

The Long-run Impacts of Adolescent Drinking: Evidence from Zero Tolerance Laws

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Facts

- ❑ Underage binge drinking in the U.S is *very common* (> 25% of 18-20 year olds in 2015).
- ❑ Underage binge drinking is *costly*:
 - Economic costs of \$24 billion (CDC, 2010)
- ❑ Underage binge drinking is associated with a number of *negative outcomes*: poor academic performance, crime, drunk driving, mortality
- ❑ Less is known about the long-term consequences of this behavior
- ❑ Better estimates of the costs of heavy alcohol consumption could be informative to policymakers as they try to design more optimal policies.

What are the effects of adolescent binge drinking on later-life health and labor market outcomes?

- ❑ Exploit cross-state variation in the rollout of “*Zero Tolerance*” laws in the U.S:
 - arose in response to congressional legislation requiring states to pass through tough youth drunk driving laws
 - $BAC \leq 0.02$ for individuals under age 21, license suspension for violators
 - by 1998 ZT laws were in place in all states – significant variation in the timing of policy adoption across states
 - laws led to large declines in heavy alcohol consumption (males), nuisance crime arrests & alcohol-related traffic fatalities among adolescents (Carpenter, 2004 & 2005)

- ❑ Link individual exposure to this policy during adolescence (based on state & year of birth) to later-life health and other outcomes (alcohol use, employment, education)

Mechanisms

- ❑ Initiation into heavy drinking during adolescence may *increase the likelihood of this behavior in adulthood (habit formation)*
- ❑ Initiation into heavy drinking during adolescence may *affect human capital formation*
- ❑ Initiation into heavy drinking during adolescence may *directly affect later-life health and development*
- ❑ Increased rates of DUI arrests

Data

- ❑ *Main analysis*: annual individual-level data from the *ACS* (2000 to 2017):
 - nationally representative cross-sectional surveys of the US population
 - individuals born between 1946 and 1982 aged 35 to 54 at the time of observation
 - information on state, year and quarter of birth (to define policy exposure)
 - information on disability outcomes (physical, cognitive or vision/hearing limitations)
 - information on education, marital status, employment

- ❑ *Auxiliary analysis*: individual-level data from the *BRFSS* (1990 to 2017):
 - state representative cross-sectional surveys
 - individuals aged 35 to 54 at the time of observation
 - detailed information on alcohol consumption during previous month

Research Design

□ Standard difference-in-differences regressions:

$$y_{icst} = \alpha + \beta_{age}(ZT_{cs} \times age_{icst}) + \gamma X_{icst} + \lambda_c + \delta_s + \eta_t + \delta_s \cdot c + \delta_s \cdot age_{icst} + \varepsilon_{icst}$$

y_{icst} : outcomes for individual i from birth cohort c born in state s observed in year t

X_{icst} : vector of individual (5-year age group dummies, gender, race) and state-level controls (unemployment rate and a series of alcohol-related policies)

$\lambda_c, \delta_s, \eta_t$: birth cohort, state of birth and survey year fixed effects

$\delta_s \cdot c$: birth state-specific linear cohort trend

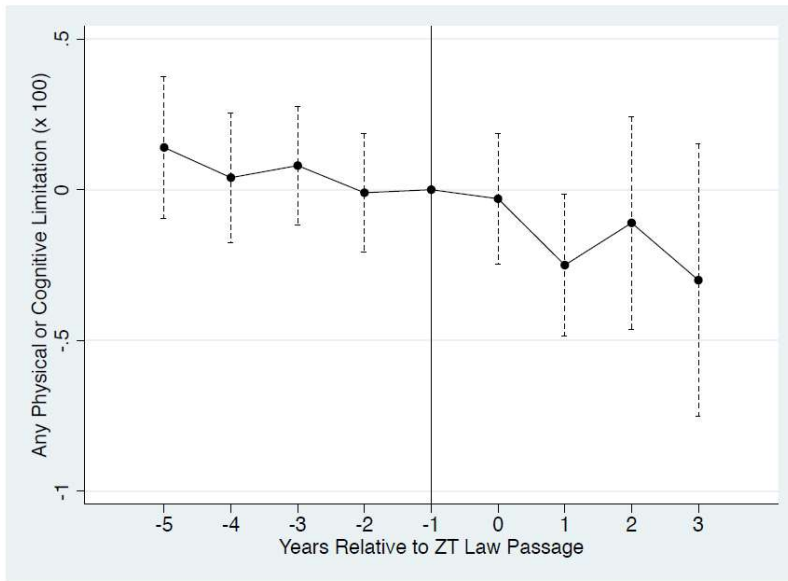
$\delta_s \cdot age_{icst}$: interactions between birth state & age group

ZT_{cs} : indicator for whether the individual was exposed to a ZT law in birth state prior to age 21

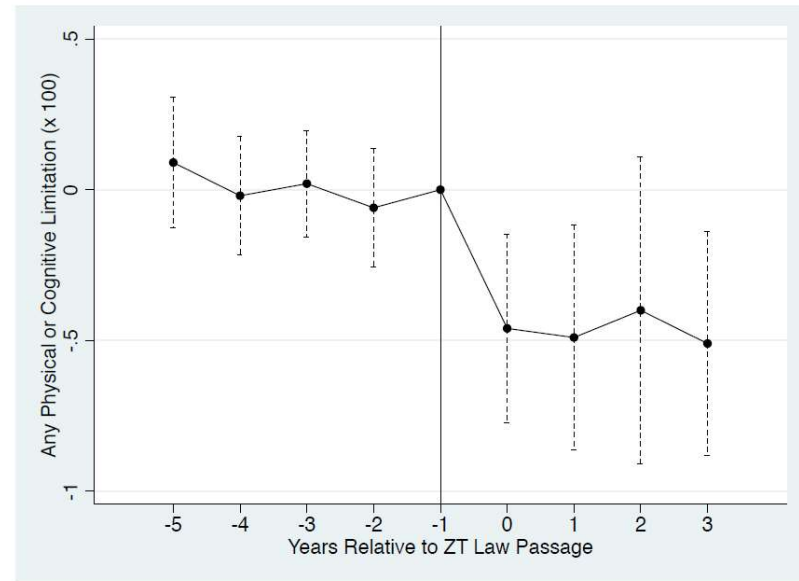
Research Design

- ❑ *Identifying assumption*: conditional on all covariates, trends in outcomes across states were not systematically related to the timing of ZT law implementation:
 - legislative history of ZT policies: arose in response to federal legislation requiring the enactment of these policies
 - timing of adoption across states is unrelated to pre-existing alcohol-related policies and other socioeconomic characteristics of the states
 - “event-study” graphs based on the timing of adoption of ZT laws:
 - no evidence of pre-trends in the years leading up to ZT law passage
 - sharp drop in disability rate for first exposed cohorts aged 40+

Research Design



(a) Age 35-39



(b) Age 40-48

ZT law exposure & later-life health

	Any limitation
ZT law	
x Age 35-39	-0.12 (0.12)
x Age 40-44	-0.32 (0.15)**
x Age 45-48	-0.98 (0.28)***
N	9914094

- ❑ Significant declines in self-reported health limitations for older age groups
- ❑ Decline in likelihood of reporting any limitation by 3% for 40-44 year olds and 8% for 45-49 year olds

ZT law exposure & later-life health

Dependent variable:	Any limitation	Any physical limitation	Any cognitive limitation	Any visual or auditory limitation
ZT law				
x Age 35-39	-0.12 (0.12)	-0.03 (0.10)	-0.08 (0.09)	-0.08 (0.06)
x Age 40-44	-0.32 (0.15)**	-0.32 (0.10)**	-0.10 (0.08)	-0.01 (0.09)
x Age 45-48	-0.98 (0.28)***	-0.43 (0.10)***	-0.73 (0.27)**	-0.35 (0.10)**
N	9914094			

- ❑ Significant declines in self-reported health limitations for older age groups
- ❑ Decline in likelihood of reporting any limitation by 3% for 40-44 year olds and 8% for 45-49 year olds
- ❑ Timing of benefits varies with the underlying limitation

ZT law exposure & later-life health

Dependent variable:	Any limitation	Any physical limitation	Any cognitive limitation	Any visual or auditory limitation
ZT law				
x Age 35-39	-0.12 (0.12)	-0.03 (0.10)	-0.08 (0.09)	-0.08 (0.06)
x Age 40-44	-0.32 (0.15)**	-0.32 (0.10)**	-0.10 (0.08)	-0.01 (0.09)
x Age 45-48	-0.98 (0.28)***	-0.43 (0.10)***	-0.73 (0.27)**	-0.35 (0.10)**
N	9914094			

- Patterns stable across a number of robustness exercises (e.g. geographic clustering in timing of adoption, endogenous migration, sensitivity to states adopting early, assess sources of identifying variation using Goodman-Bacon decomposition)

ZT law exposure & later-life labor market outcomes

Dependent variable: *Any disability*

	Men (N=4770985)
ZT law	
x Age 35-39	0.08 (0.017)
x Age 40-44	-0.36 (0.019)*
x Age 45-48	-1.13 (0.47)**
	Women (N=5143109)
ZT law	
x Age 35-39	-0.32 (0.15)*
x Age 40-44	-0.28 (0.17)
x Age 45-48	-0.84 (0.81)

ZT law exposure & later-life labor market outcomes

Dependent variable:	<i>Any disability</i>	<i>Weeks worked last year</i>	<i>Usual hours worked per week</i>	<i>Currently employed</i>
Men (N=4770985)				
ZT law				
x Age 35-39	0.08 (0.017)	0.10 (0.11)	0.03 (0.010)	0.17 (0.23)
x Age 40-44	-0.36 (0.019)*	0.15 (0.10)	-0.04 (0.12)	0.27 (0.22)
x Age 45-48	-1.13 (0.47)**	0.70 (0.28)**	1.08 (0.44)**	1.07 (0.54)*
Women (N=5143109)				
ZT law				
x Age 35-39	-0.32 (0.15)*	0.30 (0.15)**	0.33 (0.13)**	0.76 (0.31)**
x Age 40-44	-0.28 (0.17)	0.03 (0.14)	-0.00 (0.11)	0.22 (0.30)
x Age 45-48	-0.84 (0.81)	0.16 (0.46)	-0.01 (0.36)	0.89 (1.31)

- ❑ Increases in labor market attachment mirror declines in disability
- ❑ Effects are strongest among older men
- ❑ Increases in annual weeks worked among 45-48 years old men raised their annual earnings by \$736=> long-run annual economic gains of \$6 billion dollars by 2017

Mechanisms

- ❑ Increased educational attainment & marriage entry:
 - estimates small in magnitude and generally not statistically significant
 - health effects not mediated through either of these channels

- ❑ Increased DUI arrests among adolescents:
 - can explain very little of the estimated health effects

- ❑ Reduced initiation to binge drinking at a critical age period which led to decreases in heavy alcohol consumption in later adulthood (habit-formation)
 - link exposure to ZT laws during adolescence to alcohol consumption in later-life (BRFSS)

Mechanisms

- ❑ Reduced initiation to binge drinking at a critical age period which led to decreases in heavy alcohol consumption in later adulthood (habit-formation)

Dependent variable:	Alcohol consumption in previous month		
	1, if binge drank	ave. drinks per drinking episode	any alcohol
ZT law			
x Age 35-39	-0.003 (0.003)	-0.073 (0.015)***	-0.001 (0.004)
x Age 40-44	-0.007 (0.004)*	-0.08 (0.022)***	-0.013 (0.005)**
x Age 45-48	-0.021 (0.008)**	-0.193 (0.027)***	0.007 (0.015)
N	1327767	1324156	2704197

- Persistent declines in heavy episodic drinking among older individuals
- Patterns could also reflect evolution in the effectiveness of ZT laws over time: youths may gradually adapt to the policy and find alternative ways to continue drinking despite the restrictions

Conclusions

- ❑ Significant improvements in later-life health and labor market outcomes linked to the rollout of ZT laws
 - impacts concentrated among older age groups => harms from youth binge drinking may intensify with age
- ❑ Estimates imply that the laws generated annual gains of more than \$6 billion due to increased labor market attachment among middle aged
- ❑ Results highlight the critical role of early habit-formation for long-run substance use
 - individuals exposed to the laws when young were less likely to drink heavily later in life
 - scope for policy to influence initiation decisions & shape outcomes over the lifecycle