The Impact of Education on the Individual Mandate Component of the Affordable Care Act

Bradley Katcher
University of Virginia
Department of Economics
Prepared for Seminar in Policy Analysis

I. Introduction

The Patient Protection and Affordable Care Act of 2010, known commonly as the Affordable Care Act or ACA, was a law enacted to increase the insured population by several different mechanisms. First, the "Young Adult Mandate," allowed children to stay on their parents' plans until age 26. Second, it provided funding for expanded eligibility for Medicaid in states that elected to expand coverage to more individuals (up to a greater share of the federal poverty line). It set up state insurance marketplaces, also known as health exchanges, which are organizations in each state through which individuals can purchase health insurance directly. Additionally, the law afforded subsidies to low-income individuals for whom the cost of healthcare is an excessive burden. Lastly, the ACA imposed an individual mandate, requiring all individuals to purchase health insurance.[1] Should individuals elect not purchase insurance, they are subject to a tax penalty of $695 or 2.5% of household income, whichever is higher.

The individual mandate component of the Affordable Care Act is one of the most controversial components, creating a broad-sweeping mandate for health insurance coverage, regardless of health capital or perceived risk. The goal of such a mandate is to increase overall coverage rates, therefore diversifying risk pools and combating the problem of adverse selection where the sick and elderly (individuals more likely to make health insurance claims) would opt into the health insurance and the healthy individuals wouldn't. This causes health insurance pools to lack the diversification that allows insurance to function, and insurance companies end up paying out more in claims than they take in via premiums, which is unsustainable. Increasing coverage prevents the negative externality that occurs when uncovered individuals seek medical case, as in these instances, the cost of the treatment is generally borne by rest of the population.

[1] Some individuals can claim an exemption from the individual made usually for reasons relating to income or religious exemption.

Stemming from the individual mandate and the other ACA reforms, many previously uninsured individuals took up health insurance either through employers, private providers, public providers (via the expansion of Medicaid and other ways), as well as through the health insurance marketplaces created by the ACA. The National Center for Health Statistics reports that 20.0 million fewer people went without insurance in 2010 compared to 2016, and estimates from the 2016 National Health Interview Survey report that 11.2 million persons under the age of 65 are now covered by private health plans obtained through the Health Insurance Marketplace or state-based exchanges (Cohen, Zammitti, & Martinez, 2016). While this take-up of insurance is a very significant result of the ACA reforms, not much research has been conducted into determining by what mechanism insurance increased, and more importantly, which groups were most impacted.

Throughout this paper, I specifically focus on how education impacts the rate of insurance uptake resulting from the individual mandate component of the ACA. I seek to isolate the effects of the individual mandate part of the ACA using a Difference-in-Difference-in-Differences (DDD) approach, using various cutoff levels of education as the treatment, though primarily the effects of holding a college degree, controlling for the Medicaid expansion status of a state. Although this specification is intended to isolate the effects of the individual mandate component of the Affordable Care Act, due to the multitude of changes that occurred during this time, around the "post" cutoff of January 1, 2014, there is significant potential for spillover effects. Some of these potential confounders include the guarantee of new essential benefits, prohibiting individuals with pre-existing conditions from being denied insurance, increase in individuals acquiring insurance due to caps on out-of-pocket expenditures, etc. As a result, there is potential for some of the analysis to represent a more general insurance expansion, rather than the sole impact of the individual mandate.

Using the DDD approach, I can compare those at various levels of educations and see how the rate of any insurance coverage, agnostic to type of coverage, differs. The underlying hypothesis is that individuals who are of lower education levels will take up insurance at a higher rate than those with higher levels of education when legally compelled to (under the individual mandate). Those at higher levels of education may already hold health insurance plans due to their better understanding of the benefits of insurance, risk aversion, or the increased resources that their education provides.

The remainder of this paper proceeds as follows. Section II gives a more in-depth explanation of the current policy and provides a review of the current literature surrounding the impacts of the ACA with special consideration given to the individual mandate component. Section III describes the data used for the analysis. Section IV provides a detailed description of empirical methods and identification strategy. Section V presents a comprehensive depiction of the main results. Section VI offers a discussion of future implications and concludes.

II. Policy Background and Review of Literature

The Affordable Care Act was one of the most comprehensive health insurance reforms in the United States in recent history. It instituted changes to both the public and private insurance markets, with the goal primary of increasing health insurance coverage, especially to low-income individuals (The Henry J. Kaiser Family Foundation, 2012). The expansion mechanism encouraged states to extend Medicaid coverage to individuals with adjusted gross incomes up to 138% of the Federal Poverty Level (FPL), $15,415 for an individual and $31,809 for a family of four in 2012. To facilitate this, the federal government provided substantial federal funding to states for such Medicaid expansions (covering at least 90% of the costs). Next, the ACA enabled

states to create health exchange marketplaces where individuals and small employers could purchase insurance. These exchanges offered four different tiers of plans, and all plans offered are required to have a minimum standard set of coverage, known as "essential benefits."

There were also reforms made to the private insurance market. Under the law, private insurers are prohibited from denying coverage for any reason (including pre-existing conditions and health status) and were prohibited from charging people more based on their health status and gender. The costs of premiums are only able to vary in cost based on the characteristics of age, geographic area, tobacco usage, and the number of family members. The reforms also required a minimum set of services to be offered with every health insurance plan (except catastrophic insurance), including comprehensive coverage, and caps to individual annual out-of-pocket spending, known as essential benefits. Increases in health plan premiums are now subject to review, and insurers are now required to spend at least 80% of premium payments collected on medical costs or rebate the rest to policyholders. Employers of more than 50 full-time employees are required to offer health insurance coverage to their full-time employees, or else are subject to penalties of $2,000 to $3,000 per employee. Young adults are also allowed to stay on their parents' insurance plans until age 26 with the "Young Adult Mandate" component of the ACA.

The ACA reform most relevant to this paper is the individual mandate component. Beginning January 1, 2014, with some certain exemptions[2], all individuals are required to have health insurance or pay an annual financial penalty equivalent to (as of 2016) $695 per person, or 2.5% of household income, whichever is greater. While this mandate placed hefty health insurance requirements (and potential financial obligation) on many individuals, to make the mandate more feasible and affordable, the government offered premium and cost-sharing subsidies to low-

[2] Certain exemptions include financial hardship, individuals of native descent (Native American and American Indians), short-term coverage gaps (less than 3 months), and those below federal income tax filing thresholds.

income individuals. Premium subsidies[3] are provided to families without access to other coverage and fall within 100% to 400% of the federal poverty level to help reduce out-of-pocket premium costs for insurance exchanges. Cost-sharing subsidies are available to individuals with incomes between 100-250% of the FPL, with the goal of limiting out-of-pocket spending on coverage (The Henry J. Kaiser Family Foundation, 2012).

The individual mandate is commonly regarded as the most contentious component of the ACA. On one hand, some argue that the mandate is necessary to reduce adverse selection in health insurance markets, yet on the other, critics say that the ACA reforms may encourage adverse selection, as it prohibits insurers from discriminating in terms of price or coverage, against applicants based on health. This regulation has the potential of increasing premiums on healthy individuals, driving them to exit the insurance market which would cause premiums to rise even more, forcing others out of the insurance market, perpetuating cycles of exiting the market, and potentially creating "death spirals" (Chandra, Gruber, & McKnight, 2011).

Similar health care reforms to the ACA were first implemented in Massachusetts as part of a state reform. Massachusetts implemented a similar mandate, offered heavily subsidized insurance available to residents with incomes below 300% of the FPL, and automatically enrolled those who were eligible for free insurance (below 150% of the FPL). Chandra, Gruber, and McKnight (2011) examined the characteristics of the subsidized insurance pool before and after the mandate went into effect and addressed how much of an effect the mandate had, finding that at the beginning of the mandate's phase-in period, there was a greater increase in the number of healthy enrollees than in the number of enrollees with a chronic illness. When the mandate was in full effect, there ended up being many more "healthy people" than non-healthy individuals into the

[3] The subsidy amount works to ensure that the cost of insurance premiums is limited to between 2% and 9.5% of annual income.

risk pool, is attributed to a causal role of the mandate improving risk selection. However, the amount of the subsidies was much greater in Massachusetts than those provided by the federal government with the ACA. So although we see this effect in Massachusetts, the external validity may not be as great, and these results may not generalize under the ACA (Chandra et al., 2011). Additionally, because of such strong subsidies, it is hard to disentangle this subsidy effect from the individual mandate and other general insurance-related gains via the reform.

Some argue that the individual mandate is not the driving factor in the large increases in insurance changes that we have seen. As previously mentioned, the 2016 National Health Interview Survey report that 11.2 million persons under the age of 65 are now covered by private health plans obtained through the Health Insurance Marketplace or state-based exchanges (Cohen et al., 2016). Yet, this increase in insurance for non-Medicare populations (the group of interest) may not be attributed to the individual mandate. Using the Agency for Healthcare Research and Quality's Medical Expenditure Panel Survey of Households and data from the Kaiser Family Foundation's Annual Survey of Employer Health Plans to simulate the effect of the Affordable Care Act with and without the coverage mandate, Sheils and Haught (2011) determine that coverage wouldn't decrease as significantly as thought by many other estimates without the individual mandate. They determine that if the mandate were lifted, premiums would increase in cost by 12.6 percent and coverage would decrease by 7.8 million people, which is less than the coverage loss of 16-24 million people predicted by others such as the Congressional Budget Office and Jonathan Gruber's microsimulation model. Sheils and Haught include the effects of other components such as subsidies in determining the impact of increases in health insurance coverage, which they find have a much greater impact (Gruber, 2011; Sheils & Haught, 2011).

One profound impact of the individual mandate is the take up of Medicaid in place of "conditional coverage." Many individuals who are eligible for Medicaid don't have insurance through Medicaid because they don't actively use the coverage and the process to get it is administratively complicated. In the event that an eligible individual needed intense medical treatment, they would obtain insurance through Medicaid at that point, effectively making them conditionally covered (D. Cutler & Gruber, 1997). When the individual mandate comes into effect, those eligible for Medicaid formally take up the insurance at a high rate. The cohort who are eligible but uninsured constitute a large portion of the uninsured population, and formally enrolling Medicaid is a mechanism to avoid paying the individual mandate penalty. In Massachusetts, amongst those who were eligible for Medicaid, enrollment increased by 16.3 percentage points, and for those without private insurance yet eligible for Medicaid, Medicaid participation increased by 19.4 percentage points (Sonier, Boudreaux, & Blewett, 2013).

Ample evidence shows that health insurance coverage increased during ACA reforms. When looking at Medicaid, compared to the average pre-ACA uninsured rate, the ACA increased the proportion of residents with insurance by nearly double the amount in states that expanded Medicaid compared to those that didn't. This caused crowd out in the private insurance market among low-income individuals, yet increases in private insurance occurred in non-group and employer-provided coverage (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2016).

While these theoretical and simulated impacts are important to consider, there have been two empirical analyses recently conducted on the impact of the individual mandate on health insurance take-up under the Affordable Care Act. The provisions of the ACA that went into effect on in 2014, were Medicaid expansion, premium subsidies for coverage obtained through the health

exchanges, as well as the individual mandate. Disentangling these effects is essential to establishing the causal impact of the individual mandate, yet difficult to successfully accomplish.

Frean, Gruber, and Sommers (2017) estimate the impact of each of the components on insurance gains. Utilizing data from the American Community Survey from 2012 to 2015, and a difference-in-difference-in-differences approach that looks to exploit variation by income, geography, and time, they determined that the individual mandate has little effect on the increase in insurance coverage. Their analysis looks at the first two years before and after the ACA implementation, exploiting variation in Medicaid expansion status and estimates of private insurance subsidies based on the variation in subsidies across income and geography. Using this model, the authors account for 60% of the increase in insurance coverage of the ACA, believing that the remaining 40% can be attributed to the effect of increased insurance purchase rates through the creation of marketplaces, increase in consumption due to essential benefits, and a generalized insurance effect. They determine that 44% of the gains are due to enrollment of previously eligible adults and children, including the 2011-2013 early Medicaid expansion and a potential anticipatory effect of the individual mandate. 19% of the coverage gains were due to enrollment of adults who became eligible for Medicaid in 2014 Medicaid expansion. They concluded no significant reduction in private coverage resulting from the increase in the population on Medicaid. Premium subsidies were responsible for 37% of coverage gains. They also found no significant effect of the individual mandate on coverage in 2014, however, it is believed that a more general effect of the individual mandate to boost enrollment is still possible. The authors claim that the mandate encourages people to obtain coverage through one of the already established mechanisms, thus, the “direct” impact of the individual mandate is negligible (Frean et al., 2017).

Another study used administrative tax data to measure the amount paid in penalties, determining that a larger penalty used to enforce the individual mandate results in a higher increase in coverage and found a positive effect of the individual mandate on increasing coverage. At lower income levels the individual mandate has a large coverage effect, concentrated primarily in public insurance gains and a crowd out of private insurance. At higher income levels, the individual mandate has a smaller coverage effect that is concentrated among individuals in the individual insurance market. Regardless of income, this study found that the individual mandate caused individuals to obtain health insurance (Heim, Lurie, & Sacks, 2018).

Given that the individual mandate hasn't been in effect that long, there lacks much literature on the effects. The two most prominent studies, mentioned above, find contradictory results, and no study has yet to look at the impact by education level. This paper seeks to add to the literature by attempting to determine the impact of the individual mandate, specifically gradients in how education impacts the effects of the individual mandate on increasing insurance coverage.

III. Data

The data for the analysis will come from three sources. The primary source is American Community Survey (ACS) data and will also be supplemented with Medicaid expansion information from the Kaiser Family Foundation and state economic trends from the Bureau of Labor Statistics: Local Area Unemployment Statics. The ACS serves as the best choice of data for several reasons. Collected by the U.S. Census Bureau, the ACS has a very large sample size (obtaining around 3 million responses per year) compared to other surveys that ask about health insurance, and has mandatory respondent participation, unlike the CPS or BRFSS, and has geographic identifiers, unlike the NHIS (Courtemanche, Marton, & Yelowitz, 2016). This will ultimately allow to control for the effects of Medicaid expansion and state economic trends. The

ACS is also one of the primary sources used by the federal government to evaluate health insurance coverage (Finegold et al., 2014; Smith & Medalia, 2015).

The timeline of analysis is 2011 and 2016, enabling the examination of before and after trends, given that the individual mandate component came into law in 2014. Additionally, beginning in 2011 allows the separation of other ACA impacts that came into effect earlier (i.e. ability to stay on parent's insurance until 26, removal of copays on preventative services, and review of health plan premium increases) from the effects of the individual mandate (Courtemanche, Marton, Ukert, Yelowitz, & Zapata, 2017).

The variable of interest, education, was constructed using levels of educational attainment reported in the ACS, which identifies the highest "grade" of education completed. Using this data, I construct an indicator variable for college graduates (completed four years of college). Though being a college graduate is the primary treatment of interest, I consider other levels of education in my robustness checks shown in Table 12, to see if the insurance take-up effects intensify with lower levels of education. In doing so, I create indicator variables for if someone attended college (at least one year of college) as well as an indicator for completing 12th grade (high school).

Insurance coverage can be studied in many ways using the ACS. The main outcome of interest is whether someone has any insurance coverage. This is most-relevant for the goals of the ACA, and accounts for individuals who may be double-covered. Insurance coverage status can be broken down to type of coverage, namely employer-provided insurance, Medicare, Medicaid, any other governmental insurance, TRICARE or other military insurance, and Veterans Administration-provided insurance, results of which can be seen in Table 10.[4] I study the effects on uptake of public or private insurance as an outcome of interest in Table 9.

[4] Since Indian Health Services policies are not comprehensive when it comes to healthcare, they are not included in having total coverage. However, I include them in the supplemental analysis because those with Indian Health Services

The data includes many demographic variables, which will be used as controls. One advantage of the ACS is that it provides geographic, state identifiers, allowing me to link data from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics to identify unemployment rates, and control for state economic trends, as well as include state fixed effects.[5]

I link Kaiser Family Foundation (KFF) data on Medicaid expansion states to control for expansion and leverage the somewhat exogenous variation in states that expanded Medicaid. I look at whether states expanded Medicaid by 2016 to ensure that we have a conservative estimate for the individual mandate, allowing Medicaid to absorb the impact. Both traditional Medicaid expansions, as well as states that approved Section 1115 waivers for Medicaid expansion, were included in the analysis ("Status of State Action on the Medicaid Expansion Decision," 2018).

Other demographic variables include age, sex, race, if an individual was foreign born, US citizenship status, Hispanic ethnicity, marital status, number of children, income, student status, employment status, veteran status, and disability status.

Given Medicare coverage, the ACA was not intended to impact the health insurance of seniors (65+). To isolate the effects of the individual mandate, and not confound them with the provision allowing children 26 and under to stay on their parents' insurance, the primary sample of interest will include only individuals between the ages of 27 and 64, inclusive. However, for reference, analysis will be conducted on the entire sample that includes all ages to confirm that the target age range (27 to 64) is most impacted by the individual mandate reforms.

"coverage" can claim an exemption from the individual mandate penalty of the Affordable Care Act, even though they aren't technically insured with comprehensive coverage (U.S. Centers for Medicare & Medicaid Services, 2018).

[5] This is calculated as a simple average of each of the seasonally adjusted unemployment rate of the months in that year. A potential drawback is that it is a simple, rather than weighted average of employment over that year. Deviations in calculated unemployment would come from more people being in the workforce at various points throughout the year. Most of these temporary jobs do not provide health insurance, we can reasonably disregard this impact.

Given that the ACS is a survey, there is potential for selection and self-reporting bias. I utilize ACS household weights throughout my analysis (with the sole exception of those in Table 13), to try and achieve as accurately representative a sample as possible.

The trends in insurance over time show an increase in coverage after the effects of the Affordable Care Act came into law. This is illustrated in both Table 1 as well as in Figure 1. Simply looking before and after the Affordable Care Act, the percentage of individuals with health insurance increased quite substantially. For individuals aged 27-64, there was a 5.9 percentage point increase in total coverage (see Table 1).

Table 1: Health Insurance Coverage Rates by Time Period

	Coverage Rates over Time			
Type of Insurance	**Pre-ACA**	**Post-ACA**	**Difference**	**Percentage Change**
Medicare	4.3	4.6	0.3	7.0%
Medicaid	10.2	13.5	3.3	32.4%
Employer Provided	61.9	62.3	0.4	0.6%
Privately Purchased	9.3	11.4	2.1	22.6%
Veterans Affairs	2.0	1.9	-0.1	-5.0%
Indian Services	.4	.4	0	0%
TRICARE	2.4	2.4	0	0%
Public Insurance	14.2	17.4	3.2	22.5%
Private Insurance	70.3	73.2	2.9	4.1%
Any Coverage	81.1	87.0	5.9	7.3%

Note: Data for ages 27 to 64. Observations weighted by ACS household weights. N = 4,656,123 for the Pre-ACA sample, N = 4,651,488 for the Post-ACA sample. Percentage change is the change relative to Pre-ACA mean.

There was a 5.9 percentage point increase in total coverage, which corresponds to an approximate 7.3 percent increase, relative to pre-ACA coverage. When looking at public and private insurers, we see that post-ACA, there were increases in both public and private insurance, but a much greater increase in public insurance, in percentage terms. Compared to pre-ACA levels, the portion of individuals on public insurance increased by 22.5 percent compared to only 4.1

percent for private insurance. Figure 2, in the appendix, depicts change in insurance rates for public vs. private insurance mechanisms. Though it looks like public and private insurance have the same relative increase, the increase in public insurance is larger in percentage terms given its relatively lower baseline (pre-ACA) coverage rate. This large increase in public insurance is expected, given the expansion of Medicaid. Table 1 captures the change in coverage rates for all individuals between the age ranges of 27 to 64 but simply looks at the coverage rates before and after. It does not try to isolate the impact of the individual mandate or any component of the ACA. This table captures all insurance coverage related changes including Medicaid expansion. This is one of the reasons why we see such a large change in Medicaid coverage, a 32.4 percent increase, and a large contributor to the gain in public insurance. Additionally, we would think that with an individual mandate and a large expansion of public related insurance options, we would observe a crowd-out effect of private insurance. Though we observe an increase in private insurance overall, in some low-income and low-educated populations, we would expect a decrease in private insurance and an increase in public insurance from the various public health insurance related reforms. Some individuals will drop their private insurance for publicly subsidized insurance (D. M. Cutler & Gruber, 1996). The results confirm, as in Table 9, we observe an increase in public insurance and a decrease in private insurance for those without a college degree, evidence of a crowd-out effect.

As expected, the changes in coverage rates for Indian Services, TRICARE, and Veterans Affairs insurance are all insignificant. We wouldn't expect any changes in the proportion of veterans obtaining health insurance through the Veterans Affairs Administration, or other change in the proportion of individuals receiving insurance through the Armed Services TRICARE insurance as these individuals would likely have this insurance regardless. These types of insurance are not sensitive to the ACA reforms. Additionally, 69.55 percent of those who use

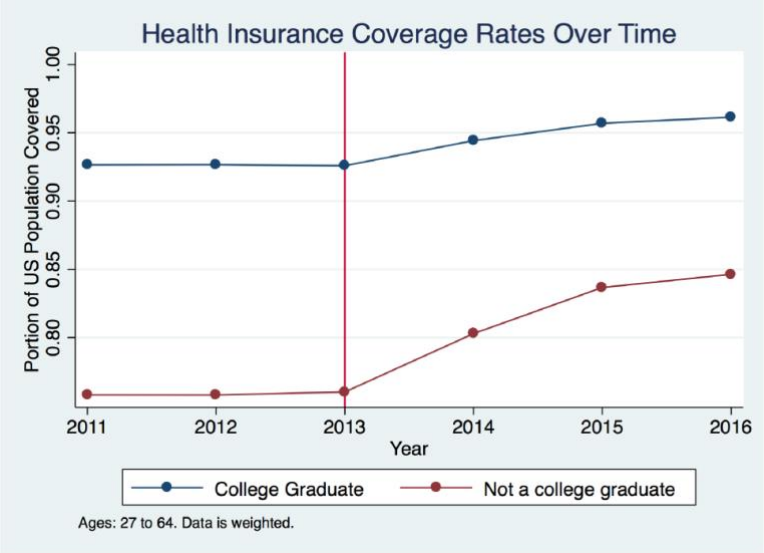
Indian Health Services have another means of health insurance. It is unlikely that because of the ACA, more people would obtain Indian Health Services. The coverage rates of the different types of insurance are shown over time in Figures 3 and 4 in the appendix.

IV. Methodology

Throughout this paper, I seek to determine the causal effect of education on health insurance take up because of the individual mandate component of the Affordable Care Act. Due to the multitude of policy changes that occurred around the "Post" indicator of the DDD model, the beginning of most ACA-related health insurance reforms (January 1, 2014), some of the effects that I estimate may be attributed to more generalized gains in health insurance, rather than specifically to the individual mandate component of the ACA. Using data from the American Community Survey, Bureau of Labor Statistics, and Kaiser Family Foundation, though I begin with a naïve difference-in-differences (DD) model, whereas the more robust primary model I use is a difference-in-difference-in-differences (DDD) identification strategy. This allows me to utilize variation in treatment based on different education levels and somewhat exogenous variation from different states that expanded Medicaid soon after the passage of the Affordable Care Act.

Figure 1, below, shows the trend in health insurance coverage over our period of interest (2011-2016) for both college graduates and those who did not graduated college, restricted to the population of interest. The line at the year 2013 indicates the cutoff point and beginning of the “post” period, as beginning in 2014, individuals were under the effect of the individual mandate and were legally compelled to have health insurance. Prior to the cutoff point, the trends for health insurance are parallel for both college graduates and those who did not graduate college, which satisfies the parallel trends requirement of the difference-in-differences model, indicating the absence of pre-treatment effects.

Figure 1: Health Insurance Coverage Rates Over Time



Note: Figure shows health insurance coverage rates over time, stratified by if an individual holds a college degree. Observations restricted to ages 27-64 and weighted by ACS household weights. The line at 2013 to represent that insurance was required beginning Jan 1, 2014.

The first specification I utilize is a simple difference-in-differences (DD) approach with treatment being education level (in this case, a binary indicator of having a college degree) and a time indicator for the implementation period of most ACA reforms, including the individual mandate (2014). Equation 1.1, below, shows the DD model. "Post" is a dummy variable indicating that the person is under the effect of the individual mandate, i.e. the year is 2014 or beyond. "Educ" is the treatment variable in the DD model, indicating that a person is not a college graduate, i.e. the indicator is 0 if the person is a college graduate, and 1 otherwise. "Expansion" is a dummy variable indicating whether an observation resided in a state that expanded Medicaid, which is thought to have accounted for a significant gains in health insurance, and a supplier of somewhat exogenous variation. In equation 1.1, $\boldsymbol{\pi}$ represents a vector of controls for economic conditions such as unemployment rates, as well as demographic characteristics. Income is also included as a control in demographic variables, as it is thought to be heavily endogenous with both education

and health insurance. ρ is a vector of time and state fixed effects, controlling for nationwide time-variant and state-specific time-invariant changes, respectively.

(1.1) $$\text{Health Insurance}_{ist} = \alpha_0 + \beta*\text{Post}_t + \theta*\text{Educ}_i + \lambda(\text{Post}_t*\text{Educ}_i) + \mu*\text{Expansion}_s + \pi + \rho + \varepsilon_i$$

In equation 1.1, above, the coefficient of interest is the estimate on λ, the interaction term between the "post" and "education" indicators, which estimates the change in the rate of health insurance coverage for those who are not college graduates after the implementation of the individual mandate. This model has several drawbacks, however. The inclusion of the "Expansion" variable, which represents being in a Medicaid expansion state, collects the impact of being in a state that expanded Medicaid. However, this doesn't measure the impact specifically for an observation who is not a college graduate under the impact of the individual mandate. Additionally, since other components of the Affordable Care Act, aside from the individual mandate, went into effect in 2014, the interaction term may account for other insurance-related increases for college-educated individuals, rather than the specific individual mandate component of the reform.

Therefore, to account for this additional variation, I utilize a difference-in-difference-in-differences model. The DDD model is more effective in capturing most of the effects of the individual mandate and subsidies on changes in health insurance coverage. The DDD model allows the estimates to better control for Medicaid expansion by interacting it with the Post and Educ terms both individually and jointly to create a DDD estimator coefficient. This Medicaid expansion indicator is not time-variant to prevent multicollinearity concerns. The DDD specification allows me to use the variation in treatment based on education levels and different states who expanded Medicaid soon after the passage of the ACA. The model that I employ can be written as such:

(1.2) $$\text{Health Insurance}_{ist} = \alpha_0 + \beta*\text{Post}_t + \theta*\text{Educ}_i + \mu*\text{Expansion}_s + \lambda(\text{Post}_t*\text{Educ}_i) + \sigma(\text{Post}_t*\text{Expansion}_s) + \varphi(\text{Expansion}_s*\text{Educ}_i) + \gamma(\text{Post}_t*\text{Expansion}_s*\text{Educ}_i) + \pi + \rho + \varepsilon_i$$

The interpretations of the variables and coefficients are largely the same as in specification 1.1. σ explains the effect of being in the period under the individual mandate (as well as other components of the ACA) and being in a state that expanded Medicaid. φ estimates the impact on insurance coverage of an individual being not college educated while in a state that expanded Medicaid. The variable of interest is the DDD estimator, γ, the interaction term between Post, Expansion, and Educ, which estimates the change in insurance coverage for an individual that is under the effect of the Individual Mandate, who is in a state that expanded access to Medicaid and does not hold a college degree.

To assess robustness to my education definition, I utilize other education cutoffs. Each estimate using different education cutoffs will utilize the same model as the college cutoff, as seen in equation 1.2. One would think that as the bar for education decreases, the effect would increase. I hypothesize that we will observe a monotonically higher increase in insurance coverage when comparing an individual who attended college at all compared to someone who never attended college. The effect should be even stronger for someone who graduated high school, relative to someone who did not. To determine insurance related gains by insurance type, I utilize the following model, equation 1.3.

(1.3) $$\text{Insurance Type}_{ist} = \alpha_0 + \beta*\text{Post}_t + \theta*\text{Educ}_i + \mu*\text{Expansion}_s + \lambda(\text{Post}_t*\text{Educ}_i) + \sigma(\text{Post}_t*\text{Expansion}_s) + \varphi(\text{Expansion}_s*\text{Educ}_i) + \gamma(\text{Post}_t*\text{Expansion}_s*\text{Educ}_i) + \pi + \rho + \varepsilon_i$$

In looking at insurance type, I analyze public insurance, private insurance, as well as the subset of each type of insurance: Medicare, Medicaid, employer-provided insurance, direct private

purchase insurance, Veterans Affairs insurance, TRICARE, and Indian Health Services as the dependent variable of insurance type.

V. Results

The basic difference-in-difference model provides a first cut, naïve estimate of the effects of the individual mandate on a non-college educated individual. Using equation 1.1, I estimate the DD model, with results shown in Table 6 in their entirety, as well as summarized in Table 7 for both age groups. The increase in insurance coverage under the impact of the individual mandate and related impacts for someone without a college degree is estimated to be an increase in insurance coverage of 4.36 percentage points. The impact of being in a Medicaid expansion state (generally, not restricted to solely post-reform) is an increase in insurance coverage of 1.2 percentage points. The 4.36 percentage point increase, caused by the mandate and likely other insurance-related gains associated with the passage of the ACA, constitutes a significant closing of the gap of the uninsured. Pre-ACA, the rate of insurance coverage for this group (ages 27 to 64) was 81.1 percent, meaning that 18.9 percent of this population was uninsured. Lessening that gap by 4.36 percentage points signifies that these reforms closed the gap of the uninsured population by approximately 23.1 percent. As expected, the effects for all ages is less than just the 27 to 64 year old population, however, it still accounts for a 3.66 percentage point increase. The unweighted estimate is in Table 13.

While the DD model gives us a rough estimate of the impact, it does not account for the impact of Medicaid expansion on an individual, rather just the impacts of being in a state that expands Medicaid coverage. For that reason, the estimated increase in insurance is likely overstated and biased upward. The DD estimate most likely captures some of the Medicaid expansion impact for individuals. However, the model likely still captures the general trend, that

non-college educated individuals take up insurance at a higher rate because of the individual mandate component of the Affordable Care Act.

To get a more accurate estimate, I utilize the DDD model specified in equation 1.2. The model predicts a statistically significant increase in the health insurance coverage rate for those who are not college graduates, compared to those who are, while in the post period (2014 and after), when the individual mandate component came into effect while controlling for the observation being in a Medicaid expansion state.[6] The increase in health insurance is approximately 1.54 percentage points, less than that estimated in the DD model. Table 2, on the next page, summarizes the results of this estimation. The unweighted model, as shown in Table 13, shows an effect of 1.38 percentage points. As demonstrated by the summarized results in Table 8, the estimate is not sensitive to the inclusion of state and year fixed effects. In practical terms, given that the pre-ACA mean coverage rate for individuals in that age group is 81.1 percent, this equates to closing around 8 percent of the pre-ACA uninsured gap.

As expected, based on the estimate in column 1 of table 8, the effect is less intense for all ages, though only slightly, with an estimated increase of 1.08 percentage points. Given that the mean coverage rate for this group prior to the ACA was 85.7 percent, this increase represents a closing of 7.55 percent of the uninsured gap. Column 5 of table 8 confirms that, as expected, there is no statistically significant change in health insurance coverage for those in the age range of 65 and over. These individuals are covered by Medicare and the design of the Affordable Care Act should not have any tangible impact on them. The mean coverage rate of these individuals is already at 99.3%, so this reform cannot significantly increase their coverage. There was a slight increase for those younger than 26, a 1.05 percentage point increase (column 6 of Table 8).

[6] The results of the main specification can be seen on the next page and of all relevant specifications on Table 8 in the appendix, as well as in their entirety on Table 6.

This indicates that the individual mandate component of the Affordable Care Act resulted in an increase in insurance coverage and a closing of the insurance gap for the lower educated populations. This estimate most likely also includes broader insurance related coverage gains associated with the Affordable Care Act and other insurance-related reforms that occurred in 2014.

Table 2: Difference-in-Difference-in-Differences Estimate

VARIABLES	Any Health Insurance Coverage
Post * Expansion * Not College Grad	0.0154***
	(0.00112)
Constant	0.581***
	(0.00346)
Observations	9,091,824
R-squared	0.170
Year FE	Yes
State FE	Yes
Ages	27 to 64
Mean Coverage Rate	.841

Note: This table shows the output of the difference-in-difference-in-differences regression shown in equation 1.2. This is a summary of the full model estimated in column 2 of Table 6, see note in Table 6. The observations are weighted by ACS household weights. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

To identify the mechanism by which insurance increased, it is important to analyze the heterogenous effects by type of insurance. I utilize the model in equation 1.3. to estimate the effects by type of insurance. Table 9 shows that the individual mandate resulted in an increase in the take-up of public insurance by 2.94 percentage points, and a decrease in the consumption of private insurance by 1.23 percentage points for the age range of interest (27 to 64). The impacts for the entire age range are less in magnitude, a 2.08 percentage point increase in public insurance and a 0.99 percentage point decrease in the consumption of private insurance. This represents a crowd

out of private insurance, as many lesser educated individuals are opting into public insurance. The increase in public insurance coverage can also be demonstrated by the table below. Table 3 (below) shows that the gain in public insurance under the ACA (though not individual mandate specific) for those without a college degree is an increase from 18.4 percent to 22.7 percent, whereas those with a college degree hold public insurance at a much lower rate and see a smaller percentage point increase in public insurance. The individual mandate did cause some people to take up private health insurance and provided subsidies for individuals to obtain private insurance. Given that those without a college degree hold public insurance at a much higher level than those with a college degree, we observe an aggregate increase in the amount of private insurance held overall, yet a crowd out effect of private insurance among those without a college degree.

Table 3: Public and Private Insurance Rates Before and After the ACA

	Pre-ACA (before 2014)		Post-ACA (2014 and after)	
	No College Degree	**College Degree**	**No College Degree**	**College Degree**
Public Insurance	.184 (.387)	.050 (.219)	.227 (.419)	.066 (.249)
Private Insurance	.613 (.487)	.899 (.302)	.644 (.479)	.913 (.292)

Note: This table shows mean coverage rates by insurance category before and after the individual mandate (January 1, 2014). Pre-ACA: no college degree n= 7,390,943, college degree: n= 1,959,258. Post-ACA: no college degree n= 7,276,905, college degree: n= 2,152,840. Observations weighted by ACS household weights. Standard deviations in parentheses.

In looking at the change in coverage levels by insurance type in Table 10, there is a statistically significant increase for Medicaid, and statistically significant decreases for the only two categories of private insurance, employer-provided and direct private purchase. As shown in Table 10, the increase in Medicaid is 2.90 percentage points, and the decreases for employer-provided insurance and direct private purchase insurance are 0.056 percentage points and 0.088

percentage points, respectively. This further shows the crowd out effect of private insurance with the expansion of public insurance. The lack of a change for the other insurance categories is largely expected.[7] Additionally, the other three main categories of insurance are TRICARE, Veterans Affairs, and Indian Health Services. Each of these types of insurance shows no statistically significant increase with the individual mandate. The individual mandate likely did not result in more people joining the military or becoming veterans for the purpose of obtaining TRICARE or Veterans Affairs Insurance. The same logic applies to Indian Health Services; additional individuals would not choose to select into tribal health services when they otherwise wouldn't have with the imposition of the individual mandate.

In further exploring the heterogenous effects of the individual mandate and other insurance-related expansions, I analyze what races were most impacted by the reforms. Table 11 shows the estimated impact of the individual mandate using the model in equation 1.2 while restricting the population to each race. The racial categories of Native Americans, Pacific Islanders, and White had significant increases in their insurance coverage rates. Blacks and other races similarly observed increases in coverage rates, however, they were generally lower in magnitude than the other races and were only marginally significant. Marginally significant and slightly negative trends were observed for Asians. The effects of the individual mandate on various races have some potentially very profound impacts on the equity and practical implications of the policy and is a question for further research and investigation.

For robustness, I use other education cutoffs aside from college graduation using equation 1.2. For those aged 27 to 64, the impact of having a college degree under the individual mandate results in an increase in insurance coverage by approximately 1.54 percentage points. As shown

[7] No individual between the age range of 27 to 64 is eligible for Medicare unless they are disabled or have end-stage renal disease, so we shouldn't expect to have any significant change in that category

in Table 12, the effect intensifies when the educational bar is decreased. The change in the rate of insurance coverage is an increase of 2.04 percentage points when the individual mandate is in effect, in a state that expanded Medicaid, for someone who has not attended college, which corresponds to closing 10.8 percent of the insured coverage gap. This effect increases to 3.70 percentage points when the cutoff becomes whether someone graduated high school, which corresponds closing of 19.6 percent of the uninsured gap. As expected, the lower the educational cutoff bar is, the more of an impact the individual mandate has on increasing insurance coverage, and this trend appears to be monotonic.

VI. Discussion, Conclusion, and Policy Implications

It is safe to conclude that the individual mandate did influence the closing the uninsurance gap, and more so for those with lower levels of education. As the cutoff for the level of education decreased, the impact of the individual mandate increased, as there was a higher increase in insurance coverage. This would tend to mean the individual mandate was successful in its goal of getting more people covered by health insurance, especially those of lower levels of education who otherwise may lack health insurance.

Given that the individual mandate penalty is slated to be repealed as part of the Tax Cuts and Jobs Act of 2017, we might expect a decrease in the insurance rate with the removal of the penalty. This a potential impact of the law that will go into effect January 1, 2019, and merits additional research and analysis.

This conclusion is based on the DDD strategy employed throughout the paper, which does have significant limitations. The limitations of this analysis and conclusions are important to recognize in interpreting the results. The most obvious and overwhelmingly important limitation is the potential for the estimates to have encompassed other insurance-related gains in addition to

the individual mandate. It's plausible that estimates included the effect of subsidies, which may have accounted for some of the insurance gains, however, using available data, that amount is not discernable. Additionally, the estimates are based on survey data which poses some accuracy issues and is a significant drawback of the data. The ability to utilize administrative tax data to determine the impact of insurance coverage on being subjected to a penalty or more specific data on health insurance coverage via Form 1095-C would go a long way to establish a more casual impact of the individual mandate component of the ACA. Income is highly endogenous with both health insurance coverage and education, so there may have been a better way to control for it. ACS household weights are used throughout the analysis, so the accuracy of the conclusions is also highly dependent on the weighting accuracy.

The results in Table 12 with regards to heterogenous effects by race are interesting and warrant more in-depth analysis to see how race is impacted by the individual mandate, as that could have profound impacts on equity with its repeal. It is possible that there will be disparate impacts of the individual mandate dependent on race.

While it might be reasonable to conclude that there is some bias in the coefficients with regards to the impact of the individual mandate, given that all estimates showed a positive impact for the lower educated, I tend to believe that it is safe to conclude that if the individual mandate does indeed have an impact, it is increasing in the lower educated.

When evaluating whether this is a worthwhile policy, it is important to consider the costs of the reform and whether any other components are more cost-effective in increasing the proportion of individuals insured. Some considerations should also be given to the implications of requiring insurance for certain populations, specifically young people. Young people end up being required to obtain insurance with minimum coverage standards that the most likely won't use to subsidize

the cost of medical expenditures to the older population. When you consider that they are paying into other social insurances, such as social security, and that many of them aren't making high wages in the early stages of their careers, it is important to think about how this impacts young individuals financially.

My conclusions support the findings of Heim, Lurie, & Sacks (2018) in observing a positive impact of the individual mandate and observing a crowd out effect of private insurance amongst the lower educated populations. I also contribute to the literature by starting to examine who was impacted by the individual mandate, rather than current literature that seeks to explain what the impact is and quantifying it as well as exploring heterogenous effects by type of insurance, race, and other education levels.

References:

Chandra, A., Gruber, J., & McKnight, R. (2011). The Importance of the Individual Mandate — Evidence from Massachusetts. *New England Journal of Medicine*, *364*(4), 293–295. https://doi.org/10.1056/NEJMp1013067

Cohen, R. A., Zammitti, E. P., & Martinez, M. E. (2016). National Health Interview Survey Early Release Program Health Insurance Coverage: Early Release of Estimates From the National Health Interview Survey, 2016. Retrieved from https://www.cdc.gov/nchs/data/nhis/earlyrelease/insur201705.pdf

Courtemanche, C., Marton, J., Ukert, B., Yelowitz, A., & Zapata, D. (2016). Impacts of the Affordable Care Act on Health Insurance Coverage in Medicaid Expansion and Non-Expansion States. *NBER Working Paper Series*, (22182). Retrieved from http://www.nber.org/papers/w22182

Courtemanche, C., Marton, J., Ukert, B., Yelowitz, A., & Zapata, D. (2017). Early Impacts of the Affordable Care Act on Health Insurance Coverage in Medicaid Expansion and Non-Expansion States. *Journal of Policy Analysis and Management*, *36*(1), 178–210. https://doi.org/10.1002/pam.21961

Courtemanche, C., Marton, J., & Yelowitz, A. (2016). Who Gained Insurance Coverage in 2014, the First Year of Full ACA Implementation? *Health Economics*, *25*(6), 778–784. https://doi.org/10.1002/hec.3349

Cutler, D., & Gruber, J. (1997). Medicaid And Private Insurance: Evidence And Implications. *Health Affairs*, *16*(1), 194–200. https://doi.org/https://doi.org/10.1377/hlthaff.16.1.194

Cutler, D. M., & Gruber, J. (1996). Does Public Insurance Crowd out Private Insurance? *The Quarterly Journal of Economics*, *111*(2), 391–430. https://doi.org/10.2307/2946683

Finegold, K., Gunja, M. Z., Sommers, B. D., Musco, T., Burke, A., & Mcdowell, A. (2014). ASPE ISSUE BRIEF SURVEY DATA ON HEALTH INSURANCE COVERAGE FOR 2013 AND 2014. *New England Journal of Medicine*. https://doi.org/10.1056/NEJMsr1406753

Frean, C., Gruber, J., Sommers, B., Frean, M., Sommers, B. D., & Chan, H. T. (2017). Premium Subsidies, the Mandate, and Medicaid Expansion: Coverage Effects of the Affordable Care Act Coverage Effects of the Affordable Care Act. *Journal of Health Economics*, *53*, 72–86. https://doi.org/10.1016/j.jhealeco.2017.02.004

Gruber, J. (2011). *Health Care Reform without the Individual Mandate Replacing the Individual Mandate would Significantly Erode Coverage Gains and Raise Premiums for Health Care Consumers*. Retrieved from https://cdn.americanprogress.org/wp-content/uploads/issues/2011/02/pdf/gruber_mandate.pdf

Heim, B., Lurie, I., & Sacks, D. W. (2018). *Does the individual mandate affect insurance coverage ? Regression kink evidence from the population of tax returns ∗*.

Sheils, J. F., & Haught, R. (2011). Without The Individual Mandate, The Affordable Care Act Would Still Cover 23 Million; Premiums Would Rise Less Than Predicted. *Health Affaris*, *30*(11), 2177–2185. https://doi.org/10.1377/hlthaff.2011.0708

Smith, J. C., & Medalia, C. (2015). Health Insurance Coverage in the United States: 2014. Retrieved from https://www.census.gov/content/dam/Census/library/publications/2015/demo/p60-253.pdf

Sonier, J., Boudreaux, M. H., & Blewett, L. A. (2013). Medicaid "Welcome-Mat" Effect Of Affordable Care Act Implementation Could Be Substantial. *Health Affairs*, *32*(7), 1319–1325. https://doi.org/10.1377/hlthaff.2013.0360

Status of State Action on the Medicaid Expansion Decision. (2018). Retrieved April 9, 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

The Henry J. Kaiser Family Foundation. (2012). *Summary of Coverage Provisions in the Affordable Care Act*. Menlo Park, CA. Retrieved from https://kaiserfamilyfoundation.files.wordpress.com/2013/01/8023-r.pdf

U.S. Centers for Medicare & Medicaid Services. (2018). Exemptions for American Indians & Alaska Natives. Retrieved April 25, 2018, from https://www.healthcare.gov/american-indians-alaska-natives/exemptions/

Table 4: Descriptive Statistics by Age Range

VARIABLES	All Ages Mean	Standard Deviation	Ages 27-64 Mean	Standard Deviation
Demographic Variables				
U.S. Citizen	.932	.252	.904	.294
Foreign Born	.129	.346	.191	.393
Hispanic	.168	.374	.153	.360
Age	38.383	23.034	45.509	10.806
Unemployed	.047	.211	.046	.210
Disabled	.002	.049	.001	.034
Student	.260	.438	.050	.219
Veteran	.082	.275	.064	.244
Female	.512	.500	.513	.500
Individual Income	36,307.84	53,368.89	44,952.29	58,866.01
State Unemployment Rate	6.785	1.887	6.796	1.887
Married	.419	.493	.636	.481
Number of Children	.531	.986	.951	1.191
Native American	.016	.127	.016	.124
Asian	.061	.239	.063	.242
Black	.134	.341	.127	.332
Pacific Islander	.004	.062	.003	.058
White	.765	.424	.765	.424
Other Race	.052	.221	.048	.215
Insurance Variables				
Medicare	.167	.373	.045	.206
Medicaid	.189	.392	.119	.324
Employer Provided	.545	.498	.621	.485
Private Purchase	.129	.335	.104	.305
Veterans Affairs	.022	.148	.019	.138
Indian Services	.005	.069	.004	.065
Tricare	.030	.171	.024	.152
Public Insurance	.331	.470	.158	.365
Private Insurance	.665	.472	.717	.450
Any Coverage	.880	.345	.841	.366
Expansion	.592	.492	.595	.491
Education Variables				
College Graduate	.213	.410	.321	.467
At least some college	.401	.490	.563	.496
At least HS graduate	.680	.466	.901	.299

Note: All variables from ACS Data, except State Unemployment Rate (BLS LAUS), and Expansion (KFF) For the all ages group, the number of observations is 18,779,946 for all variables except unemployed (15,280,139), veteran (15,035,737), and income (15,520,873). For the 27-64 age group, the number of observations is 9,307,611. All variables are dummies except age, income, state unemployment rate, and number of children. Observations weighted by ACS household weights.

Table 5: Descriptive Statistics by Time Period (Pre vs. Post)

	Pre-ACA		**Post-ACA**	
VARIABLES	Mean	Standard Deviation	Mean	Standard Deviation
Demographic Variables				
U.S. Citizen	.905	.293	.903	.296
Foreign Born	.186	.389	.196	.397
Hispanic	.149	.356	.158	.365
Age	45.473	20.734	45.545	10.878
Unemployed	.056	.229	.037	.189
Disabled	.001	.034	.001	.034
Student	.053	.224	.048	.213
Veteran	.070	.255	.058	.233
Female	.513	.500	.513	.500
Individual Income	43,041.45	55,459.61	46,844.71	61,997.54
State Unemployment Rate	8.149	1.589	5.456	.988
Married	.641	.480	.632	.482
Number of Children	.955	1.192	.947	1.190
Native American	.015	.123	.016	.125
Asian	.060	.237	.065	.247
Black	.126	.332	.128	.334
Pacific Islander	.003	.057	.004	.060
White	.770	.421	.760	.427
Other Race	.047	.211	.050	.218
Insurance Variables				
Medicare	.043	.204	.046	.209
Medicaid	.102	.304	.135	.341
Employer Provided	.619	.486	.623	.485
Private Purchase	.093	.291	.114	.318
Veterans Affairs	.020	.139	.019	.137
Indian Services	.004	.064	.004	.065
Tricare	.024	.153	.024	.152
Public Insurance	.142	.349	.174	.379
Private Insurance	.703	.457	.732	.442
Any Coverage	.811	.391	.870	.337
Expansion	.596	.491	.594	.491
Education Variables				
College Graduate	.313	.464	.328	.469
At least some college	.557	.497	.568	.495
At least HS graduate	.899	.302	.903	.297

Note: See note on Table 4. In Pre-ACA period, the number of observations for all variables is 4,656,123. In Post-ACA period, the number of observations for all variables is 4,651,488. Observations weighted by ACS household weights.

Table 6: Full Difference-in-Difference and Difference-in-Difference-in-Differences Estimates

VARIABLES	(1) Any Health Insurance Coverage	(2) Any Health Insurance Coverage
Post-ACA (2014)	-0.00263**	0.00130
	(0.00128)	(0.00133)
Expansion	0.0120***	-0.0359***
	(0.00229)	(0.00236)
Not College Grad	-0.105***	-0.137***
	(0.000424)	(0.000692)
Post*Expansion		-0.00256***
		(0.000776)
Post*Not College Grad	0.0436***	0.0345***
	(0.000533)	(0.000904)
Expansion * Not College Grad		0.0571***
		(0.000848)
Post * Expansion * Not College Grad		0.0154***
		(0.00112)
US Citizen	0.203***	0.204***
	(0.000843)	(0.000853)
Foreign Born	-0.0441***	-0.0444***
	(0.000604)	(0.000608)
Hispanic	-0.0753***	-0.0754***
	(0.000638)	(0.000645)
Age	0.00218***	0.00216***
	(1.49e-05)	(1.54e-05)
Unemployed	-0.196***	-0.197***
	(0.000941)	(0.000955)
Disabled	0.0626***	0.0624***
	(0.00455)	(0.00457)
Student	0.0258***	0.0241***
	(0.000694)	(0.000713)
Veteran	0.0745***	0.0731***
	(0.000504)	(0.000505)
Female	0.0506***	0.0500***

	(0.000312)	(0.000314)
Income	5.92e-07***	5.91e-07***
	(2.20e-09)	(2.19e-09)
Unemployment Rate	-0.0102***	-0.00935***
	(0.000286)	(0.000294)
Married	0.0851***	0.0851***
	(0.000350)	(0.000353)
Number of Children	0.00541***	0.00527***
	(0.000145)	(0.000147)
Native American	-0.0521***	-0.0524***
	(0.00142)	(0.00144)
Asian	0.0677***	0.0692***
	(0.00124)	(0.00125)
Black	0.0130***	0.0143***
	(0.00122)	(0.00124)
Pacific Islander	0.0169***	0.0155***
	(0.00265)	(0.00266)
White	0.0219***	0.0223***
	(0.00117)	(0.00119)
Other Race	0.00420***	0.00234
	(0.00145)	(0.00147)
Constant	0.560***	0.581***
	(0.00340)	(0.00346)
R-squared	0.169	0.170
Model	DD	DDD

Note: Column 1 shows a Difference-in-Differences regression with a dummy variable for any health insurance coverage as the dependent variable, and the variable of interest as Post* Not College Grad. Column 2 shows a Difference-in-Difference-in-Differences regression with a dummy variable for any health insurance coverage as the dependent variable, and the variable of interest being Post * Expansion * Not College Grad. Each coefficient * 100 signifies a percentage point increase. All variables are dummy variables with the exception of age, income, unemployment rate, and the number of children. The model also includes state and year fixed effects. All regressions are weighted by ACS household weights. The DD regression has n=9,307,611. The DDD regression has n=9,091,824. The age range for both models is restricted to ages 27 to 64, and the years of data span from 2011to 2016. For information on data, see tables 4 and 5. Robust standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Simplified Difference-in-Differences Model

VARIABLES	(1) Any Health Insurance Coverage	(2) Any Health Insurance Coverage
Medicaid Expansion State	0.00523***	0.0120***
	(0.00168)	(0.00229)
Post* Not College Grad	0.0366***	0.0436***
	(0.000409)	(0.000533)
Constant	0.542***	0.560***
	(0.00257)	(0.00340)
Observations	15,035,737	9,307,611
R-squared	0.167	0.169
Ages	All	27 to 64
Mean Coverage Rate	.880	.841

Note: Both regressions show a difference-in-differences model estimated using equation 1.1. See the full output for column 2 on Table 6, as well as the note on Table 6. Table 6 also references the variables included in the regression in column one, just with the inclusion of all ages. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 8: Simplified Difference-in-Difference-in-Differences Estimates

VARIABLES	(1) Any Health Insurance Coverage	(2) Any Health Insurance Coverage	(3) Any Health Insurance Coverage	(4) Any Health Insurance Coverage	(5) Any Health Insurance Coverage	(6) Any Health Insurance Coverage
Post * Expansion * Not College Grad	0.0108***	0.0154***	0.0155***	0.0154***	0.000443	0.0105***
	(0.000854)	(0.00112)	(0.00112)	(0.00112)	(0.000543)	(0.00321)
Constant	0.561***	0.524***	0.581***	0.581***	0.830***	1.104***
	(0.00259)	(0.00208)	(0.00267)	(0.00346)	(0.00244)	(0.00827)
R-squared	0.168	0.165	0.169	0.170	0.081	0.154
Year FE	Yes	Yes	No	Yes	Yes	Yes
State FE	Yes	No	Yes	Yes	Yes	Yes
Ages	All	27 to 64	27 to 64	27 to 64	65+	0 to 26
Mean Coverage Rate	.880	.841	.841	.841	.992	.889

Note: Each column represents a regression utilizing a difference-in-difference-in-differences regression where the dependent variable is a dummy variable for having any health insurance coverage. The reported variable is the DDD estimator. All demographic and economic variables are controlled for. Observations are weighted by ACS household weights. Coefficients show the effect size of the individual mandate and potentially other insurance-related changes as it accounts for the change in health insurance coverage rates for an observation in the Post-ACA implementation period (after January 1, 2014), who is located in a state that expanded Medicaid and does not hold a college degree. Robust standard errors are reported in parentheses. For column one (all observations), n=15,035,737. For columns 2-4 (ages 27 to 64), n=9,091,824. For column 5 (ages 65+), n=3,355,345. For column 6 (ages 0-26), n=2,472,781. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Public vs. Private Insurance Coverage Estimates

VARIABLES	(1) Public Insurance	(2) Private Insurance	(3) Public Insurance	(4) Private Insurance
Post * Expansion * Not College Grad	0.0208*** (0.000984)	-0.00994*** (0.00111)	0.0294*** (0.00103)	-0.0123*** (0.00129)
Constant	-0.331*** (0.00287)	0.602*** (0.00324)	0.0741*** (0.00333)	0.491*** (0.00394)
Observations	15,035,737	15,035,737	9,307,611	9,307,611
R-squared	0.342	0.184	0.121	0.238
Ages	All	All	27 to 64	27 to 64
Mean Coverage Rate	.331	.665	.158	.717

Note: Each column shows a regression using a dummy variable for insurance type (public or private) as the defendant variable regressed using the DDD model in equation 1.3 and the variables included in column 2 of table 6. All regressions in the table include state and year fixed effects. Interpretation is that not being a college graduate under the impact of the individual mandate in a Medicaid expansion state changes the rate of insurance by (estimated coefficient * 100) percentage points. Mean coverage rate looks over the entire time period (2011-2016), not just pre-ACA. All observations weighted by ACS household weights. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Health Insurance Coverage Change by Type of Insurance

VARIABLE	(1) Direct Purchase	(2) Employer Provided Insurance	(3) TRICARE Insurance	(4) Medicare	(5) Medicaid	(6) Veterans Affairs Insurance	(7) Indian Health
Post* Expansion * Not College Grad	-0.00564*** (0.00112)	-0.00876*** (0.00154)	0.000672 (0.000585)	0.000861 (0.000586)	0.0290*** (0.000884)	0.000818* (0.000424)	0.000126 (0.000177)
Constant	0.0491*** (0.00286)	0.458*** (0.00433)	0.00578*** (0.00155)	-0.0512*** (0.00188)	0.118*** (0.00298)	-0.0109*** (0.00120)	0.0723*** (0.000916)
R-squared	0.017	0.185	0.071	0.055	0.107	0.230	0.239
Mean Coverage Rate	.103	.621	.024	.045	.119	.019	.004

Note: Each column represents a DDD regression with a dummy variable for each type of insurance coverage as the dependent variable. The reported variable is the DDD estimator. All demographic and economic variables are controlled for. Includes state and year fixed effects. Observations were restricted to ages 27-64 and are weighted by ACS household weights. Coefficients show the effect size of the individual mandate and potentially other insurance-related changes as it accounts for the change in health insurance coverage rates for an observation in the Post-ACA implementation period (after January 1, 2014), who is located in a state that expanded Medicaid and does not hold a college degree. Mean coverage rates are reported over the entire time period (2011-2016). N=9,307,611. Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Health Insurance by Race

VARIABLES	(1) Any Insurance Coverage	(2) Any Insurance Coverage	(3) Any Insurance Coverage	(4) Any Insurance Coverage	(5) Any Insurance Coverage	(6) Any Insurance Coverage
Post * Expansion * Not College Graduate	0.0357***	-0.0101*	0.00653*	0.0725***	0.0134***	0.0206*
	(0.0119)	(0.00602)	(0.00386)	(0.0275)	(0.00119)	(0.0112)
Constant	0.365***	0.859***	0.526***	0.714***	0.563***	0.413***
	(0.0273)	(0.0153)	(0.0106)	(0.0763)	(0.00363)	(0.0251)
Observations	176,836	552,964	1,040,213	31,665	7,338,361	368,276
R-squared	0.144	0.110	0.130	0.128	0.169	0.226
Race	Native American	Asian	Black	Pacific Islander	White	Other race

Note: See note on Table 8. This represents the same type of regression, just repeated with observations restricted to each race throughout. Includes state and year fixed effects, age rage restricted to 27-64. Robust standard errors in parentheses. Interpretation of coefficients is the same. *** p<0.01, ** p<0.05, * p<0.1

Table 12: Health Insurance by Education Levels

VARIABLES	(1) Any Health Insurance Coverage	(2) Any Health Insurance Coverage	(3) Any Health Insurance Coverage
Post * Expansion * Not College Graduate	0.0154***		
	(0.00112)		
Post * Expansion * Never Attended College		0.0204***	
		(0.00127)	
Post * Expansion * Not High School Graduate			0.0370***
			(0.00262)
Constant	0.581***	0.552***	0.510***
	(0.00346)	(0.00346)	(0.00346)
Observations	9,091,824	9,091,824	9,091,824
R-squared	0.170	0.172	0.169

Note: See note on Table 8. This constitutes the same type of regression, simply using different educational cutoffs. Column 1 is exactly the same as column 4 of table 8, using a college degree as a cutoff. Column 2 uses college attendance as a cutoff. Column 3 uses high school graduation as a cutoff. Each model includes state and year fixed effects. Observations are weighted by ACS household weight and are restricted to ages 27-64. N=9,091,824. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

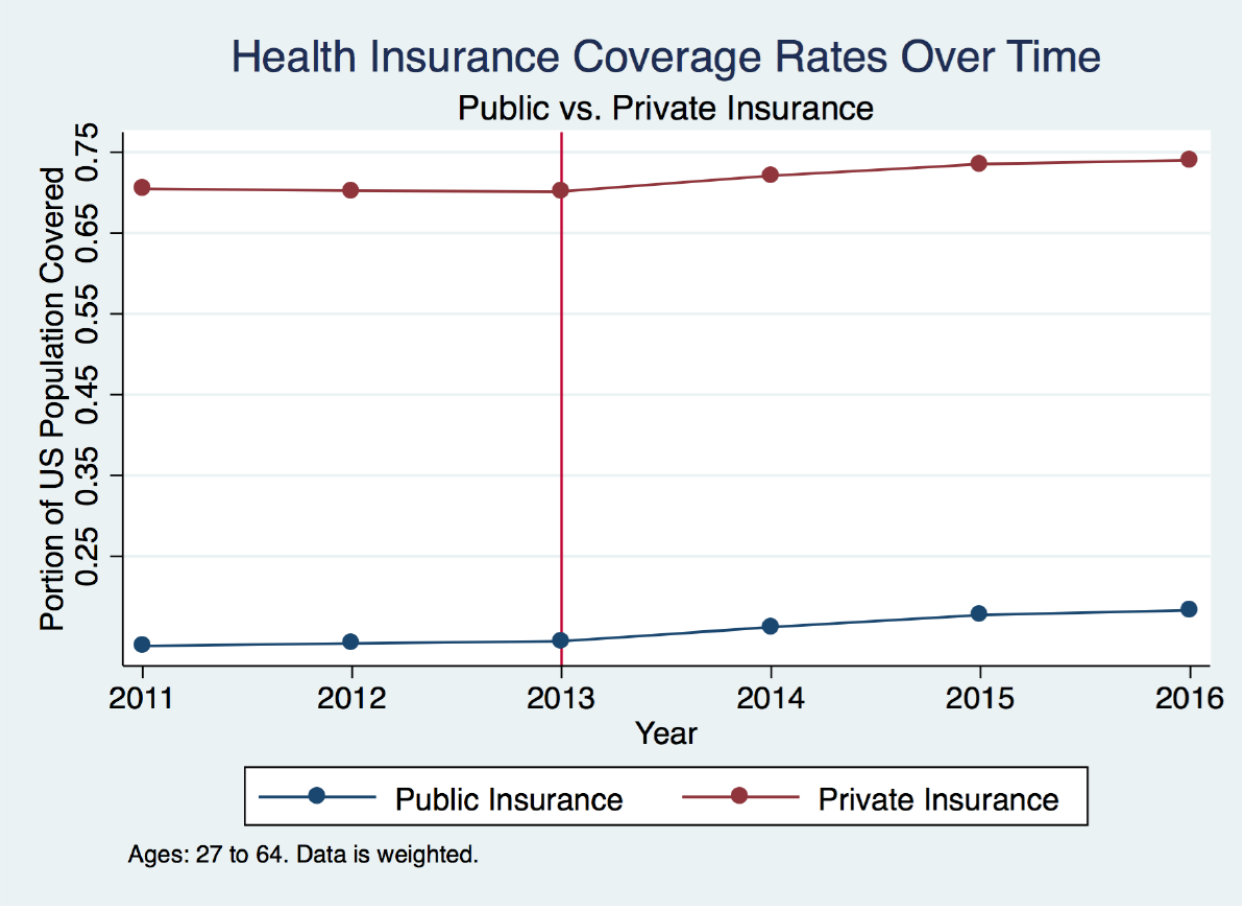
Table 13: Unweighted Difference-in-Difference and Difference-in-Difference-in-Differences Estimates

VARIABLES	(1) Any Health Insurance Coverage	(2) Any Health Insurance Coverage
Post-ACA (2014)	-0.00419***	-0.000840
	(0.000940)	(0.000975)
Expansion	0.0112***	-0.0346***
	(0.00167)	(0.00173)
Not College Grad	-0.101***	-0.133***
	(0.000311)	(0.000505)
Post*Expansion		-0.00247***
		(0.000565)
Post*Not College Grad	0.0434***	0.0354***
	(0.000391)	(0.000661)
Expansion * Not College Grad		0.0557***
		(0.000620)
Post * Expansion * Not College Grad		0.0138***
		(0.000819)
US Citizen	0.189***	0.189***
	(0.000655)	(0.000662)
Foreign Born	-0.0359***	-0.0361***
	(0.000452)	(0.000454)
Hispanic	-0.0715***	-0.0717***
	(0.000486)	(0.000491)
Age	0.00229***	0.00227***
	(1.12e-05)	(1.16e-05)
Unemployed	-0.191***	-0.191***
	(0.000720)	(0.000730)
Disabled	0.0825***	0.0818***
	(0.00315)	(0.00317)
Student	0.0219***	0.0202***
	(0.000531)	(0.000545)
Veteran	0.0730***	0.0717***
	(0.000374)	(0.000375)

Female	0.0514***	0.0507***
	(0.000230)	(0.000232)
Income	5.70e-07***	5.68e-07***
	(1.69e-09)	(1.68e-09)
Unemployment Rate	-0.0102***	-0.00939***
	(0.000211)	(0.000216)
Married	0.0845***	0.0845***
	(0.000261)	(0.000263)
Number of Children	0.00605***	0.00593***
	(0.000108)	(0.000110)
Native American	-0.0647***	-0.0654***
	(0.00107)	(0.00108)
Asian	0.0656***	0.0675***
	(0.000953)	(0.000965)
Black	0.00819***	0.0103***
	(0.000945)	(0.000957)
Pacific Islander	0.0151***	0.0131***
	(0.00198)	(0.00200)
White	0.0309***	0.0315***
	(0.000907)	(0.000919)
Other Race	0.00956***	0.00825***
	(0.00114)	(0.00115)
Constant	0.565***	0.585***
	(0.00252)	(0.00256)
R-squared	0.157	0.158
Model	DD	DDD

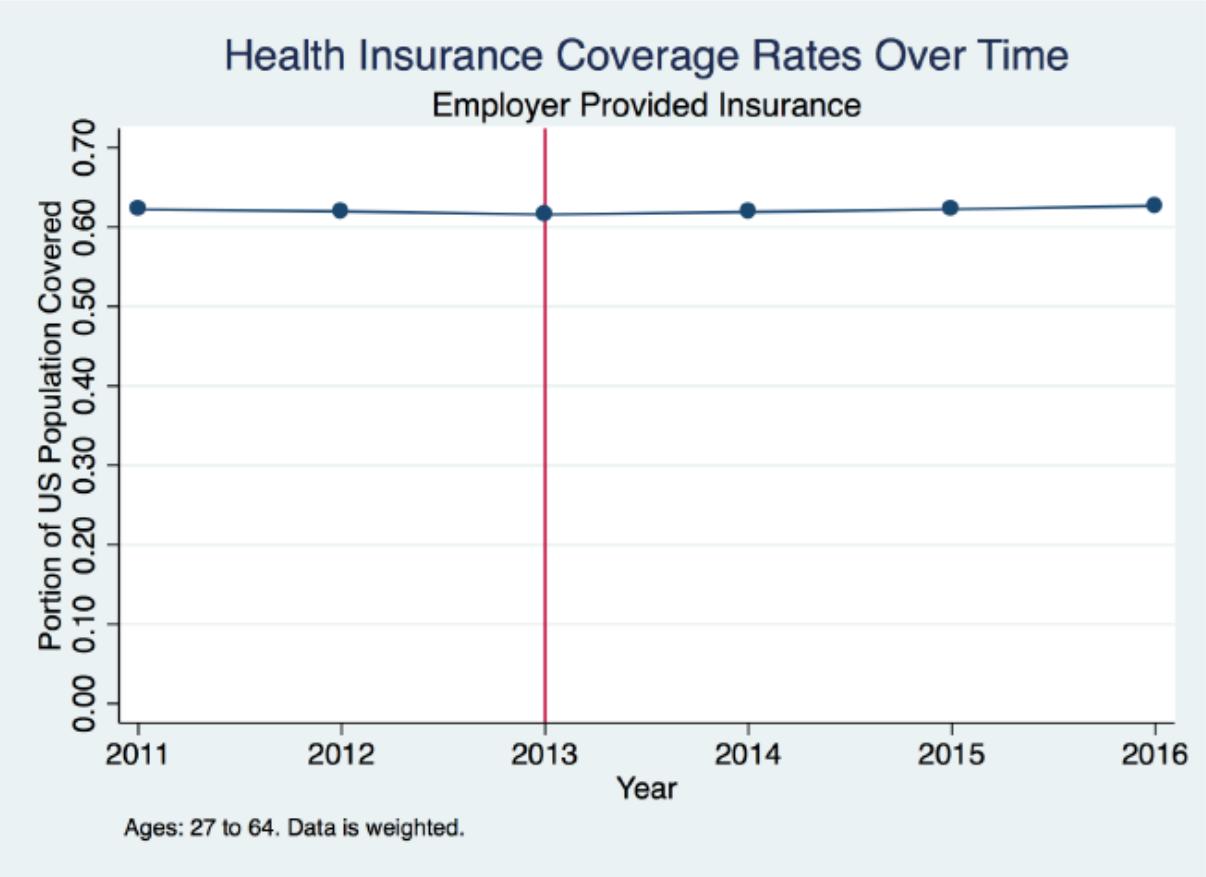
Note: Column 1 shows a Difference-in-Differences regression with a dummy variable for any health insurance coverage as the dependent variable, and the variable of interest as Post* Not College Grad. Column 2 shows a Difference-in-Difference-in-Differences regression with a dummy variable for any health insurance coverage as the dependent variable, and the variable of interest being Post * Expansion * Not College Grad. Each coefficient * 100 signifies a percentage point increase. All variables are dummy variables with the exception of age, income, unemployment rate, and the number of children. The model also includes state and year fixed effects. The regressions are left unweighted. The DD regression has n=9,307,611. The DDD regression has n=9,091,824. The age range for both models is restricted to ages 27 to 64, and the years of data span from 2011to 2016. For information on data, see Tables 4 and 5. Robust standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Figure 2: Public vs. Private Health Insurance Coverage Rates



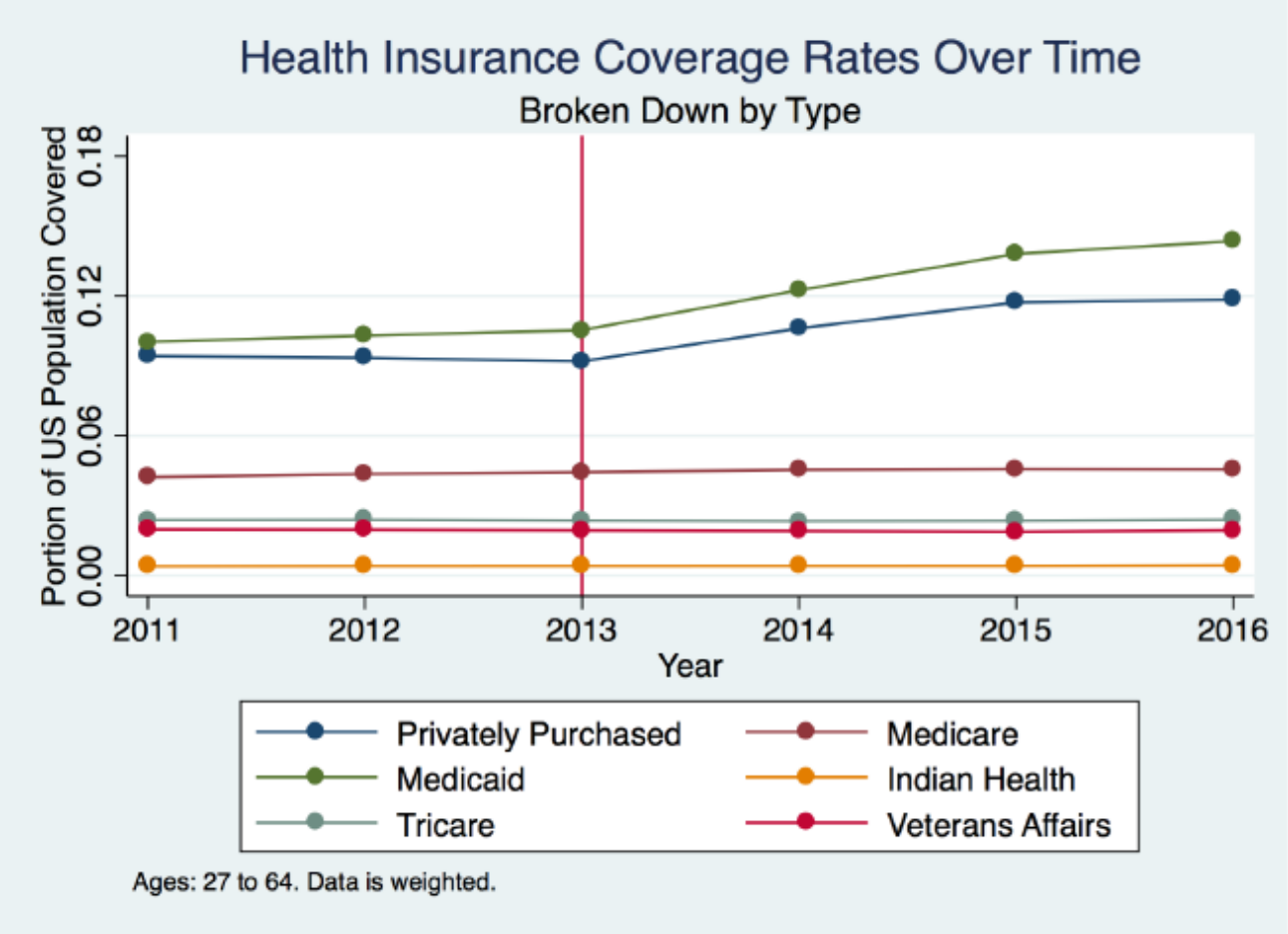
Note: Figure shows health insurance coverage rates over time for both public and private health insurance. Observations restricted to ages 27-64 and weighted by ACS household weights. The line at 2013 to represent that insurance was required beginning Jan 1, 2014.

Figure 3: Health Insurance Coverage Rates for Employer Provided Insurance



Note: Figure shows health insurance coverage rates over time for insurance provided by an employer. Observations restricted to ages 27-64 and weighted by ACS household weights. The line at 2013 to represent that insurance was required beginning Jan 1, 2014.

Figure 4: Health Insurance Rates by Type of Insurance



Note: Figure shows health insurance coverage rates over time for types of insurance (privately purchased (not from employer), Medicare, Medicaid, TRICARE, Veterans Affairs, and Indian Health Services). Observations restricted to ages 27-64 and weighted by ACS household weights. The line at 2013 to represent that insurance was required beginning Jan 1, 2014.