Effects of North Carolina's 0.08% BAC Limit

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Abstract

Studies of the effects of 80 mg/dL (0.08%) BAC laws on motor vehicle crashes in the U.S. have found equivocal and somewhat conflicting results. The present study was conducted to clarify the effect of reducing the BAC limit from 100 mg/dL to 80 mg/dL without the confounding effect of a new administrative license revocation law. Using time-series analysis we found no significant change in the rate or the trend of several measures of alcohol involvement in crashes coinciding with introduction of the lower BAC limit. Finally, using FARS data we compared several measures of alcohol involvement--(1) driver BAC $\geq$ 10 mg/dL, (2) driver BAC $\geq$ 100 mg/dL, (3) police-reported alcohol involvement, (4) single vehicle nighttime crash, (5) single vehicle nighttime male driver crash, and (6) estimated alcohol involvement--for North Carolina with 37 states that had retained higher per se limits from 1991 through 1996. Comparing 24 months before and after enactment of the NC law, no measure declined by a significantly greater amount in North Carolina than in the other 37 states. Hence, it appears that lowering the BAC limit to 80 mg/dL in North Carolina did not affect alcohol-related crashes.

Introduction

In the U.S., alcohol is involved in about 7% of all traffic crashes, but is much more commonly involved in fatal crashes. During 1998, 38% of fatal crashes involved a drinking driver or non-occupant. Presently, 49 states have enacted a per se illegal BAC for drivers; 32 states set the limit at 100 mg/dL. Both experimental and epidemiologic evidence suggest that a BAC limit of 100 mg/dL may be too high. A variety of behaviors and cognitive functions pertinent to driving begin to show evidence of impairment at BACs as low as 40 mg/dL. The best epidemiologic information currently available on BAC and the risk of a driver crashing generally appears to show an increase in the slope of the risk curve at a BAC of about 80 mg/dL. In view of this evidence, many states have considered lowering the *per se* BAC limit from 100 mg/dL to 80 mg/dL. Presently, 17 states have done so. North Carolina reduced its limit to 80 mg/dL effective October 1, 1993.

Data on BACs of persons involved in fatal crashes suggests, however, that reducing the legal BAC limit may have little effect. Fatality Analysis Reporting System (FARS; NHTSA, 1998)

data indicate that among fatally injured drivers who have been drinking, BACs are well in excess of the existing legal limit (100 mg/dL in most states). Thus it can be argued that drivers killed in alcohol-related crashes are already in substantial violation of the BAC limit and, consequently, that reducing the legal limit will likely have no effect. Accordingly, it is important to determine whether a lowered BAC limit results in fewer crashes, or at least fewer alcohol-related crashes.

Among the 17 states that have reduced the *per se* illegal BAC limit to 80 mg/dL, only the California law has been subjected to a thorough evaluation. A study conducted shortly after the lower BAC limit took effect found a 12% decrease in alcohol-related fatalities, but no corresponding decline in non-alcohol crashes (NHTSA, 1991). However, it was not possible to determine whether the decrease in alcohol-related fatalities that occurred was due to the 80 mg/dL law, an ALR law that was implemented 6 months later, or some combination of the two. In a more recent study of the California law, Rogers (1995) examined a large number of crash types and severity levels using time series analysis techniques to control for a variety of factors such as amount of driving and general economic conditions. No decrease in alcohol-involved crashes or alcohol-involved fatal crashes was found to be associated with the 80 mg/dL law. Some decline was found in surrogate measures for alcohol crashes: nighttime serious injury or fatal crashes and fatal or injury crashes occurring between 2 and 3 am.

In a preliminary evaluation of the first five states to reduce BAC limits to 80 mg/dL, six overlapping measures or indicators of drinking-driving available from FARS were examined for comparable time periods before and after the lower BAC limit was enacted: (1) driver BAC $\geq$ 10 mg/dL, (2) driver BAC $\geq$100 mg/dL, (3) police-reported alcohol involvement, (4) estimated alcohol involvement (e.g., police reported drinking, positive BAC measurement, or alcohol violations/citations), (5) single-vehicle nighttime crashes, and (6) single-vehicle nighttime male driver crashes (NHTSA, 1994). The findings were inconsistent across the five states, with anywhere from zero to four of the six indicators examined showing a statistically significant decline. A more recent, 11-state study also found inconsistent results (Apsler et al., 1999).

Hingson et al. (1996) reported findings that appear to corroborate the preliminary results reported by NHTSA, using a more controlled research design. Using an approach that has subsequently been criticized, each of the first five states to reduce their per se limit to 80 mg/dL was matched with a similar state from the same general region that did not reduce the limit. Unfortunately, as was the case in California, it is difficult to disentangle the effects of the 80 mg/dL laws from administrative license revocation laws that took effect at about the same time as the 80 mg/dL laws in three of the five states. Moreover, nearly half (4/9) of the statistically significant effects the NHTSA study found occurred in Vermont and Utah, yet Hingson et al. found no decline in Vermont, and an increase in alcohol-involved crashes subsequent to the 80 mg/dL law in Utah.

Overall then, the available empirical evidence on the effect of 80 mg/dL legislation to date is not strong, but does suggest that there may be a desired effect. The greatest drawback in previous studies has been the inability to attribute apparent effects clearly to 80 mg/dL laws rather than to co-existing ALR laws, which have been demonstrated to reduce drinking-driving.

Materials and methods

To shed additional light on the effects of reducing the *per se* BAC limit to 80 mg/dL, we examined data from North Carolina. As in California, there is a sufficiently large number of crashes in North Carolina to conduct time series analyses using monthly crash rates, allowing use of North Carolina as its own 'control.' An additional benefit to this study is that effects of North Carolina's ALR law, which was enacted in 1983, are not confounded with the 80 mg/dL law. Thus, the methodological problems that have confounded interpretation of results from previous studies can be avoided by using North Carolina data.

In the present study, we examined crashes prior to vs. following implementation of the 80 mg/dL law. Time series analyses were employed to examine a number of potential indicators of the effects of this new law, including alcohol-related crashes as identified by the investigating officer, alcohol-related fatal crashes, and alcohol-related injury crashes. In addition, because reports of alcohol involvement in all but fatal crashes are somewhat problematic, proxy measures for alcohol-related crashes (nighttime crashes, fatal/serious injury nighttime crashes) were also examined. A series of before-after comparisons using FARS data were also conducted, using the 37 states that had not enacted 80 mg/dL limits by 1995 as a comparison group.

Results

For the following analyses, we used data obtained from the North Carolina Division of Motor Vehicles, Collision Reports section. We examined changes only for those crashes where drivers of motor vehicles had been drinking (either by objective measurement or officer judgment) as the criterion of interest. Crashes that involved alcohol only by virtue of drinking by a pedestrian or bicyclist were not considered alcohol-involved crashes for purposes of this evaluation.

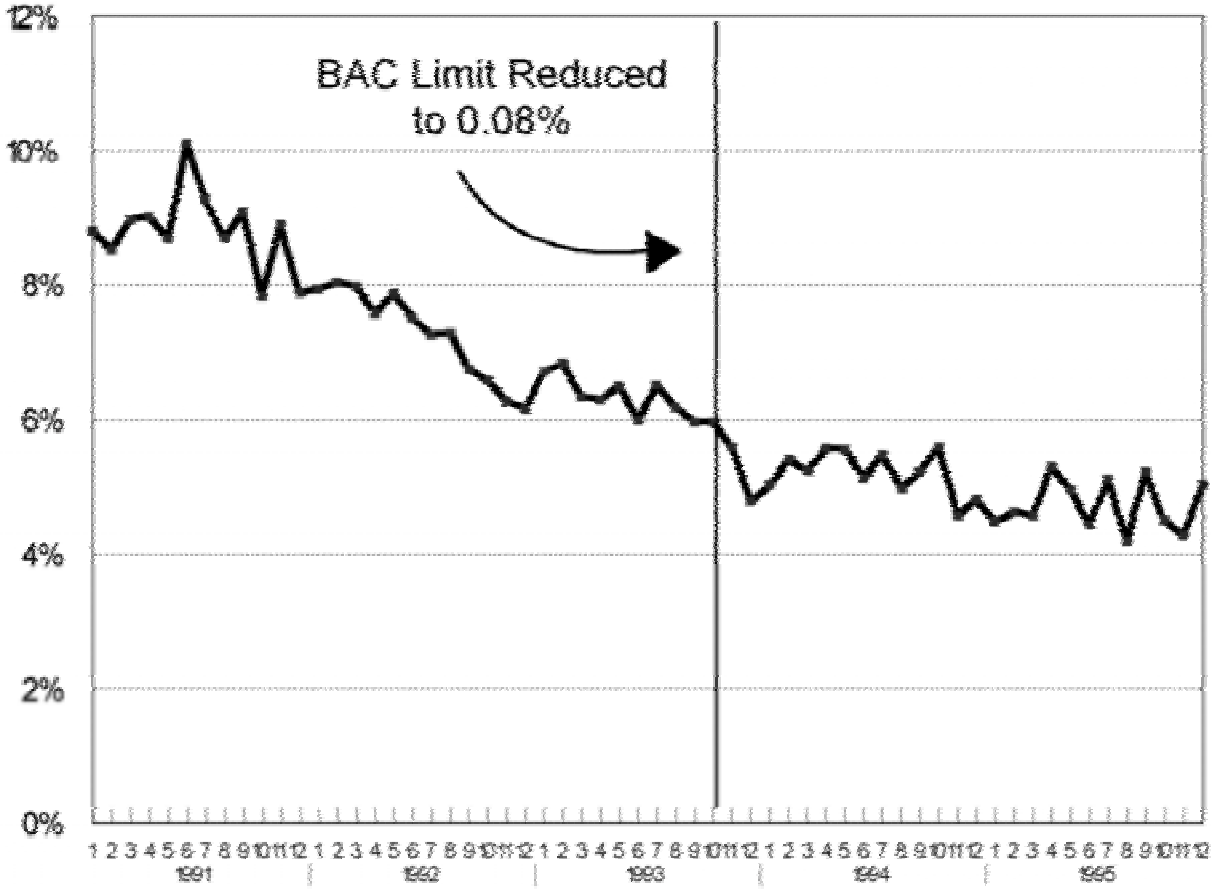
Figure 1 shows the percent of all crashes that involved a drinking driver by month from January 1991 through December, 1995. It is clear that the most dramatic part of the decline in alcohol involvement occurred well in advance of the reduction in the BAC limit. Although 'anticipatory' effects of traffic laws are sometimes seen, that does not appear to have occurred in the present case. Legislation to reduce the BAC limit was introduced in the North Carolina General Assembly in March of 1993 and was passed in July.

Examination of the data series suggests that if there was a time-delineated shift (rather than simply a general continuing decline), it probably occurred somewhere in early- to mid-1992, fully a year before the 0.08% legislation was introduced. We are unable to find any events or policy changes that occurred around that time which might have resulted in such a decline.

Because of the variety of factors that influence motor vehicle crashes in general, and those involving alcohol in particular, it is necessary to conduct more sophisticated, time-series analyses to determine whether an intervention has produced an effect. Accordingly, a number of time series models were fit to the number and proportions of various types of motor vehicle crashes occurring in North Carolina by month from January 1991 through December 1995. Structural

time series models were fit to the data then used to estimate any changes in the number of

alcohol-related crashes that coincided with implementation of the lower BAC limit.



We considered two basic types of intervention effects: a step shift in the level of the series at the point of intervention and a change in the trend or slope (rather than an abrupt shift) of the series beginning at the time of intervention. A number of different models were fit to several different data series (number of alcohol-related crashes, proportion of crashes involving alcohol, log and logit of the proportion involving alcohol), for several levels of crash severity as well as standard surrogate measures for alcohol involvement. None of these produced a statistically significant step shift or change in trend coincident with enactment of the lower BAC limit.

Using data from the Fatality Analysis Reporting System (FARS), we also compared the trend in alcohol-related fatal crashes in North Carolina from 1990 - 1995 with that in eleven other states that have had consistently high rates of testing for alcohol among fatally injured drivers (> 80% for each year). A model was fit to the logit transform of the proportion of all fatally injured drivers in the12 states with BAC > 100 mg/dL who were North Carolina drivers. Again, intervention effects added to the model did not approach statistical significance for either a shift in level (p=.862) or a change in trend (p=.509).

As a final set of analyses for this study, we examined several indicators of alcohol involvement in North Carolina fatal crashes compared to fatal crashes in the 37 U.S. states that did not have an 0.08% BAC limit at any time during the period 1991 - 1996. These analyses looked at the six

criterion variables reported in the NHTSA preliminary study of the effects of 0.08% discussed above. To avoid the kinds of criticisms directed at Hingson et al. (1996) concerning selection of 'matching' or comparison states, we elected to compare North Carolina with all states that had a BAC limit of 0.10% during the period we examined.

For ease of comparison with other analyses in the literature, we used the same statistical measures as those employed by Hingson et al. (1996), that is, a ratio of relative risks of alcohol involvement comparing North Carolina to the other 37 states. As can be seen below, there was no difference between North Carolina and the states that retained a 100 mg/dL BAC limit on any of the six measures comparing the 24 months before the lower limit took effect with the subsequent 24 months. A value greater than one for the ratio of North Carolina to the other 37 states indicates that the measure declined more in North Carolina than in the other states.

Summary of findings from six indicators in FARS data, North Carolina vs. 37 other states, 48-month period (Oct. 1, 1991 - Sept. 30, 1993 vs. Oct. 1, 1993 - Sept. 30, 1995).

Criterion Measure	RR_{NC}/RR_{37}	95% CI
BAC $\geq$ 10 mg/dL	1.04	.94, 1.14
BAC $\geq$ 100 mg/dL	1.02	.92, 1.13
Police-Reported Alcohol	1.07	.95, 1.20
Single Vehicle Night Crash	0.97	.92, 1.16
Single Vehicle Night Crash, Male Driver	0.93	.81, 1.06
Estimated Alcohol	1.05	.96, 1.15

Discussion

The failure to find changes in any of a variety of indicators of alcohol involvement that might be attributed to the lower BAC limit in North Carolina, suggests that the law has not had the intended effect. There are a number of possible explanations for this. First, and perhaps most likely, is simply that reducing the legal limit to 80 mg/dL from 100 mg/dL does not affect drinking-driving behavior, but there are other possible explanations. Given the dramatic decline in alcohol-related crashes that occurred in North Carolina (and elsewhere) during the early 1990s, it may be that any potential effect of reducing the BAC limit was simply obscured by a broad change in drinking-driving behavior that was already occurring.

Another explanation for the failure of an effect to materialize for the lower BAC limit is that the new, lower level was not sufficiently publicized. That hypothesis is undermined by results of a telephone survey of 802 licensed drivers 17 months after the lower limit was enacted, in which 73% of drinkers indicated that they knew the limit had been lowered (Foss et al., 1999). Another possible explanation for the failure to detect any effect of the new law is that it was not being enforced, but that was not the case. An examination of persons who had completed the mandatory screening and treatment process indicated that, beginning in October 1993, the number of persons arrested with BACs of 80 – 90 mg/dL increased immediately. Telephone interviews with prosecutors in several counties confirmed that there was no change in their approach to DWI prosecution, nor did they detect any difficulty in obtaining convictions at the lower BAC limit.

Finally, it is worth noting that the failure to find a clear effect of the 80 mg/dL law in North Carolina is consistent with the existing literature. Most examinations of 80 mg/dL laws have been confounded by the enactment, in close temporal proximity, of administrative license revocation laws. It has, therefore, not been possible to disentangle effects of these two kinds of laws. Most states for which the effect of a 80 mg/dL law has been studied show no clear effect of a 80 mg/dL law by itself. For nearly every other state there are conflicting findings. Accordingly, although there are a variety of reasons that states might want to reduce their BAC limit for drivers from 100 mg/dL to 80 mg/dL, expectations that doing so will reliably produce an observable decrease in alcohol-involved crashes or fatalities may well meet with disappointment.

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