The Effect of the Dependent Coverage Mandate on Risky Health Behaviors by Young Adults

CHIAO-HAN LIN*

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Abstract

The dependent coverage mandate, the first mandate of the Patient Protection and Affordable Care Act (ACA), has allowed young adults to remain covered under their parents' health insurance policy until age 26 since 2010. We examine risky health behavioral responses among young adults to healthcare reform. Using a quantile regression approach, we find that states with low to moderate drug-related mortality rates have experienced increases in the unintentional drug poisoning death rate. In the findings of the subsample analyses, males increase in the unintentional drug poisoning death rate. The results suggest that males may increase in risky health behaviors after they are insured, which is consistent with the ex-ante moral hazard explanation. On the other hand, females decrease in the unintentional drug poisoning death rate which may be caused by ex-post moral hazard. The dependent coverage mandate expands the availability of addiction treatment and thereby restrain the risky health behaviors by females.

∗ Department of Economics, The Graduate Center, The City University of New York, 365 Fifth Ave., New York, NY 10016. E-mail: clin@gradcenter.cuny.edu.

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1. Introduction

Young adults have the highest uninsured rate of any age group in the United States. Most young adults lose both public (i.e., Medicaid or CHIP) and private health insurance as dependents at two critical transition points: turning 19 or graduating from college. Generally, young adults have a hard time obtaining private health insurance coverage as new entrants to the labor market. Young adults typically find a job that comes without employer-sponsored health insurance (ESHI), and most of them cannot afford the cost of health insurance coverage if they are unemployed. Over half of uninsured nonelderly adults are between the ages of 19 and 35 (Kriss et al. 2008). However, according to Morbidity and Mortality Weekly Report (MMWR), 12.9 percent of men and 17.4 percent of women aged 18-29 are reported to have at least one of six selected chronic conditions[1]. In addition, McKernan, Braga and Karas (2015) report that 25 percent of young adults aged 18-34 have past-due medical debt. Young adults are the most vulnerable population subgroup in the United States.

The Affordable Care Act (ACA) allows adult children to be covered by their parents' employer-sponsored health insurance plans until age 26[2]. The dependent coverage mandate (DC) was enacted in March 2010 and took effect six months later in September 2010[3]. This federal mandate applies to young adults in all states regardless of the following facts: financial dependency, residency with parent, student status, employment and marital status[4]. Prior to the federal mandate, approximately 37 states had passed state laws that expanded the age of dependents on health

[1] Asthma, arthritis, hypertension, cancer, diabetes or heart disease.
[2] Including self-insured firms.
[3] Any grandfathered plan does not have to provide dependent coverage if the adult child has another offer of employer-sponsored coverage aside from coverage through the parent until 2014.
[4] States may continue to apply state-level regulation to cover young adults beyond age 26 without preventing the application of the ACA.

insurance policies. Yet, state laws vary widely regarding who is eligible for the dependent coverage mandate (See *Appendix Table 1*). Besides that, firms with self-funded health insurance plans are exempt from state-level regulation under the Employee Retirement Income Security Acts (ERISA) of 1974. According to the 2008 Kaiser Family Foundation, Health Research & Educational Trust (HRET), and Norc at The University of Chicago (NORC) Employer Health Benefits Survey, roughly 55 percent of parents receiving employer-sponsored health insurance plans are from self-insured firms. Levine, McKnight and Heep (2011) show that the state regulation would lead to a 3 percentage point reduction in the uninsured rate, and predict that the uninsured rate will reduce 7 percentage points after the federal mandate. Thus, the federal mandate may still show strong effects on numerous young adults who are exempt from the previous state laws.

2. Health-Related Outcomes

Empirical research on public health insurance like Medicare and Medicaid has been examined over the years, but only few studies about the impact of private health insurance. The implementation of the dependent coverage mandate offers a unique opportunity to investigate the expansion of the private sector. Most existing literature shows substantial impacts following the dependent coverage mandate. The enrollment of employer-sponsored health insurance through parents is growing; in the meantime, the enrollment of uninsurance and other sources of health insurance[5] decreases. (Antwi et al., 2013). The utilization of medical care is much more efficient as

[5] Individual purchased insurance in own name, employer-sponsored health insurance (own policy) and public health insurance.

Emergency Department (ED) visits have dropped, and physician visits have increased (Wong et al., 2015; Antwi et al., 2015; Anderson et al., 2012; Jhamb et al., 2015).

Moreover, some of the impact of the dependent coverage mandate on health-related outcomes found in previous studies. The usage of health care in mental illness is more responsive to health insurance coverage than the usage of health care in general. The empirical evidence is consistent with the theoretical assumption. Studies show that mental illness inpatient admissions from the ER have statistically significantly increased; in the meantime, there is no evidence that the intensity of inpatient treatment[6] changed after the implementation of the dependent coverage mandate (Antwi et al., 2015). Less is known about the impact of the dependent coverage mandate on young adults' health-risk behaviors. Barbaresco et al. (2015) shows that the dependent coverage mandate increased the probability of risky drinking[7] by 0.8 – 1.4 percentage points, but the dependent coverage mandate does not affect smoking or alcoholic drinks per month. Heightened engagement in risky health behaviors can trigger substantial morbidity, and even cause serious negative consequences. It is necessary to understand the effects of health insurance on risky health behaviors by young adults.

3. Mechanism

3.1 Income Effect

Generally speaking, young adults tend to be more responsive to changes in income than older adults, more educated individuals, and higher income-level individuals. Busch et al. (2014) find

[6] Length of stay, number of procedures and total charges.

[7] Excessive drinks per month or any binge drinking. National Institute on Alcohol Abuse and Alcoholism (NIAAA) defines binge drinking as 5 drinks for men and 4 drinks for women in about 2 hours.

that young adults lowered the share of out-of-pocket expenditures from 4.2 percent to 2.9 percent after the implementation of the dependent coverage mandate. Chen et al. (2016) find that overall health care expenditures and out-of-pocket payments decreased 14 percent to 21 percent, respectively. The dependent coverage mandate helps young adults overcome the barrier of high health care costs. Theoretically, the decrease in health care costs increase disposable income and may increase demand.

3.2 Substitution Effect

The opioid epidemic in the United States began in 1990s when pharmacists and doctors over-prescribed opioid pain killers. Becker et al. (2011) find that, unlike older adults with a physician source of non-medically used opioids, young adults are more likely to obtain opioids from friends, family or dealers. The dependent coverage mandate could increase the risk of doctor shopping[8]. After the implementation of the dependent coverage mandate, the newly insured young adults may be inclined to obtain prescription drugs from medical sources. The unintentional drug poisoning death rates have been increasing rapidly, surpassing the homicide firearm death rate, and keeping up with the unintentional motor vehicle (MV) traffic death rate, the number one leading cause of death for the age group 23-25 in the United States (see *Figure 1*)[9].

3.3 Moral Hazard

Ex-ante moral hazard in health economics is when individuals change their behaviors by increasing in risky health behaviors or reducing investments in their own health after they are insured (Ehrlich

[8] A patient obtains prescription drugs from healthcare practitioners for nonmedical use.
[9] Data source: WISQARSTM (Web-Based Injury Statistics Query and Reporting System). Available here: http://www.cdc.gov/injury/wisqars/index.html

and Becker, 1972; Barbaresco et al. 2015). In contrast, ex-post moral hazard in health economics refers to the increase in health care utilization when an individual becomes insured. Generally, the uninsured are more likely to postpone or forgo preventable services and health care (Cassedy et al. 2008; Collins et al. 2012). With health insurance, individuals with addictive issues are more likely to receive treatment for substances abuse.

3.5 Willingness to Marry and Have Children

Uninsured young adults might obtain health insurance coverage through their spouse by getting married. Previous studies show that marriage, committed relationships or parenthood may reduce engagement in risky health behaviors (Bachman et al., 1997; Reynolds et al., 2010). However, the dependent coverage mandate does not extend to a dependent's spouse or children. Thus, the dependent coverage mandate might decrease the likelihood of getting married and having children, and then increase engagement in risky health behaviors.

3.6 Other Factors

It is commonly believed that young adults' risky health behaviors may be simply driven by pleasure, but they also may be induced by pressures and stress. Baicker et al. (2013) suggest that health insurance can reduce the risk of developing or triggering depression. The dependent coverage mandate might help to lower the pressure and decrease the likelihood of risky health behaviors.

Taken together, an increase in health care utilization may ease mental illness; on the other hand, an increase in risky health behaviors may worsen mental illness. Since the dependent coverage mandate may cause the opposite effects on risky health behaviors, the net effects of the mandate

on risky health behaviors are ambiguous. To investigate further than prior studies, we aim to address the behavioral concerns raised by Barbaresco et al. (2015).

4. Data

We use the Web-based Injury Statistics Query and Reporting System (WISQARS) Fatal Injury Data from the National Vital Statistics System (NVSS). The National Vital Statistics System shares the national official vital statistics, which were collected by the National Center for Health Statistics (NCHS) from 1999 to 2015. The WISQARS provides death rates by leading cause of death, injury intent, and injury mechanism categories.

We use aggregated data by state level from 2002 to 2013 to compare the trends before and after the implementation of the dependent coverage mandate. We utilize the unintentional drug poisoning death rate[10] as outcome. The year 2010 was excluded from our analyses because the implementation of the dependent coverage mandate in September may cause ambiguous effects. It is because that more than sixty-five companies continued coverage between May and September before the implementation of the dependent coverage mandate.

We focused on young adults aged 23-25 instead of those aged 19-25, which most previous studies use. Young adults aged 23-25 are a "cleaner" treatment group (Barabresco et al., 2015) because most dependents commonly age out of their parents' plans at the age 22 when they graduate from college. Antwi et al. (2015) show that the uninsured rate for young adults aged 23-25 decreases much more than the rate for those aged 19-22. Besides, the placebo test results for health insurance

[10] National Institute on Drug Abuse (NIDA) defines the medical examiner or coroner records that individual dies because of an accidental drug overdose on the death certificate, which including a drug was taken accidentally, too much of a drug was taken accidentally, the wrong drug was given or taken in error, and an accident occurred in the use of a drug(s) in medical and surgical procedures.

and labor market[11] outcomes are poor if the treatment group is young adults aged 19-25 (Slusky, 2013).

5. Methodology

5.1 Baseline Model / Reduced Form

We examined how the dependent coverage mandate affects risky health behaviors by young adults. Our baseline estimating regression was:

$$DRate_{st} = \beta_0 + \beta_1 \times (1 - k_{st})DC_{st} + \varphi PDMP_{st} + \delta X_{st} + \pi_s + \lambda_t + \epsilon_{st} \qquad (1)$$

The dependent variable $DRate_{st}$ is the unintentional drug poisoning death rate in state s in year t. The treatment variable $DC_{st} = 1$ if states extended dependent coverage up to age 26; otherwise, $DC_{st} = 0$. The variable k_{st} is the fraction of private-sector enrollees that are enrolled in self-insured plans at firms that offer health insurance[12] in state s in year t from year 2002 to 2009[13]; otherwise, $k_{st} = 0$. We use the Prescription Drug Monitoring Program ($PDMP_s$), a state-run database to control prescription drug dispensing, as a covariate (See *Appendix Table 2*). The dummy variables $PDMP_{st} = 1$ if state collects data on schedule II controlled substances[14]. The control variable X_{st} denotes time-variant variables at the state level: percentage of individuals with high school degree and less, percentage of white, percentage of married individuals, percentage of

[11] Dependent variables: probability of being employed, probability of working full time, probability of having hours that vary, and hours worked.

[12] Medical Expenditure Panel Survey Insurance Component (MEPS-IC) is an annual survey that collects information about employer-sponsored health insurance offerings in the United States since 1996 and provide private sector state-level estimates.

[13] 2007 data was not collected by Agency for Healthcare Research and Quality, Center for Financing, Access and Cost Trends. We estimated $k_{2007} = {(k_{2006} + k_{2008})}/{2}$.

[14] The U.S. Drug Enforcement Administration (DEA) classified controlled substances into five schedules depending upon the drug's acceptable medical use and the drug's abuse or dependency potential.

the rural population, the state unemployment rate and the state poverty rate. π_s and λ_t represents time-invariant state and year fixed effects, respectively.

5.2 Difference-in-Difference

Most previous research has used triple differences by comparing treatment and control groups (younger or older age group) before and after the implementation of the dependent coverage mandate to identify the causal effect. The key assumption of the difference-in-difference analysis is that the trends are parallel between treatment and control groups if there is no treatment. We compared trends in young adults aged 23-25 as a treatment group with young adults aged 16-18 and aged 27-29 as a control group before and after the implementation of the dependent coverage mandate. We estimated

$$DRate_{st} = \alpha T_g + \beta \times (1 - k_{st})DC_{st} + \eta\left[T_g \times (1 - k_{st})DC_{st}\right] + \varphi PDMP_{st} + \delta X_{gst} + \pi_s + \lambda_t + \epsilon_{gst} \quad (2)$$

$T_g = 1$ if it is treatment group aged 23-25; otherwise, $T_g = 0$. $(1 - k_{st})DC_{st}$ indicates the period after the state law was implemented. The interaction of T_g and $(1 - k_{st})DC_{st}$ captures the impact of the dependent coverage mandate among the treatment groups relative to the control group. η is the identical coefficient of the difference-in-difference estimate.

5.3 Two-Stage Least Squares (2SLS)

However, the patterns of risky health behaviors might differ by age cohort, which is against the assumption of the difference-in-difference analysis. Slusky (2015) shows that the placebo test results from triple differences approach were also statistically significant using data before the

dependent coverage mandate. We used two-stage least squares (2SLS) regression analysis to explore the mechanism whereby the dependent coverage mandate, as the mandate operates through uninsured rate, affects the unintentional drug poisoning death rate. The dependent coverage mandate is suggested to lead to an increase in the number of young adults in health insurance coverage. Then the decrease in the uninsured rate in turn changes in health-risk behaviors. To estimate the effect of the dependent coverage mandate, we modeled the first-stage regression as

$$Uninsured_{st} = \alpha_{10} + \alpha_{11} \times (1 - k_{st})DC_{st} + \varphi PDMP_{st} + \delta X_{st} + \pi_s + \lambda_t + u_{st} \quad (3)$$

The second-stage regression is

$$DRate_{st} = \alpha_{20} + \alpha_{21} Uninsured_{st} + \varphi PDMP_{st} + \delta X_{st} + \pi_s + \lambda_t + v_{st} \quad (4)$$

Substituting equation (3) into equation (4), which yields the reduced form equation for $DRate_{st}$, is equal to the baseline model equation (1), which is our reduced form model.

5.4 Quantile Regression

The drug epidemic in the United States is pandemic but not uniform. The magnitude of the death rate ranges very widely from 0 to 42 per 100,000 across states (see *Table 1*). The simple ordinary least squares (OLS) methodology may miss the disparities in the entire distribution of the death rate. In order to better understand the impact of the dependent coverage mandate at different points of the death rate's conditional distribution, we use quantile regression to comprehensively analyze the effects of the dependent coverage mandate on specified quantile ($0 < \theta < 1$) of the conditional distribution of the death rate.

Quantile regression can estimate the coefficient β_θ at several θth quantiles of the conditional distribution of the death rate. Assume that

$$Q_\theta(y|x) = x'\beta_\theta$$

To establish a valid estimator of β_θ that is consistent and asymptotic normal, it is necessary that the error term u_θ satisfies the assumption of $Q_\theta(u_\theta|x) = 0$ namely. u_θ is independent of x at θth quantile of the conditional distribution of the death rate. In this paper, the error term u_θ is assumed to be heteroskedastic. The best way to estimate the covariance matrix is the design matrix bootstrap (Buchinsky et al., 1998).

5.5 Alternative Specification

To distinguish the state-level and federal-level effects of the dependent coverage mandate, we used an alternative approach to measure

$$DRate_{st} = \gamma_0 + \gamma_1 DC_{st} + \gamma_2 \times k_{st} DC_{st} + \varphi PDMP_{st} + \delta X_{st} + \pi_s + \lambda_t + \epsilon_{st} \qquad (5)$$

The parameter of interest is γ_1, which captures the change of the death rate relative to the implementation of the dependent coverage mandate after year 2010. The state-level effect of the dependent coverage mandate prior to year 2010 is $\gamma_1 + \gamma_2 k$. We expected γ_1 to be positive and $\gamma_2 k$ to be negative, which should be consistent with the idea from previous studies that state-level change is smaller than federal-level change.

6. Results

First, we present the trend in the unintentional drug poisoning death rates in *Fig. 1*. The trend rose at a modest rate from 2006 to 2013, following a rough number 5 per 100,000 increase from 2002 to 2006, but we do not observe strong change after the implementation of the dependent coverage mandate. The descriptive statistics of young adults aged 23 – 25 before and after the implementation of the dependent coverage mandate are shown in Table 1. The means of the death rate increased from 10.48 per 100,000 to 16.43 per 100,000. The mean of uninsured rate are statistically different. For the demographic variables, there is evidence of differential change in the percentage of individuals with high school degree and less, percentage of white, percentage of married individuals, the state unemployment rate, and the state poverty rate after the implementation of the dependent coverage mandate.

Table 2 contains regression results from Eq. (1). In Table 2, the dependent coverage mandate increased the death rate by 2.18 per 100,000 or about 21.9% since $e\text{^}(0.198) \approx 1.219$. Although the findings are imprecisely measured, the results show a moderate increase in the unintentional drug poisoning death rate.

Reynolds et al. (2010) show that individuals have different patterns of health-risky behaviors across gender, race and socio-economics status. Health-risky behaviors are similar between males and females in early adolescence but, starting in high school, males are active risk-takers who are more physically aggressive and impulsive than females (Byrnes et al., 1999). From the Monitoring the Future Study, white have a higher rate of substance use than African Americans and Hispanics (Johnston et al., 2007). Therefore, we examine the heterogeneity by race and gender. Columns (1) and (2) of Table 3 report the results for white and other (combined), and columns (3) and (4) of

Table 3 report the results for male and female. Other races (7.11 per 100,000) experienced a larger effect of the mandate than white (1.99 per 100,000). However, low R^2 in other races is not economically relevant (Lev 1989). Specifically, the unintentional drug poisoning death rate for male increased substantially by 5.37 per 100,000, while the death rate for female decreased by 0.42 per 100,000. Again, these effects are all statistically insignificant, as the standard error is large. Thus we still do not have any evidence that the dependent coverage mandate affects risky health behaviors by young adults.

Table 4 lists the summary statistics of the treatment and control groups. The unintentional drug poisoning death rate and the uninsured rate for young adults aged 16-18 are lower relative to those aged 23-25 and 27-29. The unintentional drug poisoning death rate at aged 27-29 is slightly higher than at aged 23-25, while the uninsured rate at aged 27-29 is a bit lower than at aged 23-25. The difference-in-difference estimates are shown in Table 5. We estimate that the dependent coverage mandate statistically significantly increased the unintentional drug poisoning death rate of young adults aged 23-25 by 5.61 per 100,000, using the control group aged 16-18. But it statistically significantly decreased by 2.25 per 100,000, using the control group aged 27-29. The increase in unintentional death rate in the United States partly caused by drug epidemic. The reason that the death rate for young adults aged 27-29 outweighs the rate for those aged 23-25 is unknown.

Table 6 reports the two-stage least squares (2SLS) estimates. To check on the validity of our study design of 2SLS, the F statistics on the excluded instruments in the first stage show weak correlation between the uninsured rate and the dependent coverage mandate (data not shown). The results suggest that the dependent coverage mandate is a weak instrument which leads to an inconsistent estimate (Bound et al., 1995). That is, the uninsured rate does not significantly decrease after the

implementation of the dependent coverage mandate. The evidence is consist with previous study (Antwi et al., 2013) that the increase in employer-health insurance as dependent is offset by the decrease in employer-health insurance in own name and public health insurance.

Representing this range of disparities, *Figure 2* plots the results of simultaneous quantile regression with the entire sample, which is relatively large for the bottom tail of the conditional distribution of the unintentional drug poisoning death rate. Table 7 reports the effect of the mandate of dependent coverage on death rate at five different quantiles using the entire sample. Panel A of Table 7 shows the model of quantile regression with robust standard errors, and Panel B of Table 7 shows the model of simultaneous quantile regression estimating the covariance matrix via bootstrapping. The results show that the dependent coverage mandate had a statistically significant impact on the death rate at the 25^{th} percentile and the median of the conditional distribution. That is, the dependent coverage mandate appears to affect individuals in the state with a low to moderate drug-related mortality rate. To justify the application of quantile regression, we tested the equality of the slope coefficients in different points of the conditional distribution. The results indicate that the slope coefficients have no statistical differences across quantiles in the conditional distribution of the unintentional drug poisoning death rate (data not shown).

Table 8 contains regression results from Eq. (5). The dependent coverage mandate increased the unintentional drug poisoning death rate by 4.35 per 100,000 or about 11.1% since $e\text{^}(0.105) \approx 1.111$. The mean of parameter k prior to year 2010 is 0.5528. Thus, the effect of dependent coverage prior to year 2010 is $\gamma_1 + \gamma_2 k = 4.35 + (-6.23) \times 0.5528 = 0.91$ per 100,000. The result is consistent with Levine et al. (2011) findings that the change in the state regulation is smaller than the change in the federal mandate.

It is acknowledged at the outset that the unintentional drug poisoning death rate is not an ideal data outcome for measuring substance misuse and abuse. Drug abuse may or may not lead to drug overdose. The prevalence of the drug epidemic is likely to be underestimated by the limitation of this analysis. Another limitation of this analysis is the state-level aggregated data. The use of aggregated data in this study may cause an aggregation bias, whereby the variables in question may not be homogeneous across all individuals. Particularly, the dependent coverage mandate is more likely to affect families with high socio-economic status because young adults can only obtain health insurance coverage through their parents' employee-sponsored health insurance plans.

7. Discussion and Conclusion

The health care reform debate over the connection between the Affordable Care Act and the drug epidemic is relatively fresh. In this study, we argue that the dependent coverage mandate plays a role in the drug epidemic. First, the pattern shows that the unintentional drug poisoning death rates are on the rise in states with low to moderate drug-related mortality rates. Yet, the magnitude of the increase in the unintentional drug poisoning death rate is large enough to cause concern. Second, the unintentional drug poisoning death rate for male increases, which can be attributed to the implementation of the dependent coverage mandate. This may be due to the fact that the mandate reduces the opportunity cost of obtaining drugs and ultimately lead to an increase in drug abuse. Third, females decrease in the unintentional drug poisoning death rate after the implementation of the dependent coverage mandate which may be caused by ex-post moral hazard. The dependent coverage mandate expands the availability of addiction treatment and thereby restrain the risky health behaviors by females. Overall, we find mixed evidence regarding the impact of the

dependent coverage mandate on the drug epidemic. Future research to understand the heterogeneity in the treatment effect is necessary.

FIGURE 1. 3 Selected Leading Causes of Unintentional Injury Death age 23-25

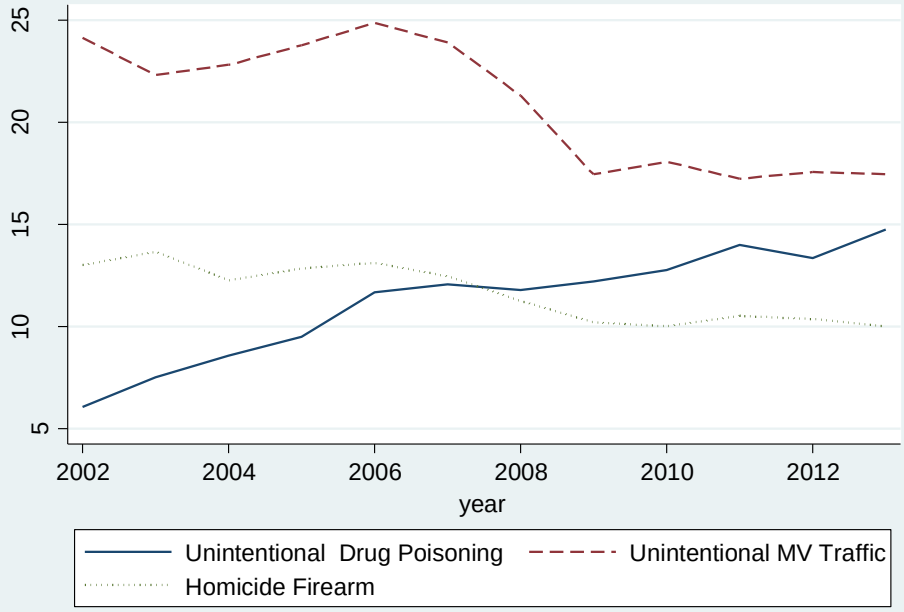

Table 1. Descriptive Statistics, age 23 – 25

	2002-2009			2011-2013			Diff
Variable	Mean	Min	Max	Mean	Min	Max	
Dependent variable							
Death Rate	10.48	0	41.75	16.43	4.84	39.3	5.95***
	(6.80)			(6.23)			(0.73)
Control variables							
Uninsured Rate	29.32	5.4	50.7	25.97	5.76	50.62	-3.35***
	(7.47)			(8.37)			(0.83)
PDMPs	0.47	0	1	0.89	0	1	
	(0.50)			(0.32)			
high school degree and less	59.72	48.85	71.84	55.92	47.7	66.07	-3.8***
	(4.44)			(4.11)			(0.43)
white	83.29	49	100	81.21	46.43	100	-2.08**
	(10.97)			(10.48)			(1.06)
married	27.83	6.67	62.73	21.43	3.27	48.39	-6.41***
	(9.23)			(9.17)			(0.9)
rural population	26.64	5.05	61.34	26.60	5.05	61.34	-0.04
	(14.45)			(14.52)			(1.41)
state unemployment rate	5.46	2.6	13.3	7.48	2.9	13.1	2.02***
	(1.69)			(1.82)			(0.17)
state poverty rate	12.22	5.4	23.1	14.20	7.6	22.5	1.98***
	(3.07)			(3.32)			(0.31)
N	355			110			

Table 2. OLS estimates of the effect of the dependent coverage mandate at age 23-25, year 2002-2013

	(1) Level	(2) Log
$(1-k)$DC	2.178	0.198
	(2.608)	(0.306)
PDMPs	-1.16	-0.08
	(1.045)	(0.108)
N	463	449
R^2	0.735	0.739

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

Table 3. OLS estimates of the effect of the dependent coverage mandate by race and gender

	(1) White	(2) Other (combined)	(3) Male	(4) Female
$(1-k)\mathrm{DC}$	1.992	7.106	5.368	-0.418
	(3.094)	(4.723)	(4.396)	(1.699)
PDMPs	-1.171	-1.662	-1.689	-0.596
	(1.282)	(2.594)	(1.71)	(0.835)
N	463	463	453	453
R^2	0.727	0.266	0.679	0.551

Robust standard errors in parentheses

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

Table 4. Sample Characteristics

Variable	All observations	Age 23 – 25	Age 16 – 18	Age 27 – 29
Dependent variable				
Death Rate	10.51	11.89	2.64	14.15
	(8.41)	(7.13)	(2.08)	(8.59)
Control variables				
Uninsured Rate	21.86	28.41	11.86	24.9
	(10.04)	(7.86)	(5.24)	(7.47)
high school degree and less	64.19	58.68	94.68	39.49
	(23.49)	(4.67)	(2.65)	(7.18)
white	82.45	82.73	82.25	82.72
	(10.98)	(10.87)	(11.42)	(10.72)
married	24.65	26.09	0.78	47.63
	(20.51)	(9.64)	(0.95)	(8.95)
N	1,299	465	352	482

Table 5. Difference-in-difference estimates of the effect of the dependent coverage mandate

	Control groups		
	Age 16 – 18	Age 27 – 29	Age 16 – 18 & Age 27 – 29
$T \times (1-k)DC$	5.608***	-2.252***	-0.303
	(1.032)	(0.712)	(0.698)
T	17.231***	-2.249**	1.535***
	(5.01)	(1.076)	(0.402)
$(1-k)DC$	-2.841**	3.078	0.849
	(1.385)	(2.025)	(1.437)
PDMPs	-1.15*	-1.709*	-1.437***
	(0.685)	(0.938)	(0.786)
N	817	947	1,299
R^2	0.745	0.735	0.711

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

Table 6. 2SLS estimates of the effect of the dependent coverage mandate

	(1) Reduced form	(2) 2SLS	
Death rate		Uninsured rate	Death rate
$(1-k)\mathrm{DC}$	2.178	-0.483	
	(2.608)	(2.598)	
uninsured rate			-4.509
			(23.986)
PDMPs	-1.16	0.811	2.497
	(1.045)	(1.058)	(20.01)

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

Figure 2. Simultaneous Quantile Regression

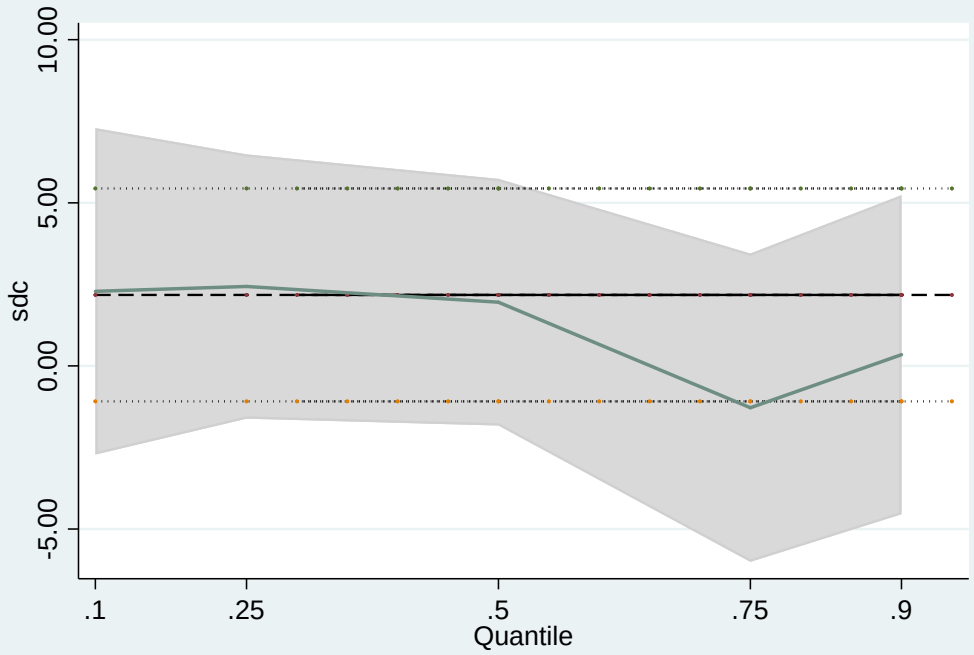

Table 7. Quantile regression estimates of the effect of the dependent coverage mandate

	Panel A Quantile Regression				
	(1)	(2)	(3)	(4)	(5)
VARIABLES	0.1	0.25	0.5	0.75	0.9
$(1-k)$DC	2.288	2.436**	1.954*	-1.279	0.345
	(1.506)	(1.023)	(1.076)	(1.776)	(1.765)
PDMPs	-0.57	-0.45	-0.462	-0.189	0.096
	(0.605)	(0.584)	(0.564)	(0.802)	(0.729)
Robust	v	v	v	v	v
Bootstrap					
N	465	465	465	465	465
	Panel B Simultaneous Quantile Regression				
	(1)	(2)	(3)	(4)	(5)
VARIABLES	0.1	0.25	0.5	0.75	0.9
$(1-k)$DC	2.288	2.436	1.954	-1.279	0.345
	(2.089)	(2.352)	(2.27)	(2.729)	(3.242)
PDMPs	-0.57	-0.45	-0.462	-0.189	0.096
	(1.321)	(1.163)	(1.244)	(1.361)	(0.98)
Robust					
Bootstrap	v	v	v	v	v
N	465	465	465	465	465

Standard errors in parentheses

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

Table 8. Alternative OLS estimates of the effect of dependent coverage mandate

	(1) Level	(2) Log
DC	4.35	0.105
	(5.101)	(0.705)
kDC	-6.229	-0.027
	(7.882)	(1.091)
PDMPs	-1.16	-0.08
	(1.046)	(0.108)
N	465	449
R^2	0.735	0.739

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Appendix Table 1. The State Laws of Dependent Coverage

State	Effective	Limiting age	Non-students	Married	Child
Colorado	2006	24	Yes		
Connecticut	2009	26	Yes		
Delaware	2006 [p]	23	Yes		
Florida	1998 [p] / 2009	24 / 30	Yes		
Georgia	2006 [p]	25			
Idaho	2007 [p]	24			
Illinois	2009 [p]	26	Yes		
Indiana	2007 [p]	24	Yes	Yes	
Iowa	2008	24			
Kentucky	2008	25			
Louisiana	2009	23			
Maine	2007 [p]	25			No
Maryland	2007	25	Yes		
Massachusetts	2006 [p]	25	Yes	Yes	
Minnesota	2008	25	Yes		
Missouri	2008	25	Yes		
Montana	2008	24	Yes		
Nevada	1995	23			
New Hampshire	2007 [p]	25			
New Jersey	2005 [p]	30	Yes		No
New Mexico	2006 [p]	24	Yes		
New York	2009	29	Yes		
North Dakota	1995	25			
Ohio	2010	28	Yes		
Oregon	2007 [p]	23	Yes		
Pennsylvania	2009	29	Yes		No
Rhode Island	2005 [p]	25			
South Carolina	2008	22			
South Dakota	2007 [p]	29		Yes	
Tennessee	2008	23	Yes		
Texas	2003	24	Yes		
Utah	1995	25	Yes		
Virginia	2006 [p]	25		Yes	
Washington	2007	24	Yes		
West Virginia	2007	24	Yes	Yes	
Wisconsin	2010	26	Yes		
Wyoming	2009	22			

Note: p – passed

Source: Colorado Rev. Stat. § 10-16-104.3; Connecticut C.G.S.A. § 38a-497; Delaware Code Ann. Tit. 18, § 3354; Florida 627.6562; Georgia Code § 33-30-4; Idaho Stat. § 41-2103; 215 ILCS 5/356z.12; Indiana IC 27-8-5-2,28 and IC 27-13-7-3; Iowa Code § 509.3 and §514E.7; Kentucky Rev. Stat. § 304.17A-256; Louisiana Rev. Stat. Ann. § 22:1003; Maine 24-A MRSA § 2742-B; Maryland Code Insurance § 15-418; Massachusetts Gen. Laws Ann. Ch. 175 § 108; Minnesota Chapter 62E.02; Missouri Rev. Stat. § 354-536; Montana MCA 33-22-140; Nevada NRS 689C.055; New Hampshire Rev. Stat § 420-B:8-aa; New Jersey S.A. 17B:27-30.5; New Mexico Stat. Ann. § 13-7-8; New York 2009 Assembly Bill 9038; North Dakota Cent. Code § 26.1-36-22; Ohio Rev. Code § 1751.14, as amended by 2009 OH H 1; Oregon O.R.S. § 735.720; Pennsylvania 2009 SB 189; Rhode Island Gen. Laws § 27-20-45 and Gen. Laws § 27-41-61; South Carolina Code Ann. § 38-71-1330; South Dakota Codified Laws Ann. 3-12A-1; South Dakota Codified Law § 58-17-2.3; Tennessee Code Ann. 56-7-2302; Texas V.T.C.A. Insurance Code § 846.260 and V.T.C.A. Insurance Code § 1201.059; Utah Code Ann. Title 31A § 22-610.5; Virginia Code Ann. 38.2-3525; Washington RCWA 48.44.215; West Virginia Code § 33-16-1a; Wisconsin Stat. § 632.885; Wyoming Stat. § 26-19-302;

Appendix Table 2. The Prescription Drug Monitoring Programs

State	Year enacted	Drug schedules monitored	Year became operational
Alabama	2004	II-V	2006
Arizona	2007	II-IV	2008
Arkansas	2011	II-V	2013
California	1939	II-IV	1939
Colorado	2005	II-V	2007
Connecticut	2006	II-V	2008
Delaware	2010	II-V	2012
Florida	2009	II-IV	2011
Georgia	2011	II-V	2013
Idaho	1967	II-V	1967
Illinois	1961	II-V	1968
Indiana	1997	II-V	1998
Iowa	2006	II-IV	2009
Kansas	2008	II-IV	2011
Kentucky	1998	II-V	1999
Louisiana	2006	II-V	2008
Maine	2003	II-IV	2004
Maryland	2011	II-V	2013
Massachusetts	1992	II-V	1994
Michigan	1988	II-V	1989
Minnesota	2007	II-IV	2010
Mississippi	2005	II-V	2005
Montana	2011	II-V	2012
Nebraska	2011	II-V	2011
Nevada	1995	II-IV	1997
New Hampshire	2012	II-IV	2014
New Jersey	2008	II-V	2011
New Mexico	2004	II-V	2005
New York	1972	II-V	1973
North Carolina	2005	II-V	2007
North Dakota	2005	II-V	2007
Ohio	2005	II-V	2006
Oklahoma	1990	II-V	1991
Oregon	2009	II-IV	2011
Pennsylvania	1972	II-V	1973
Rhode Island	1978	II-IV	1979
South Carolina	2006	II-IV	2008
South Dakota	2010	II-V	2011
Tennessee	2003	II-V	2006
Texas	1981	II-V	1982
Utah	1995	II-V	1996
Vermont	2006	II-IV	2009
Virginia	2002	II-IV	2003
Washington	2007	II-V	2011
West Virginia	1995	II-IV	1995
Wisconsin	2010	II-V	2013
Wyoming	2004	II-IV	2004

Sources: National Alliance for Model State Drug Laws (NAMSDL); Prescription Drug Monitoring Program Training and Technical Assistance Center (PDMP TTAC)

Note: Schedule I: drugs with no currently accepted medical use and a high potential for abuse. Schedule II: drugs with a high potential for abuse which may lead to severe psychological or physical dependence. Schedule III: drugs with a moderate to low potential for physical and psychological dependence. Schedule IV: drugs with a low potential for abuse and low risk of dependence. Schedule V: drugs consist of preparations containing limited quantities of certain narcotics.