

ORIGINAL ARTICLES

Effects of recent 0.08% legal blood alcohol limits on fatal crash involvement

Ralph Hingson, Timothy Heeren, Michael Winter



This article is dedicated to Ross H and Geri J Goughler who in 1992, while traveling to a Thanksgiving visit with their daughter, were struck and fatally injured by a driver in New Mexico. Police reports indicated the driver had been drinking but his blood alcohol level was below 0.10%, the legal limit at the time. He was not charged with a drunk driving violation.

Abstract

Objectives—This study assessed whether states that lowered legal blood alcohol limits from 0.10% to 0.08% in 1993 and 1994 experienced post-law reductions in alcohol related fatal crashes.

Methods—Six states that adopted 0.08% as the legal blood alcohol limit in 1993 and 1994 were paired with six nearby states that retained a 0.10% legal standard. Within each pair, comparisons were made for the maximum equal available number of pre-law and post-law years.

Results—States adopting 0.08% laws experienced a 6% greater post-law decline in the proportion of drivers in fatal crashes with blood alcohol levels at 0.10% or higher and a 5% greater decline in the proportion of fatal crashes that were alcohol related at 0.10% or higher.

Conclusions—If all states adopted the 0.08% legal blood alcohol level, 400–500 fewer traffic fatalities would occur annually.

(*Injury Prevention* 2000;6:109–114)

Keywords: fatal crash; legal blood alcohol limit; drunk driving

Traffic crashes are the leading cause of death for persons between the ages of 1 and 24 in the United States¹ and alcohol is involved in nearly 40% of fatal traffic crashes.² In 1998, 15 935 persons died in alcohol related traffic crashes² and approximately one million are injured each year.³ Those deaths and injuries cost the nation over \$45 billion in lost economic productivity, hospital and rehabilitation costs.³

To reduce alcohol related traffic deaths, 17 states have lowered their criminal per se legal blood alcohol limit from 0.10% to 0.08%. To reach 0.08% blood alcohol content (BAC), a 170 pound (77.1 kg) male would have to consume four drinks in one hour on an empty stomach, and a 135 pound (61.2 kg) female would need to consume three drinks in one hour.³

Experimental laboratory studies have shown that at 0.08% BAC, driving performance is impaired. At 0.08%, there is reduced peripheral vision, poor recovery from glare, poorer performance on complex visual tracking, and reduced divided attention performance.⁴ Driver simulation and road course studies have

revealed poor parking performance, impaired driving performance at slow speed, and steering inaccuracies.⁵ Roadside observational studies have identified speeding and breaking performance deterioration.⁶ A national comparison of drivers in single vehicle fatal crashes with drivers not involved in crashes stopped at roadside indicated that each 0.02% increase in BAC nearly doubles the risk of fatal crash involvement.⁷ In all age and sex groupings at a BAC of 0.05%–0.09%, the fatal crash risk was at least nine times greater than at zero BAC.

Many countries have established blood alcohol limits at 0.08% or lower.³ Austria, Canada, the United Kingdom, and Switzerland have 0.08% blood alcohol limits. Legal limits range from 0.05%–0.8% in Australia, and are at 0.05% in Finland, France, Germany, the Netherlands, Norway, and Japan. Sweden has a legal blood alcohol limit of 0.02%, a level similar to the zero tolerance laws for drivers under age 21 now found in all states in the United States.

In California, the largest state to adopt a 0.08% law, researchers found a 12% decline in alcohol related fatal crashes after the law was adopted (National Highway Traffic Safety Administration, 1991). Because California also adopted an administrative license revocation (ALR) law six months after the 0.08% per se law, the separate effects of each law were difficult to determine. According to one study, most of the effects occurred after the ALR provisions were added (Rogers, 1995⁸).

Johnson and Fell monitored six measures of driver alcohol involvement in the first five states to adopt 0.08% laws (Utah, Oregon, Maine, California, and Vermont) and identified several statistically significant pre-law to post-law decreases.⁹ Because the study did not compare states with the 0.08% law to states that did not have the law, researchers could not determine whether the changes were independent of general regional trends. The researchers did conclude the effects of the law were independent of national trends.

Another study, conducted by the authors of this report, examined the first five states to lower legal blood alcohol limits to 0.08% relative to nearby states which retained 0.10% as the legal limit. These 0.08% law states experienced a 16% greater post-law decline in the proportion of fatal crashes that involved a fatally injured driver with a BAC of 0.08% or

**Boston University
School of Public
Health: Social and
Behavioral Sciences
Department**
R Hingson

**Epidemiology and
Biostatistics
Department**
T Heeren

**Data Coordinating
Center**
M Winter

Correspondence to:
Dr Ralph W Hingson, Social
and Behavioral Sciences
Department, Boston
University School of Public
Health, 715 Albany Street,
T 2W, Boston, MA 02118
(e-mail: rhingson@bu.edu)

higher.¹⁰ Comparison states were selected which had parallel pre-law trends in the proportion of fatally injured drivers with BACs of 0.08% or higher, similar population sizes and geographic proximity. The results of this study resembled those initially found in both the United Kingdom and France when those countries first combined 0.08% laws with automatic license revocation.^{11 12} In the United Kingdom the proportion of drivers killed with an illegal BAC declined from 25% the year before the law to 15% the following year. During the first year after France's 0.08% law, traffic deaths declined 13.9%.

Because all of the 0.08% law states also had ALR laws and some adopted them in close time proximity to the 0.08% laws, our earlier study was not able to fully disaggregate 0.08% law effects from ALR law effects. National studies indicate ALR laws are associated with 6%–9% reductions in alcohol related fatal crashes.^{13 14} Some investigators have noted that the paper did not detail comparison state selection criteria and questioned whether selection of different comparison states would have altered the study's findings.^{15 16} They argued that the use of multiple comparison states or a national comparison would be a preferable approach.

Foss *et al* conducted a time series analysis of alcohol related fatal crashes from 1991 through 1996 before and after North Carolina adopted a 0.08% law in 1993.¹⁷ They did not find a statistically significant reduction in alcohol related fatalities after the law. They also compared the proportion of drivers in North Carolina in fatal crashes with a BAC of 0.01% or higher during the 33 months before and the 39 months after North Carolina's 0.08% law to the proportion in the 37 states without a 0.08% law. Using an analytic approach similar to that used in our earlier paper, North Carolina experienced a 6% greater decline during the post-law period. A similar decline was found among drivers with a BAC of 0.10% or higher. Neither decline was statistically significant when compared to non-0.08% law states. Given the number of crashes in these states, an 8% greater post-law decline in North Carolina would have been needed for statistical significance. That analysis had less than 80% power to detect a 10% post-law reduction in study outcomes and less than 60% power to detect an 8% decline. In this context, statistical power describes the likelihood of detecting a true 0.08% law effect. Most researchers would argue that a study should have power of 80% or higher. No power calculations were presented for the time series analyses, making these null findings difficult to interpret. In studies of single states changing a traffic law, potentially meaningful post-law

reductions in alcohol related traffic deaths may not reach statistical significance. The same magnitude of decline however, if observed in multiple states adopting the law, can be statistically significant.

Two multistate studies of 0.08% laws were recently published.^{15 18} Apsler *et al* studied the first 11 states to adopt 0.08% laws.¹⁵ They examined each state separately using intervention model time series analysis of trends in the ratio of fatal crashes involving drivers with BAC of 0.10% or higher relative to fatal crashes with no driver alcohol involvement. Examining data from the Fatality Analysis Reporting System from 1982–97 they found 0.08% laws either alone or in conjunction with ALR laws were associated with significant declines in seven states. In five of those states, declines were specifically associated with 0.08% laws alone. No comparison areas were included in the analysis to rule out regional or national secular trends. Voas and Tippetts conducted a national study from 1982–97 and identified an 8% decline in the proportion of drivers with positive BACs involved in fatal crashes relative to other fatal crashes.¹⁸ Using regression models they determined this reduction was independent of other drinking while under the influence laws such as 0.10% per se laws and ALR laws as well as safety belt laws and demographic, economic, and seasonal factors and per capita alcohol consumption. They projected that there would be 500–600 fewer deaths nationwide if all states adopted 0.08% laws.

In a review of all the 0.08% law studies cited above the United States General Accounting Office concluded “there are strong indications that 0.08% BAC laws in combination with other drunk driving legislation (particularly license revocation laws), sustained public education and consistent enforcement efforts can save lives”.¹⁶ However, the report also indicated “the evidence does not conclusively establish that 0.08% BAC laws by themselves result in reduction in the number and severity of alcohol related crashes”.

There is a need to further explore whether lowering the legal blood alcohol limit from 0.10% to 0.08% produces reductions in alcohol related fatal crashes beyond that achieved by administrative license revocation laws.

STATES RECENTLY ADOPTING 0.08% LAWS

In 1993 and 1994, six states not included in our first study¹⁰ lowered their criminal per se legal blood alcohol limits from 0.10% to 0.08% (Kansas, North Carolina, Florida, New Mexico, New Hampshire, and Virginia) (table 1). This study explores whether these newer 0.08% laws reduced alcohol involvement in fatal crashes and whether the declines were independent of implementation of ALR laws. The analysis period extends beyond previously published studies into 1998.

Table 1 Analysis periods: recent 0.08% law states and comparison states

New 0.08% law states	Date of law	Comparison state	Analysis period
Kansas	July 93	Oklahoma	July 88–June 98
North Carolina	October 93	Tennessee	Oct 88–Sept 98
Florida	January 94	Georgia	Jan 89–Dec 98
New Mexico	January 94	Colorado	Jan 89–Dec 98
New Hampshire	January 94	Connecticut	Jan 89–Dec 98
Virginia	July 94	Maryland	July 90–June 98

Methods

This study compared fatal crash trends in the six states that adopted 0.08% laws between 1993 and 1994 with nearby states that retained 0.10% as their legal blood alcohol limit. We sought to address criticisms of our earlier analysis of the first five states to adopt 0.08% legislation by (1) explicitly describing comparison state selection criteria, (2) comparing states with new 0.08% laws to matched individual comparison states as well as comparing them to all other states without 0.08% laws, and (3) conducting separate analyses of states adopting 0.08% laws and ALR in close time proximity and those that adopted 0.08% laws several years after they adopted ALR laws. This latter analysis was done to assess whether 0.08% laws have effects independent of ALR laws.

We searched for comparison states which (1) were contiguous, (2) had similar population size, (3) had 75% or more of fatally injured drivers tested for BAC, and (4) had similar pre-0.08% law trends in the proportion of fatal crashes that were alcohol related. Five of the six comparison states met all our criteria. New Hampshire did not share a common border with a New England 0.10% law state. Vermont and Maine have 0.08% per se laws and Massachusetts adopted a 0.08% ALR law in 1994. Consequently, New Hampshire was compared with Connecticut, the most populous state in New England that retained a legal BAC of 0.10%. We selected comparison states that were contiguous or from the same geographic region because they would be more likely to experience similar economic trends and weather patterns that could affect trends in fatal crashes.

In each pair of states, we examined the maximum equal number of pre-law and post-law years for which fatal crash data were available. Table 1 lists the 0.08% law states, their comparison states and the analysis periods.

We examined (1) the proportion of drivers in fatal crashes who had BACs at 0.10% or higher and (2) the proportion of fatal crashes that were alcohol related, where alcohol was present in a driver or pedestrian at BACs of 0.10% or higher. We also examined fatal crash data from the United States Department of Transportation Fatality Analysis Reporting System. Alcohol results were derived based on imputational methods used by the National Highway Traffic Safety Administration to calculate annual state and national data on alcohol involvement in fatal crashes.¹⁹ This method uses actual blood alcohol test results when available and estimates the proportion of untested drivers and crashes where alcohol was present at levels of 0.01% to 0.09% and at 0.10% and higher based on characteristics identified in states with high levels of alcohol testing to significantly predict alcohol involvement in fatal crashes with a high degree of accuracy. We used data calculated by the imputational method. This method controls for any pre-law to post-law variability between 0.08% law and

comparison states in the percentage of drivers tested for alcohol.

The proportion of drivers in fatal crashes who had raised BACs of 0.10% or higher was examined instead of the absolute number of drivers in fatal crashes with raised BACs to control for the long term downward trend in fatal crashes over the last decade and changes in exogenous variables that might influence driver involvement in fatal crashes such as the economy, safety characteristics of vehicles and highways, and the price of fuel. For similar reasons, we examined the proportion of fatal crashes that were alcohol related rather than the absolute number of alcohol related fatal crashes.

Within each state, the change in the level of alcohol involvement in fatal crashes from the pre-law to post-0.08% law period is described through the ratio (relative risk) of the post-law to pre-law proportion of crashes involving alcohol according to the measures described above. A relative risk of less than 1.0 indicated a reduction in the level of alcohol involvement. This relative risk (RR) is related to the percentage change in crashes with drivers with higher BACs:

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

and changes are described through this percentage change.

Within each state pair, the relative change (and the 95% confidence interval) 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 fatal crashes in the 0.08% law state relative to the comparison state.

Meta-analytic methods were used to calculate an overall relative change due to 0.08% laws across the set of six state pairs.²⁰ This overall effect is a weighted average of the individual state effects, where states with more crashes are weighted more heavily. A test of heterogeneity of effects across the six state pairs was conducted to test the significance of state to state variation in effects. Regardless of the observed variation in effect, the relative change in the proportion of fatal crashes involving alcohol was treated as a random effect in the meta-analysis. A pooled estimated 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 one from this ratio gives an estimate for the overall percentage of change in the proportion of alcohol involved fatal crashes in the 0.08% law states relative to control states.

In a commentary on meta-analytic approaches DerSimonian and Laird indicate that meta-analysis "is becoming increasingly popular in medical research where information on the efficacy of a treatment is available from a number of clinical studies with similar treatment protocols. If considered separately any one study may be either too small or too limited

Table 2 Proportion of drivers in fatal crashes with a BAC of 0.10% or higher before and after the passage of 0.08% legal blood alcohol limit in six states

0.08% Law states and comparison states	Proportion before 0.08% law (n)	Proportion after 0.08% law (n)	% Change in proportion (RR)	Ratio of the RRs (95% CI)
Kansas (0.08%)	0.24 (649/2723)	0.19 (574/3068)	-22% (0.78)	0.96 (0.85 to 1.10)
Oklahoma	0.23 (928/4114)	0.18 (885/4821)	-19% (0.81)	
North Carolina (0.08%)	0.20 (1847/9381)	0.15 (1507/9997)	-23% (0.77)	0.95 (0.88 to 1.04)
Tennessee	0.25 (1929/7594)	0.20 (1704/8361)	-20% (0.80)	
Florida (0.08%)	0.21 (3925/18499)	0.15 (2875/19739)	-31% (0.69)	0.93 (0.86 to 1.00)
Georgia	0.21 (2012/9755)	0.15 (1616/10585)	-26% (0.74)	
New Mexico (0.08%)	0.31 (875/2841)	0.23 (651/2782)	-24% (0.76)	0.94 (0.83 to 1.06)
Colorado	0.25 (876/3509)	0.20 (825/4086)	-19% (0.81)	
New Hampshire (0.08%)	0.23 (220/944)	0.18 (155/851)	-22% (0.78)	0.93 (0.75 to 1.14)
Connecticut	0.28 (648/2329)	0.23 (502/2137)	-16% (0.84)	
Virginia (0.08%)	0.22 (1028/4669)	0.19 (931/4971)	-15% (0.85)	0.93 (0.81 to 1.07)
Maryland	0.14 (501/3551)	0.13 (469/3644)	-9% (0.91)	
Overall law effect				0.94 (0.90 to 0.98)

BAC = blood alcohol content; CI = confidence interval; RR = relative risk.

in scope to come to unequivocal or generalizable conclusions about the effect of a treatment. Combining the findings across such studies represents an attractive alternative to strengthen the evidence about the treatment efficacy".²⁰

They caution against integrating results from studies that are diverse in terms of design and methods used. This is clearly not a problem in the analysis we conducted because in this study all six states adopted 0.08% criminal per se laws within a one year time period and exactly the same outcome measures and comparison state selection criteria were used in each analysis.

Of note, four of the 0.08% law states (Kansas, North Carolina, Florida, and New Mexico) had ALR laws in effect for three or more years before the legal limit was lowered to 0.08%, most if not all of the pre-0.08% law analysis periods in those states. Hence, simultaneous enactment of ALR laws could not account for any differential post-0.08% law reductions in alcohol related fatal crashes in those states. Analyses were repeated for those states as a group.

Results

DRIVERS IN FATAL CRASHES WITH RAISED BACS

Based on the meta-analysis, the six 0.08% states experienced a 6% greater relative post-0.08% law decline in the proportion of drivers

in fatal crashes with raised BACs at 0.10% or higher ($p < 0.01$, table 2). The proportion of drivers in fatal crashes with raised BACs declined 26.1% from 0.218 (8545/39 057) to 0.161 (6693/41 408) in 0.08% law states. In the comparison states, the decline was 20.2% from 0.223 (6894/30 852) to 0.178 (6002/33 634). Each 0.08% law state experienced a greater decline than its respective comparison state. There was no significant variation in 0.08% law effect across the six state pairs.

In the four 0.08% law states with ALR laws in place long before the 0.08% limit was adopted, the meta-analysis indicated the relative post-0.08% law decline in the proportion of drivers with raised BACs was also 6% greater than their comparison states experienced ($p < 0.02$). Those four 0.08% law states experienced a 27.5% post-0.08% law decline from 0.218 (7297/33 444) to 0.158 (5607/35 586). Their comparison states experienced a 21.3% decline from 0.230 (5745/24 972) to 0.181 (5030/27 853). Results were similar when we examined the proportion of drivers in fatal crashes with BACs at 0.01% or higher (data available on request).

ALCOHOL RELATED FATAL CRASHES

Based on our meta-analysis, the 0.08% law states experienced a relative 5% greater post-law decline in the proportion of fatal crashes that involved alcohol at BACs of 0.10% or

Table 3 Proportion of fatal crashes involving a driver or pedestrian with a BAC of 0.10% or higher before and after the passage of 0.08% legal blood alcohol limit in six states

0.08% Law states and comparison states	Proportion before 0.08% law (n)	Proportion after 0.08% law (n)	% Change in proportion (RR)	Ratio of the RRs (95% CI)
Kansas (0.08%)	0.36 (664/1834)	0.29 (589/2049)	-21% (0.79)	0.95 (0.85 to 1.07)
Oklahoma	0.36 (994/2778)	0.30 (960/3217)	-17% (0.83)	
North Carolina (0.08%)	0.36 (2217/6209)	0.28 (1847/6512)	-21% (0.79)	0.95 (0.89 to 1.02)
Tennessee	0.40 (2021/5104)	0.33 (1834/5546)	-16% (0.84)	
Florida (0.08%)	0.38 (4568/12035)	0.29 (3611/12537)	-24% (0.76)	0.97 (0.92 to 1.04)
Georgia	0.35 (2292/6489)	0.28 (1882/6836)	-22% (0.78)	
New Mexico (0.08%)	0.50 (1060/2115)	0.41 (814/2003)	-19% (0.81)	0.93 (0.84 to 1.02)
Colorado	0.38 (928/2441)	0.33 (910/2735)	-12% (0.88)	
New Hampshire (0.08%)	0.35 (232/657)	0.29 (167/572)	-17% (0.83)	0.95 (0.79 to 1.15)
Connecticut	0.42 (678/1608)	0.37 (544/1488)	-13% (0.87)	
Virginia (0.08%)	0.35 (1133/3230)	0.31 (1037/3381)	-13% (0.87)	0.90 (0.80 to 1.01)
Maryland	0.26 (632/2415)	0.25 (591/2326)	-3% (0.97)	
Overall law effect				0.95 (0.92 to 0.99)

BAC = blood alcohol content; CI = confidence interval; RR = relative risk.

higher, $p < 0.01$ (table 3). As a group, the 0.08% law states experienced a 21.4% post-law reduction from 0.379 (9874/26 080) to 0.298 (8065/27 054). The comparison states experienced a smaller decline, 16.0% from 0.362 (7545/20 835) to 0.304 (6722/22 148). Again, each 0.08% law state experienced a greater decline than its respective comparison state. There was no significant heterogeneity in trend between 0.08% law states.

In the four 0.08% states with longstanding ALR laws, the meta-analysis indicated the relative post-law decline was also 5% greater in the 0.08% law states than their comparison states ($p < 0.03$). As a group, 0.08% law states with long standing ALR laws experienced a 22.5% reduction in the proportion of fatal crashes involving alcohol at 0.10%+ from 0.383 (8509/22 193) to 0.297 (6862/23 101) while their comparison states experienced a 17.8% decline from 0.371 (6235/16 812) to 0.305 (5586/18 334). Results were similar when we examined trends in the proportion of fatal crashes involving alcohol at 0.01% or higher (data available upon request).

Discussion

On both measures of alcohol involvement in fatal crashes examined in this study, recent 0.08% law states experienced significantly greater post-law declines than their comparison states. These declines were significant not in each individual 0.08% state relative to its paired comparison state, but in the 0.08% law states as a group relative to the comparison states as a group. These are not contradictory findings. Given the number of crashes in each state, the statistical power of showing a significant decline in any individual state was low. The power to detect an 8% post-law decline, as reported by Voas and Tippetts,¹⁸ in individual 0.08% law states in this study was between 12% and 60%. By pooling the results across states, using meta-analysis, the statistical power was stronger. The meta-analysis had 97% power of significantly detecting such a decline. Further, all six 0.08% law states had greater post-law declines than their respective comparison states and there was no significant heterogeneity in effect between 0.08% law states.

The relative post-0.08% law declines were significantly greater, even in 0.08% law states with longstanding ALR laws, suggesting the post-0.08% law declines were independent of ALR laws. One comparison state, Tennessee, did not have an ALR law. Even if we deleted the North Carolina-Tennessee pair from our analysis of states with longstanding ALR laws, the post-law declines in 0.08% states with longstanding ALR laws were significantly greater than their comparison states again showing effects of 0.08% laws independent of ALR. Georgia, Florida's comparison state, adopted an ALR law during the study period after Florida adopted its 0.08% law. That made it more difficult for us to detect the greater post-0.08% law reductions we found on study outcomes in Florida.

All of the 0.08% states had criminal per se laws before the study period as did four comparison states Oklahoma, Georgia, Colorado, and Connecticut. In addition, all states in the study except New Hampshire had safety belt laws throughout the study. Also, all states had a minimum legal drinking age of 21 before the study period. Thus, passage of those laws during the study period did not confound results.

Of note, the comparison states in this study experienced very similar trends on study outcomes during the study period as all remaining states in the United States without 0.08% laws. There were no significant differences on study outcomes from the pre-law to post-law periods between comparison states and other non-0.08% law states. Also, the decline in study outcomes were significant in the 0.08% law states relative to these other 0.10% law states. Thus, it is unlikely that there were any biases in the selection of comparison states.

A limitation of this study was that the level of alcohol testing of fatally injured drivers was not as high and consistent as in an earlier analysis of the first five states with 0.08% laws. Consequently, we were not able to examine the effects of the law on drivers with BACs of 0.08% and 0.15% and higher. None the less, this study replicates the earlier analysis of the first five 0.08% law states, which indicated 0.08% laws significantly reduce the proportion of fatal crashes that involve alcohol. Further, this study identified effects of 0.08% laws that were independent of ALR legislation. While the 0.08% reductions in alcohol related fatal crashes in this study were 5%–6% and smaller than the 16% reduction observed earlier in states passing 0.08% laws and ALR laws in close time proximity, the decline in the more recent 0.08% law states is close to what might have been anticipated given that ALR laws have been found in national studies to produce 6%–9% reductions in alcohol related fatal crashes.^{13 14}

In 1998 there were 8503 fatalities in crashes involving alcohol at levels of 0.10% or higher in states that had not yet lowered the legal per se limit to 0.08%. If all those states were to adopt a 0.08% per se limit and were to experience the 5% reduction in alcohol related traffic crashes experienced by these recent 0.08% law states, 400–500 fewer fatalities would occur annually. Currently, 33 states do not have 0.08% criminal per se legal blood alcohol limits and 10 states have still not adopted ALR laws. All states should adopt both ALR and 0.08% laws.

1 US Department of Health and Human Services. *Health United States 1996–1997 and injury chartbook*. Washington, DC: DHSS, 1997. (DHHS Publication No PHS 97-1232 7-0248 (7/97).)

2 National Highway Traffic Safety Administration. *Traffic safety facts 1998: alcohol*. Washington, DC: Department of Transportation, National Center for Statistics and Analysis, 1999.

3 National Highway Traffic Safety Administration. *Setting limits, saving lives: the case for .08% BAC laws*. Washington, DC: NHTSA, 1997. (Publication No DOT HS 808 524.)

4 Moskowitz H, Burns M. Effects of alcohol on driving performance. *Alcohol Health and Research World* 1990;14: 12–14.

5 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: 329–45.

- 6 Damkot DK, Perrine MW, Whitmore DG, et al. *On the road: driving behavior and breath alcohol concentration. Vols I and II.* Washington, DC: Department of Transportation, 1975. (Technical report DOT HS 364 37567.)
- 7 Zador P. Alcohol-related relative risk of fatal driver injuries in relation to driver age and sex. *J Stud Alcohol* 1991;53:301-10.
- 8 Roger PN. *The general deterrent impact of California's .08% blood alcohol concentration limit and administrative per se license suspension laws.* Sacramento, CA: Department of Motor Vehicles, 1995.
- 9 Johnson D, Fell J. The impact of lowering the illegal BAC limit in five states in the US. Washington, DC: US National Highway Traffic Safety Administration. *39th Annual Proceedings of the Association for the Advancement of Automotive Medicine.* Chicago, IL, 16-18 October 1995.
- 10 Hingson R, Heeren T, Winter M. Lowering state legal blood alcohol limits to 0.08%: the effects on fatal motor vehicle crashes. *Am J Public Health* 1996;86:1297-9.
- 11 Ross HL. Law science and accidents: the British Road Safety Act of 1967. *Journal of Legal Studies* 1973;2:1-79.
- 12 Ross HL. *Deterring the drinking driver: legal policy and social control.* Lexington, MA: Lexington Books, 1982.
- 13 Zador P, Land A, Fields M, et al. Fatal crash involvement and laws against alcohol impaired driving. *J Public Health Policy* 1989;10:467-85.
- 14 Klein T. *Changes in alcohol-involved fatal crashes associated with tougher state alcohol legislation.* Washington, DC: National Highway Traffic Safety Administration, 1989. (Contracts No DTNH-22-88-L-07045.)
- 15 Apsler R, Chan AR, Harding W. *The effects of 0.08% BAC law.* Washington, DC: National Highway Traffic Safety Administration, 1999.
- 16 General Accounting Office. *Highway safety's effectiveness of state .08 blood alcohol laws.* Washington, DC: General Accounting Office, 1999. (GAO/RCED-99-179.)
- 17 Foss D, Stewart R, Reinfurt D. *Evaluation of the effects of North Carolina's 0.08% BAC law.* Chapel Hill, NC: Highway Safety Research Center, University of North Carolina, November 1998.
- 18 Voas R, Tippetts AS. *Relationship of alcohol safety laws to drinking drivers in fatal crashes.* Washington, DC: National Highway Traffic Safety Administration, 1999.
- 19 Klein T. *Methods for estimating posterior BAC distribution for persons involved in fatal crashes.* Washington, DC: National Highway Traffic Safety Administration, 1986. (DOT HS 807 094.)
- 20 DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials* 1986;7:177-88.

Brazil bans computer games for violent content

Brazil's Justice Ministry recently banned six computer games for their violent content, including one that they said encouraged a medical student to go on a deadly shooting rampage last month in a movie theatre, Reuters reported in December. The games the Justice Ministry banned stores from selling are *Doom*, *Mortal Kombat*, *Requiem*, *Blood*, *Postal*, and *Duke Nukem*. The ministry also said it would rule on other games with violent content in 120 days. "The games are considered violent and affecting people who play them, particularly children", the Justice Ministry spokeswoman said. "As for *Duke Nukem*, the ministry regulation says its virtual world may have motivated Mateus da Costa Meira to stage the cinema shooting on November 3 in Sao Paulo". Stores that violate the ban will be fined \$11 000 per day.

Accident man gets £3526 bill

A pub landlord knocked down by a bus has received a £3526 bill for damaging the vehicle. Norman Green, 51, of Thornbury, near Bristol, was crossing a city centre street when he was sent sprawling and suffered four broken ribs, which laid him off work for 14 weeks. He was stunned when the bus company asked him to pay for repairs to a light and windscreen broken in the collision and threatened to take him to court if he refused to pay. The company said the accident happened because "Mr Green was not looking where he was going" and it had suspended the summons until his finances improved.

Screening teens for suicide

In spite of the fact that suicide is the third leading cause of death among adolescents, less than one quarter of US pediatricians and family physicians screen these patients for risk factors associated with suicide. A recent study reported nearly one half of the 600 physicians surveyed reported that at least one of their patients had attempted suicide in the past year. Routine screening was associated with more frequent counselling about safe storage of firearms and car occupant safety. Apparently, one barrier (or excuse) for not screening more often is concerns about confidentiality. Another may be the lack of evidence that the counselling provided is effective (*Arch Pediatr Adolesc Med* 2000;154:162-8).

Surviving massive burns

A surprising report in *JAMA* suggests that most children who survive a massive burn have a satisfying quality of life. The study by Sheridan and colleagues from the highly respected Shriners Burn Hospital in Boston was based on an evaluation of 68 children who had burns involving more than 70% of their body surface. The assessment took place an average of 15 years after the injury. The burned children were compared with age matched general population norms using a standardized measure. The unexpectedly good results are either a tribute to the excellent aftercare program or may reflect weaknesses in the measure itself (*JAMA* 2000;283:69-73).

Aggressive children? Is it hormones after all?

A study shows an association between low levels of salivary cortisol and early and persistent aggression in boys 7-12. The key finding is aggression that starts early and persists among this subgroup of children. The study is based on a four year follow up of 38 school aged boys. Aggression was measured by peer evaluations. Those with low cortisol levels on two occasions displayed three times as many aggressive symptoms and were three times more likely to be chosen as most aggressive by their peers. Interestingly, the investigator noted that "stress delivered to a pregnant female mammal can permanently reset the cortisol system in the infant" (*Arch Gen Psychiatry* 2000;57:38-43).