a non-linear difference-in-differences design to examine the impact of the dependent coverage provision of the Affordable Care Act (ACA) on the prevalence of prescription opioid misuse and abuse. Consequently, I study some of the mechanisms driving my results. I draw on a sample of responses of non-institutionalized individuals using data from the National Survey of Drug Use and Health (NSDUH) from 2008 to 2014. I find that the expansion is associated with an 11.2% decline in prescription opioid misuse and a 25% decrease in opioid abuse among young adults. In addition, I find evidence of a possible substitution effect in the setting in which young adults receive treatment for their drug disorders. Results show that young adults are 18.6% more likely to receive outpatient treatment as a consequence of gaining private coverage from the provision.

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1 Introduction and Motivation

The current opioid epidemic is the fastest growing drug problem in the United States. Since its beginning in 1999, more than 400,000 people have died from a drug overdose involving opioids (CDC, 2018)¹. Deaths from prescription pain relievers have been the dominant driver of the epidemic (Powell, Pacula & Taylor, 2015). In 2016, about 19,354 people died from overdoses involving prescription opioids (National Institute on Drug Abuse, 2018).² Due to the magnitude of the problem, in 2014 the Center for Disease Control and Prevention added preventing opioid abuse to its list of top five public health challenges (Kolodny et al., 2015).

Overdose deaths are, however, extreme cases of the problem. The epidemic is much more severe when other factors are considered such as morbidity related to the prevalence of opioid misuse. The share of individuals using opioid pain relievers non-medically has been growing steadily in the past decade, and to an extent that it is now being considered a public health crisis. (Kolodny et al., 2015)

Young adults are particularly at higher risk of having opioid pain reliever disorders. (Alpert, Pacula & Taylor, 2015; Grecu, Dave & Saffer, 2017). In 2016, 3.3 million people in the United States reported having misused opioid pain relievers, with young adults accounting for the largest percentage. About 7.1% of individuals aged 18-25 report having misused pain relievers in the past year (SAMHSA, 2017).³

An early provision of the Affordable Care Act might have contributed to the problem. In 2010, the Obama administration passed a mandate that allowed individuals to remain under their parents' private health insurance coverage until they turn 26 years of age. The young adult provision expanded coverage to more than two million individuals (Antwi, Moriya & Simon, 2015). Spillovers from this coverage extension may be reflected in the rate of opioid misuse.

¹<https://www.cdc.gov/drugoverdose/epidemic/index.html>. Accessed on 2018-12-22

²<https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates>. Accessed on 2018-12-22

³<https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR1-2016/NSDUH-FFR1-2016.htm>opioid. Accessed on 2018-12-22

In this study, I examine the impact of the young adult provision on the prevalence of opioid pain reliever misuse and abuse. I draw on a sample of responses of non-institutionalized individuals using data from the National Survey of Drug Use and Health (NSDUH). Following the literature that has examined the dependent coverage provision and the opioid epidemic, I apply a non-linear difference-in-difference model. I classify individuals aged 22-25 in the treatment group and compare them to a control group of older individuals aged 26-29 that were not affected by the provision. I consider three sets of outcomes: health insurance status, opioid use disorders measured by opioid misuse and abuse, and the settings in which treatment for substance use disorders is received.

The underlying hypothesis of this study is that access to the healthcare system, through the obtainment of private insurance coverage, can impact opioid pain reliever misuse and abuse in opposite directions through different mechanisms. First, gaining private coverage increases the demand for medical care, which can also increase access to prescriptions for pain relievers from physicians. This may provide incentives for misusers to get involved in unscrupulous schemes to obtain pain relievers. For example, misusers might seek prescriptions from multiple doctors, a practice is known as "doctor shopping". If this is the case, one can expect the prevalence of pain reliever misuse to rise due to the negative externality produced by the expansion to opioid access.

Alternatively, acquiring private health insurance coverage improves access to substance abuse treatment. The gain of private coverage provides a new source of payment for substance use disorder treatment, reducing the out-of-pocket costs for newly insured individuals (Saloner et al., 2018). If individuals decide to take advantage of these benefits and seek rehabilitation and detoxification therapies, one can expect the prevalence of opioid misuse to fall. This effect would be greater in magnitude, particularly among young adults with substance use disorders given their historically low rates of insurance.

The ACA's dependent coverage provision could also change the settings and types of care received by individuals needing treatment, especially among the previously

uninsured. Young adults with opioid use disorders may replace daily visits to public sector, safety net providers, that accept uninsured patients for medication-assisted treatment (MAT) provided at a private physicians office (Saloner et al., 2018; Meinhoffer and Witman, 2018). Saloner et al. (2018) find that admissions of young adults to specialty inpatient treatment facilities declined by 11% after the ACA's dependent coverage mandate went into effect. Similarly, Meinhoffer and Witman (2018) find that the 2014 Medicaid expansion resulted in increased admissions to treatment in outpatient settings for rehabilitation involving MAT. Meanwhile, inpatient treatment for rehabilitation remained unchanged. In addition, entry into coordinated care can significantly improve individuals' overall health. Access to suitable care and improvements in young adults' health may lead to a decline in the prevalence of opioid misuse among this group.

Newly insured individuals will be subject to prescription laws and regulations once they formally enter the health care system. This can potentially increase the difficulty for misusers to obtain opioids regardless of the recently gained access to prescriptions. Evidence on the effect of these programs, such as Prescription Monitoring Programs (PDMs), on opioid-related outcomes is mixed. Early studies find no significant impact of these programs on reducing the prevalence of opioid misuse. However, recent work on this topic documents that "mandatory-access" provisions have significantly reduced measures of opioid misuse as well as overlapping prescribing and doctor shopping behavior (Jena et al., 2014; Buchmuller & Carey, 2010; Grecu et al., 2017; Bao et al., 2016; Ali et al., 2017).

The impact of the ACA's private coverage expansion on opioid misuse is ambiguous and therefore subject to an empirical study. The economics literature, thus far, has offered little evidence on the externalities associated with extending medical access to populations with disproportionately low rates of insurance such as young adults with possible drug disorders. The ACA's young adult provision provides a unique opportunity to study the causal implications and mechanisms underlying the opioid epidemic. My analysis exploits the exogenous expansion in health insurance coverage

among a segment of young adults to explore the effects of the mandate on the prevalence of opioid misuse and abuse.

This paper makes three important contributions to the growing literature on the opioid crisis. First, to the best of my knowledge, this is the first study that uses the ACA's dependent coverage provision, as a natural experiment, to look at the externalities resulting from extending private coverage to young adults on the prevalence of opioid misuse and abuse. Second, it extends prior studies to test the impact of the expansion on treatment for substance use disorders using four years of post-enactment data. Third, I implement a non-linear difference-in-differences design to obtain estimates on the marginal effects of the young adult provision.

The rest of the paper is organized as follows. In section 2, I provide a background on the opioid epidemic and the ACA's dependent coverage provision. Section 3 presents a review of results from the recent literature. Section 4 describes the data used and provides summary statistics. Section 5 describes my empirical approach. In section 6, I present results for the marginal effects of the young adult provision. Section 7 explains the limitation of the study. Section 8 presents a thorough discussion of the results obtained from the non-linear difference-in-differences design. Section 9 contains the conclusion.

2 Background

2.1 The Opioid Epidemic

It is believed that the current opioid epidemic began in the late 1990s. Today, it has become the largest and fastest growing drug problem in the United States (Meinhofer and Witman, 2018). From 1999 to 2017, more than 400,000 people have died from an overdose involving some type of opioid (prescription and illicit opioids). In 2017 alone, approximately 70,200 people died from an opioid overdose (CDC, 2018). The figure from 2017 is six times larger in comparison to 1999. The unprecedented increase in opioid abuse, has led the Center for Disease Control and Prevention to call this the

worst drug epidemic in U.S. history (Kolodny et al., 2015).

Unlike other illegal drugs, opioid pain relievers, which historically have been the main driver of the epidemic, have legitimate medical functions (Powell, Pacula & Taylor, 2018). Several organizations including the American Pain Society, the American Academy of Pain and Medicine, and other pain patient groups advocated for a campaign which encouraged health care professionals to assess pain as the fifth vital sign and urged a more aggressive use of opioids to treat chronic non-cancer pain (Kolodny et al., 2015). Shortly after, as a consequence of the campaign, physicians started using opioid pain relievers as first-line therapy for treating chronic pain. However, they often neglected the high risks for addiction associated with pain relievers.

Over the years, physicians developed over-prescribing behaviors, especially those with limited training in pain management such as primary care doctors. As a result, the total number of prescriptions filled for opioid pain relievers more than doubled to 274 million in just one decade (Dave, Deza and Horn, 2018). For example, the number of Oxycontin prescriptions for non-cancer pain increased nearly tenfold from 1999 to 2002 (Alpert et al., 2018). The increased supply of opioid pain relievers led to high levels of diversion to non-medical use fueling the epidemic.

Legitimate prescriptions filled by physicians remain as an important source of supply of opioids for misusers. In 2016, about 4.3 million people indicated that they obtained pain relievers through prescriptions either from one or multiple doctors (SAMHSA, 2017). This statistic could be even greater if we consider the fact that prescription for pain relievers are also a significant supply source to tertiary channels such as street dealing and misusers' friends and relatives (Simeone, 2017). Alpert et al. (2016) find evidence of plausible spillovers from the increased access to opioids given by the implementation of Medicare Part D. This relative expansion in opioid supply resulted in the escalation of admissions for opioid abuse treatment and opioid related mortality among younger individuals who were not eligible for the program's benefits (Alpert et al., 2016). These effects were, not surprisingly, higher among young adults.

The economic burden of the current opioid epidemic including health care, criminal

justice costs, and costs due to the loss in productivity was estimated to be around \$78 million in 2013 (Florence et al.,2016).

2.2 The Affordable Care Act’s Dependent Coverage Provision

The main objective of the Patient Protection and Affordable Care Act (ACA) has been to “expand health insurance coverage to populations with historically limited access to healthcare services” (Saloner, Antwi, Maclean & Cook, 2018). The dependent coverage mandate is an early provision that allowed young individuals to remain as dependents under their parents’ private health insurance plans until they turn 26 years of age.

The provision was implemented in September 2010 with the intention of addressing the issue of the historically high rates of uninsured young adults relative to other age groups. Prior to the ACA, the loss of insurance coverage among the non-elderly peaked at ages 21 to 23 and close to 40% (Antwi, Moriya & Simon, 2013). The main reason for young adults’ lack of coverage was because they aged out of their parents’ private plans. Insurers would normally drop non-student dependents at age 19 and student dependents at age 23 (Deb & Norton, 2018). Empirical evidence shows that the expansion achieved its desired goal by increasing the number of insured young adults by over two million individuals (Antwi, Moriya and Simon, 2012; Sommers, Buchmuller, Carey & Kronick, 2012). In addition, Sommers et al. (2013) find a 5.1 percentage point increase in private insurance coverage among individuals aged 19-25 using data from the 2005-2011 National Health Interview Survey (NHIS).

The prevalence of mental health and substance use disorders peak at young adulthood (SAMHSA, 2017), and insurance coverage has been historically low among the overall population with behavioral problems. Because of these reasons, the dependent coverage provision has the potential of being substantially important for young adults with such disorders by providing them with coverage for treatment. In the past, addiction services were provided in separate specialty care addiction treatment programs. Financing for such services was provided by the government and other public sources separately from healthcare coverage. (McLellan & Woodworth, 2014). To address this

issue, the ACA requires health insurance plans to offer coverage for substance use disorders as one of the ten essential health benefits (McLellan & Woodworth, 2014). This means that the provision has the potential to curb the opioid epidemic by extending the availability of coverage to previously uninsured young adults. A priori, it is uncertain whether the newly insured will take advantage of this benefits.

3 Review of the Literature

3.1 Medicaid Expansion, Full Implementation of the ACA and Medicare Part-D

A substantial portion of the literature has looked at the effect of other provisions of the ACA on substance and opioid use disorders. The literature agrees that expansions of insurance coverage have increased utilization for substance and opioid use treatment. There is also evidence that insurance coverage has decreased the financial barriers to treatment, as well as the share of uninsured individuals.

Meinhoffer & Witman (2018) look at the impact of the 2014 ACAs Medicaid expansion on treatment utilization for opioid use disorders using data from 2008-2016 TEDs. They find that treatment admissions increased by 5.4 percentage points (18%) in expansion states. This overall increase in treatment utilization was driven by a substantial increase in Medicaid coverage (113%). Their results show evidence of a dynamic substitution towards outpatient treatment for opioid addiction in expansion states. They find that outpatient treatment involving MAT increased by 5.3 percentage points. Meanwhile, inpatient treatment for opioids remained unaffected.

Ali et al., (2015) and McKenna (2017) analyze the impact of the national implementation of the ACA. They find that the full expansion of health insurance coverage increased treatment utilization for substance and opioid use disorders among adults. Although, this effect is conditional on perceiving a need for treatment (Ali et al., 2015). The share of the uninsured declined as a result of the ACA implementation. McKenna (2017) finds that after the coverage expansion, adults with opioid use disorders were

more likely to report that insurance paid for their treatment.

Powell et al. (2015), use the introduction of the Medicare Prescription Drug Benefit Program (Medicare Part-D) to estimate the effects of the differential increased supply of opioid pain relievers in states with larger portions of elderly individuals on abuse and overdose deaths among populations that are not eligible for Part-D. They show that the increased supply of opioids resulting from the implementation of Part-D caused economically important levels of diversion for non-medical purposes. They find that a 10% increase in opioid medical distribution leads to a 7.4% increase in opioid related deaths and a 14.1% increase in substance abuse treatment admissions. Effects were larger among young adults.

3.2 The Affordable Care Act's Dependent Coverage Provision

The literature on the dependent coverage provision coincides that the expansion of private coverage reduced the share of uninsured young adults. Furthermore, the provision decreased out-of-pocket spending, which increased the demand for medical services. The literature on behavioral health gives mixed results. On one hand, the provision has increased treatment utilization for mental health services, but on the other hand, there exists limited evidence of the expansions' effect on treatment for substance use disorders.

Antwi, Moriya & Simon (2015) use data from the Nationwide Inpatient Sample (NIS) from 2007 to 2011 and show that the prevalence of uninsured young adults hospitalized declined by 10.8% as a result of the expansion. Inpatient hospital visits increased by 3.5% among individuals 23-25 years of age, while, mental health visits also increased by 5.5%.

Ali et al. (2016) and Deb & Norton (2018) show evidence of a decline in healthcare spending caused by the provision's implementation. This could have led to changes in location settings where young adults seek attention. For example, Deb & Norton (2018) find that the number of office-based visits increased by 42.7 percentage points, while there was a small reduction of 4.3 percentage points in emergency room visits.

These results were robust across several types of non-linear specifications.

At least two studies have examined the impact of the dependent coverage provision on treatment for mental and substance use disorders. Saloner et al. (2014), using data from the 2008-2012 NSDUH find that mental health treatment increased by 5.3 percentage points for a subset sample of individuals aged 18-25 with possible mental disorders. For people using mental health treatment, uninsured visits declined by 12.4 percentage points. Whereas, the share of young adults with private insurance increased by 12.9 percentage points. The authors were unable to find any effect of the provision on treatment utilization for substance use disorders. In a different study, however, Saloner, Antwi, Maclean and Cook (2018) use admissions data from the Treatment Episode Data Set (TEDS) and find that admissions to treatment for substance use disorders declined by 85.6 percentage points (11%) after the expansion for individuals ages 21-24. In addition, the share of young adults covered by private insurance increased by 5.4 percentage points and the share with private payments increased by 3.7 percentage points.

The existent literature has studied the effects of extending health insurance coverage on treatment utilization among young adults with substance use disorders. However, no study has focused on the unintended effects that the dependent coverage provision has had on the prevalence of non-medical use of opioid pain relievers among young adults.

3.3 State Laws and Other Regulations Designed to Restrict Access to Opioid Pain Relievers

State level Prescription Drug Monitoring Programs (PDMPs) are among the most studied policies designed to combat the current prescription opioid crisis.

PDMPs are statewide databases designed to curtail access to prescription opioids by tracking the prescribing and dispensing of controlled substances (Dave, Deza & Horn, 2018). The literature provides limited evidence on the efficacy of these programs. Early studies find no effects of PDMPs on opioid related outcomes. However, recent

studies have identified that PDMPs with mandatory provisions implemented in some states have reduced the number of opioid related admissions to treatment and doctor shopping behavior.

Jena et al. (2014) use data from a national sample of U.S. Medicare beneficiaries in 2010 and find that PDMPs have no impact in the number of prescriptions filled by multiple providers. Ali, Classen, Mutter and Novak (2017) use 2004-2014 NSDUH data to examine the impact of PDMPs on individual level opioid related outcomes among adults. They find no significant impact of a PDMP implementation on the non-medical use, abuse and initiation of opioid pain relievers. In addition, they do not find a significant effect on initiation and use of heroin. However, they show evidence of a reduction in doctor shopping behavior caused by the implementation of PDMPs. Furthermore, Bao et al. (2016) assess the effects of PDMP implementations on the prescribing of opioids with the purpose of managing pain in the ambulatory care sector. Results from their analysis indicate that the implementation of PDMPs are associated with a 30% reduction of prescriptions for schedule II opioids, relative to the rate of prescribing prior implementation.

Greco, Dave and Saffer (2017) use data from the Treatment Episodes Data Set from 2002 to 2016 to determine the differential effects of mandatory access provisions for PDMP utilization. Using a difference-in-difference model, the authors find that the adoption of a mandatory access provision reduced opioid related treatment admissions by 20 to 26%, relative to the sample mean for adopting states in the year prior implementation. The authors' results suggest that there are some heterogeneous effects among age groups. Their estimates indicate that the impact is larger for young adults. Mandatory access PDMPs reduced opioid related admissions by 5.8 fewer admissions per 10,000 individuals ages 18 to 24. Buchmuller and Carey (2018) apply difference-in-difference models to aggregated claims data from the Medicare prescription Drug Program (Medicare Part-D) to evaluate the effect of PDMPs on prescription drug utilization among Medicare Beneficiaries. The authors' results show that mandatory access programs decreased the share of Part-D beneficiaries taking opioids by 2.4%.

They also find evidence of a 6% decline in the share of opioid takers with overlapping claims and a 5% decline in the share of takers with more than seven-months supply. However, their results do not find a significant effect on opioid poisoning incidents. In addition, the previous studies show that those PDMPs that do not require providers' participation are not effective in reducing non-medical use of prescription opioids.

In another largely recognized study, Alpert, Powell and Pacula (2018) use the introduction of an abuse deterrent version of Oxycontin as a natural experiment to examine the implications of a supply side disruption of a highly abusable opioid. The authors leverage data from multiple sources including the National Survey on Drug Use and Health (NSDUH), administrative data from the Drug Enforcement Administration (DEA) as well as data from the National Vital Statistics System (NVSS). Exploring cross state variation in Oxycontin exposure, they find that states with higher rates of Oxycontin misuse experienced disproportionate increases in heroin deaths. Specifically, a 1 percentage point increase in initial Oxycontin exposure led to an increase of 2.2 heroin overdose deaths per 100,000 people in 2013. Their findings suggest a substitution effect towards illegal opioids produced by the supply disruption of Oxycontin.

4 Methods

4.1 Non-linear Difference-in-Differences

Following the literature on the dependent coverage provision, I use a non-linear difference-in-difference to derive the incremental effects of the policy. In non-linear DD models, the identification of the sign and magnitude of the treatment effect is not as easily derived as in linear DD models. Puhani (2012) explains that for non-linear models, the treatment effect is not a simple cross difference, but a difference between cross differences. An easier way to motivate the treatment effect in a non-linear DD model is to view the model in a potential outcomes framework. In this framework, the potential outcome corresponding to treatment in the treated group is observed. The potential outcome corresponding to the treated group in the treated period not receiving treat-

ment is not observed, but is estimated in the regression model. The treatment effect is an estimate of the difference between these two potential outcomes.

For simplicity, consider a binary indicator for the group of individuals of ages 22-25 ($Treat = 1$) denoting the treatment group, a binary time indicator ($Post = 1$) denoting the years after the implementation of the young adult provision, and a vector X denoting a set of covariates that control for demographic characteristics. Then, consider a logit regression specification in a DD design for binary outcomes such as insurance status, opioid misuse and abuse, and treatment settings for substance use disorders:

$$E[Y] = \Lambda(\beta_0 + \beta_1 Treat + \beta_2 Post + \beta_3(Treat * Post) + X\Theta) \quad (1)$$

Then Puhani (2012) shows that the treatment effect is given by

$$\tau = E[Y^1|Treat = 1, Post = 1, X] - E[Y^0|Treat = 1, Post = 1, X] \quad (2)$$

Where Y^1 and Y^0 denote potential outcomes with and without the treatment policy respectively. In the regression specification,

$$\tau = \Lambda(\beta_0 + \beta_1 + \beta_2 + \beta_3 + X\Theta) - \Lambda(\beta_0 + \beta_1 + \beta_2 + X\Theta) \quad (3)$$

In addition my models include age and year fixed effects that control for time invariant determinants of Y . Standard errors are clustered by age and year. All models include indicators for age group and for the time period when the individual is observed. In addition, the preferred specification includes covariates that control for gender, race or ethnicity and for residence in a metropolitan area. Controls for education and income levels were not included in the preferred specification due to a concern for potential endogeneity which could bias my estimates.

5 Data

This study utilizes pooled data from the 2008-2014 National Survey of Drug Use and Health (NSDUH).⁴ The NSDUH is an annual cross-sectional, nationally representative

⁴Data was obtained from <https://www.datafiles.samhsa.gov/study-series/national-survey-drug-use-and-health-nsduh-nid13517>

survey of non-institutionalized individuals in the United States. It is conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA). The NSDUH collects detailed information on the use and abuse of drugs and alcohol, mental health problems and behavioral health treatment utilization. The survey provides information on self-reported insurance status as well as non-medical opioid pain reliever misuse within the past year. It also asks respondents questions to assess symptoms of opioid use disorders (dependence and abuse) using screening criteria from the *Diagnostic and Statistical Manual of Mental Disorders (DMS-IV)* (Ali et al., 2015). These measures capture personal, legal and school or employment problems related to the non-medical use of opioid pain relievers as well as problems in reducing their non-medical consumption (Saloner & Cook, 2014). For example, if respondents report having misused opioid pain relievers, they would be asked questions about dependence such as whether they experienced withdrawal symptoms after cutting back on the substance. Respondents are also asked questions regarding abuse symptoms. For example, whether they have had any problems with family, friend or with the law, related to their misuse of opioids during the past year. Also, whether they have continued misusing opioids despite the occurrence of these problems.

The NSDUH is a convenient source of data for the study of the opioid epidemic for two reasons. First, questions regarding opioid pain reliever misuse direct respondents to provide information about prescription pain relievers specifically, and not over-the-counter painkillers such as Aspirin. Second, respondents are told to report on their non-medical use of opioid pain relievers only. The NSDUH defines misuse as either: a) using pain relievers not prescribed to the respondent; or b) the respondent took the drug only for the experience or feeling caused as a result of taking the drug.

5.1 Outcomes

This paper examines several sets of outcomes which include health insurance status, opioid use disorders, and the setting in which treatment for substance use disorders was received.

Health insurance status is measured by the type of insurance coverage reported by respondents (e.g. uninsured, covered by private health insurance, and any type of health insurance coverage). These three variables are binary and obtain the value of one if the observation reports having any type of insurance coverage, being covered by a private plan, and being uninsured, and zero otherwise.

The set of opioid use disorders outcomes are measured by several dependent variables. First, I look at self-reported non-medical use of opioid pain relievers in the past month and year. Misuse of opioid pain relievers are binary variables that obtain the value of one if the individual reports having misused opioids in the past month and year, and zero otherwise. In order to mitigate recall bias and for consistency with other variables, misuse in the past year is the preferred outcome.

In addition, two outcomes measuring the respondents abuse and dependence of pain relievers are considered. The first outcome includes both categories: abusers and dependents. The second outcome excludes dependents in order to estimate the impact of gaining coverage on opioid abuse.

As mentioned above, the NSDUH determines whether individuals had problems concerning opioid abuse and dependence based on criteria from the Diagnostic and Statistical Manual of Mental disorders, Fourth edition (DSM-IV). Dependence and Abuse of pain relievers are two mutually exclusive categories with dependence taking precedence. Respondents are categorized as having pain reliever dependence if they report a positive response to three or more of the six questions regarding substance dependence plus a seventh question regarding withdrawal symptoms. Likewise, respondents are categorized as having abused pain relievers if they report a positive response to one or more of the four questions regarding social problems related to opioids and were determined not to be dependent upon pain relievers.

Outcomes for substance use treatment settings are measured by the type of location where respondents received current or past year treatment for their drug disorders. Following Ali et al. (2015) I have aggregated treatment locations into inpatient setting and outpatient setting. Inpatient setting is a binary variable that takes the value of

one if individuals have received treatment overnight at a hospital or if individuals have received treatment in a residential rehabilitation facility and zero otherwise.

In a similar manner, the variable for outpatient treatment takes the value of one if individuals have received treatment for their drug disorders at a rehabilitation facility (not overnight), mental health care center or a private doctor's office in the past year and zero otherwise. Also, a variable for treatment received at the emergency room is included as an outcome.

This study does not include those who received treatment through self-help groups. This is because these types of treatments are usually not covered by health insurance and therefore, do not relate to the insurance coverage expansion (Ali et al., 2015). One limitation of the NSDUH is that treatment for opioid use is not reported by location. Instead, the outcomes aggregated by treatment setting include other drugs such as cocaine, heroin, tranquilizers and stimulants in addition to pain relievers. However, the survey reports opioid treatment received at any location. I consider this variable to estimate the overall impact of gaining insurance coverage on utilization for opioid treatment.

5.2 Summary Statistics

The data restricted to 22-29-year-old individuals has 18,849 observations. Table 1 reports summary statistics for treatment and control groups in the pre-expansion period (2008, 2009, 2010) and in the full study period. As expected, demographic means are similar among the treated and control groups with the exemption of their marital status, education and income levels. Among the 22-25 year-olds in the treated group, 53.3% are females, 12.7% are black, 17.7% are Hispanic, 9.4% are from another race, and 21.7% are married in the pre-mandate period. Among the 26-29-year-old control group 53.6% of individuals are females, 11.9% are black, 19.8% are Hispanic, 9.9% are from another race and 40.6% are married in the pre-expansion period.

The younger treated group is, on average, more educated than the older comparison group at the high school and some college level with 29.2% and 30.6% respectively.

Whereas, these rates for the older group are 27.9% and 26.4% respectively. However, young adults are less educated at the college or higher education level (25.7%). Whereas, 30.3% of older individuals have graduated college.

Young adults are relatively poorer than their counterparts as 29.7% of individuals in this group have a total family income of less than \$19,000 per year, 39.5% have a total family income between \$20,000 and \$49,000 per year, 14.8% have an annual family income between \$50,000 and \$74,000 , and only 16% earn \$75,000 or more annually in the pre-expansion period. Whereas, 21.2% of older individuals have a total family income of less than \$19,000 per year, 40.87% have a total family income between \$20,000 and \$49,000 per year, 19.2% have an annual total family income between \$50,000 and \$74,000 and 18.78% earn \$75,000 or more annually in the pre-expansion period.

As shown in Table 2, Insurance status differs substantially among treated and control groups in the pre-expansion period. Only Medicaid coverage rates are similar for both groups with 13.9% of 22-25 year-olds and 13.5% of 26-29 year-olds being covered through Medicaid. Among Young adults, 69.7% have any type of health insurance coverage, 51.4% report having private insurance coverage, and 30.3% are uninsured. Whereas, 73% of older adults have any type of health insurance coverage, 56.1% report having private insurance coverage, and only 27% are uninsured.

Table 3 presents descriptive statistics for opioid use disorders. In the pre-expansion period, opioid use disorders are more prevalent on young adults. Among the treated group, 10.7% and 4.5% of individuals report having misused opioid pain relievers in the past year and past month respectively. About 1.76% of young adults are opioid pain reliever dependents or abusers. Among the older comparison group, 8.3% and 3.2% of individuals report misusing opioid pain relievers in the past year and month respectively. Moreover, about 1.2% meet the criteria for opioid pain reliever dependence or abuse.

Table 4 shows that treatment rates for drug disorders are higher for young adults in the pre-expansion period. About 5.8% of individuals report having received treatment

in an emergency room, 19.9% report having received treatment in an inpatient setting and 39.9% received outpatient treatment in the past year. Among the control group, 4.9% of older individuals report having received treatment at the emergency room, 18.1% received inpatient treatment and 49% received treatment in an outpatient setting during the past year. Individuals aged 22-25 received lower rates of treatment for opioid use disorders than 26-29-year-olds. About 24.8% of young adults report having received treatment for their opioid use disorder in the past year. Whereas, 25.49% of older adults received treatment for this condition.

6 Results

6.1 Health Insurance Status

Table 6 contains marginal effect estimates of the difference-in-difference model for the causal impact of the young adult provision on health insurance status using logit regressions along with controls, and age and year fixed effects. After the implementation of the mandate, the likelihood of young adults having any type of health insurance coverage increased by 6.4 percentage points relative to older adults. This is a statistically significant increase of 9.18% from the pre-expansion baseline mean.

The increase in insurance coverage is largely driven by the increased share of privately insured young adults. Private health insurance coverage for young adults increased by 6.7 percentage points, which represents a 13.05% increase from the baseline mean relative to adults aged 26-29. The increase in private insurance coverage was substantially offset by a 6.4 percentage point decrease in uninsured young adults relative to the comparison group. This represents a 21.1% decline from the baseline mean. These results are consistent in direction and significance with other studies. (Antwi et al., 2013; Saloner et al., 2018).

6.2 Opioid Use Disorders Outcomes

Table 6 contains regression results for the impact of the young adult mandate on opioid use disorder outcomes. Results indicate that the expansion had a statistically significant impact in reducing reported non-medical use of opioid pain relievers in the past month and year. Relative to adults aged 26-29, young adults' opioid pain reliever misuse in the past month and year declined by 1.1 and 1.2 percentage points, respectively. This represents a 24.4% reduction in past month misuse and a 11.2% reduction in misuse of pain relievers in the past year. Also, results show suggestive evidence that the insurance expansion is associated with declines in the rates of dependence and abuse of opioid pain relievers.

As described above, the NSDUH categorizes individuals as pain relievers dependents or abusers using the DSM-IV criteria. Column 3 shows results for the effect of the expansion on opioid pain reliever dependence or abuse combined. The expansion is associated with a 0.3 percentage point decrease in pain reliever abuse or dependence in the past year among individuals aged 22-25. This represents a 16.6% reduction in the share of young adults categorized with either condition in the past year. Excluding opioid dependents, column 4 shows that after the expansion young adults are 0.1 percentage points less likely to abuse opioids relative to the control group. This represents a 25% decline from the baseline mean. These effects are statistically significant at the 10% level.

One of the limitations of using the publicly available version of the NSDUH is that it does not include state identifiers. Therefore, I am unable to control for state-level laws such as prescription drug monitoring programs (PDMPs) that restrict access to prescription pain relievers. Hence, there exists a concern for potential endogeneity as these declines in opioid pain reliever measures may not be caused by increased access to private insurance. However, Ali et al.(2017) using the NSDUH, find no statistically significant impact of two measures of PDMPs implementation on pain reliever misuse, past-year dependence and abuse and initiation of non-medical use of

painkillers. Similarly, other studies find no evidence of PDMPs being effective on curbing the prescription opioid crisis, especially if providers are not required by law to utilize these programs (Grecu et al., 2017; Buchmuller Carey, 2017; Dave et al., 2018; Jena et al., 2014).

6.3 Treatment for Substance Use Disorders

A possible mechanism that can explain the decline in opioid misuse among young adults is the increased access to drug treatment caused by the exogenous gain of private health insurance. As described above, the sudden gain of health insurance may serve as an incentive for individuals to increase their demand for drug treatment and other health services. Most importantly, gaining private health insurance provides an incentive for young adults with drug disorders to substitute expensive inpatient treatment at hospitals and rehabilitation facilities for relatively less expensive treatment in outpatient settings, such as medically assisted treatment (MAT) provided at a private doctor's office.

Table 7 contains regression results for the impact of the ACA provision on the utilization of treatment for substance use disorders. Column 1 shows that the expansion did not have any impact on treatment received at the emergency room as the coefficient is not statistically significant. Column 2 suggests that after the expansion, individuals aged 22-25 were 4.1 percentage points less likely to receive inpatient treatment relative to the control group. This represent a 20% decline from the pre-expansion mean. The coefficient, however, is not statistically significant at conventional levels.

Column 3 shows that there is a statistically significant increase in outpatient treatment associated with gaining private health insurance. After the implementation of the young adult provision, individuals in the treated group were 7.4 percentage points more likely to receive treatment in outpatient settings. This marginal effect represents an 18.6% increase from the pre-mandate baseline mean. Column 4 provides suggestive evidence of an increase of 0.9 percentage points in treatment for opioid pain relievers. This represents a 3.63% increase from the baseline mean among young adults.

However, this effect is not statistically different from zero.

Overall, these results suggest a potential substitution effect from young adults with substance use disorders. Individuals in the treated group are more likely to seek outpatient treatment as a result of obtaining private coverage. These results are consistent with those previously found in the literature (Meinhoffer & Witman, 2014).

7 Limitations

There are some limitations in this study that should be considered. First, the National Survey of Drug Use and Health data is a survey that measures stigmatized conditions and behaviors. Therefore, there are some concerns about non-response and social desirability bias. However, the surveyors mitigate these factors by using audio computer-assisted self-interviewing and survey instruments designed to reduce such biases (Saloner et al., 2014).

Second, since the NSDUH is a self-reporting survey, there exists a potential concern for recall bias and measurement error. Individuals are directed to report their opioid misuse in the past year and past month and treatment received in the past year. However, respondents might report answers outside of these time frames. Also, individuals in 2011 might report opioid pain reliever misuse or treatment received in 2010 when the expansion was not fully implemented. This would understate the impact of the policy.

Third, for reasons of data confidentiality, the NSDUH does not report individuals' age as a continuous variable. Therefore, I cannot exclude 26 year-olds from the analysis as it is commonly practiced in the literature.

Fourth, the difference-in-differences design allows me to control for time-varying factors that might be correlated with insurance coverage and opioid pain reliever misuse, as well as age and year fixed effects. However, given that the publicly available data from the NSDUH does not report state identifiers, I cannot control for other simultaneous state-level programs such as PDMPs that are designed to curb prescrip-

tion for highly addictive drugs. Also, I cannot rule out the influence of other legislation that occurred prior or during the study period such as the Mental Health Parity and Addiction Equity Acts.

Fifth, I was not able to observe changes in dependent coverage versus changes in other types of private coverage since the NSDUH does not specify if whether coverage is provided directly to the individual or if the person is under someone else's plan.

8 Discussion

A fully comprehensive analysis of a provision extending health insurance coverage to a large underserved population must account for the possible externalities that the mandate may produce such as opioid use and abuse. Substance use disorders, in general, are important to examine because they have a high prevalence among young individuals and insurance coverage has been historically restricted (Saloner et al., 2018). Consequently, I examine changes in misuse and abuse of opioid pain relievers among adults aged 22-25 before and after the implementation of the 2010 ACA provision that allowed these individuals to remain under their parents' private plans.

Several important findings emerge from my analysis. This paper builds on the growing literature that documents that the dependent coverage provision increased health insurance coverage and demand for care. (Antwi et al., 2015; Saloner et al., 2014; Ali et al., 2016; Saloner et al., 2018). I find that the provision achieved its intended goal of increasing coverage among young adults. The share of privately insured 22-25-year-olds increased by 13% as a result of the expansion relative to a comparable group of individuals aged 26-29. This effect was offset by a 21.1% decline in uninsured young adults.

In addition, I find evidence of a reduction in the prevalence of opioid pain reliever misuse and abuse associated with the obtainment of private coverage from the ACA's provision. A priori, the effect of extending medical access to opioid prescriptions to a population with higher risks of addiction is ambiguous. Often, increased access to

opioid pain relievers results in diversion towards non-medical use. (Powell et al., 2015). Counter to this hypothesis, results show that the expansion of private coverage caused a decline of 11.2% on the prevalence of opioid non-medical use among young adults. More importantly, after the implementation of the dependent coverage the share of young adults with opioid use disorders (dependence or abuse) declined by 16.6%. Similarly, after excluding individuals diagnosed with opioid dependence, I find that the share of young adults abusing pain relievers declined by 25%.

A possible mechanism that can be driving the decline in the prevalence of opioid abuse among young adults is the increased access to drug treatment caused by the exogenous gain of private health insurance. In fact, I find that young adults are 18.6% more likely to receive treatment for substance disorders in outpatient settings, which includes mental health centers and private doctors' offices. On the other hand, the provision did not have any impact on treatment received as an inpatient. Nonetheless, the sign of the estimate presents suggestive evidence that inpatient treatment declined among young adults.

One can infer a substitution effect on treatment settings caused by the expansion. Some young adults may have replaced specialty rehabilitation and detoxification treatment in public settings for similar care in non-residential rehabilitation centers, mental health centers, and private doctors' offices. Substitution across settings could be beneficial for young adults as it more appropriately places them in more suitable and cost-effective care. (Saloner et al., 2018; Meinhoffer & Witman, 2018). Furthermore, outpatient services deliver more personal and confidential care. This is important because the primary reason for patients not seeking treatment is not perceiving a need for it (Ali et al., 2015).

Also, outpatient rehabilitation services are a more efficient way of curbing addiction as they provide relatively less expensive therapies with higher levels of efficacy. For example, medically assisted treatment (MAT) with methadone and buprenorphine have proven to effectively reduce opioid addiction (Meinhoffer & Witman, 2018). These services are also more likely to be covered by private insurance. The ACA requires

health insurance plans to cover substance use disorders services as one of the ten essential health benefits. Therefore, preventive and rehabilitation services must be offered at parity with other essential benefits (McLellan & Woodworth, 2014). Another possible explanation for the reduction in opioid use and abuse attributed to the coverage expansion is that the general health of young adults may have improved as a result of entering coordinated care.

My findings are in line with previous studies showing that dependent coverage provision reduced the share of uninsured young adults and changed the settings in which individuals with substance disorders received attention, by increasing treatment utilization in outpatient settings (Meinhoffer & Witman, 2018; Saloner et al., 2018). These results overall reflect the importance of assessing the possible externalities caused by a large expansion in health insurance.

The results in this study imply that the expansion of private coverage, which did not directly target opioid abuse, could have plausibly contributed to curbing the opioid epidemic instead of enhancing it.

9 Conclusion

The United States is currently experiencing an unprecedented drug crisis. Opioid pain relievers, which have a legitimate medical function have been the main driver of the epidemic. This paper evaluates the extent to which expansion in medical access to prescriptions for opioid pain relievers to a population that is at higher risk of misuse and abuse contributed to the problem. Using data from the 2008-2014 waves of the NSDUH and a non-linear difference-in-difference design, I analyze the impacts of the Affordable Care Act's dependent coverage provision on opioid use disorders. My findings shed light on the important role that health insurance plays in the rehabilitation of individuals with substance use disorders and suggest that increased access to preventing and rehabilitation services in more appropriate settings have the potential of curbing the opioid epidemic.

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11 Tables

Table 1: Treatments vs Control Demographics

	(1)	(2)	(3)	(4)
	Control	Treated	Control	Treated
	2008-2010	2008-2010	2008-2014	2008-2014
Female	0.536	0.533	0.537	0.534
Male	0.464	0.467	0.463	0.466
Hispanic	0.198	0.177	0.190	0.177
Black	0.119	0.127	0.121	0.133
White	0.584	0.602	0.586	0.593
Other Race	0.099	0.094	0.103	0.097
Married	0.406	0.217	0.394	0.204
Less Than HS	0.154	0.145	0.141	0.130
High School	0.279	0.292	0.267	0.295
Some College	0.264	0.306	0.277	0.312
College	0.303	0.258	0.316	0.263
Less Than \$20,000	0.212	0.297	0.210	0.305
\$20,000-\$49,000	0.409	0.395	0.405	0.391
\$50,000-\$74,000	0.192	0.148	0.188	0.142
\$75,000 or more	0.188	0.160	0.198	0.163
Observations	8205	27163	19849	61612

Table 2: Insurance Status - Descriptive Statistics

	(1)	(2)	(3)	(4)
	Control	Treated	Control	Treated
	2008-2010	2008-2010	2008-2014	2008-2014
Any Insurance	0.730	0.697	0.735	0.731
Private Insurance	0.561	0.513	0.552	0.536
Medicaid	0.135	0.139	0.147	0.147
No Insurance	0.270	0.303	0.265	0.269
Observations	8169	27020	19743	61177

Table 3: Opioid Pain Relievers Use Disorders - Descriptive Statistics

	(1)	(2)	(3)	(4)
	Control	Treated	Control	Treated
	2008-2010	2008-2010	2008-2014	2008-2014
Misuse Past Year	0.083	0.107	0.079	0.096
Misuse Past Month	0.032	0.045	0.032	0.039
Abuse/Dependence	0.013	0.018	0.014	0.018
Abuse	0.002	0.004	0.002	0.003
Observations	8199	27124	19827	61531

Table 4: Treatment Settings for Substance Use Disorders - Descriptive Statistics

	(1)	(2)	(3)	(4)
	Control	Treated	Control	Treated
	2008-2010	2008-2010	2008-2014	2008-2014
Emergency Room	0.049	0.058	0.075	0.069
Inpatient Treatment	0.181	0.199	0.241	0.226
Outpatient Treatment	0.490	0.398	0.495	0.439
Treatment For Opioids	0.255	0.247	0.320	0.304
Observations	204	788	493	1669

Inpatient setting is defined as treatment received overnight at a hospital or a residential rehabilitation facility.

Outpatient setting is defined as treatment received at a rehabilitation facility, and [private doctor's office.

Table 5: Effect of the Young Adult Provision on Insurance Coverage

	(1)	(2)	(3)
	Any	Private	Uninsured
	Insurance	Insurance	
DD	0.064*** (0.006)	0.067*** (0.006)	-0.064*** (0.006)
Female	0.095*** (0.004)	-0.031*** (0.004)	-0.095*** (0.004)
Black	-0.087*** (0.008)	-0.241*** (0.006)	0.087*** (0.008)
Hispanic	-0.193*** (0.004)	-0.269*** (0.004)	0.193*** (0.004)
Metropolitan Area	0.047*** (0.004)	0.105*** (0.004)	-0.047*** (0.004)
Observations	81066	81187	81066

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 shows the marginal effects on insurance status.

Regressions include age and year fixed effects.

Standard errors are clustered by age and year.

Table 6: Effect of the Young Adult Provision on Opioid Use Disorders

	(1)	(2)	(3)	(4)
	Pain Reliever Misuse Past Year	Pain Reliever Misuse Past Month	Pain Reliever Dependence/Abuse	Pain Reliever Abuse
DD	-0.012*** (0.004)	-0.011*** (0.001)	-0.003* (0.002)	-0.001* (0.000)
Female	-0.029*** (0.002)	-0.013*** (0.001)	-0.005*** (0.001)	-0.001*** (0.000)
Black	-0.037*** (0.003)	-0.013*** (0.002)	-0.017*** (0.002)	-0.001* (0.001)
Hispanic	-0.038*** (0.003)	-0.015*** (0.002)	-0.011*** (0.002)	-0.001** (0.000)
Metropolitan Area	0.010*** (0.003)	0.002 (0.002)	-0.000 (0.001)	0.000 (0.001)
Observations	81358	81461	81461	81461

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 shows the marginal effects of opioid misuse in the past year and month, opioid abuse or dependence and opioid abuse only. Regressions include age and year fixed effects. Standard errors are clustered by age and year.

Table 7: Effect of the Young Adult Provision on Treatment Settings For Substance use Disorders

	(1)	(2)	(3)	(4)
	Emergency Room	Inpatient Treatment	Outpatient Treatment	Opioid Treatment
DD	-0.007 (0.008)	-0.041 (0.026)	0.074** (0.032)	0.009 (0.037)
Female	0.012*** (0.004)	0.008 (0.018)	0.082*** (0.017)	0.086*** (0.017)
Black	-0.021** (0.009)	-0.050* (0.028)	-0.131*** (0.029)	-0.296*** (0.042)
Hispanic	-0.004 (0.005)	-0.052 (0.033)	-0.110*** (0.038)	-0.189*** (0.028)
Metropolitan Area	0.014*** (0.005)	0.051** (0.026)	-0.007 (0.026)	0.002 (0.021)
Observations	6208	2169	2169	2162

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 shows the marginal effects on location settings for treatment.

Regressions include age and year fixed effects. Standard errors are clustered by age and year.

Inpatient setting is defined as treatment received overnight at a hospital or a residential rehabilitation facility.

Outpatient setting is defined as treatment received at a rehabilitation facility, mental health care center or a private doctor's office