Public Health Briefs

Lowering State Legal Blood Alcohol Limits to 0.08%: The Effect on Fatal Motor Vehicle Crashes

Ralph Hingson, ScD, Timothy Heeren, PhD, and Michael Winter, MPH

ABSTRACT

Objectives. This study was undertaken to determine whether reductions in alcohol-related fatal crashes following adoption of 0.08% legal blood alcohol limits were independent of general regional trends.

Methods. The first five states that lowered legal blood alcohol limits to 0.08% were paired with five nearby states that retained a 0.10% legal standard. Within each pair, comparisons were made for the maximum equal available number of pre- and postlaw years.

Results. States adopting 0.08% laws experienced 16% and 18% relative postlaw declines in the proportions of fatal crashes involving fatally injured drivers whose blood alcohol levels were 0.08% or higher and 0.15% or higher.

Conclusions. If all states adopted 0.08% legal blood alcohol limits, at least 500 to 600 fewer fatal crashes would occur annually. (*Am J Public Health.* 1996;86:1297–1299)

Introduction

In 1994, 16 589 people died and nearly 297 000 persons were injured in alcohol-related traffic crashes.[1] Several different types of studies have reported that driver impairments begin at blood alcohol levels well below the 0.10% legal standard in most states. Experimental laboratory studies have shown that at 0.08%, a level reached by a 150-lb person consuming four drinks an hour on an empty stomach, there is reduced peripheral vision, poorer recovery from glare, poor performance on complex visual tracking, and reduced divided attention performance.[2] Driver simulation and road course studies have revealed poor parking performance, impaired driver performance at slow speeds, and steering inaccuracies[3]; roadside observational studies have identified speeding and breaking performance deterioration.[4] A national comparison of drivers in single-vehicle fatal crashes with drivers not in fatal crashes but stopped at roadside surveys indicated that each 0.02% increase in blood alcohol level nearly doubles the risk of fatal crash involvement. In all age and sex groupings, the fatal crash risk at a blood alcohol level of 0.05% to 0.09% was at least nine times greater than that at zero blood alcohol.[5]

To reduce alcohol-related fatal traffic crashes, 14 states have lowered the legal blood alcohol limit from 0.10% to 0.08%. Johnson and Walz[6] monitored six different measures of driver involvement in alcohol-related fatal crashes in the first five states to adopt 0.08% laws. Nine of the 30 pre- to postlaw comparisons identified statistically significant decreases. However, comparison areas were not included to assess whether the postlaw declines were independent of general regional trends. Thus, this study was undertaken to assess whether, relative to nearby states, states adopting a 0.08% legal limit experienced a reduction in the proportion of fatal crashes involving (1) fatally injured drivers with blood alcohol levels of 0.08% or higher and 0.15% or higher, and (2) any driver with a blood alcohol level at 0.08% or higher and 0.15% or higher.

Methods

Prior to 1992, five states had lowered the legal blood alcohol limit from 0.10% to 0.08%: Utah (August 1983), Oregon (November 1983), Maine (August 1988), California (January 1990), and Vermont (July 1991). Each of these states was paired with a nearby state that retained a 0.10% legal limit. Within each pair, comparisons were made for the maximum equal number of available pre- and postlaw years. Thus, Utah was compared with Idaho from August 1976 to July 1991, Oregon with Washington from November 1976 to October 1991, Maine with Massachusetts from August 1984 to July 1993, California with Texas from January 1986 to December 1993, and Vermont with New Hampshire from July 1990 to June 1993.

To minimize potential bias resulting from variation in testing policies, the analysis initially focused on fatally injured drivers with blood alcohol levels of 0.08% or greater. During the analysis period, blood alcohol test results were available from the US Fatal Accident Reporting System for 81% of fatally injured drivers

The authors are with the Social and Behavioral Sciences Department and the Department of Epidemiology and Biostatistics, Boston University School of Public Health, Boston, Mass.

Requests for reprints should be sent to Ralph Hingson, ScD, Boston University School of Public Health, 85 E Newton St, M840, Boston, MA 02118.

This paper was accepted April 12, 1996.

TABLE 1—Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol Was 0.08% or More, Before and After the Passage of 0.08% Legal Blood Alcohol Limits in 5 States

0.08% Law States and Comparison States	Proportion before 0.08% Law (n)	Proportion after 0.08% Law (n)	% Change in Proportion (RR − 1)	Ratio of RRs (95% CI)
Oregon (0.08%)	0.29 (1275/4455)	0.24 (1023/4186)	−15% (0.85)	0.82 (0.75, 0.89)
Washington	0.28 (1735/6184)	0.29 (1582/5390)	+5% (1.05)	
Utah (0.08%)	0.14 (319/2252)	0.16 (329/2085)	+11% (1.11)	0.78 (0.64, 0.95)
Idaho	0.15 (310/2057)	0.22 (382/1773)	+43% (1.43)	
Maine (0.08%)	0.26 (262/1024)	0.22 (207/942)	−14% (0.86)	0.93 (0.77, 1.12)
Massachusetts	0.22 (726/3241)	0.21 (562/2703)	−7% (0.93)	
California (0.08%)	0.22 (4275/19370)	0.19 (3174/16278)	−12% (0.88)	0.82 (0.77, 0.88)
Texas	0.20 (2364/11924)	0.21 (2340/10961)	+8% (1.08)	
Vermont (0.08%)	0.25 (47/186)	0.25 (46/181)	+1% (1.01)	1.45 (0.87, 2.44)
New Hampshire	0.22 (62/280)	0.15 (34/222)	−31% (0.69)	
Overall law effect				0.84 (0.78, 0.90)

Note. RR = relative risk; CI = confidence interval.

in the study states. Because not all drivers in fatal crashes are fatally injured, the proportion of crashes with any driver with blood alcohol levels of 0.08% or greater was also examined. Included were analyses of the proportion of crashes with drivers—fatally injured or otherwise—with blood alcohol levels of 0.15% or greater to examine whether 0.08% laws reduce crashes involving severely intoxicated drivers.

The proportion of fatal crashes involving fatally injured and other drivers with blood alcohol levels at or above 0.08% or 0.15% was examined instead of the absolute number of crashes involving drivers with these alcohol levels. This was done to control for both the long-term downward trend in total fatal crashes from 1980 to 1993[7] and changes in exogenous variables that might influence the total number of fatal crashes, such as the economy, the safety characteristics of vehicles and highways, and the price of fuel.

Within each state, the change in the level of alcohol involvement in fatal crashes from before to after the implementation of a 0.08% law is described through the ratio (relative risk) of the postlaw to prelaw proportion of crashes with drivers with high blood alcohol levels. A relative risk less than 1.0 indicates a reduction in the level of alcohol involvement. This relative risk is related to the percentage of change in the proportion of crashes with drivers with high blood alcohol levels:

$$\text{Percentage Change} = 100\% \times (p_{post} - p_{pre})/p_{pre} = RR - 1,$$

and changes are described through this percentage change.

Within each state pair, the relative change (and the 95% confidence interval [CI]) in the proportion of alcohol-involved crashes in the law state relative to the control state was calculated as the ratio of the two relative risks. Subtracting 1 from this ratio gives the percentage change in the proportion of alcohol-involved crashes in the law state relative to the control state.

Meta-analytic methods[8] were used to calculate an overall relative change due to 0.08% laws across the set of five state pairs. States implemented their 0.08% laws in different years and under different circumstances. A test of the heterogeneity of effects across the five state pairs was thus conducted to test the significance of state-to-state variation in effects. Regardless of the observed variation in effects, the relative change in the proportion of crashes involving drivers with high alcohol levels was treated as a random effect in the meta-analysis. A pooled estimate and standard error for the natural log of the ratio of relative risks from each state pair were calculated. This estimate and its 95% confidence interval were transformed back to the scale of the ratio of relative risks for presentation, and subtracting 1 from this ratio gives an estimate for the overall percentage of change in the proportion of alcohol-involved crashes in law states relative to control states.

Results

Four of the five 0.08% law states showed a reduction relative to their control states in the proportion of crashes with a fatally injured driver whose blood alcohol was 0.08% or greater (Table 1). The 95% confidence intervals for these relative reductions remained below 1.0 for three of the five law states. The variation across the five law states in these relative reductions was not significant ($P = .168$). The pooled estimate of the law effect suggests that overall, the 0.08% law states experienced a 16% postlaw reduction in the proportion of fatal crashes with a fatally injured driver whose blood alcohol was 0.08% or greater (95% CI = 22%, 10%). Overall, the 0.08% law states also experienced an 18% postlaw reduction in the proportion of fatal crashes with a fatally injured driver whose blood alcohol was 0.15% or greater (95% CI = 23%, 13%) (Table 2).

Similar results were observed for the proportion of fatal crashes with any driver whose blood alcohol was 0.08% or greater (a 13% reduction) or 0.15% or greater (a 19% reduction) (data available on request).

Discussion

Several methodological issues should be considered in interpreting the results of this study. First, blood tests were obtained from 88% of fatally injured drivers in the 0.08% law states and from 74% of such drivers in comparison states, and these proportions did not change from pre- to postlaw years. This high consistent rate of testing favors the validity of results measuring fatally injured drivers. Blood tests were completed on half of all drivers in fatal crashes in study states during the analysis.

TABLE 2—Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol Was 0.15% or More, Before and After the Passage of 0.08% Legal Blood Alcohol Limits in 5 States

0.08% Law States and Comparison States	Proportion before 0.08% Law (n)	Proportion after 0.08% Law (n)	% Change in Proportion (RR − 1)	Ratio of RRs (95% CI)
Oregon (0.08%)	0.22 (992/4455)	0.18 (769/4186)	−17% (0.83)	0.79 (0.70, 0.88)
Washington	0.20 (1266/6184)	0.21 (1158/5390)	+5% (1.05)	
Utah (0.08%)	0.10 (220/2252)	0.12 (245/2085)	+20% (1.20)	0.91 (0.72, 1.15)
Idaho	0.11 (232/2057)	0.15 (265/1773)	+33% (1.33)	
Maine (0.08%)	0.19 (198/1024)	0.15 (143/942)	−21% (0.79)	0.77 (0.61, 0.97)
Massachusetts	0.15 (493/3241)	0.15 (418/2703)	+2% (1.02)	
California (0.08%)	0.16 (3009/19370)	0.14 (2291/16278)	−9% (0.91)	0.82 (0.76, 0.89)
Texas	0.15 (1780/11924)	0.16 (1804/10961)	+10% (1.10)	
Vermont (0.08%)	0.19 (36/186)	0.19 (34/181)	−3% (0.97)	1.23 (0.68, 2.23)
New Hampshire	0.17 (48/280)	0.14 (30/222)	−21% (0.79)	
Overall law effect				0.82 (0.77, 0.87)

Note. RR = relative risk; CI = confidence interval.

Second, unlike previous studies, this analysis included comparison states to control for regional fatal crash trends.

Third, 0.08% law states may have been more concerned about alcohol-impaired driving and more responsive to legislative initiatives to reduce the problem. They were more likely to have other stringent laws that have been shown to reduce alcohol-related fatal crashes. All 0.08% law states had criminal per se laws in effect prior to the study, compared with only two comparison states: Texas and Vermont. The comparison states of Idaho and Washington introduced criminal per se laws during the study. It is likely that the 0.08% law effects were independent of criminal per se laws. Before the 0.08% law, reductions in alcohol-involved fatal crashes were seen both in pairs of states where both 0.08% law states and comparison states had criminal per se legislation throughout the study and in pairs where comparison states adopted the law during the study period.

All five 0.08% law states also had administrative licence revocation laws during the study, three of which were implemented within 1 year of the state's 0.08% law. Administration licence revocation laws have been associated with 5% declines in fatal crashes.[9] Among the control states, only New Hampshire had this law during the study period. This restricted our ability to separate the effects of 0.08% legislation from administrative licence revocation laws. Maine was the only 0.08% law state to implement an administrative licence revocation law prior to the study period and hence the only state where post-0.08% law reductions in alcohol-involved fatal crashes could be clearly separated from the effects of administrative licence revocation laws passed during the study period.

Finally, this analysis focused only on fatal crashes. Studies of other traffic laws indicate that the magnitude of their impact can be influenced by accompanying educational and enforcement efforts.[10–12] Studies of 0.08% laws are needed that not only assess the laws' impact on fatal crashes but also measure how effectively the laws are implemented.

On balance, the results of this study suggest that 0.08% laws, particularly in combination with administrative licence revocation, reduce the proportion of fatal crashes involving drivers and fatally injured drivers with blood alcohol levels of 0.08% or higher and 0.15% or higher. This legislation warrants consideration in other states. □

Acknowledgments

This study was supported by grants from the National Institute on Alcohol Abuse and Alcoholism, the US Centers for Disease Control and Prevention, and the Massachusetts Governor's Highway Safety Bureau.

The study is dedicated to Lori Lynn Webb and Mitch Pewitt, both of whom died, and Kara Webb Hensel and Millie and Roy Webb, who were seriously injured, in a crash involving a driver with a 0.08% blood alcohol level.

References

1. *The Costs of Alcohol-Related Traffic Crash Injuries.* Washington, DC: US Dept of Transportation, National Highway Traffic Safety Administration; 1994. DOT HS 808 021.
2. Moskowitz H, Burns M. Effects of alcohol on driving performance. *Alcohol Health Res World.* 1990;14:12–14.
3. Mortimer RG, Sturgis SP. Effects of low and moderate levels of alcohol on steering performance. In: Israelstam S, Lambert S, eds. *Alcohol, Drugs and Traffic Safety.* Toronto, Canada: Addiction Research Foundation; 1975:329–345.
4. Damkot DK, Perrine MW, Whitmore DG, Todissie SR, Geller HA. *On the Road: Driving Behavior and Breath Alcohol Concentration,* Vols I and II. Washington, DC: Dept of Transportation; 1975. Technical Report DOT HS 364 37567.
5. Zador P. Alcohol-related relative risk of fatal driver injuries in relation to driver age and sex. *J Stud Alcohol.* 1991;53:301–310.
6. Johnson D, Walz M. *A Preliminary Assessment of the Impact of Lowering the Illegal Per Se Limit to .08% in Five States.* Washington, DC: US Dept of Transportation, National Highway Traffic Safety Administration; 1994; Technical Report 1–8. DOT HS 808 207.
7. *Traffic Safety Facts, 1994.* Washington, DC: US Dept of Transportation, National Highway Traffic Safety Administration; 1995. DOT HS 808 292.
8. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Controlled Clin Trials.* 1986;7: 177–188.
9. Zador P, Land A, Fields M, Weinberg K. Fatal crash involvement and laws against alcohol impaired driving. *J Public Health Policy.* 1989;10:467–485.
10. Blomberg R. *Lower BAC Limits for Youth: Evaluation of the Maryland .02 Law.* Washington, DC: US Dept of Transportation; 1992. DOT HS 806 807.
11. Voas RB, Lacey JH. Issues in the enforcement of impaired driving laws in the United States. In: *Surgeon General's Workshop on Drunk Driving Background Papers.* Rockville, Md: US Dept of Health and Human Services, Office of the Surgeon General; 1989:136–156.
12. Ross HL. *The Deterrent Capability of Sobriety Checkpoints: Summary of the American Experience.* Washington, DC: National Highway Traffic Safety Administration; 1992. NHTSA Technology Transfer Series 28.