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Variation in U.S. Traffic Safety Policy Environments and Motor Vehicle Fatalities 1980–2010

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Abstract

Objective—To examine the impact of variation in state laws governing traffic safety on motor vehicle fatalities.

Study Design—Repeated cross sectional time series design.

Methods—Fixed effects regression models estimate the relationship between state motor vehicle fatality rates and the strength of the state law environment for 50 states, 1980–2010. The strength of the state policy environment is measured by calculating the proportion of a set of 27 evidence-based laws in place each year. The effect of alcohol consumption on motor vehicle fatalities is estimated using a subset of alcohol laws as instrumental variables.

Results—Once other risk factors are controlled in statistical models, states with stronger regulation of safer driving and driver/passenger protections had significantly lower motor vehicle fatality rates for all ages. Alcohol consumption was strongly associated with higher MVC death rates, as were state unemployment rates.

Conclusions—Encouraging laggard states to adopt the full range of available laws could significantly reduce preventable traffic-related deaths in the U.S. – especially those among younger individuals. Estimating the relationship between different policy environments and health outcomes can quantify the result of policy gaps.

Keywords

traffic fatalities; alcohol policies; traffic polices

Introduction

Traffic fatalities are a major cause of death in the United States, the second greatest contributor to years of life lost before age 75, and a leading cause of death in the first three decades of life.[1] Over the last three decades, deaths resulting from motor vehicle collisions (MVCs) have declined by nearly 35%.[2] Nevertheless, in 2011, there were 32,367 traffic-

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related deaths and mortality rates varied five-fold among states. About a third of these deaths occurred among people aged 25 years and younger.[3] Alcohol has been involved in about a third of fatal collisions nationwide since 1994, currently ranging from about 16% in Utah to 48% in Hawaii.[3]

Each state is responsible for establishing driving and alcohol laws. The federal government encourages laws by either withholding funding for the state if a particular law is not passed or providing an opportunity for additional funding if passed. Federal legislation in 1984 prompted all 50 states to adopt laws that defined the legal age for possession and purchase of alcohol at 21 years of age by 1988, along with other provisions aimed at reducing alcohol consumption and drunk driving among teens.[4] In addition, the federal government conditioned national highway funding on states' adoption of the zero tolerance law for younger drivers in 1995 and the 0.08 BAC limit for adults in 2000, which led to all states' adoption of these laws. Beyond these provisions, however, the majority of laws geared toward reducing traffic fatalities have been enacted at the state level. Indeed, considerable variation in state speed limits followed the 1995 federal repeal of the 55 MPH national speed limit.

Extensive scholarship has demonstrated the effectiveness of laws requiring safety belt use,[5] properly restraining infants, toddlers, and older children,[6–8] rear seating mandates for children,[7, 9] graduated driver's licenses,[10, 11] lower speed limits,[12, 13] penalties for cellphone use while driving[14, 15], defining acceptable blood alcohol content limits for drivers at 0.08 or lower;[16] restrictions on possessing and serving alcohol in bars and restaurants [17]; alcohol sales regulations including minimum legal drinking age laws;[18–20] fines and jail sentences for alcohol-impaired driving;[21] and zero-tolerance laws (lower legal blood alcohol content limits) for younger drivers.[16, 22, 23] Strong enforcement provisions, such as the primary enforcement of seat belt laws, may also contribute to larger reductions in motor vehicle deaths.[24, 25] Such evidence led the U.S. Task Force on Community Preventive Services to recommend adoption of these laws.[26]

Despite this evidence, sizeable differences among states in the number of laws they have enacted remain. Assessing this variation presents a number of methodological challenges. First, data regarding the features of laws and their enforcement are often incomplete, limiting the capacity of researchers to adequately measure the regulatory environment and, most especially, to understand the impact of changes in this environment over longer time frames. Although organizations such as the National Highway Traffic Safety Administration (NHTSA) and the Insurance Institute for Highway Safety (IIHS) periodically survey the extent of each state's adoption of the available traffic and alcohol laws, these data are generally available for only a short time period for only a subset of laws, and/or for only a selected number of states.

Using indices or scales of existing policies is one way to capture variation in the strength of the regulatory environment. Scales measuring the strength of national tobacco [27] and alcohol policies[28, 29], have been used to rank Organization for Economic Co-operation and Development (OECD) member country approaches to addressing these commodities. A small number of scholars have assessed the relationship between variation in a set of alcohol policies and alcohol-related outcomes in Europe [30] and in the U.S., but these efforts are still nascent [31, 32] To date, there is no single index measuring all traffic related policies. Most studies have captured only a subset of state regulations that may be at play on the road, focusing primarily on either laws related to drinking and driving or laws related to occupant and passenger safety [33]. As a result, the net effects of this extensive policy variation have not been fully evaluated.

An additional barrier to studying the effects of multiple laws on traffic fatalities involves endogeneity biases resulting from the need to control for variables (such as alcohol consumption) that may lead to higher death rates, but that may also be the objects of legislative action. Typically, researchers have used state-level or regional fixed effects in regression models to control for heterogeneity between states in alcohol consumed[34, 35], but these methods do not account for endogeneity and can provide biased estimates of the effects of alcohol related laws.

This study addresses these gaps by: 1) developing a measure of the overall state regulatory approach to traffic fatality prevention; 2) quantifying the net effects of both traffic and alcohol control policies on traffic fatalities over the past 30 years; and 3) using an instrumental variable approach to address endogeneity biases.

Study data

The study uses data on 27 alcohol and traffic related evidence-based laws whose presence or absence has been investigated in all 50 states from 1980–2010. Laws included met the following criteria: 1) it was specifically aimed at changing individual behaviors 2) there was evidence regarding their effectiveness in improving health outcomes in the peer-reviewed literature; and 3) data for enactment of the law could be found for all states and years.

The dataset was constructed by retrieving, validating, standardizing, coding, and merging existing data on selected laws from publicly available data sources.[36–39] Published studies were used as reliable data sources only if the authors described how the statutes were located and listed their effective date. Original legal research was conducted to locate data missing from the published studies for certain states and years, and to retrieve data regarding child restraint laws.[40] For a small amount (less than 5%) of missing law data (such as one missing year of data for a state), linear interpolation methods were used to provide values for missing data points. All laws were coded as binary variables for their presence or absence in each state in each year. When this process involved adapting existing data sources, a conservative estimation of the strength of state laws was used. For example, the IIHS evaluates the quality of graduated drivers' license regulations on a scale from 0 (no law), 1(marginal), 2(fair), and 3 (good). For these laws, states were counted as having the law only when they receive a score of 3 [41]. State speed limits on urban interstates are operationalized as less than or greater than or equal to 60 miles per hour for each year.[42, 43] Table 1 identifies the laws included in the study, their definition and data source.

Numerators for traffic fatalities come from the U.S. Fatality Analysis Reporting System, a census of all motor vehicle crashes that result in the death of the driver or at least one occupant.[2] The denominators, 100 million vehicle miles traveled (VMT), obtained from the NHTSA, capture the changing risk of motor vehicle collisions since it gives a yearly measure of the amount of driving in any given state and year.[44]

Methods

This study uses a repeated cross sectional time series design and a fixed effects specification to analyze panel data, and employs instrumental variable techniques to estimate endogenous regressors.[45] Three outcomes are assessed: the yearly state MVC fatality rate for all ages, for those under 25 years, and for those aged 25 and over. The fixed effects approach allows states to begin the time series with different laws and risk factors, and tests the relationship between each subsequent law change and resulting yearly changes in fatality rates, allowing each state to serve as its own control. The fixed effects control for unobserved (and unobservable) state characteristics such as geographical and cultural differences that do not change over time.

To capture the myriad state laws related to reducing MVC deaths, a total policy adoption score was constructed that reflects the proportion of the 27 driving safety and occupant protection laws or specific enforcement provisions a state has adopted in any given year (see table 1). The policy adoption score is lagged by one year (to reflect the time between adoption and implementation and to reduce simultaneity biases) and divided into quartiles with the lowest quartile as the reference group. Thus, the measure captures the relative strength of a state's law environment versus other states and allows for changes over time. Due to the law adoption score time lags, models exclude 1980, but include all years from 1981–2010, leading to a total sample size of 1450 observations (50 states X 29 years).

Several state characteristics associated with traffic fatalities are used as control variables. These include Census Bureau measures of state socioeconomic levels (percent of the state's population living in poverty), the percent of the state population that is unemployed (several studies have demonstrated a direct relationship with the motor vehicle fatality rate [35, 46, 47]) the percent of the population aged 15–24 (those at highest risk of traffic-related death), population density (population per square mile), and the per capita miles of highway for each state in each year.[48] Models contain yearly state tax revenues per capita adjusted for inflation (in 1980 constant dollars) as a proxy measure of state capacity to undertake regulation and enforcement activities.[49] All models include a variable representing years and a year-squared term to account for nonlinear trends. Finally, gallons of ethanol (drinking alcohol) purchased per capita are included for each year in each state.[50]

The first four laws listed in table 1 are designed to affect alcohol consumption. Because these laws can only affect motor vehicle fatalities via alcohol consumption (the tax on beer, the 21 year old minimum legal drinking age, Sunday sales restrictions, and beer keg registration laws) they are used as instrumental variables (IVs) to estimate it.[20, 22, 51–56] The resulting "instrumented" alcohol consumption measure is included in the final statistical model estimating MVC death rates. All four IVs are consistently negatively associated with alcohol consumption and together explain nearly a third of within state variation in alcohol consumption over time (see appendix). Tests for under-identification (Anderson LR test) and over-identification (Hansen's J statistic) indicate the appropriateness of the four laws as IVs.[57]

Several specifications assure the analysis is robust to other potential biases. First, the series of equations is estimated using the Generalized Method of Moments (GMM), which allows for more efficient estimates (lower risk of a type two error) than standard two stage least squares approaches to panel IV models. Second, results are presented using robust standard errors which are resistant to heteroskedasticity that could occur from correlated error terms due to, for example, short-term regional similarities not captured in the fixed effects. All statistical analyses were performed using STATA 12.1.[58]

Results

As shown in Figure 1, fatality rates from motor vehicle crashes declined during the study period. However, the rate of decline slowed between the mid-1990s and 2007 until dropping steeply in 2008. Further, the proportion of deaths of those under 25 years of age declined sharply in the 1980's, but has remained fairly steady at about 30% since the late 1990s. The portion of all traffic fatalities that involved alcohol exhibited a similar trend to deaths under age 25. Over this same period, the total number of laws that states have adopted has steadily increased, although the gap between the states with the highest and the lowest policy adoption scores has widened.

Table 2 presents mean values and standard deviations for policy adoption scores and covariates at decade intervals. The average state score grew significantly over time, increasing from 7.65 in 1980 to 58.99 in 2010, reflecting increasing law adoption within all states. However, the gap between states with higher and lower scores also grew, as demonstrated by the increase in the standard deviation of the total policy adoption score and the increase in the gap between the highest and lowest score quartiles, which grew from a difference of about 8% in 1980 to about 30% in 2010.

The proportion of states adopting the laws did not consistently increase over time. While only 14 states in 1980 had a minimum legal drinking age of 21, all 50 states had raised their drinking age by 1990, prompted by federal action. However, between 2000 and 2010, the number of states with bans on Sunday alcohol sales fell from 20 to 14 as states repealed these laws.

Population density grew steadily over time, while the miles of road per capita and the percentage of younger drivers in the population declined. State poverty rates remained fairly steady. Ethanol alcohol consumption declined from about 2.81 gallons per capita in 1980 to about 2.52 gallons per capita in 2010. Alcohol consumption also varied substantially by state. In 2010, 3.34 gallons of ethanol alcohol were consumed on average by every resident over the age of 14 in Nevada, compared to 1.46 gallons in Utah.

Figure 2 depicts gaps and differences among states in policy scores, motor vehicle fatality rates, and alcohol consumption at four points in time over the study period. States in the highest policy quartile in 1980 were not necessarily in the highest quartile in 2010. In 1980, 3 states (HI, LA, TN) had the largest number of evidence-based laws. By 2010, only one of these (TN) joined an additional 11 states (AL, AK, CA, CO, GA, KS, ME, NJ, RI, WA, WI) in the top quartile. The second panel of this figure displays the geographical distribution of the overall decrease of deaths in MVC. Some states with higher rates of deaths in 1980 continue to have higher rates in 2010 when compared to the other states, as in the case of MT. The third panel of figure 2 shows alcohol consumption in states by quartiles. Medians for these quartiles ranged from 2.14 gallons in quartile 1 to 4.54 gallons in quartile 4. Noteworthy is the overall increase in alcohol consumption in 2010 after a steady decline from 1980 to 2000.

In Table 3, models 1–3 show the relationship between the total policy adoption score and state traffic fatality rates by age group. As can be seen in model 1, there is a dose-response relationship between the strength of the state policy adoption scores and the magnitude of its negative association with the overall MVC fatality rate, after controlling for other state characteristics and population factors. Alcohol consumption was positively associated with MVC fatality rates. The results of the IV tests (in all three models) indicate that the IVs were not under-identified (null hypothesis is rejected) nor over-identified and can be considered valid.

When fatality rates are restricted to those under 25 years of age (model 2), the relationship between policy adoption scores and state traffic fatality rates persists, albeit with a slightly smaller magnitude. Alcohol consumption, however, is no longer independently associated with MVC fatality rate among this age group. When the fatality rates are restricted to those 25 years and over (model 3), there is a negative-dose relationship to higher quartiles of state law adoption scores. The instrumented variable for alcohol consumption is positively associated with higher state fatality rates for those over 25 years, holding policy adoption scores and other factors constant.

Unemployment rates are strongly negatively associated with state motor vehicle fatality rates for all age groups, as expected. Unsurprisingly, population density is positively

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associated with MVC fatality rates in all age groups, but the magnitude is small. As expected, the proportion of the population aged 15–24 is positively associated with MVC death rate for the whole population and for those under 25, but not among those 25 and over.

Discussion

The number of state traffic safety laws has varied historically, and these differences grew more pronounced between 1980 and 2010, creating very different state law environments across the country. This study advances knowledge in the field by including a broader set of traffic safety laws than have been typically used in previous studies. Measuring differences in these state law environments with policy adoption scores reveals the relative progress states have made towards adopting the fullest protections on the road, highlighting where public health advocates should focus attention. Ongoing surveillance of variation in the full range of state laws, as demonstrated here, is necessary to monitor continued progress in reducing motor vehicle fatalities.

This study also provides evidence of the human cost of these differences in state law environments. While all states have increased the number of laws they have adopted, the results of this study quantify the toll exacted by gaps in state traffic safety policies. Results show that states that adopted a greater number of the evidence-based policies had significantly lower than expected fatality rates for all age groups. Such evidence may aid policymakers and advocates in establishing state agendas for improving traffic safety.

Last, this study demonstrates the utility of an instrumental variable approach to address measurement and estimation problems that previous studies have encountered when adding direct measures of alcohol consumption into analyses of state law effects on motor vehicle fatalities. The findings confirm the importance of alcohol consumption patterns on traffic safety, while addressing measurement and estimation problems of including alcohol consumption directly in studies of traffic safety laws. Although alcohol consumption has fluctuated over the past 30 years, higher alcohol consumption rates are associated with higher state fatality rates for adults over 25 years of age. The use of instrumental variables in this study introduces only the residual alcohol consumption in a state net the four laws used as IVs into the model. Thus the four alcohol laws used as IVs not only reduce alcohol consumption (see appendix), but are also particularly effective in reducing alcohol-related traffic fatalities among those under age 25.[20, 22, 41, 51–53, 55, 56]. The finding that alcohol consumption, net of the 4 most common alcohol regulations, continues to be a predictor of MVC deaths among those over age 25 suggests the need for additional approaches to reducing alcohol consumption that may lead to impaired driving among this age group.

This study has several limitations. First, policy scores are comprised only of laws with the strongest evidence base, for which data are available, and that varied only in the ways that can be consistently codified for analysis. Other state or local laws that have been shown to be effective (zoning restrictions for alcohol sales[59, 60] or height/weight regulations for child car seats[61, 62]) could not be included here, resulting, possibly, in an underestimation of the effects of policy adoption scores on traffic fatalities. Second, some of these laws, specifically those aimed at restraining children and youth in the car, should have an impact only on fatality rates for those under 25 and their inclusion may result in an overestimation of the association between the strength of the law environment and deaths to those over 25. However, their adoption reflects an important component of the comprehensiveness of the state's traffic safety approach. Third, policy scores are measured based on the presence or absence of the laws in a given year, without accounting for any exception or exemption from compliance provided in the laws. For instance, the law restricting cell phone use while driving was measured as being present even if there was an exception for those using handsfree devices. Fourth, states differ in their approaches to enforcement which could enhance or impede the effectiveness of otherwise similar laws. Measures of enforcement (e.g. number of sobriety checkpoints, fines collected, jail terms served) are not incorporated in the analysis because these data are not available and may not be consistent over time.[63] Alternatives such as arrests for driving while intoxicated could serve as a proxy, but cannot be added into these same models without risking endogeneity bias. Interestingly, one gross measure of state capacity for enforcement, state total tax revenue, was not significant in any of these analyses. Assessing levels of enforcement over all states over this period presents enormous data collection challenges.[64] Fifth, the policy adoption score "weighs" all laws equally. While this technique may oversimplify the alcohol and driving law environment, there is currently no standard for rating the importance of one type of law over another (i.e. is it more important to reduce speed limits or to mandate seat belt use?), especially when states have different combinations of laws in place. This is an area for future research.

Conclusion

There are substantial gaps among states in establishing evidence-based laws that reduce traffic fatalities. Such gaps in law adoption signal missed opportunities with substantial consequences. For states with the fewest number of laws in place, emulating states with a more comprehensive alcohol and traffic law approach may hold the potential to save hundreds of lives, reduce injuries, and decrease the considerable economic burden of motor vehicle collisions. In their efforts to reduce traffic fatalities, public health advocates and policymakers should focus attention on states where such protections are weakest to bring them up to speed.

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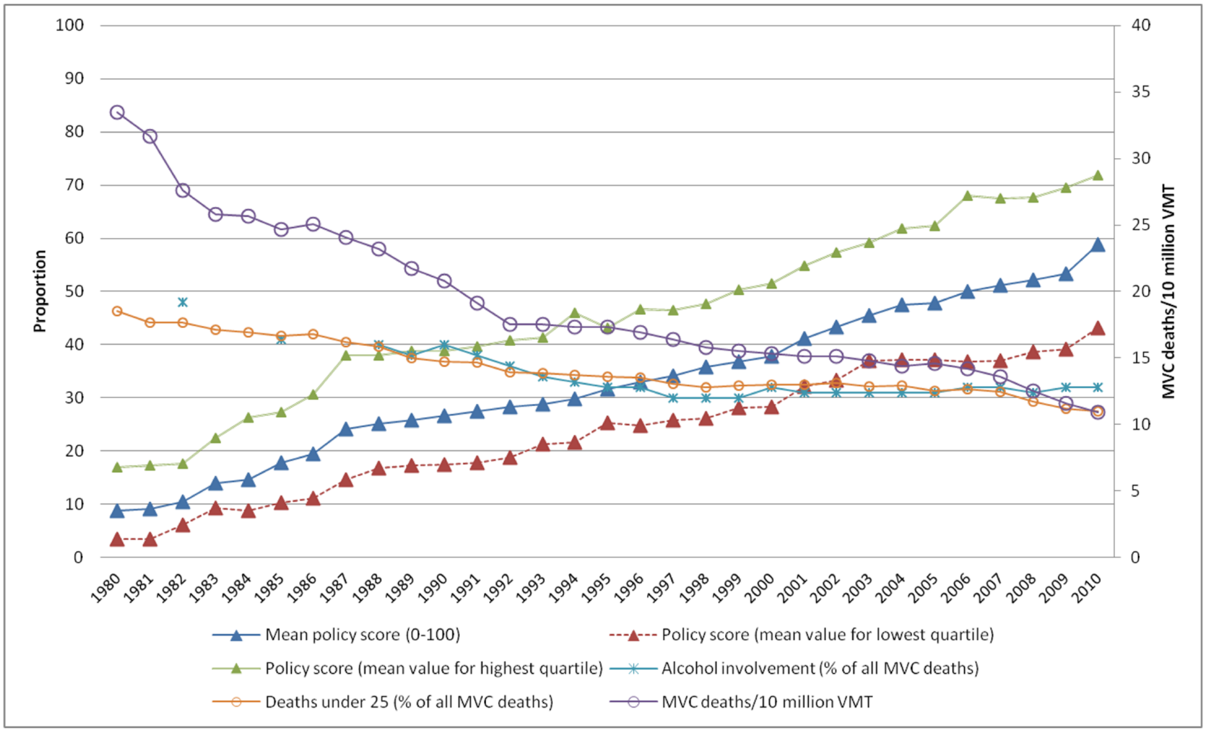

Figure 1.

Traffic-related deaths and state law environment strength by year, 1980–2010

Source: Fatal Accident Reporting System (FARS); Authors' calculations.

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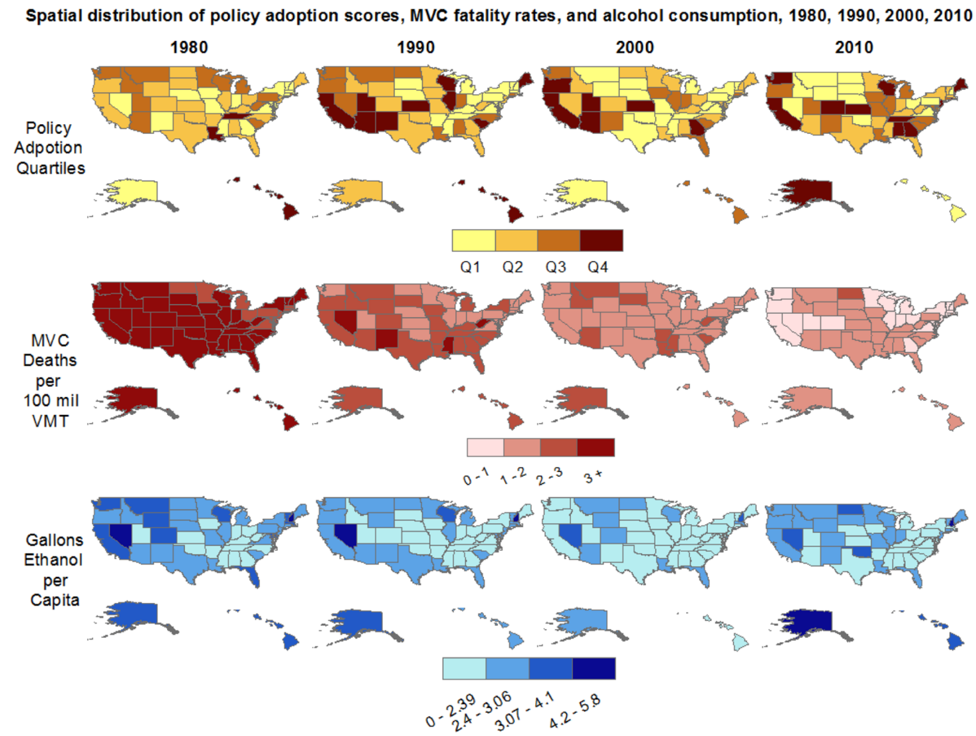

Figure 2.

Spatial distribution of policy adoption scores, MVC fatality rates, and alcohol consumption, 1980, 1990, 2000, 2010

Table 1

Evidence-based state health laws included in analysis

Health domain	State law		Data source
Alcohol regulations (included as instrumental variables for alcohol consumption	**1**	Minimum legal drinking age (21 years)	28, 32, 41, 50, 51
	2	Beer tax (cents)	
	3	Sunday alcohol sales restrictions	
	4	Keg registration	
Alcohol-impaired driving, (included in state policy adoption scores)	**5**	Zero tolerance laws (lower blood alcohol content for people <21 years than for adults)	27–30, 32, 52–54
	6	Blood alcohol levels <0.08 (for all drivers)	
	7	Restrictions on open alcoholic beverage container in motor vehicles	
	8	Mandatory prison days for driving under the influence	
	9	Minimum fines for driving under the influence	
	10	Mandatory community service for driving under the influence	
Risky/distracted driving (included in state policy adoption scores)	**11**	Graduated drivers' license requirements for younger drivers	
	12	Restrictions on cell phone use by drivers	
	13	Restrictions on texting while driving	
	14	Primary enforcement of laws 12 and 13 (distracted driving laws)	
Driver protection/seatbelt regulations (included in state policy adoption scores)	**15**	Adult seatbelt requirements	
	16	Primary enforcement of seatbelt requirements	
	17	Minimum fines for non-seatbelt use	
Child passenger safety regulations (included in state policy adoption scores)	**18**	Any child restraint device requirement (irrespective of whether a device type is specified)	
	19	Infant seat requirement	
	20	Toddler seat requirement	
	21	Booster seat requirement	
	22	Rear seating requirements for children	
	23	Seatbelt substitution for children	
	24	Primary enforcement of child restraint device laws	
	25	Primary enforcement of child rear seating laws	
Other regulations (included in state policy adoption scores)	**26**	Motorcycle helmet requirements for all riders	
	27	Maximum urban speed limit (<60 MPH)	

Note: This list of laws is not exhaustive. It contains only laws for which there is some indication of effectiveness and impact on health outcomes and for which data are publicly available for all states and years.

Table 2

Means and Standard Deviations of Study Variables, US states, 1980–2010

	1980		1990		2000		2010	
	Mean	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**
Total Policy adoption score (0–100)	7.65	4.32	33.67***	6.45	43.68***	7.16	58.99***	10.46
Min legal drinking age =21 (# states)	14	-	50***	-	50	-	50	-
Beer keg registration (# states)	1		5**		15**		31***	
Sunday ban on alcohol sales (# states)	20	-	20	-	20	-	14**	-
Beer tax (cents)	0.21	0.21	0.24*	0.20	0.25*	0.20	0.26	0.21
Alcohol consumption, gallons per capita	2.81	0.80	2.47***	0.57	2.25***	0.45	2.52***	0.47
Poverty (%)	13.16	4.12	13.13	4.16	10.78***	2.92	14.19***	3.32
Unemployment Rate (%)	6.48	1.86	-	-	3.90***	0.94	8.84***	2.04
Pop density (population/mile^2)	152.13	217.47	163.78***	228.63	179.09***	246.11	194.95***	261.05
Population 15–24 (%)	19.18	0.95	14.77***	0.99	14.39*	1.31	14.09	0.87
Miles road per capita	30.87	31.26	27.19***	26.97	24.43**	26.01	22.99***	24.31
Tax revenues per capita	655.21	471.41	768.15***	241.70	922.19***	192.63	978.59	381.17
Vehicle miles traveled (VMT)	30351	29986	42481***	45019	54926***	56202	59258***	60388
Under 25 death rate (per 100 million VMT)	1.67	0.33	0.81***	0.19	0.53***	0.16	0.31***	0.14
Over 25 death rate (per 100 million VMT)	1.87	0.50	1.34***	0.32	1.07***	0.28	0.83***	0.27
Total death rate (per 100 million VMT)	3.54	0.78	2.15***	0.49	1.60***	0.43	1.13***	0.37

* statistically significant difference ($p<0.05$);

** statistically significant difference ($p<0.01$);

*** statistically significant difference ($p<0.001$) compared to previous period.

The total policy adoption score is the proportion of all laws (except those in the alcohol law domain) listed in the table that each state has in place each year.

Table 3

Fixed effects regression of state MVC fatality rates per 100 million VMT, 1980–2010

	Model 1: Total MVC fatality rate	Model 2: MVC fatality rate (under 25 years)	Model 3: MVC fatality rate (25 years and older)
Law adoption score Q2 (versus Q1-lowest)	−0.045* -(0.088, −0.001)	−0.026** (−0.046, −0.006)	−0.019 (−0.047, 0.010)
Law adoption score Q3	−0.134*** (−0.193, −0.074)	−0.06*** (−0.090, −0.029)	−0.073*** (−0.111, −0.036)
Law adoption score Q4 (highest)	−0.145*** (−0.228, −0.061)	−0.062** (−0.102, −0.023)	−0.073** (−0.124, −0.023)
Alcohol consumption (gallons, per capita)	0.683* (0.058, 1.308)	0.185 (−0.110, 0.480)	0.449* (0.092, 0.807)
Percent poverty (%)	0.002 (−0.012, 0.0015)	0 (−0.006, 0.006)	0 (−0.008, 0.009)
Unemployment Rate (%)	−0.038*** (−0.055, −0.020)	−0.018*** (−0.027, −0.010)	−0.021*** (−0.031, −0.010)
Population density (per square mile)	0.005*** (0.003, 0.007)	0.003*** (0.002, 0.004)	0.002** (0.001, 0.004)
Population aged 15–24 (%)	0.055** (0.014, 0.095)	0.047*** (0.028, 0.067)	0.011 (−0.012, 0.033)
N	1450	1450	1450

* $p<0.05$;

** $p<0.01$;

*** $p<0.001$

Table includes regression coefficients and their 95% confidence intervals in parentheses. Models estimated using two-stage General Method of Moments (GMM). Alcohol consumption is treated as endogenous and instrumented using law variables (Sunday ban, log beer tax, minimum legal drinking age, keg registration). Models additionally control for time, time^2, miles road per capita and taxes per capita. Policy adoption scores are lagged 1 year.

Appendix

State alcohol laws and state alcohol consumption (gallons) per capita, 1980–2010

	Model 1	Model 2	Model 3	Model 4
Log beer tax rate (cents)	−0.385*** (−0.426, −0.343)	−0.315*** (−0.354−0.276)	−0.317*** (−0.356, −0.278)	−0.301*** (−0.341, −0.262)
Minimum legal drinking age (yearly increments above 18)		−0.152*** (−0.170, −0.135)	−0.153*** (−0.166, −0.130)	−0.148*** (−0.166, −0.130)
Sunday alcohol sales ban			−0.082** (−0.161, −0.003)	−0.103** (−0.182, −0.023)
Keg registration legislation				−0.065*** (−0.098, −0.032)
Constant	1.762*** (1.690, 1.834)	2.306*** (2.213, 2.397)	2.336*** (2.239, 2.432)	2.372*** (2.274, 2.469)
R^2	0.1811	0.3095	0.3114	0.3181
N	1450	1450	1450	1450

Coefficients from fixed effects panel regression models. Confidence intervals in parentheses.

** statistically significant difference (p<0.01);

*** statistically significant difference (p<0.001) compared to previous period.