Does Mandatory Ignition Interlock Lower Fatality Rates?

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Abstract

Objective This project was to investigate if State Ignition Interlock Laws have an impact on traffic fatality rates per 100,000 persons. The specific laws that will be focused upon will be those that are implemented after a driver's first conviction of driving under the influence (DUI).

Methods Using traffic data from 1983 to 2012. From each of the 50 states and the District of Columbia. From 1995 until 2012, 19 states made ignition interlock systems mandatory after individuals be convicted of their first offence. Accounting for state and year effects in addition to clustering within states, traffic fatality data of the 18 states with the policy is compared to the other remaining states without the policy.

Conclusions Requiring ignition interlock systems for all drivers convicted after their first driving-impaired convictions does have a relationship of lowering traffic fatality rates per 100,000 by an average degree of -1.321 deaths compared to states without the law implemented.

Methods & Data

The method used to analyze what is essentially a staggered entry implementation of the mandatory interlock systems, an analysis was done using two-way Fixed Effects, to see if there was any change in the fatality rates experienced by all states with the policy improved the fatality rate compared to their pre-policy fatality rates, beyond how much average control states' fatality changed averaged out over the states. Two way Fixed Effects ultimately considered considering parallel trends is seen to be reasonable when analyzing the exogeneity based on policy implementation order or sequencing figure to the right. This is because the fitted line is relatively flat.

This analysis uses clustered state-level Fixed Effects ($\boldsymbol{\alpha}$) and time ($\boldsymbol{\delta}$) Fixed Effects measured yearly. The final model focuses on regressing the mandatory interlock systems regulation on traffic fatality rates per 100,000 people:

$$\boldsymbol{FatalityRate_{it} = \alpha_i + \delta_t + \beta_1 InterlockTreatment_{it} + \beta_2 Demographics_{it,2} + \beta_3 Oth.\,Policy\,Regulations_{it,3} + \beta_4 UrbanVsRural_{it,4} + \varepsilon_{it}}$$

All Models Refer to Table on the Right

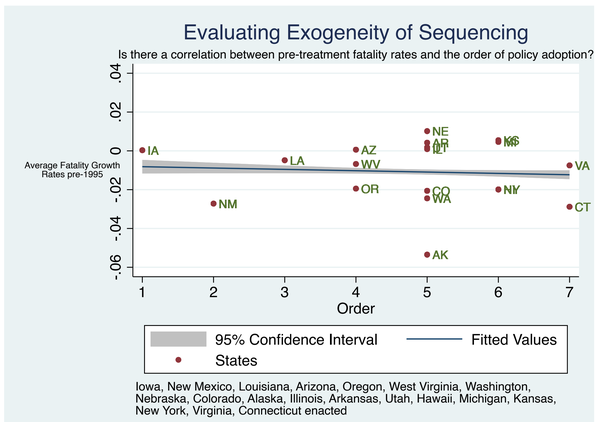
- Model 1 illustrates a simple Fixed Effects regression using state and time fixed effects controlled.
- Model 2 then expands upon this simple regression by adding controls such as other alcoholic-focused policies and state demographics.
- Model 3 then attempts to control if there is any bias being attributed to the policy coefficient coming from urban or rural differences in road densities.
- Model 4 develops this by controlling for laws regarding distracted or impaired driving of any kind such as seatbelt laws, speeding, or cellphone distractions. This is the final model fully developed because it has the least chance of any omitted variable bias problems as it removes any time invariant differences attributed to the states. These time invariant differences may include all policies relating to driving safety.

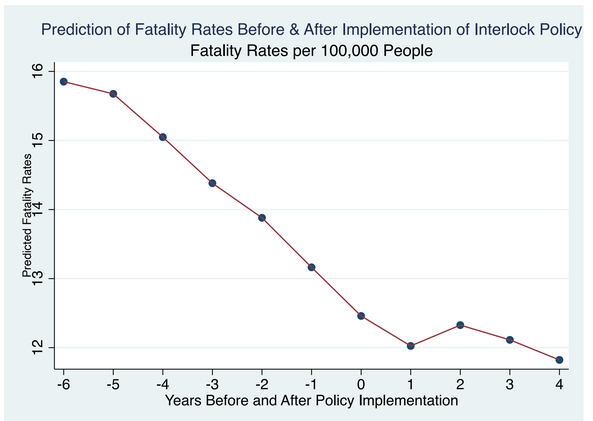
Results

To analyze the regression table below, the interpretation of the results focus on the coefficient as how on average the treated states' fatality rates changed compared to their pre-treatment fatality rates before the policy implementation, beyond how much the average control state's fatality rate changed over time on average.

The initial first fixed effect model regression utilizing only state and time fixed effects does not show statistical significance. At first this did not look promising but was assumed that there must be an omitted variable bias (OVB) causing this insignificance and causing an upward bias towards this insignificance. Therefore, the regression model was progressively changed with added controls with respects to different possible stories that may be additionally causing this this OVB risk. When reaching the third or penultimate model, the Mandatory Ignition Interlock policy after the first DUI conviction is shown to be statistically significant in illustrating a coefficient of -1.220 at the bare minimum 90% confidence interval. Finally with the inclusion of controls for reckless or distracted driving policies, the coefficient for the ignition interlock systems increased in absolute value to a lower number and a higher significance of 95% confidence interval with a coefficient of -1.321.

Additionally, the other policies and controls could be argued to be possibly driving the decrease in traffic fatalities seen in the graph on the right below in the lag years preceding the ignition interlock system policy implementations hence their inclusion as the model progressed. The left graph allows for this method





Regressions of Traffic Fatality Rates per 100,000 Persons in State Populations on the Implementation of Mandatory Ignition Interlock Systems after First Driving Under the Influenced Offense

Models 1-4: Fixed Effects

VARIABLES	(1) Traffic Fatality Rates	(2) Traffic Fatality Rates	(3) Traffic Fatality Rates	(4) Traffic Fatality Rates
Mandatory Ignition Lock Law	-0.753	-1.087	-1.220*	-1.321**
	(0.773)	(0.683)	(0.650)	(0.639)
Constant	20.05***	18.73	28.85*	25.67*
	(0.446)	(15.02)	(12.21)	(11.87)
Observations	1,530	1,530	1,500	1,500
Adjusted R-squared	0.603	0.649	0.705	0.664
Number of States	51	51	50	50
State FE	**Yes**	**Yes**	**Yes**	**Yes**
Year FE	**Yes**	**Yes**	**Yes**	**Yes**
Contr. Other Alcoholic policies[1]	**No**	**Yes**	**Yes**	**Yes**
Demographic Controls	**No**	**Yes**	**Yes**	**Yes**
Contr. Urban/Rural	**No**	**No**	**Yes**	**Yes**
Contr. Speeding/Distracted Driving & Seat Belt Laws[2]	**No**	**No**	**No**	**Yes**

1.Includes dummy variables for periods in which the following regulations exist in a given state: Legal BAC Limit<0.8; Administrative License Suspension; Permitted Preliminary Breath Testing; Minimum Drinking Age of 21; Ignition lock Mandatory only if BAC ≥0.15 for First Offense
2. Includes dummy variables for periods in which the following regulations exist in a given state: Ban on Texting While Driving; Ban on Handheld Devices for all Drivers; Ban on Handheld Devices for Learning Drivers; Primary Enforcement Seat Belt Law; Secondary Enforcement Seat Belt Law. **Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1**

Background

To be able to protect human lives, over the years states have implemented different policy reforms to hopefully lower fatality rates of traffic related incidents. These policies ranged from alcohol level tests, revoking driving licenses of individuals, speed limits, and even installations of interlock systems in the cars of citizens. At first glance, most policies are forms of convince/coerce drivers from driving and putting others at risk. These may seem reasonable ideas to stop rational individuals from putting themselves and others at harm. But these do not have the physical power from stopping anyone from actually driving in the first place. The only policy that has self-enforcement power over these potentially dangerous drivers are installed ignition interlock system. These systems forcibly inhibit possibly intoxicated individuals from driving due to it requiring a breath sample with a BAC lower than a pre-set level that is considered safe to drive. Due to this inhibitor from involuntary dangerous driver conditions, the goal of this study is to see if statistically did they have any true causative effect on lowering fatality rates within the states that implemented them.

Limitations

Limitations of the study include the fact that the study was observational in nature rather than a randomized controlled trial. There are ethical considerations to this however since this policy deals with lives at stake. Despite this ethical limitation, compared to another work in literature focusing on this exact policy, results were found to be similar even with different model designs(Kaufman & Wiebe, 2016). Additionally, like mentioned in similar policy evaluation analysis on this topic, laws and legislations may differ at even by municipality or local level (Kaufman & Wiebe, 2016). The assumption that the enforcement or implementation of these systems are equivalent at all levels as well, and if proven not true may yield different results. There may be even a difference in conclusion if the study were to be focused on only alcoholic-related traffic fatalities to see if the policy makes a difference within that realm.

Conclusions

In conclusion, there is good indication that the implementation of the ignition interlocking systems do influence traffic fatality rates. The implications of this study shows that if implemented across more states, on average lives will be saved. The coercive power of a physical system in risky drivers that have already demonstrated alcohol influenced incidents and convictions is a policy worth pursuing.

References

Kaufman EJ, Wiebe DJ. Impact of State Ignition Interlock Laws on Alcohol-Involved Crash Deaths in the United States. *Am J Public Health*. 2016;106(5):865-871. doi:10.2105/AJPH.2016.303058