1999 HOUSE TRANSPORTATION

HB 1134

1999 HOUSE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. 1134

House Transportation Committee

❑ Conference Committee

Hearing Date January 14, 1999

Tape Number	Side A	Side B	Meter #
1	x		26.1-55.0
1		x	41.3-42.0
Committee Clerk Signature			

Minutes:

CHAIRMAN KEISER OPENED THE HEARING ON HB 1134; A BILL RELATING TO ALCOHOL CONCENTRATION FOR MOTOR VEHICLE OPERATORS.

REP. LLOYD introduced the bill. (See attached testimony).

REP. JENSEN asked Rep. Lloyd what the potential is for increased funding. Is that dependent on the standard? Could we get the money whether we do this or not?

REP. LLOYD replied that the state must mandate .08 in accordance with the federal level to get the funding. It is specifically stated as such.

REP. MICKELSON questioned the limits in other countries. Referring to one ranging from .05 to .08, is that a range or different levels for different sexes and sizes of people?

REP. LLOYD was unaware of the range.

REP. MAHONEY noted that HB 1131 was one to increase penalties, and it varies across the country. In comparison, did they look at bills like 1131 and compare the differences state to state?

REP. LLOYD replied yes. There are lots of variations across the nation. He wasn't sure how they compared, but stated that there are certain restrictions. The covering of Blood Alcohol Concentration has gotten a very favorable response by victims and the general public. Even some of those impaired drivers have given a good response.

REP. SCHMIDT asked if the range in other countries might apply for a 170 lb. man versus a 130 lb. man?

REP LLOYD said possible a woman versus a man.

REP. GRUMBO questioned the accuracy of a breathalyzer test.

REP. LLOYD said that all he has read on the issue is that the accuracy shows the level of .08. That is all the information that he has been given.

CHAIRMAN KEISER asked if in drafting the bill, was there any fiscal impact?

REP. LLOYD said that nothing was discussed with him, and in discussions with the law enforcement, they eluded to that.

CHAD HAGEN, President of the North Dakota Fraternal Order of Police, testified in support of HB 1134. He said that the problem of drunk driving is an increasing problem. He said that many people are picked up at the 1.7 Blood Alcohol Level and that the lower areas of .10 and under are where the increased risk is taking place. The problem starts earlier than .10 and this is where it needs to take place. Commercial drivers level is at .04, and the same standard should go

for motor vehicle drivers as does for air, boat, and train travel. He was simply speaking for the law enforcement aspect.

BOB GRAVELINE, North Dakota Safety Council, testified in favor of HB 1134. He simply said if you drink, don't drive; if you drive, don't drink.

MARSHALL MOORE, Director of the Department of Transportation, testified in favor of HB 1134. He said that safety on the highways is violated by obstacles such as alcohol, speeding, and the lack of wearing seat belts. He noted that the driver has a big impact. He gave support of the bill, and support of Rep. Lloyd's testimony.

CHAIRMAN KEISER asked if the fund was UN-restrictive.

MOORE answered completely.

CHAIRMAN KEISER further asked if the money will show past 2003, as noted on the fiscal note?

MOORE said yes, that was as far as they could go, but that it could still go beyond that.

REP. KEMPENICH asked Chad Hagen what the numbers range from of drivers pulled over?

CHAD answered that the number of DUI drivers arrested that are obviously intoxicated range from .15 - .2 are the real power/professional drinkers. The ones right on the border with a .10 are very suspicious.

REP. MAHONEY mentioned that the talk about fatalities and accidents - many are alcohol related. What level is used when they say alcohol related?

CHAD said that there is not a set level. Whenever injury is involved - alcohol is suspected and they wait for the results to come back.

REP. MAHONEY said for statistical purposes, is it a .01-.06?

CHAD replied that he did not know.

JANET SEAWORTH, Executive Director, North Dakota Beer Wholesalers, testified in opposition to HB 1134. (See attached testimony).

REP. JENSEN questioned the impact that this will have on the industry.

JANET replied that there would be no effect.

AL STENEHJEM, Executive Director of the North Dakota Hospitality Association, testified in opposition to HB 1134. (See attached testimony).

TOM SMITH, NDWLDA, testified in opposition to HB 1134.

REP. JENSEN asked if there is any economic impact on the industry.

TOM said no.

REP. LLOYD mentioned that the word "fatality" is used a lot. He said that they did not consider fatalities and accidents the same. Fatalities are not just the issue.

Testimony was submitted by LONNIE OLSON in opposition to HB 1134. (See attached testimony).

CHAIRMAN KEISER CLOSED THE HEARING ON HB 1134.

January 15, 1999

COMMITTEE ACTION

REP. MEYER moved a DO NOT PASS motion. REP. KEMPENICH seconded the motion. The motion carried.

ROLL CALL - 10 YAE, 5 NAE, 0 ABSENT AND NOT VOTING.

FLOOR ASSIGNMENT - REP. MAHONEY

Date: 1/14/99
Roll Call Vote #:

1999 HOUSE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 1134

House Transportation Committee

☐ Subcommittee on

or

☐ Conference Committee

Legislative Council Amendment Number

Action Taken DO NOT PASS

Motion Made By Rep Meyer Seconded By Rep Kempenich

Representatives	Yes	No	Representatives	Yes	No
Represenatative Keiser, Chair	✓		Representative Thorpe		✓
Represenatative Mickelson, V. Ch.	✓				
Representative Belter		✓			
Representative Jensen	✓				
Representative Kelsch	✓				
Representative Kempenich	✓				
Representative Price		✓			
Representative Sveen		✓			
Representative Weisz	✓				
Representative Grumbo	✓				
Representative Lemieux		✓			
Representative Mahoney	✓				
Representative Meyer	✓				
Representative Schmidt	✓				

Total (Yes) 10 No 5

Absent ~~2~~ 0

Floor Assignment Rep. Mahoney

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

HB 1134: Transportation Committee (Rep. Keiser, Chairman) recommends **DO NOT PASS** (10 YEAS, 5 NAYS, 0 ABSENT AND NOT VOTING). HB 1134 was placed on the Eleventh order on the calendar.

1999 TESTIMONY

HB 1134

ND Legislative Assembly

ND Legislative Assembly
Box 248
Northwood, ND
3671 5th Ave.NE 58267

Phone: 701-587-5080
FAX: 701-587-5345
email: elloyd@state.nd.us

Thursday, January 14, 1999

HOUSE BILL NO. 1134: BLOOD ALCOHOL CONTENT OF 0.08%.

The bill lowers the Blood Alcohol Content (BAC) from 0.10 % to 0.08 %.

Alcohol in the blood is the concern. The level of the content is the problem.

The risk of being in a motor vehicle crash rises gradually with each BAC level, but then rises very rapidly after a driver reaches or exceeds 0.08% BAC compared to drivers with no alcohol in their system. This is more than a couple of beers after work or a couple of drinks of wine with dinner. A 170 lb male would have to consume more than four drinks in one hour on an empty stomach to reach a BAC of 0.08%.

Lowering the BAC level to 0.08% makes it possible to convict seriously impaired drivers whose BAC levels are now considered marginal because they are at or just over 0.10.

There are now 16 states that have lowered the level to 0.08%. Research studies show that, when the first 5 states to lower their BAC to 0.08 were compared with 5 nearby states that retained their rate at the 0.10 limit, a 16% reduction was experienced in the porportion of fatal crashes with a fatally injured driver whose B AC was 0.08 or higher. An 18% reduction occurred in crashes when the drivers BAC was 0.15

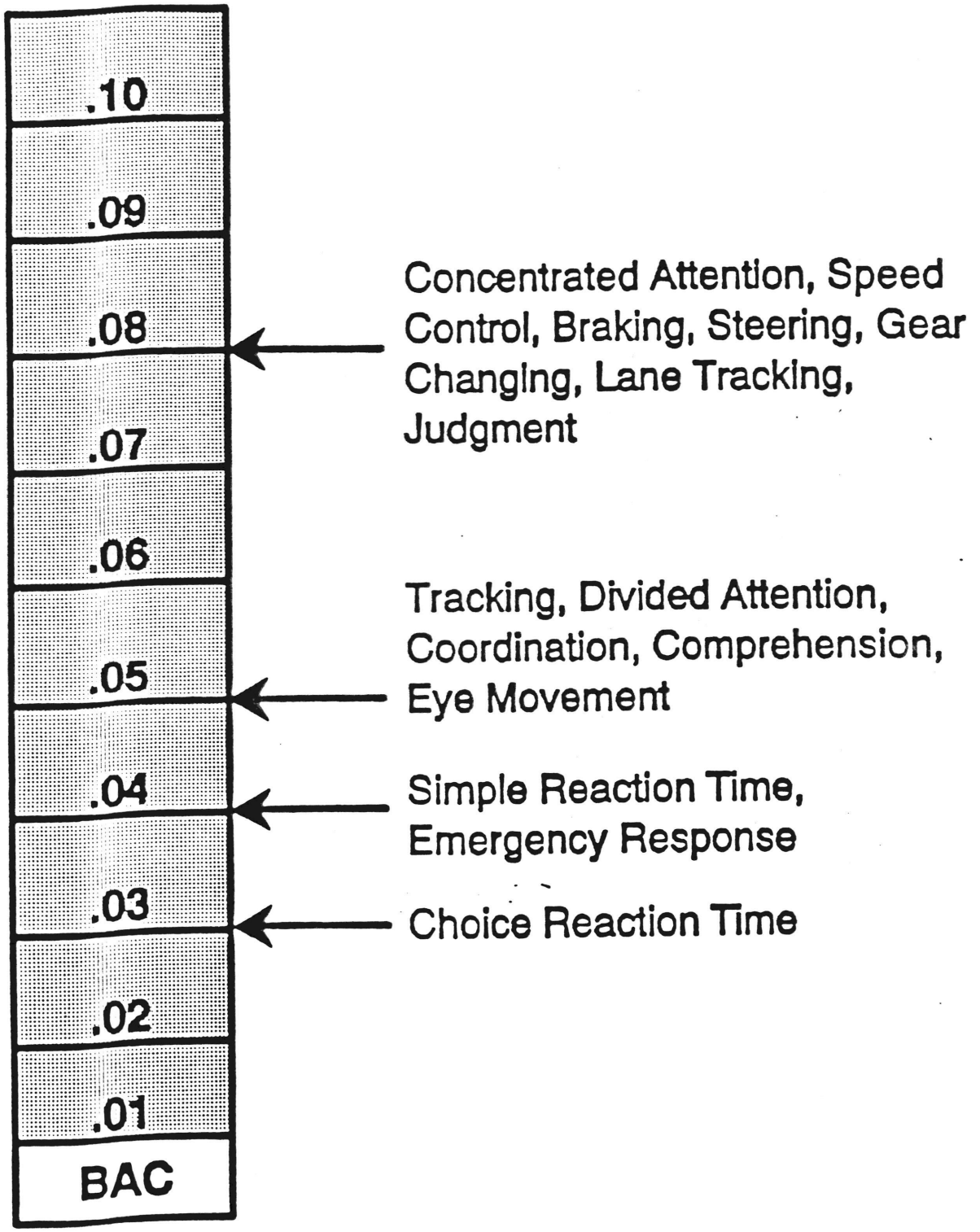
or higher. Not only did the 0.08 BAC law reduce the overall fatalities of alcohol fatalities, but also reduced fatalities at the higher BAC levels.

The US Senate approved an amendment to the ISTEA reauthorization in 1998 that would have required states to enact a 0.08% BAC limit. The House Rules Committee eliminated this amendment entirely from its transportation bill. However, a highway funding incentive was authorized for states that adopt a 0.08% BAC limit. Adoption of the 0.08% level in ND at this time allows our state highway system to receive up to $460,000 in the year 1999, $566,400 in 2000, $637,200, in 2001, $708,000 in 2002 and $778,800 in 2003. These total a lot. $_____? These funds, authorized by TEA-21, Section 163, can be used for traffic safety or even for construction. No ND state match is required.

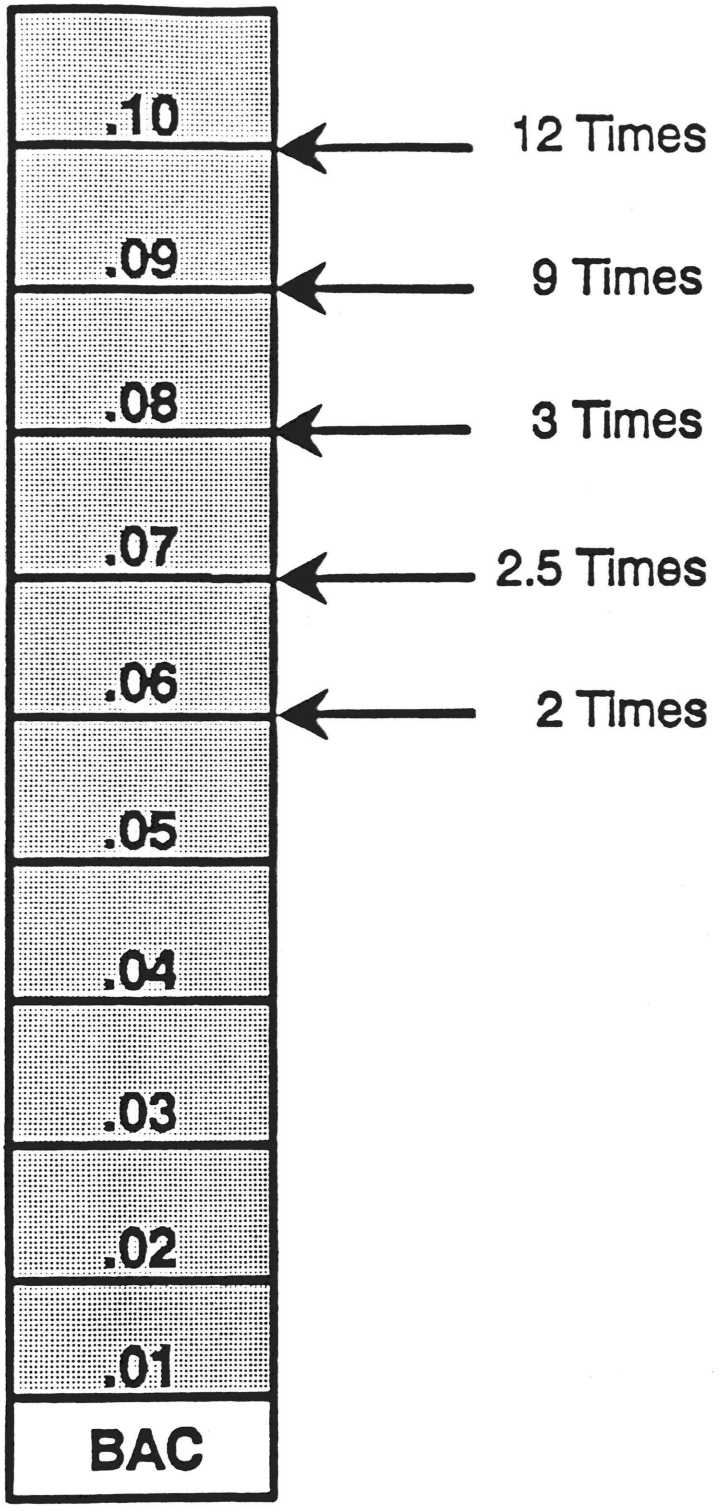
Australia, Canada, Switzerland, Norway, Finland, Sweden, Great Britain, Netherlands, and Austria have 0.08 or lower BAC level limits. And, in the US for commercial drivers it is 0.04%.

I have received considerable support from the ND citizenry. And I hope you recognize the value of lowering the BAC level to 0.08. Thank You.

Edward Lloyd
Representative
District 19



BAC and Impairment



BAC and Crash RIsk

BAC Limits in Other Countries

Country	Illegal Per Se
Canada	.08
Great Britain	.08
Australia	.05 - .08
Austria	.08
Switzerland	.08
Netherlands	.05
Norway	.05
Finland	.05
Sweden	.02

The .08 Per Se Law Will:

- Increase the arrest and conviction rates for impaired drivers at .10 and above.
- Raise the perceived risk of arrest for driving after drinking.
- Improve public awareness about how much alcohol it takes to be dangerously impaired.
- Bring the U.S. closer to per se limits of most industrialized nations.

.08 Per Se

Lowering the limit from the current level to .08 would set the boundary at a level at which driving skills are proven to be compromised for the vast majority of drivers. It is a limit which is reasonable and necessary for the driving safety of all.

SAFETY INCENTIVES TO PREVENT OPERATION OF MOTOR VEHICLES BY INTOXICATED PERSONS

402 & 410 0.7% · 460,000 566,400 637,200 708,000 778,800 ·

Year	1997(ISTEA)	1998	1999	2000	2001	2002	2003
Authorization	0	$55M	$65M	$80M	$90M	$100M	$110M

1/2 of 1% 325,000 400,000 450,000 500,000 550,000

Program Purpose

A new program of incentive grants (under Section 163 of chapter 1 of Title 23) to encourage States to establish 0.08 percent blood alcohol concentration (BAC) as the legal limit for drunk driving offenses. A State may use these grant funds for any project eligible for assistance under Title 23. [1404]

↳ This includes Constr.

Distribution of Funds

Available funding each year is apportioned among all eligible States according to the Section 402 formula—

- 75 percent based on the ratio of the State's population in the latest Federal census to the total population in all States.
- 25 percent based on the ratio of the public road miles in the State to the total public road miles in all States.

The apportionment to each State is no less than one-half of one percent.

Eligible Recipients

Any State that has in effect and is enforcing a 0.08 percent BAC law, before the end of the fiscal year, is eligible to receive incentive funds for that fiscal year. The law must provide that any person with a blood alcohol concentration of 0.08 per cent or greater while operating a motor vehicle in the state shall be deemed to have committed a *per se* offense of driving while intoxicated (or an equivalent *per se* offense).

For purposes of this section, those jurisdictions defined as "States" in chapter 1 of Title 23 are eligible to receive Section 163 incentive funds; this includes the 50 States, the District of Columbia, and Puerto Rico.

Program Administration

The Federal share of a project funded under this section is 100 percent

1-8-98

Submitted by the North Dakota Department of Transportation. If you have any questions, you may contact Marshall W. Moore, Director at 701-328-2581.

(3)

Testimony of Janet Demarais Seaworth
Executive Director
North Dakota Beer Wholesalers Association

HB 1134
House Transportation Committee

Mr. Chairman, members of the committee, my name is Janet Seaworth. I'm the Executive Director of the North Dakota Beer Wholesalers Association. North Dakota's beer wholesalers, along with their brewers are committed to reducing the problems associated with drunk driving. It's a goal we all share. One proposal often touted as the next step is lowering the BAC from .10 to .08. As we look for solutions however, it's important to make sure that we focus on the real cause of the drunk driving problem. We believe that .08 is a step in the wrong direction.

***Lowering the BAC to .08 will not reduce the number of alcohol-related crashes.** Drivers with a low BAC do not contribute significantly to the problem. According to the U.S. Department of Transportation, the average BAC level among fatally injured drinking drivers is .17%, more than twice the proposed .08% arrest level. Nearly two-thirds of all alcohol-related fatalities involve drivers with BACs of .14% and above.[1] North Dakota's stats are similar. According to NHTSA 1997 Data Files, 69.4% of alcohol-related fatalities involved North Dakota drivers with BAC levels of .14% and above. And according to figures for 1997 from the NDDOT, 28 of 34 alcohol fatalities involved BACs over .10. In 1998, only one of the 27 alcohol fatalities involved a BAC less than .10. Clearly, lowering the BAC limit will have no effect on the drivers who already ignore current law. In 1991, in testimony before the Governor's DUI Task Force, the state toxicologist testified that the average BAC of apprehended drivers in North Dakota was .163%, more than two times the proposed .08%. It was the state toxicologist's opinion that lowering the BAC to .08 would not reduce traffic fatalities.

***States with .08 BAC do not have a lower incidence of drunk driving deaths than states with a .10 BAC.** Look at the comparisons: According to NHTSA 1996 data, New Mexico had the nation's highest rate of alcohol-related traffic deaths despite the fact that they lowered their level to .08%. And in North Carolina, another .08% state, the alcohol-related fatality rate rose 21%.[2] In fact, a very recent study conducted by the University of North Carolina, at the request of NHTSA, concluded that lowering the BAC limit .08% in North Carolina had no effect. And last month, after a lengthy investigation into the effectiveness of .08, the New Jersey Senate Task Force on Alcohol Related Motor Vehicle Accident and Fatalities declined to endorse .08, stating that its effectiveness had not been shown.

***Lowering the BAC to .08 will dilute law enforcement efforts and resources.** According to

traffic safety specialists, lowering the BAC merely increases the population subject to arrest and increases the likelihood that chronic alcoholics or repeat offenders will be less likely to be arrested. [3]

***Real progress is being made in lowering the number of deaths caused by drunk drivers.** The long term trend is clear: from 1982-1995, drunk driving deaths declined 35%. Drunk driving fatalities are at their lowest point since 1982.[4]

***The state should focus on real solutions to fight drunk driving.** North Dakota's wholesalers, along with the beverage and hospitality industry has taught responsible drinkers to hand over the keys when they have had too much. And we have urged that the real way to reduce drunk driving is to target the real problem - high BAC drivers. We support efforts such a graduated penalties, administrative license revocation, mandatory minimum sentences, mandatory treatment for repeat offenders, vehicle forfeiture and ignition interlocks. It's clear that to reach today's drunk driver, we need to try new strategies that target alcohol abusers.

Thank you.

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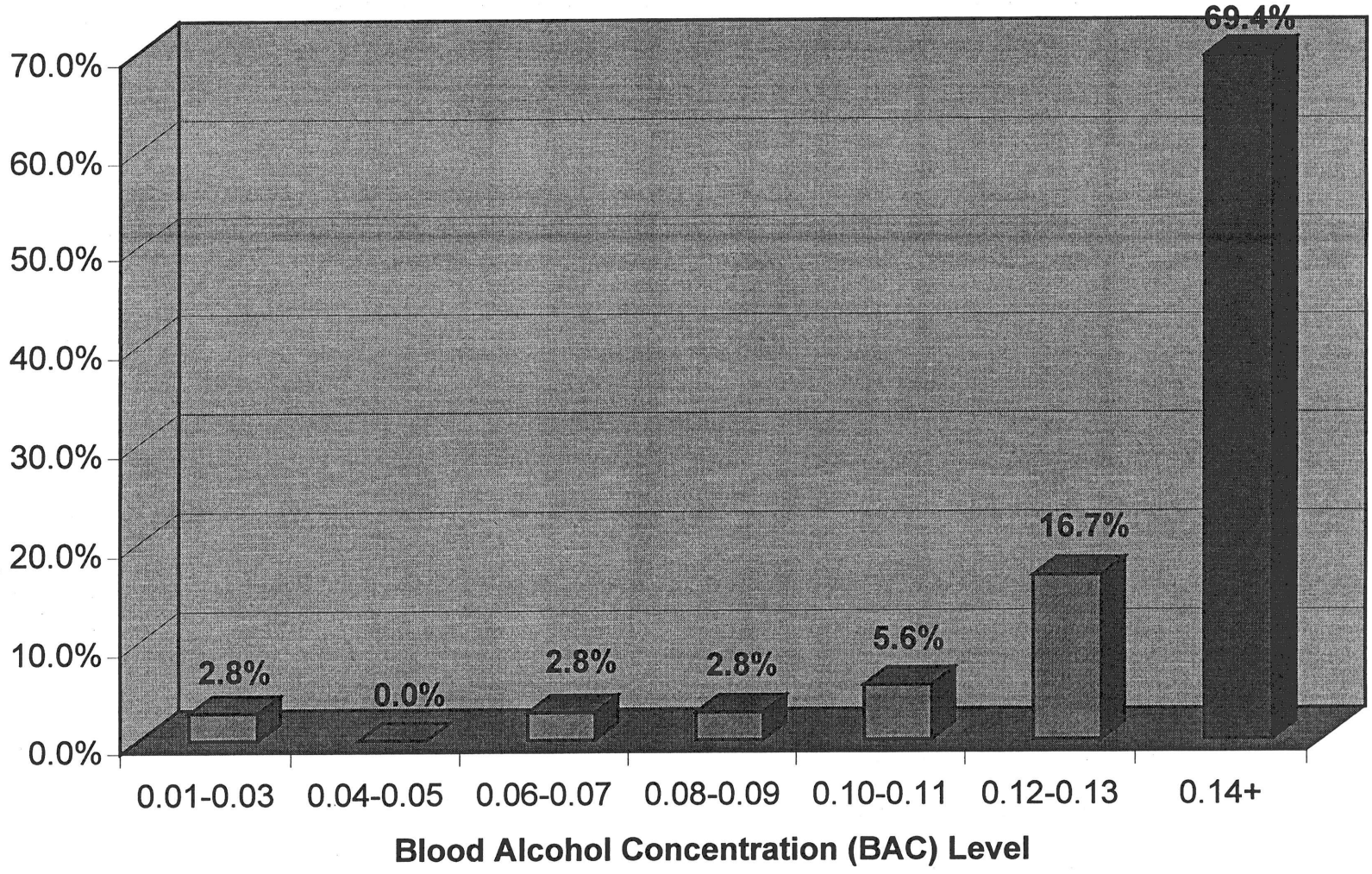
[1]National Highway Traffic Safety Administration, "1996 Drivers of vehicles in transport with known alcohol-test results," *Fatal Accidnet Reporting System* [CD-ROM and database on-line] (Washington D.C.: U.S. Department of Transportation, 1996).
[2]Id.
[3]Pete Youngers, "Federal Anti-Alcoholism Diverts Dollars From Effective Safety Measures," The Moderation Reader, Nov/Dec, 1990, p. 36.
[4]National Highway Traffic Safety Administration, "1996 Drivers of vehicles in transport with known alcohol-test results," *Fatal Accident Reporting System* [CD-ROM and database on-line](Washington D.C.: U.S. Department of Transportation, 1996).

For more information, contact NDBWA, P.O. Box 7401, Bismarck, ND, 58507, (701) 258-8098.

North Dakota Drivers Involved in Alcohol-Related Traffic Fatalities by Known BAC 1997



Source: National Highway Traffic Safety Administration 1997 Data Files. Numbers represent traffic fatalities in which a driver involved was actually tested at 0.01% BAC or above.

Alcohol Fatalities	1996	1997	1998 *
Less than 0.1	8	5	1
0.1-0.15	4	9	7
Greater than .15	20	19	19
No sample	0	1	0
Total Alcohol fatalities	32	34	27
Total Fatalities:	85	105	92

Alcohol-Related Fatalities	1996	1997	1998 *
	3	9	5
	0	1	2
	0	1	3
	7	2	4
	10	13	14
	85	105	92

Total Alcohol Fatalities	1996	1997	1998
	11	14	6
	4	10	9
	20	20	22
	7	3	4
	42	47	41
	85	105	92

Fatality Restraint Use		1996	1997	1998
Yes		12	13	18
None		60	78	62
Unknown		7	7	6
N/A:				
	Pedestrians	4	5	4
	Bicyclists		1	
	Other	2	1	2
Total Fatalities:		85	105	92

* 1998 - at the time of this data analysis, there are 4 fatalities which have incomplete data.

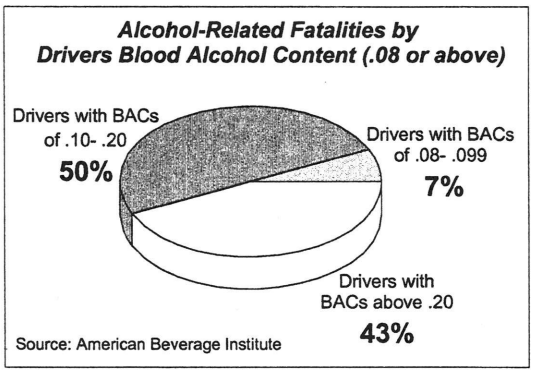
Ann Lunde, Research Analyst
Drivers License & Traffic Safety Division
North Dakota Department of Transportation
January 12, 1999 328-4397

Lowering the BAC to .08

A Step in the Wrong Direction

Lowering the legal blood alcohol limit (BAC) to .08 percent is an unproven proposal that doesn't focus on the real cause of the drunk driving problem. It is a step in the wrong direction.

Lowering the per se BAC misses the target. Responsible drinkers have gotten the message that driving drunk is no longer socially acceptable. The problem persists largely due to a stubborn group of "hard core" drunk drivers. One study looked at fatally injured drivers with BACs of .08 and above and found that *93 percent of the deaths are caused by drunk drivers at or above a .10 BAC.* It doesn't make sense to pass new laws arbitrarily enlarging the pool of drunk drivers by including a group not causing the problem.



More attention should be paid to the "high-BAC" driver. A study by the Traffic Injury Research Foundation found that almost 80 percent of drunk drivers killed in the U.S. in 1991 had a blood alcohol content of .15 percent or above and about one-half had a BAC of .20 percent or above. Furthermore, drivers with BACs in excess of .15 represent one percent of all drivers on weekend nights, but account for half of weekend-night fatalities. People driving with BACs of .15 or higher won't change their ways just because the BAC is lowered, but it will have a chilling effect on responsible consumers. Thus, a .08 per se law completely misses the mark of the vast majority of drunk driving fatalities.

Per se .08 laws aren't needed. Many states already have laws which provide for a drunk driving conviction if a person demonstrates visible signs of impairment, even if their BAC is below .10 percent. For example, if a driver is swerving, runs a stop sign and can't walk a straight line, but registers a .08 percent BAC, they can already be convicted in most states. Lowering the per se BAC level to .08 would mean that everyone who has a BAC of .08 or .09 could be arrested for the criminal offense of drunk driving. Doing so will create a new class of criminals, making it less likely that the real drunk drivers will be caught.

There's a lack of evidence that .08 works. Three of the five states which reduced their BAC limits to .08 by the end of 1991 had less success than the nation as a whole in the fight against drunk driving, while the other two states barely kept pace with the national decline. And even drinking drivers themselves say .08 won't work. A 1992 national study of drinking drivers by the University of New Hampshire's Survey Center found an .08 limit would only cause one percent of them to drink significantly less.

Through education, awareness and law enforcement, the nation is making a great deal of headway in the fight against drunk driving. In fact, the drunk driving fatality rate as a percent of miles driven has steadily declined, down 53 percent from 1982-1993. To continue that progress, it is important to focus on the high-BAC drinking drivers.

North Dakota State Hospitality Association

ALLAN STENEHJEM, Executive Director/Secretary

You and your neighbors are fed up with a few speeders who race through your neighborhood. While most drivers obey the posted 25-mph limit, a couple of reckless fools consistently drive 50 mph or more, especially on weekend nights. Two solutions are proposed at the next neighborhood meeting: Demand better police enforcement of the current 25-mph speed limit or drop the limit to 20 mph. Which would you choose to correct the problem?

HB 1134 proposes to redefine the essence of the drunk driving debate to include responsible social drinking – the legislative equivalent of dropping the speed limit to catch people who ignore the current limit.

This bill would lower the drunken-driving threshold from .10% blood-alcohol concentration to a .08% Concentration. If this passes a 120 pound woman will be considered legally drunk if, over a two hour period, she drinks two 6-ounce glasses of 13% wine, the average size and alcohol content served in restaurants. If apprehended, this woman faces arrest, fines, jail, higher insurance rates and license revocation for behavior that today is considered

919 South 7th Street • P.O. Box 428 • Bismarck, ND 58502 — Phone: 701-223-3313 • 1-800-627-3374 • Fax: 701-223-0215

responsible and not part of the drunken-driving problem. Meanwhile, the real problem of product abusers who drive goes unabated.

The problem facing this committee should be what to do about people that ignore our current BAC level and insist on driving. In ND the average BAC level of an individual involved in a Fatality is .17% BAC, more than twice the level targeted in this Bill.

Ironically, proposals to redefine "drunk" will actually hurt the fight against drunken driving. By diluting the definition of "drunken driver" to include social drinking, we will automatically increase the pool of "drunks" substantially without increasing the resources to fight the problem. This will have a debilitating effect on the already underfunded law enforcement efforts to stop truly drunken drivers.

Redefining "drunken driving" to include responsible social drinkers is the worst thing we can do to get tough on drunken driving. This politically expedient solution distracts attention from the real problem, unfairly punishes responsible social drinkers and, most important, does not save lives. If .08% BAC Laws work, why

is it that of the 10 states with the lowest alcohol-related fatality rate, only two have a .08% BAC Standard.

In 1996 there were 8 alcohol fatalities in the state with BAC less than .10% and 3 alcohol related fatalities. In 1998 there was 1 Alcohol Fatality and 5 Alcohol related fatalities. Through our efforts of tougher penalties and education we have created such a stigma about DUI that it has changed the behavior of most social drinkers. This trend in the reduction of alcohol fatalities shows we are making progress in our efforts. But, with one segment of society, safety advocates acknowledge defeat: that is the chronic drunken driver.

In 1996 there were 20 alcohol fatalities at .15% BAC and above. In 1998 the number was 22 Fatalities. It's this segment of society that we need to target tougher laws. And this bill will do nothing to address this problem

If we want to send a message to this group of people then pass HB 1131 that will send a stronger message that ND is serious about this issue. There are other bills introduced and there is discussion on a more comprehensive approach to deal with the real problem, that being the truly drunk driver.

The ND Hospitality Association is serious about this issue. We have put a program together and are working with an insurance company that provides liability and dram shop insurance to the bars and restaurants in the state. Part of the program requires that each bartender and server be trained in a certified Alcohol server program. This program teaches bar staff on how to recognize and prevent intoxication in others. This certification is so effective that insurance companies offer a discount on insurance premiums for establishments that complete this program.

It's time to get back to basics. Irrefutable data prove that today's drunk driving problem is caused by alcohol abusers. To reach today's drunk driver, we need to target these alcohol abusers. When these offenders record sky-high BAC levels, they should be presumed to have a drinking problem and treated accordingly. As the founder of Mothers Against Drunk Driving said: "if we really want to save lives, let's go after the most dangerous drivers on the road."

North Dakota Beer Wholesalers Association

MEMO

TO: THE HONORABLE GEORGE KEISER
FROM: JANET SEAWORTH
DATE: JANUARY 14, 1999
RE: .08 EFFECTIVENESS STUDIES

I have enclosed the studies addressing .08, a summary of the NHTSA Impaired Driving Program (.08 incentives are contained in Section 163), and the results of a poll conducted last February by USA WEEKEND. The poll, although admittedly not scientific, found that 82% of the public did not support lowering the BAC to .08.

With regard to the studies, the study by Robert A. Scopatz, Ph.D., Data Nexus, Inc., found fatal sampling flaws in the analysis by researcher Ralph Hingson. Hingson had paired .08% states with selected .10% states, and had determined that .08% would save some 500 to 600 lives per year . When the states selected by Hingson were replaced with other logical examples, the Hingson conclusion disappeared. Further, since all five of the .08% states had administrative license revocation laws during the study, there was no way to separate the effects of .08% legislation from administrative license revocation laws. And, importantly, the Hingson analysis relies on an assumption that California has experienced a decrease in fatalities as a result of .08%. In 1995 however, the California Department of Motor Vehicles study found "no statistically significant effects associated with the timing of the .08% law." That study is also included for your review.

I have also included the North Carolina study, which was requested by NHTSA, and which discusses the four studies relied upon by proponents of .08. The University of North Carolina study again concluded that it was not possible to disentangle effects of ALR laws from those of the lower BAC limit.

Finally, I have included the findings and recommendations of the New Jersey Senate Task Force on Alcohol Related Motor Vehicle Accidents and Fatalities. The findings discuss the conflicting studies regarding the effect of .08, and determine that nationally, the drunk driving fatality rate has declined over the previous 15 years because of prevention and enforcement programs and treatment programs for the DWI offender, whether or not in conjunction with a change to .08. The Task Force declined to make any recommendation to implement .08. If I can be of further assistance, please call.

NDBWA
P.O. Box 7401
Bismarck, ND 58507-7401
FAX and Phone: 701-258-8098

National Highway Traffic Safety Administration

Impaired Driving Program

October 1998

The National Highway Traffic Safety Administration's (NHTSA) mission is to save lives, prevent injuries and reduce traffic-related health care and other economic costs. The goal of NHTSA's Impaired Driving program is to reduce alcohol-related fatalities to 11,000 by the year 2005. This report serves as an update of some of our program activities at the national level in impaired driving.

TRAFFIC SAFETY FACTS

In 1997, 41,967 people were killed in motor vehicle traffic crashes, 16,189 fatalities were alcohol-related. This represents an average of one alcohol-related fatality every 32 minutes. The 16,189 alcohol-related fatalities (38.6 percent of the total traffic fatalities for the year) is the lowest reported level of alcohol-related fatalities since NHTSA began reporting in the 1970's

TRANSPORTATION EQUITY ACT FOR THE 21st CENTURY (TEA-21)

Impaired Driving Provisions

On June 9, 1998, President Clinton signed into law the Transportation Equity Act for the 21st Century (TEA-21), P.L. 105-206. TEA-21 includes several incentive programs and a couple of sanction provisions related to impaired driving.

Impaired Driving Incentives

Section 410-Incentive Grants to States

Basic Grant A - a state may satisfy 5 of the 7 criteria:

1. An administrative license revocation law with a 90-day suspension for the first offense and a one-year suspension for the second and subsequent offense or revoke such license, if such individual is a repeat offender within a 5-year period. The suspension must take effect within 30 days of the offense.

2. An underage-drinking program, which may include specially distinguished or tamper-resistant driver's licenses.

3. A special enforcement program that includes an education component and either sobriety checkpoints an equivalent program.

4. A graduated licensing system that is a three-stage system including driving restrictions in the first two stages, a mandatory safety belt requirement, and a zero tolerance requirement.

5. A program for drivers with high BAC's which may include graduated penalties and alcohol assessments.

6. A young adult drinking driver program for those 21-34 which may include awareness campaigns; traffic safety partnerships with colleges, employers and the hospitality industry; alcohol assessment for first-time offenders; and incorporation of treatment into judicial sentencing.

7. A BAC testing program for drivers involved in fatal crashes and, beginning in FY 2001, a testing rate that is equal to or greater than the national average.

Basic Grant B - a state is eligible for a grant if:

1. The percentage of fatally injured drivers with a .10 BAC has decreased in each of the three most recent calendar years, and

2. The percentage of fatally injured drivers with a .10 BAC is lower than the national average.

Supplemental 410 Grants--The bill authorizes five supplemental grants, each worth not more than 10% of the states' FY 97 402 apportionment. A state must receive a basic grant before it can be eligible for a supplemental grant.

1. Video equipment for detection of drunk driving.

2. Self-sustaining drunk driving program.

3. A law to reduce driving with suspended license (e.g. zebra tags).

4. A program to acquire passive alcohol sensors.

5. An effective DWI tracking system.

6. Other innovative programs.

Section 163 - .08 State Incentives

Section 163 would provide grants to states that have "enacted and (are) enforcing" a .08 (per se) BAC law. States would receive grants based on the proportion of 402 funds they receive for the year. The federal share for the funding would be 100%. Funds could be used for any purpose under Title 23.

Impaired Driving Sanctions

Section 164--Minimum Penalties for Repeat Offenders

Each state shall pass a law that provides, as a minimum penalty, that an individual convicted of a second or subsequent offense for driving while intoxicated or driving under the influence after a previous conviction for the offense shall:

A. Receive a driver's license suspension for not less than one year.

B. Be subject to the impoundment or immobilization of each of the individual's motor vehicles or the

installation of an ignition interlock system on each of the motor vehicles.

C. Receive an assessment of the individual's degree of abuse of alcohol and treatment as appropriate. And,

Second offense receive:

1. An assignment of not less than 30 days of community service, or

2. Not less than 5 days imprisonment.

Third or subsequent offense receive:

1. An assignment of not less than 60 days of community service, or

2. Not less than 10 days imprisonment.

Section 154--Open Container Laws

Under this provision, each state will pass a law that prohibits the possession of any open alcohol beverage container, or the consumption of any alcohol beverage, in the passenger areas of a motor vehicle.

For more information on the Transportation Equity Act please go to the Department's Website at: *www.dot.gov*. Fact sheets are provided on each of the provisions of the Act.

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January 14, 1999

George J. Keiser
House Transportation Committee Chairman

RE: House Bill 1131 and 1134

Dear Honorable Representative Keiser:

As President of the North Dakota State's Attorney's Association, for 1998-1999, I have read with interest House Bills 1131 and 1134. House Bill 1131 provides for an increase of imprisonment for a second DUI conviction within five years from four days to five days imprisonment, and increases the alternative of community service in lieu of the imprisonment from ten days to 30 days of community service. North Dakota State's Attorney's Association is wholeheartedly in agreement to this bill. We understand that there is some rumblings about the reduction of the DUI for a first time DUI offense coming from Bismarck. We have not seen any bill drafts in regard to this, however have heard rumors of a bill to decriminalize first offense driving under the influence convictions. As an association, we oppose any reduction in first offense DUI penalties. The demographics that we have seen are such that often times the first time offender on a DUI has driven a number of times under the influence prior to the first conviction. In light of that, we believe that any weakening of first offense DUI's is contradictory to good public policy.

In reviewing House Bill 1134, which provides for reducing the per se alcohol concentration level for motor vehicle operators from .10 to .08, we have a number of concerns. It is fairly common for low alcohol readings for the defendants to have fairly good field sobriety tests. Tests such as the horizontal gaze nystagmus may be difficult show the possibility that an individual's alcohol concentration would be at a .08. Of bigger concern, we recognize the reluctance of some juries, particularly in western North Dakota, to convict individuals of DUI with low blood alcohol concentration levels. We are aware of a number of counties, again particularly in western North Dakota, where juries are very reluctant to convict people for DUI's of less of a .14 or .15. In those cases where a person has a blood alcohol concentration of a .08 or .09, or some cases less, yet are effected in a greater way by the alcohol, juries have convicted these individuals of driving under the influence. A number of years ago, former state's attorney of Benson County, Mike Steffan, obtained a jury conviction of DUI for someone who had an alcohol concentration of .07. The ability to get the conviction for driving under the influence was under the alternative pleading of "a person under the influence of alcohol". As you know, our DUI law actually provides two alternative, that being the per se statute, namely the .10 blood alcohol concentration, and "driving under the influence", wherein under the influence is defined as a person not possessing that clearness of intellect that they would ordinarily possess. The political

ramifications of lowering the BAC level to.08 could have a backlash effect on all DUIs. If there are a number of cases which go to a jury for the lower BAC level of .08 or .09, and juries become reluctant to convict on those, the backlash could have an effect on the DUIs above .10. It further could contribute to a greater number of cases going to a jury trial since the defendant would feel they have a better chance.

Other options would be to increase the suspension period for driving under the influence convictions, or even lowering the BAC level for the purposes of drivers license suspensions. As you know, the suspension of driving privileges is entirely administrative, and has nothing to do with the criminal conviction. Under the administrative hearing procedure, the respondents are not afforded the right to a jury trial, since the administrative hearing process and administrative suspensions pertain to public safety. Thus under the administrative hearing suspension procedure, there could be no jury backlash.

I appreciate the opportunity to voice our concerns.

Respectfully submitted,

LWO

Lonnie W. Olson
Ramsey County State's Attorney
President, ND State's Attorney Assoc.

LWO/cj

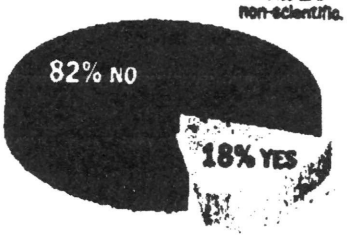
RESULTS OF FEBRUARY'S NATIONAL FORUM:

Don't lower intoxication limits

71,123 readers participated in USA WEEKEND's Feb. 13-15 National Forum by calling a toll-free number or voting online.

Do you support lowering the legal intoxication limit nationwide?

Results are non-scientific.



In an attempt to reduce drunken driving, 15 states have lowered the legal intoxication level from .10% to .08% blood alcohol content (BAC). And there is a movement to make .08% a national standard.

The issue is highly controversial. The USA WEEKEND results are non-scientific. The examples of what it takes to reach .08% are hotly argued because of variables in drink size and alcohol content. Both of these scenarios result in a .08% level: A 120-pound woman drinking two 6-ounce glasses of wine (13% alcohol) in two hours and a 137-pound woman drinking three 12-ounce beers (4.5% alcohol) in one hour.

Mothers Against Drunk Driving lambasted the call-in. MADD National President Karolyn Nunnallee says: "All scientifically valid surveys on the same issue show Americans overwhelmingly want .08 BAC laws. ... The results of this [USA WEEKEND] survey do not reflect public attitudes on lower BAC limits."

Those who oppose a national .08 limit, including the alcohol and restaurant industries, contend a new law won't stop alcohol abusers from driving.

At press time, Congress was voting on the issue.

Evaluation of the Effects of North Carolina's 0.08% BAC Law

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November, 1998

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Executive Summary

Sixteen states have reduced the *per se* illegal blood alcohol concentration (BAC) limit for drivers to 0.08%. There is a substantial amount of evidence from experimental studies to indicate that a variety of individual skills are impaired at BACs well below 0.08%. Epidemiologic studies indicate that the risk of a crash increases sharply for drivers with BACs above 0.08%. To date, however, few studies have been done to determine whether reducing the legal BAC limit translates into reduced numbers of alcohol-related motor vehicle crashes.

Four previous studies of the effects of 0.08% laws on motor vehicle crashes have found equivocal and somewhat conflicting results. In California, a 1991 study reported a 12% decrease in alcohol-related fatalities following implementation of an 0.08% BAC limit. However, California also enacted an Administrative License Revocation (ALR) law six months after lowering the BAC limit, and it was not possible to determine whether the ALR law , the 0.08% law, or the combination of the two was responsible for the decrease. A later study of the California law, looking at longer time periods, found no significant decrease in alcohol-involved crashes as a result of the lower BAC limit.

Two studies examined the first five states to reduce their BAC limit to 0.08%. One study found decreases in at least one indicator of drinking-driving in four of the five states. A second study, using a somewhat different research design, found a decrease in high BACs among fatally injured drivers in three of the five states. Again, however, it was not possible to disentangle effects of ALR laws from those of the lower BAC limit in three of the states studied. Further clouding the issue is the fact that the two states that showed no decrease in the second study were among those in which the earlier study had found an apparent decline in drivers with high BACs.

The present study was conducted in an effort to clarify the effect of reducing the BAC limit to 0.08%. North Carolina enacted an 0.08% BAC limit on October 1, 1993. No other legislation that would significantly affect drinking-driving was enacted in close proximity to the 0.08% law.

Using telephone survey data, we were able to gauge public knowledge and awareness of the 0.08% BAC limit in North Carolina. Interviews with 802 randomly sampled persons in four counties found that about two-thirds believed the BAC limit had changed in the past two years. Just over one-third were able to report the limit correctly as 0.08%. A substantial proportion of the sample did not drink and, as would be expected, drinkers were more aware that the limit had changed (73%) than non-drinkers (56%). They also were twice as likely to know the new limit (50% vs. 26%). Those who reported drinking at least once a week were even more likely to know the new limit (67%). Respondents overwhelmingly (85%) believed that lowering the BAC limit increased the likelihood that individuals would be arrested for drinking-driving.

To determine whether the 0.08% law produced a decrease in alcohol-related crashes, we examined several indicators. Alcohol involvement in all crashes in North Carolina between 1991 and 1995, as well as fatal and serious injury crashes only were examined. In addition, surrogate measures of alcohol-related crashes (nighttime crashes; nighttime fatal and serious injury crashes) were also examined. All these measures have been declining, almost continuously, in North Carolina since the early 1980s. To control for the effects of this general trend, as well as seasonal fluctuations, we carried out structural time series analyses examining monthly crash statistics. In each case we looked for evidence of either an immediate decrease in the rate or a change in the general trend of alcohol-related crashes following implementation of the lower BAC limit. There was no significant change in the rate, nor in the trend, coinciding with introduction of the lower BAC limit, for any of the measures examined.

To determine whether the trend in alcohol-related crashes in North Carolina may have benefitted in comparison with a broader general trend in the U.S. (which had leveled out and appeared to be on the verge of increasing again), we compared North Carolina fatal crash data with those from 11 other states that have high rates of alcohol testing for fatally injured drivers. The data series representing the North Carolina proportion of all fatally injured drivers in the 12 states who had BACs in excess of 0.10% was examined for either a step shift or a change in the trend. Again there was no evidence that the pattern in North Carolina changed following enactment of the lower BAC limit, or that it differed in comparison to the other 11 states.

To see whether the BAC levels of persons had been reduced by the 0.08% law, even if not brought below the 0.10% threshold of the previous limit, we examined the mean monthly BACs of fatally injured drivers whose BAC was above 0.10%. Again there was no evidence of an effect of the new BAC limit. The monthly average BACs remained essentially unchanged from 1990 through 1995, with an overall mean of 0.21%.

Finally, we conducted a series of simple before-after comparisons of various indicators of alcohol involvement in fatal crashes. These analyses examined each of the six measures that the National Highway Traffic Safety Administration used in its initial examination of the effect of 0.08% laws: (1) driver BAC $\geq$ 0.01%, (2) driver BAC $\geq$ 0.10%, (3) police-reported alcohol involvement, (4) single vehicle nighttime crash, (5) single vehicle nighttime male driver crash, and (6) estimated alcohol involvement. To examine changes in these measures we used the same analytic approach employed by Hingson et al. (1996) in their widely-cited study of the first five states to enact 0.08% limits – comparing changes in North Carolina rates with those in comparison states. To avoid potential pitfalls of trying to select a single appropriate comparison state, we compared North Carolina data with all 37 states that had retained higher per se limits from 1991 through 1996.

Of the six measures considered, two showed a significantly greater decrease in North Carolina than in the comparison states: police-reported alcohol and estimated alcohol, which is based in part on police report as well. For both these measures, the apparent effect of the 0.08% law is an artifact of grouping several months data before the law took effect, rather than an effect of the law itself. During the pre-0.08% period, noteworthy changes occurred in North Carolina that are obscured when the data are grouped. When analyses to ameliorate this artifact were conducted, none of the six measures showed a significantly greater decrease in North Carolina than in the states that retained a higher BAC limit.

Although North Carolina has a reputation for being progressive and aggressive in its efforts to deal with drinking drivers, it does not appear that the state is so different as to render it non-comparable to other states. Several indicators of alcohol use in fatal crashes during the early 1990s were similar to those for other states. On the salient measures of police-reported alcohol involvement and the proportion of killed drivers with a BAC in excess of 0.10%, the rates in North Carolina were lower by differences of 2.3% and 1.7%, respectively, both of which are statistically significant.

In conclusion, it appears that lowering the BAC limit to 0.08% in North Carolina did not have any clear effect on alcohol-related crashes. The existing downward trend in alcohol-involvement among all crashes and among more serious crashes continued, but does not appear to have changed following enactment of the lower BAC limit. When compared with the 11 other states that measure alcohol use by the large majority of fatally injured drivers, as does North Carolina, the measured BACs of fatally injured drivers did not decline as a result of the 0.08% law in North Carolina. Finally, the North Carolina trend in several other commonly used indicators of alcohol involvement in fatal crashes did not differ in comparison with the 37 states that retained higher BAC limits.

BACKGROUND

Motor vehicle crashes account for approximately half of all fatalities resulting from unintentional injury (Baker et al., 1992). In the U.S., alcohol is involved in about 7% of all traffic crashes, but is much more commonly involved in fatal crashes. During 1997, an estimated 35.6% of traffic fatalities in North Carolina were *alcohol-related* (i.e., involved a driver, pedestrian, or bicyclist with BAC > 0.01%; NHTSA, 1998). This is somewhat less than the 38.6% of fatalities with alcohol-involvement nationally during 1997. Although there has been clear improvement in the proportion of alcohol-related crashes during the past decade, motor vehicle crashes in which alcohol was centrally involved continue to be a major part of the injury problem nationally, as well as in North Carolina.

Following national movement toward establishment of *per se* limits (a blood alcohol concentration [BAC] that is considered to be illegal, regardless of evidence of impaired behavior) and the move to raise the legal drinking age to 21 in all states, traffic safety efforts in many states are now focusing on lowering the *per se* BAC limit from 0.10% to 0.08%. Continuing a trend for North Carolina to be among the leaders in state efforts to combat impaired driving., the illegal *per se* BAC limit was reduced to 0.08% effective October 1, 1993.

Both experimental and epidemiologic evidence suggests that a BAC limit of 0.10% is too high. A variety of behaviors and cognitive functions begin to show evidence of impairment at BACs as low as 0.04% (Moscowitz & Burns, 1990). In addition to this experimental evidence, the best epidemiologic information currently available on BAC and the risk of a driver crashing shows a clear increase in the slope of the risk curve at BACs of about 0.08%. Hence there is a clear and substantial scientific basis for setting the *per se* BAC limit at 0.08% (or lower).

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, 1991) data indicate that among fatally injured drivers who have been drinking, BACs are well in excess of the current legal limit of 0.10% (in most states). Thus it is argued that drivers killed in alcohol-related crashes are already in substantial violation of the BAC limit and that, therefore, reducing the legal limit will likely have no effect.

A counter argument can be made that, although individuals drive with BACs in excess of the legal limit, reducing that limit can send the message to heavier drinkers that they need to reduce their consumption when they are going to drive. Thus, if drinking drivers believe (though incorrectly) that they are 'okay,' to drive after drinking a certain amount, a lowered BAC limit will send the message that their personal "drinking limit" must be lowered as well. Accordingly the predicted effect of a lowered legal BAC limit would be to reduce the general BAC level among drinking drivers, even though it might not bring persons in line specifically with the new, lower limit. This is the classic public health approach, wherein benefits for a population are achieved through policies that alter, even fractionally, the risk of entire groups rather than concentrating on individuals.

Since a number of states have already enacted 0.08% BAC limits, evidence has begun to accumulate on the effect of this lower limit. These results are briefly reviewed below.

Previous Evaluations of 0.08% BAC Laws

There have been four attempts to empirically determine the effects of 0.08% *per se* laws.

- California's 0.08% law was initially examined under the sponsorship of the National Highway Traffic Safety Administration (NHTSA, 1991); more recently the California Department of Motor Vehicles conducted its own assessment (Rogers, 1995).
- In 1994 the NHTSA released the results of a preliminary assessment of the effects of the lowered BAC limit in the first five states to reduce their *per se* limit to 0.08%.
- Most recently Hingson et al. (1996) reported results of another study of the effects seen in the first five states to reduce their BAC limit to 0.08%.

California

Among the 16 states that have reduced the *per se* illegal BAC limit to 0.08%,[1] only the California law has been subjected to a thorough evaluation. Because California has a very large number of crashes, it was possible to conduct a scientifically valid examination of the effects of the lower BAC limit shortly after the new law took effect. A study conducted by Research and Evaluation Associates (NHTSA, 1991) shortly after the lower BAC limit took effect found a 12% decrease in alcohol-related fatalities, but no corresponding decline in non-alcohol crashes. Unfortunately, another law – providing for administrative license revocation (ALR) for persons found driving with illegal BACs – took effect six months after the 0.08% law was implemented. Moreover, a good deal of public discussion about the ALR law occurred prior to its enactment, overlapping the period immediately following enactment of the 0.08% law. As a result, it was not possible to determine whether the decrease in alcohol-related fatalities that occurred was due to the 0.08% law, the ALR law, or some combination of the two.

In 1995 another study examined effects of the California 0.08% law (Rogers, 1995). A large number of crash types[2] were studied using time series analysis techniques to control for a variety of factors such as amount of driving and general economic conditions (indicators of crash exposure). Trends were examined for a five year period prior to implementation of the lower BAC limit and four years following implementation. No decrease in alcohol-involved crashes or alcohol-involved fatal crashes was found to be associated with the 0.08% 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.

First Five States to Enact 0.08% BAC Limit

In a preliminary evaluation of the first five states to reduce BAC limits to 0.08%, six measures or indicators of drinking-driving available from FARS were examined for comparable time periods before and after the lower BAC limit was enacted in five states where the lower limit had been in effect for two

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[1] Alabama, California, Florida, Hawaii, Idaho, Illinois, Kansas, Maine, New Hampshire, New Mexico, North Carolina, Oregon, Utah, Vermont, Virginia and Washington.

[2] Alcohol-involved crashes, nighttime crashes, 2-3 am crashes, and single vehicle crashes were all examined. Moreover, each of these types was considered for three different degrees of severity: fatal crashes only, fatal + severe injury, and fatal + injury.

years or more (NHTSA, 1994)[3]. The findings were inconsistent across the five states, with anywhere from zero to four of the six indicators examined showing a statistically significant decline. In three of the five states, the proportion of drivers in fatal crashes found to have a BAC above 0.10% did decline significantly. Despite a somewhat inconsistent pattern of changes on the other measures, it is noteworthy that no significant declines on any of the six measures were found in the rest of the nation. Although this comparison does not control for other possible explanations for this change besides the lower BAC limit, it does help to rule out the possibility that the observed changes merely reflect a general and widespread decline in drinking-driving that has been documented (Transportation Research Board, 1994).

Hingson et al. (1996) reported findings that appear to corroborate the preliminary results reported by NHTSA, using a more controlled research design. Each of the first five states to reduce their per se limit to 0.08% was matched with a similar state from the same general region that did not reduce the limit. Among the 0.08% states, compared with 'matching' states, there was a significant reduction in the proportion of fatal crashes in which a fatally injured driver had a BAC above 0.08%. Similar results were obtained for the proportion of fatally injured drivers with BACs above 0.08%. Unfortunately, as was the case in California, it is difficult to disentangle the effects of the 0.08% laws from administrative license revocation laws that took effect at about the same time as the 0.08% laws in three of the 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 0.08% law in Utah.

Overall then, the available empirical evidence on the effect of 0.08% 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 0.08% laws rather than to co-existing ALR laws, which have been demonstrated to reduce drinking-driving (Wagenaar et al., 1995). Another problem is the inherent difficulty in finding appropriate 'matches' to 0.08% states. For example, although Vermont and New Hampshire are both small, largely rural New England states, they are dramatically different politically and in other ways specific to drinking-driving (e.g., sobriety checkpoints are constitutionally prohibited in New Hampshire). Similarly, Utah and Idaho are sparsely populated states in the intermountain west, but there are numerous differences, not the least of which is the presence of a large Mormon population in Utah – potentially a critical confounding factor in studies of alcohol use.

Distinctiveness of the North Carolina Study

To shed additional light on the effects of reducing the *per se* BAC limit to 0.08%, we examined data from North Carolina. There is a sufficiently large number of crashes in North Carolina to conduct time series analyses using monthly crash rates, thus allowing use of North Carolina as its own 'control.' An additional benefit of this study is that effects of North Carolina's ALR law, which was enacted in 1983, are not confounded with the 0.08% law. No other major drinking-driving legislation was enacted in close temporal proximity to the October 1, 1993 date on which the 0.08% BAC limit took effect. Thus, the methodological problems that have confounded interpretation of results from others states, rendering conclusions about the effects of 0.08% laws tentative, can be avoided by using North Carolina data.

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[3] Indicators examined were: (1) driver BAC ≥0.01%, (2) driver BAC ≥0.10%, (3) police-reported alcohol involvement, (4) 'estimated' alcohol involvement (e.g., police reported drinking, positive BAC measurement, or alcohol violations/citations), and two surrogate measures, (5) single-vehicle nighttime crashes, and (6) single-vehicle nighttime male driver crashes.

In the present study, the primary focus of analysis was on crashes prior to and following implementation of the 0.08% law. Time series analyses were employed to examine various possible indicators of the effects of this new law. We considered a variety of outcome or criterion variables: 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. Although not the primary focus of this research, we were able to obtain information about the general public's knowledge about and perceived effects of the 0.08% law. This information will help to place the effects on crash rates in context. We turn first to the question of public awareness of the new law.

❑ PUBLIC KNOWLEDGE AND PERCEPTIONS OF THE LOWER BAC LIMIT

A critical element in the success of any social policy approach that involves individuals making a choice to alter their behavior is that the public whose behavior is targeted must be aware of the policy. It is often assumed by policy makers that enacting a policy or law is sufficient to achieve its goal. It is axiomatic, however, that without awareness, no effect can be expected. There appear to be essentially three ways in which the public might have learned about the new, lower BAC limit: through the media, through direct experience (being arrested), and subsequently, by word of mouth from individuals who initially learned about the law through one of the two primary channels.

As a proposed law is being deliberated in the legislature, media attention will likely alert some proportion of the public to the issue. Following passage, additional media attention should provide the first information that there is a new BAC limit (albeit not yet in effect). At about the time the new law becomes effective, additional media attention as well as public information/education campaigns should increase awareness. Upon implementation of the law, if it is enforced, awareness should begin to grow slowly. There was relatively little media attention to the 0.08% BAC law as it was being considered, or when it took effect. However, enforcement was vigorous, as is typical in North Carolina.

We were able to obtain one "point-in-time" indicator of awareness of the new 0.08% BAC limit 17 months after the law went into effect. During February, 1995, the Insurance Institute for Highway Safety sponsored a telephone survey in North Carolina to obtain a variety of traffic safety-related information. At our request, a few questions about the 0.08% law were included and the data were provided to HSRC for those items as well as the other questions in the survey. This survey consisted of interviews with 802 randomly selected individuals living in four areas in the state. Consequently, these data are not from a representative sample of the entire state. However, the four areas do provide broad geographic representation. Figure 1 shows the locations where interviews were conducted (Cumberland, Guilford,

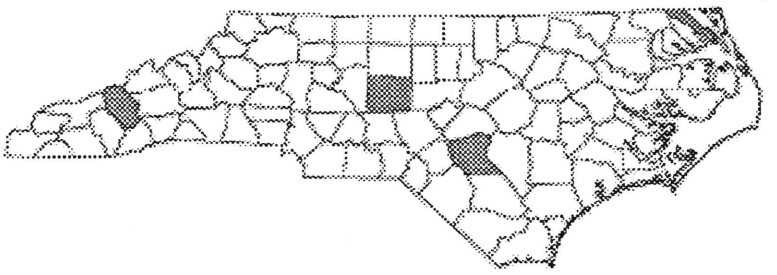

Figure 1 Counties where telephone interviews were conducted

Haywood, and Pasquotank counties)[4]. The demographic characteristics of the composite of these four counties are quite similar to the state as a whole. Table 1 presents 1990 census information on race, sex and age characteristics of the state as a whole, the four counties where interviews were conducted, and the sample of interviewed respondents. This allows for a direct comparison of how well the full interview sample represents the population of the counties interviewed. It is clear that the sample of persons interviewed somewhat over represents females, whites, and persons in the primary age group for drinking-driving.

Table 1. Demographic Characteristics of Survey Respondents and Sampled Geographic Regions

	Population	% Male	% Nonwhite	Age 21 - 35
North Carolina	6,628,637	48.5	24.4	25.6
4-County Population (Mean)		48.4	26.6	25.9
Cumberland County	274,566	51.7	38.1	33.0
Haywood County	46,942	47.7	2.0	19.9
Guilford (High Point)	347,420	47.3	28.2	26.5
Pasquotank (Elizabeth City)	31,298	46.7	38.0	24.1
4-County Survey Respondents (N)	802	40.8	18.4	31.2

Note. Population data are from 1990 census.

In addition to a series of questions pertaining to seat belts and drinking-driving enforcement, respondents were asked the following questions regarding the BAC limit:

- Do you know the legal blood alcohol limit (BAC) for drivers in North Carolina?
    - If respondents said yes, they were asked: "What is it? [The legal blood alcohol limit in North Carolina?]"
- Has the legal blood alcohol content limit for drivers in North Carolina been changed since 1992?
- Do you think that reducing the blood alcohol limit (BAC) has made it more likely that drinking drivers in North Carolina will be arrested for DWI?
- How much publicity have you seen or heard about the new blood alcohol limit (BAC) since it took effect? Would you say this new limit has been publicized. . . *Very well, Pretty well, Not very well, Not at all well.*
- What effect, if any, has the change in the blood alcohol limit had on your own behavior? Would you say you (*Are less likely to drive after drinking since the limit was lowered, Drive more carefully after drinking since the limit was lowered, Drink less since the limit was lowered, Have*

[4] These four counties had been selected as demonstration counties for the 'Booze It and Lose It' campaign which began in November, 1994. Interviews were conducted to learn of residents awareness of that program, and other highway safety issues.

made no change [drink and drive the same as before]. Unread options: *Don't drink, Don't drink & drive*).

Knowledge of the BAC Limit

Only half of the respondents (50%) claimed to know the BAC limit (see Figure 2). Of those, nearly three-quarters (74%) correctly reported the limit as 0.08%. Another 17% reported the old limit of 0.10%. Thus, among all respondents, only 37% knew the correct BAC limit.

When asked whether the BAC limit had changed since 1992, sixty-four percent of respondents thought it had; another 27% were not sure and 10% said it had not.

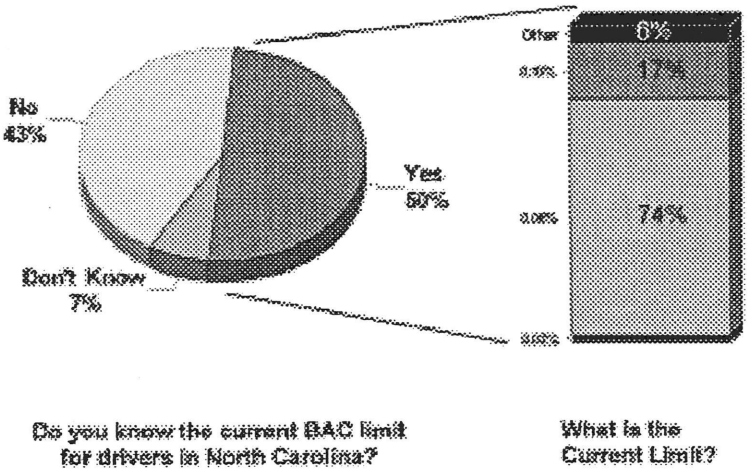

Figure 2 Reported knowledge of new BAC limit.

Knowledge both of the limit and that it had changed was related to education, sex, and race. As is shown in Figure 3, males, those with higher levels of formal education and whites were more likely to know the BAC limit had changed and what the new level was.

It would appear that general knowledge in the population of the new BAC limit was poor. However, this kind of information is not so relevant to non-drinkers as it is for drinkers, and a substantial proportion of North Carolina residents are non-drinkers. Survey data routinely collected on alcohol use indicate that from 45 - 50% of adults in North Carolina report being non-drinkers (Kroutil et al., 1997). In the present sample 70% reported being non-drinkers.

As is shown in Figure 4, those persons who reported that they do drink were far more likely to be aware of the BAC limit and that it had changed recently. Knowledge of the limit was even more closely related to reported frequency of drinking. Whereas 67% of those who drink more than once a week knew the new limit, barely a quarter of non-drinkers could report that 0.08% was the limit (not shown in figure).

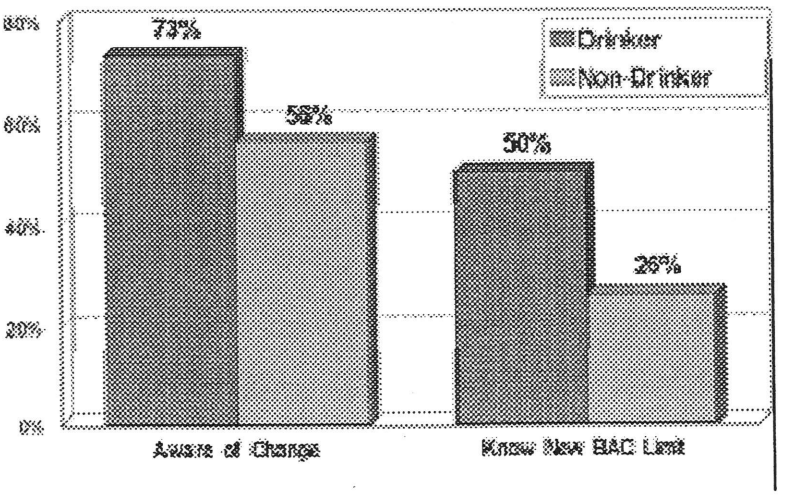

Figure 3 Drinker vs. non-drinker knowledge of 0.08% BAC limit

Drinking status also significantly modified the relationship between knowledge of the BAC limit and demographic characteristics. When drinking status is controlled, neither sex nor race is related to knowledge that the BAC limit had changed (although there is still a weak relationship between race and knowledge among non-drinkers). Among both drinkers and non-drinkers, males are more likely to know the correct BAC limit. Among drinkers, there were no racial differences in knowledge of the limit, but among non-drinkers blacks were less likely to know the current BAC limit.

Not surprisingly, level of formal education was strongly related to knowledge of the BAC limit and that it had changed. Among both drinkers and non-drinkers this relationship remains strong. Moreover, education largely explains the racial differences in knowledge of the limit and that it had changed. Controlling for education had no effect on the relationship between sex and knowledge. Consistently across levels of education, males were more knowledgeable about the new limit than females.

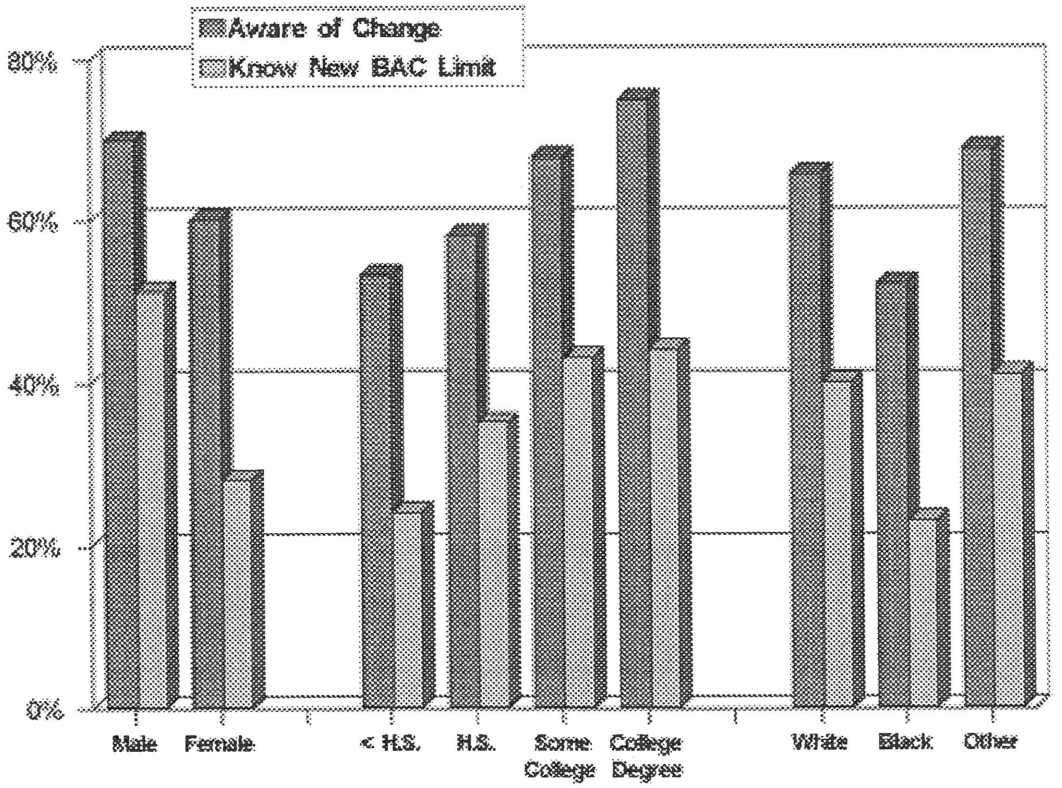

Figure 4 Knowledge of BAC limit by demographic subgroup

Perceived Publicity about the New Law

It is clear that some 17 months after the change formally took place a substantial number of North Carolinians did not know that the BAC limit had been lowered. It is probably not of great importance that non-drinkers were unaware of this change. Nearly three-quarters (73%) of drinkers thought the limit had changed, but only half (50%) could correctly identify the new BAC limit. Even among persons who reported that they drink once a week or more, fully a third could not correctly identify the new limit.

A question arises, then, as to how well the new limit was conveyed to the public. We have no objective way to measure that, but it is possible to address respondents' perceptions of how well the law was publicized. Figure 5 shows the distribution of responses to the question, "How much publicity have you seen or heard about the new blood alcohol limit (BAC) since it took effect? Would you say this new limit has been publicized..." (This question was asked only of those 512 respondents who thought the law had changed.) Despite a substantial lack of knowledge about the new limit, respondents in general appear to believe that the new law was well-publicized. Two-thirds (68%) thought the law was publicized either very well (26%) or pretty well (42%).

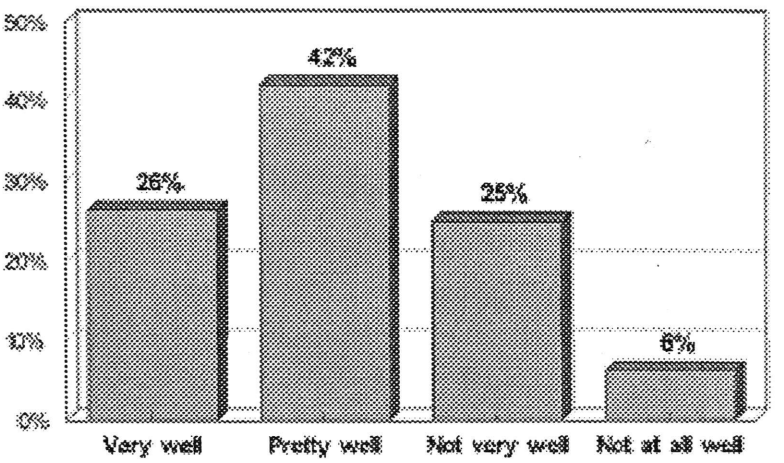

Figure 5 How well has the new BAC limit been publicized? (N = 512)

Perceived publicity of the lower limit was clearly related to age, with older respondents believing the publicity had been more extensive. Education was weakly related to perceived publicity. Less educated respondents were somewhat more likely to believe the change in the law had been well-publicized. Drinking status, race, and sex were unrelated to perceptions about publicity of the law.

Those respondents who correctly identified the new BAC limit were somewhat more likely to believe the law had been well-publicized. This association undoubtedly would have been stronger if the question had been asked of all respondents, including those who did not think there had been a change.

Perceived Effect of the Lower BAC Limit

Respondents overwhelmingly (85%) believed that lowering the BAC limit increased the likelihood that individuals would be arrested for drinking-driving. The vast majority denied that it had any relevance to them, however. Fifty-two percent of those who knew of the change reported either that they don't drink or don't drink and drive. Another 18% said the law had not affected their behavior. (In all likelihood some of these individuals also meant they were unaffected because it didn't apply to them.) Nine percent indicated that they are less likely to drive after drinking and 3% reported that they began drinking less. Of the entire sample, fewer than 6% reported that they had driven after having anything to drink during the past month. Only two admitted that they might have been above the legal limit.

Roadside survey studies of drivers' perceptions of risk of apprehension have demonstrated that those individuals to whom DWI laws are most likely to apply (e.g., persons coming from bars, and those with elevated or illegal BACs) are least likely to believe they will be detected or arrested (Foss & Perrine, 1990). A similar finding emerged in the present survey. In response to the question of whether the new limit would increase the likelihood of individuals being arrested for drinking-driving, persons who drink most frequently (more than once a week) were least likely to believe the likelihood of arrest was increased by the law (see Figure 6).

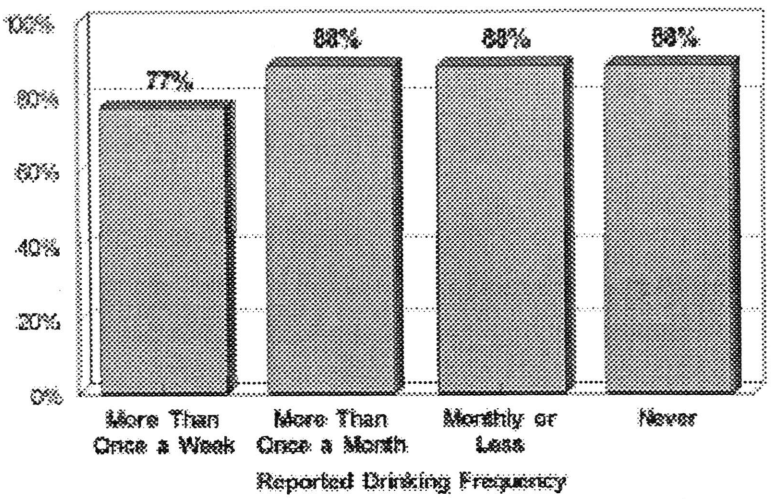

Figure 6 Perceived likelihood that DWI arrests will increase following new law by respondent drinking frequency.

❑ CHANGES IN ALCOHOL-RELATED CRASHES

For the following crash analyses, we used data reported to the North Carolina Division of Motor Vehicles, Collision Reports section (the North Carolina Traffic Crash File). Since January 1991 information obtained from the North Carolina Medical Examiner's Office concerning alcohol use by drivers killed in crashes has been used to update information recorded by investigating officers at the crash scene. As a result, data on alcohol involvement in fatal crashes prior to this date are not directly comparable to the more recent information.

Figure 7 shows the proportion of fatal crashes in North Carolina that involved alcohol from 1991 through 1995 as reported by the NC Division of Motor Vehicles in its annual Crash Facts report. There was a dramatic decline in alcohol-related fatal crashes, from 42% to 27% – a 36% relative decrease. The majority of this decline occurred from 1991 to 1993. Although the sharpest drop occurred during the year when the lower BAC limit took effect, the new limit was in effect only for the final three months of 1993.

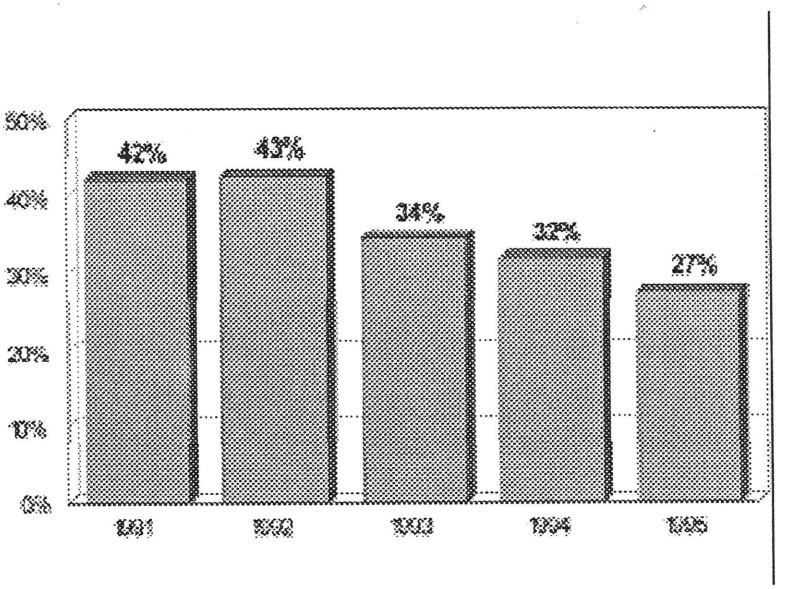

Figure 7 Percent of North Carolina fatal traffic crashes involving alcohol, 1991 - 1995 (source: NC Div. of Motor Vehicles).

Because the 0.08% law applies to operators of vehicles, 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. That is, those 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 8 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.[5]

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.

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[5] We examined coverage of this issue in the Raleigh *News & Observer*, one of the two major newspapers in the state that give detailed coverage of legislative activity. Given the high level of interest in drinking-driving issues in North Carolina, the low amount of coverage accorded this issue is fairly striking. This may be due, in part, to the fact that the legislation was not the subject of extensive debate. The bill received little attention until the final days of the session, when it was passed.

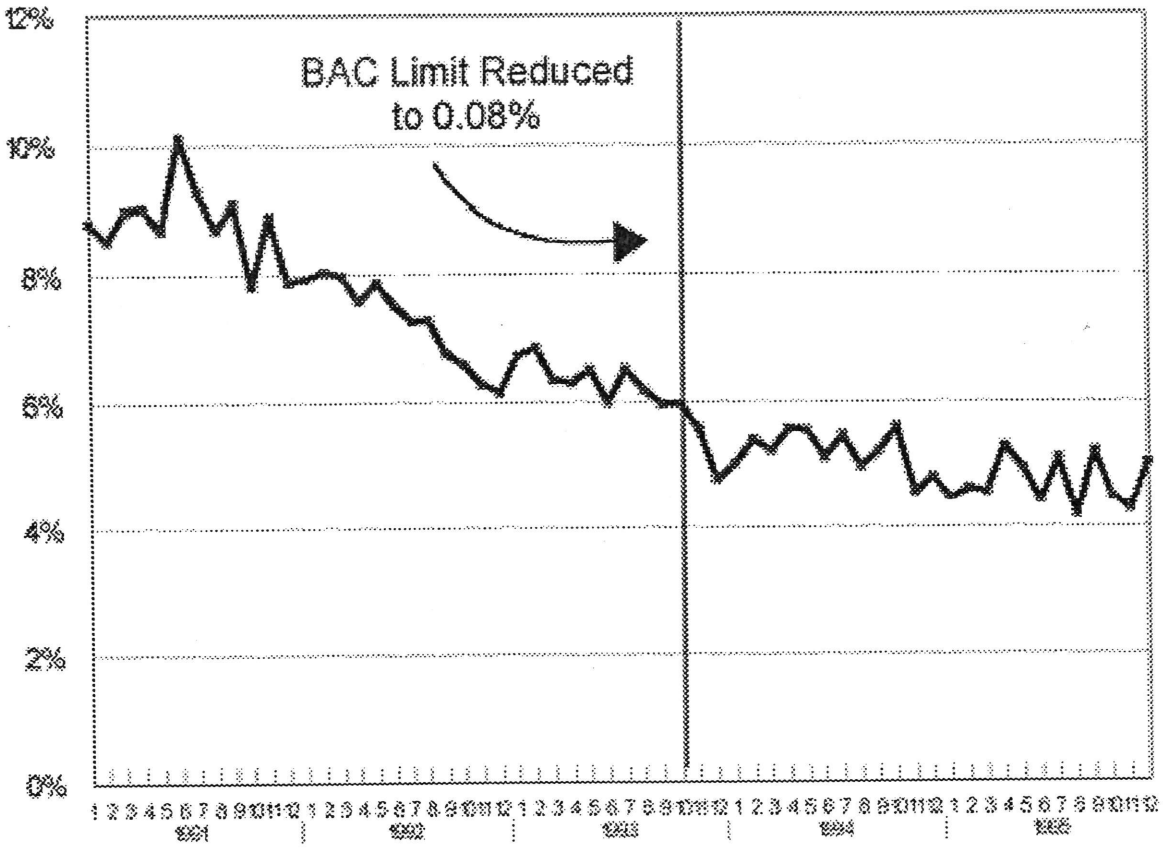

Figure 8 Percent of all North Carolina crashes involving alcohol, 1991 - 1995.

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 had an effect. Accordingly, a number of time series models were fit to the number of various types of motor vehicle crashes occurring in North Carolina by month from January 1991 through December 1995. These models were used to estimate any changes in the number of alcohol-related crashes that coincided with implementation of the lower BAC limit. Structural time series models were fit to the data using the software package STAMP (Structural Time Series Analyser, Modeler and Predictor) developed at the London School of Economics and ESRC Centre in Economic Computing (Harvey, 1989).

The components of structural time series models consist of a level, a trend, seasonal factors, effects due to various "regression variables" and intervention effects (see Harvey, 1989, for a thorough discussion of these models). The level, trend, and seasonal factors can either vary stochastically over time, to accommodate the possibility that they do not remain constant, or be constrained to take on fixed values. Regression variables can include autoregressive terms (lagged values of the response variable) as well as other explanatory factors associated with the response variable. In the models that follow, two basic types of intervention effects were considered. One includes a step shift in the level of the series at the point of intervention; the other hypothesizes a change in the trend or slope (rather than an abrupt shift) of the series beginning at the time of intervention. The objectives of model development are to construct a model that produces essentially uncorrelated residuals, has statistically significant parameters, and fits the data series as well as possible.

As an illustration of the modeling procedure, consider the following model fit to the data series of monthly alcohol-related crash frequencies. The model was fit using a log transformation, so the response variable was $\log_e$ (alcohol related crashes)[6]. The model contains a stochastic level, stochastic slope, and stochastic seasonal factors. Three regression variables were included: an autoregressive term at lag 7, the log of all crashes (to control for amount of travel), and a variable that represents the number of weekends in each month (since alcohol-related crashes are more common on weekends). The intervention variable was a unit step-function occurring in October 1993. Results from this model are shown in table 2.

Table 2. Parameters for model of North Carolina alcohol-related crashes ($\log_e$), 1991 - 1995

Parameter	Estimate	s.e.	t-ratio	p-value
Level*	-3.23	2.23	-1.450	.156
Trend*	-.007	.0014	-4.661	<.0001
$\log_e$ (A-R crashes, at lag 7)	.469	.121	3.850	.0001
$\log_e$ (all crashes)	.644	.181	3.556	.001
Weekends	.053	.010	5.55	<.0001
Intervention (Lower BAC limit)	-.008	.025	-.330	.744

* level and trend estimates represent final estimates at end of series.

Test for Seasonality $\chi^2_{(11)} = 33.79$, p = .0004

Residual Autocorrelations	*Goodness-of-Fit*
Q(5) = 4.30	$R^2 = .874$
Q(10) = 11.55	$R^2_D = .780$
Q(15) = 12.38	$R^2_S = .624$

For simplicity, estimates of the 11 seasonal parameters are not shown, but rather only an overall test for seasonality. There is a significant seasonal component in alcohol-related crashes during the time period from 1991 through 1995.

Information concerning residual autocorrelation is presented by the three values of the Ljung and Box Q-statistic. This statistic Q(k) is based on the sum of squares of the first k residual autocorrelations and is approximately distributed as χ^2 with $k - \tau$ degrees of freedom, where τ is the number of stochastic components in the model. Thus, values of Q(k) that remain at a value of k or smaller tend to indicate that the residuals are sufficiently uncorrelated. Thus, for Table 2 above,

$$Q(k) = Q(5) = 4.30 \simeq 5 = k$$

[6] Time-series analyses often use log-transformations because data transformed in this way exhibit more desirable mathematical properties.

and similarly for Q(10) = 11.55 $\simeq$ 10 and Q(15) = 12.38 $\simeq$ 15. These suggest that the residuals in the model for alcohol-related crashes are reasonably uncorrelated. Note that k = 5, 10 and 15 are selected to be representative of the possible range of residual autocorrelations.

Three goodness-of-fit measures are also shown for the model. R^2 is a measure of the overall fit of the model, part of which is due to the trend and seasonal factors. R^2_D is a measure of the goodness-of-fit of the detrended series (that is, with any general trend removed) and R^2_S the fit of the deseasonalized series (i.e., with seasonal fluctuations removed).

The estimated intervention effect shown in table 2 is quite small and is not statistically significant (p = .744). This estimate represents a decrease in the value of the logarithm of alcohol-related fatal crashes by .008 beginning in Oct. 1993 and persisting through the end of the series.

When the change in slope or trend (in October, 1993), rather than a step shift, was modeled, the estimated effect was .006. Thus, the effect is a slight increase in the (downward) slope of the series, but again, the estimate is not statistically significant (t = .951, p = .348).

The models described above represent the *number* of alcohol-related crashes per month as a function of the monthly frequencies of all crashes, seasonality, general trend and number of weekends per month. We also tried an alternative approach, modeling the *proportion* (or percent) of all crashes that were alcohol-related to see if changes could be detected that coincided with the 0.08% legislation. Specifically, we constructed a data series where $P_t \equiv$ percent of all crashes in month t that were alcohol-related, and time series models were fit to P_t, $\log_e (P_t)$, and logit $(P_t) = \log_e (P_t/(100-P_t))$ Models fit to each of these three data series were of the same structure and produced similar estimates of intervention effects. Hence, only results for the logit models are reported below.

Because the new BAC limit may have affected only more serious crashes, which are most likely to be alcohol-related, we conducted additional analyses to examine the percent of all fatal and serious injury crashes that were alcohol-related. Although reporting of alcohol involvement in North Carolina crashes is considered to be quite good, surrogate measures of alcohol-involved crashes are sometimes used to supplement analyses that are based on officers' judgments about alcohol involvement. Hence, additional analyses were conducted using each of the following as the 'response' variable:

- percent of all crashes that occurred during nighttime hours (between the hours of 8:00 p.m. and 4:00 a.m.), and

- percent of all fatal and serious injury crashes occurring during nighttime hours.

The results obtained when fitting models to logit transforms of each of the series described above are presented in table 3.[7] Two separate models were fit to each data series – one with a step shift at time of intervention (October 1, 1993) and one with a change in slope at time of intervention. None of these effects was statistically significant in any of the models.

[7] More extensive description of these models is given in Appendix A.

Table 3. Parameters for logit models of various indicators of alcohol-involved North Carolina crashes, 1991 - 1995.

Outcome Variable	Modeled intervention effect	Estimate	s.e.	p-value
Percent of crashes involving alcohol – *all levels of severity*	Shift in level	-.038	.038	.320
	Change in trend	.001	.009	.866
Percent of crashes involving alcohol – *severe and fatal crashes only*	Shift in level	.023	.058	.698
	Change in trend	-.0001	.003	.986
Percent of crashes occurring at night – *all levels of severity*	Shift in level	-.022	.022	.308
	Change in trend	.001	.003	.762
Percent of crashes occurring at night – *serious and fatal crashes only*	Shift in level	.050	.040	.222
	Change in trend	.003	.002	.288

Comparison of North Carolina Crash Trends to Other States

Although none of the analyses indicate that the lower BAC limit had an effect on alcohol-related crashes, it was thought that perhaps the effect of the new law might have been to prevent an upturn in alcohol-involved crashes that appeared to be afoot nationally. It is possible that the rate of decline in alcohol-related crashes was already so great in North Carolina when the new law came into effect that it could not produce an added benefit. We reasoned that perhaps having this law in place as the broader trend in alcohol-related crashes leveled might serve to mitigate that effect in North Carolina. Accordingly we compared the trend in alcohol-related fatal crashes in North Carolina with that in eleven other states that have had consistently high rates of testing for alcohol among fatally injured drivers (> 80% for each year 1991 - 1995).[8] The mean testing rate for these 11 states was 89.9% (vs. 85.3% for NC) for the five year period.

Data on BAC's of drivers killed in motor vehicle crashes in North Carolina and the 11 other states were obtained from the Fatality Analysis Reporting System (FARS). The data covered the time period from January 1990 through December 1995. Over this time period, 26.1% of drivers killed in motor vehicle crashes in North Carolina were reported to have BAC's of 0.10% or higher. In the other states this

[8] The states selected were Colorado, Connecticut, Hawaii, Illinois, Massachusetts, Montana, New Mexico, Oregon, Rhode Island, Washington, and Wisconsin. Among these states, Oregon, Hawaii, and New Mexico have 0.08% BAC limits. However, only the New Mexico law, which also changed in 1993, presents a problem for this analysis. The law in Oregon did not change during the analysis period and Hawaii's change only applied to the final few months of the period. Including New Mexico in this analysis has a slight tendency to work against finding an effect of the North Carolina law. However, because of its relatively small population, excluding New Mexico from the analysis would not materially change the results.

percentage ranged from 30.8% (Massachusetts) to 44.1% (Montana). The overall rate of alcohol involvement for the 11 states combined was 36.8%.

Three monthly data series were created:

- the percent of all fatally injured drivers in North Carolina having BAC's $\geq 0.10\%$
- the percent of all fatally injured drivers in the 11 comparison states with BAC's $\geq 0.10\%$
- the logit transform of the proportion of all killed drivers with BAC's $\geq 0.10\%$ among the 12 states that were North Carolina drivers

Time series models were then fit to each of these data series. The data series for percent of fatally injured North Carolina drivers with BAC $\geq 0.10\%$ was essentially a random series (i.e., there were no significant autocorrelations). In this case the basic time series model reduced to a regression line fit to the data points. The estimated model parameters are shown in table 4. When added to the model, neither a step shift ($p = .728$) in October 1993, nor a change in trend component ($p = .765$), was statistically significant.

Table 4. Regression statistics for percent of fatally injured North Carolina drivers with BAC $\geq 0.10\%$ by month, 1990 - 1995.

Parameter	Estimate	s.e.	t-statistic	p-value
Intercept	31.90	1.16	27.57	<.0001
Trend	-.159	.028	-5.79	<.0001

Goodness-of-Fit
$R^2 = .324$
$R^2_D = .500$

The data series for the percent of fatally injured drivers with BAC's > 0.10% in the group of comparison states was also an essentially random series with a slight downward trend. The autocorrelation function, however, suggested that the data contained some seasonal variation. Thus a model that contained a fixed level, fixed slope and stochastic seasonal effects was fit to this series. Results are summarized in table 5.

Table 5. Regression statistics for percent of fatally injured drivers in 11 comparison states with BAC ≥ 0.10% by month, 1990 - 1995.

Parameter	Estimate	s.e.	t-statistic	p-value
Level	40.64	.713	56.96	< .0001
Trend	-.107	.017	-6.25	< .0001

Test for Seasonality $\chi^2_{(11)} = 17.27$, p = .100

Residual Autocorrelations
Q(5) = 5.00
Q(10) = 11.25
Q(15) = 17.38

Goodness-of-Fit
$R^2 = .383$
$R^2_D = .471$
$R^2_S = .199$

Thus both series show general decreases in alcohol involvement over time, though the rate of decrease is slightly greater for the North Carolina series (-.159 vs -.107).

A more direct way of examining alcohol-related fatalities in North Carolina relative to those in the comparison states is to consider the proportion of all fatally injured drivers with BAC > 0.10% who were North Carolina drivers. A model was fit to the logit transform of this proportion. Parameter estimates for the best fitting model to this series are shown in table 6.

Table 6. Parameter estimates for best fitting model for North Carolina alcohol-related (BAC ≥ 0.10%) fatalities relative to those in 12 States, 1990 - 1995.

Parameter	*Estimate*	*s.e.*	*t-statistic*	*p-value*
Intercept	-1.95	.276	-7.06	< .0001
Trend	-.004	.002	-2.10	.039
Autoregressive Lag 1	.147	.119	1.23	.236
Autoregressive Lag 5	-.325	.119	-2.74	.008

Residual Autocorrelations
Q(5) = 6.71
Q(10) = 10.58
Q(15) = 16.20

Goodness-of-Fit
$R^2 = .165$
$R^2_D = .495$

This series also displays a slight downward trend (.004) in the proportion of alcohol-related crashes involving North Carolina drivers during the period from 1990 through 1995. 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).

These results confirm earlier analyses, again showing that alcohol-related crashes have been declining in North Carolina over the past several years but that no specific effects are found that can be attributed to the lowered *per se* illegal BAC limit.

Analyses of BAC Data for Fatally Injured Drivers in North Carolina

Evaluations of drinking-driving interventions often look only at fatal crashes. There are two reasons to do this. First, having a much greater involvement of alcohol, fatal crash rates are probably more sensitive indicators of drinking-driving. Second, measurement of alcohol involvement is generally better in fatal crashes.

Hence, in addition to the data extracted from FARS, information on BAC's of killed drivers was also obtained from the North Carolina Medical Examiner's (ME) office. These data covered the time period January 1991 - December 1995. From these data, two monthly time series were constructed and analyzed. The first was the monthly percent of all fatally injured drivers who had BAC's $\geq$ 0.10%. This is essentially the same as one of the data series extracted from FARS, although the beginning of the time interval is 1991 rather than 1990. Where the time intervals overlap, the agreement between the two series is close but not identical.

The behavior of the ME data series is quite similar to that from FARS. Namely, the data series is essentially a random series with no significant autocorrelation structure. A straight line fit to the data contains a significant negative (or decreasing) trend, $p < .0001$. Neither a shift in level nor a change in trend effect was statistically significant, $p = .113$ and $p = .325$, respectively.

The second data series was a month-by-month series of mean BACs for fatally injured drivers in North Carolina crashes whose BAC's were0.10% or higher. The mean of these monthly means was 0.21% and over the 60 month interval the values ranged from 0.16% to 0.26%. This series did contain some significant autocorrelations but did not exhibit any long term trends. A model fit to this series contained a fixed level and autoregressive terms at lags 5 and 6. Adding a linear trend term to the model yielded an estimated trend of .00011 with a standard error of .00016 ($p = .460$). Similarly, neither a shift in level nor a change in trend intervention was significant, with p-values of .254 and .598, respectively.

In summary, the proportion of fatally injured drivers having BAC's $\geq$ 0.10% has continued its decline through 1995, but with no abrupt changes that can be attributed to the 0.08% law. The mean BAC of fatally injured drivers with BAC's $\geq$ 0.10%, on the other hand, has remained relatively constant with an overall mean of 0.21%.

The failure to find an effect that might be attributed to the lower BAC limit in North Carolina, considering a variety of indicators of alcohol involvement, suggests that the law has not had the intended effect. There are a number of possible reasons for this. First, and perhaps most likely, is simply that reducing the legal limit does not affect drinking-driving behavior. There are other possible explanations. It may be that the proportion of the drinking-driving population that such a law would affect had already changed their behavior before the limit was lowered in North Carolina, where drinking-driving is less common than in other states. Or, similarly, given the dramatic decline in alcohol-related crashes that was occurring in North Carolina during the early 1990s, it may be that any possible effects of reducing the BAC limit were simply obscured by a broad change in drinking-driving behavior that was already occurring.

Yet another possible explanation for the failure of an effect to materialize for the lower BAC limit is that this new, lower level was not sufficiently well publicized. There was relatively little media attention to the 0.08% law, either when it was being considered, when it passed, or when it was enacted. On the other hand, beginning about 14 months after the BAC limit was lowered, there was a great deal of publicity about DWI enforcement in conjunction with the "Booze-it-and-Lose-it" campaign, which featured sobriety

checkpoints in every North Carolina county. Most publicity about DWI enforcement in North Carolina does mention the BAC limit of 0.08%, though there was no particular mention that the limit was lower than it had been previously.

One important consideration in the analysis of crashes where alcohol involvement is judged rather than measured is the possibility that the new law may have increased officers' sensitivity to alcohol involvement, either individually or, perhaps, via organizational policy (having signaled to law enforcement agencies that drinking-driving was of heightened concern to the legislature). In the present situation, increases in officers' sensitivity to alcohol involvement would work against our finding an effect of the law. If the proportion of alcohol-involved crashes actually decreased, while officers' diligence in reporting alcohol involvement increased, the latter would tend to mask the former. However, the failure to find any change in alcohol involvement in fatal crashes or surrogate measures of alcohol involvement suggests that real effects of the 0.08% law are probably not being masked by changes in alcohol detection where officer judgment is central.

Another possible explanation for the failure to detect an effect of the new law is that it was not being enforced. If persons with BACs of 0.08-0.09% were not being arrested, or if those arrested at that level were not being prosecuted or convicted, that information would begin to spread and would dilute, or eliminate, any possible effect of the new law. To address this possibility, changes in DWI arrests and convictions following implementation of the 0.08% law as well as possible effects on the court system were examined.

Changes in DWI Arrests and Convictions

It was expected that the number of arrests for DWI would increase following enactment of the 0.08% law. For example, roadside survey data from Ohio and Minnesota indicate that lowering the illegal BAC from 0.10% to 0.08% would have increased the number of nighttime drivers who are in violation of the DWI law by 44% to 52% in those states (Foss & Perrine, 1990; Foss, Beirness & Sprattler, 1994).

We had hoped to examine the trend in DWI arrests as part of this study. This would have been complicated by the variety of overlapping special enforcement efforts that have occurred in North Carolina during the 1990s, but these could likely have been dealt with satisfactorily. However, a serious disruption in the availability of driver history file data occurred as the North Carolina Division of Motor Vehicles revised their data system. As a result we were not able to track arrest and conviction data as we had hoped.

An HSRC study using data obtained before the disruption, however, does provide an indication of changes in DWI arrests that occurred following implementation of the new BAC limit (Foss, Martell & Stewart, 1995). The proportion of persons arrested with BACs below 0.10% increased 20-fold immediately after the lower BAC limit took effect, going from less than 1% to approximately 10% of DWI arrests. Arrests of persons with 'marginally' illegal BACs of 0.10-0.11% appear to have increased somewhat as well. However, the overall number of arrests did not increase. Whether this reflects a general downward shift in BACs among the driving population, or that fact that officers' time was more often spent arresting more prevalent types of drinking drivers – those with lower, but still illegal, BACs – is not known. In view of data reported above showing no apparent change in drinking-driving as a result of the new law, it appears that the latter explanation is more likely.

In sum, the 0.08% BAC law did not affect the size of the case load in the North Carolina Substance Abuse Treatment system. However, the make-up of the population of individuals screened for alcohol/substance abuse problems did change by virtue of an influx of persons arrested with lower BACs, who were less likely to be diagnosed as needing treatment for alcohol use problems. Hence, although

persons with BACs of 0.08-0.09% may not have been arrested in proportion to their prevalence, they were by no means being overlooked by law enforcement officers.

Changes in DWI Case Loads for Prosecutors and the Courts

It is of interest to know what effect the new law has had on the criminal justice system. Although the study of California's 0.08% BAC limit indicated little effect on case loads, there was still some concern that an overload might result in North Carolina. In addition, it is possible that persons with low BAC arrests were less likely to be charged or convicted, which might undermine the effect of the new law. To determine whether any of these effects may have occurred, we conducted key informant interviews with county prosecutors (or their representatives) from six counties selected to provide a rough representation of the state.

Figure 9 shows the counties where interviews were conducted. These represent both urban and rural counties as well as the three naturally occurring geographic regions of the state: the western/mountain region, the more heavily populated and industrialized Piedmont (central) region, and the eastern/coastal region.

Among the main issues pursued were (1) whether the new law produced a notable increase in the workload for prosecutors; (2) what, if any, effect the law had on the way cases were prosecuted; (3) whether prosecutors were less likely to charge persons arrested with low BACs; or (4) whether judges appeared to have viewed cases with marginal BACs at time of arrest (i.e., 0.08-0.09%) any differently from the way they viewed marginal BACs (0.10-0.11%) prior to the law.

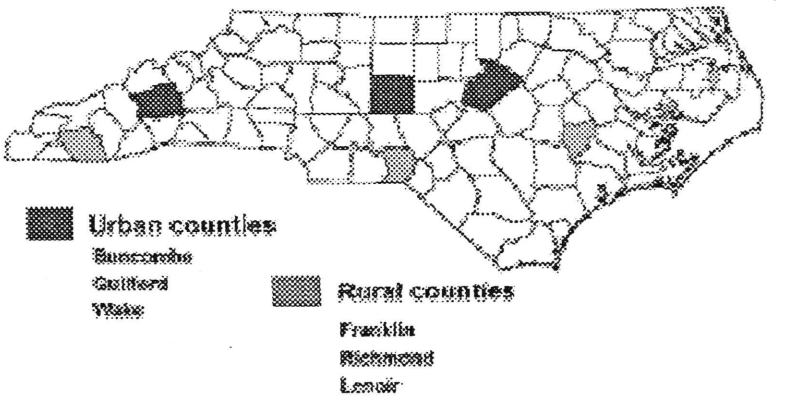

Figure 9 Counties where prosecutors were interviewed.

These interviews produced no evidence that the new law had increased the perceived number of arrests, or that persons with BACs of 0.08-0.09% were not being charged or convicted. Because there was no apparent effect of the 0.08% law on prosecutors' case loads, procedures, or conviction rates, we did not pursue discussions with representatives from a larger sample of counties.

❑ COMPARISON OF NORTH CAROLINA ALCOHOL-RELATED FATAL CRASHES WITH THOSE IN OTHER STATES

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% laws in the first five states to enact such laws (described below; NHTSA, 1994).

Alcohol use, and its involvement in crashes, has been on the decline for many years in the U.S. Therefore, it is necessary to include an appropriate comparison group (state or states) when examining changes in alcohol involvement in crashes across time to evaluate the effect of an intervention, such as the reduction of the BAC limit. Although there is some appeal to choosing a comparison group that is 'similar' to the state under consideration, it is difficult to know the relevant characteristics upon which states should be matched. Hingson et al. (1996) have been criticized for, among other things, their choice of comparison states (Scopatz, 1998). Although there is merit to the arguments advanced by both sides on this issue, it is probably impossible to convincingly argue that a particular state is the best (or even an appropriate) match to any other state. Consequently, rather than comparing alcohol involvement in North Carolina crashes with those of any particular state or subset of states, we elected to compare North Carolina with all states that had a BAC limit of 0.10% during the entire period we examined (January 1, 1991 – December 31, 1996).[9]

As mentioned above, there are shortcomings in every indicator of alcohol involvement in crashes. If we rely only on police reports of alcohol involvement, there is the likelihood that some alcohol-related crashes are misjudged as not involving alcohol. If we rely only on data where a driver's BAC was objectively measured, a large and unrepresentative proportion of crashes are excluded from analysis. To address this problem, several years ago the National Highway Traffic Safety Administration developed a technique to estimate alcohol involvement in fatal crashes where no objective measure of alcohol was obtained (Klein, 1986). Using discriminant function analyses it is possible to estimate, with a substantial degree of precision, the likelihood that a crash involves a drinking driver, given other characteristics of the crash, the driver and the vehicle he/she is driving. These estimates[10] of alcohol involvement are used by the NHTSA in their analyses of alcohol involvement in fatal crashes and are included in publicly distributed crash data files. The estimates provide an indication of whether a driver involved in a fatal crash had a non-zero BAC (i.e., > 0.01%) and also the probability that the driver's BAC was in excess of 0.10%, the legal limit in most states. We examined two criterion variables, using Klein's estimation procedures, for all drivers involved in fatal crashes:

- Any alcohol involvement by a driver (BAC ≥ 0.01%) and
- Whether there was evidence of alcohol in excess of 0.10% for a driver.

For completeness, and to parallel various other studies of alcohol use by drivers in fatal crashes, we also looked at the following four variables, comparing North Carolina with the 37 other states:

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[9] The following states had an 0.08% BAC limit in effect for at least some portion of the period from 1991 to 1996 and were, therefore, excluded from the analyses: Alabama, California, Florida, Hawaii, Kansas, Maine, New Hampshire, New Mexico, Oregon, Utah, Virginia, Vermont.

[10] It is important to note that although we refer to these as estimated values, since they result from use of an estimation procedure, a large proportion of these data represent an actual measurement. When a measurement is present, the 'estimated BAC' is the measured value. Only in those instances where no BAC measurement is available do the data actually include estimated values.

- Police-reported alcohol involvement
- Single vehicle nighttime crashes (a traditional proxy or surrogate measure for drinking-driving)
- Single vehicle nighttime crashes by male drivers (another commonly used proxy measure for drinking-driving)
- Estimated alcohol involvement (based on police report, driver record of previous alcohol citation, and measured BAC)

As noted above, each of these measures taken alone has shortcomings. The most appropriate way to address this problem is to look at each of the measures to see whether a consistent picture emerges. If the 0.08% law has a clear and strong effect, that should be detectable using any one of the measures–and the effect should appear with all of them. Should there be inconsistencies in results among the measures, we believe that based on the strengths and weaknesses of each, more credence should be given to findings based on the two variables based on the statistical estimation procedures. The other four measures are less robust in that, in one way or another, they incorporate only some of the information that the estimates include.

The most appropriate, though statistically complex, way to examine the effect of a point-in-time intervention, such as enactment of a law, is through the use of statistical modeling procedures to examine a series of data points, as was done in the analyses reported above. However, prior to conducting detailed time-series analyses for each of the several indicators of alcohol-involvement in fatal crashes for North Carolina and the 37 comparison states, we decided to first do a simple before-after comparison. We planned to conduct time-series analyses using only those indicators that showed a clear effect in the simple before-after comparison.

The following analyses consider all drivers involved in fatal crashes between 1991 and 1996, as reported in the NHTSA Fatality Analysis Reporting System (FARS). This provides data for a 33 month period prior to implementation of the 0.08% law in North Carolina and 39 months following its enactment. 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.[11]

Driver BAC of 0.01% or Greater

During the 33 months prior to enactment of the 0.08% law, 24.4% of drivers involved in a fatal crash in North Carolina had an estimated BAC of 0.01% or greater. That declined to 20.1% in the 39 months immediately following enactment of the lower BAC limit, which is a statistically significant decline of 17.4% ($p < .001$). The risk ratio for alcohol involvement at this level before vs. after enactment of the law is 1.21, with a 95% confidence interval of 1.14 to 1.29. Among the 37 states without an 0.08% BAC limit, there was a decrease in estimated alcohol involvement, from 28.1% to 24.5%, a decline of 12.8%, which is also statistically significant ($p < .001$). The before-after risk ratio for these 37 states is 1.15, with a 95% confidence interval of 1.13 to 1.16. The comparison of the change in these states vs. North Carolina, given by the ratio of these two risk ratios, is 1.06. Although this reflects a 6% greater decline in North Carolina, the 95% confidence interval for this ratio is .98 to 1.14, indicating that the difference in declines between North Carolina and the other states is not statistically significant.

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[11] We wish to gratefully acknowledge the assistance of Dr. Tim Heeren, Boston University, who provided detailed information on their calculations.

Hence, the conclusion is that the proportion of drivers involved in fatal crashes who had a BAC above 0.01% declined significantly, and to about the same degree in both North Carolina and the other 37 states.

Table 7. Drivers age 21 or older in fatal crashes with estimated BAC of 0.01%, 1991 - 1996, North Carolina vs. 37 states without 0.08% BAC limit before and after enactment of 0.08% limit in North Carolina.

	North Carolina		Other 37 States	
	≥ 0.01%	**< 0.01%**	**≥ 0.01%**	**< 0.01%**
Before (1/1/91 to 9/30/93)	24.4% (1,014)	75.6% (3,147)	28.1% (24,027)	71.9% (61,487)
After (10/1/93 to 12/21/96)	20.1% (1,093)	79.9% (4,337)	24.5% (26,272)	75.5% (81,005)
Decline	17.4%*		12.8%*	
Risk Ratio (before/after)	1.21		1.15	
95% Confidence Interval	[1.14, 1.29]		[1.13, 1.16]	
* $p < .001$	$RR_{NC}/RR_{37} = 1.06$, 95% CI = .98 to 1.14			

Driver BAC of 0.10% or Greater

We would not necessarily expect that lowering the BAC limit to 0.08% would reduce the proportion of drivers who had any alcohol in their system, which the previous analysis examined. Many drivers with a positive – but low – BAC are below both the former and new BAC limits. If the law is effective, however, it should reduce the proportion of drivers with higher BACs. In particular, we would expect a decrease in the proportion of drivers with BACs above 0.10% in North Carolina compared with states that retained a 0.10% BAC limit. We turn to that analysis now, the results of which are summarized in Table 8.

Table 8. Drivers age 21 or greater in fatal crashes with estimated BAC ≥ 0.10%, 1991 - 1996, North Carolina vs. 37 comparison states.

	North Carolina		Other 37 States	
	≥ 0.01%	**< 0.01%**	**≥ 0.01%**	**< 0.01%**
Before (1/1/91 to 9/30/93)	22.2% (924)	77.8% (3,237)	23.8% (20,383)	76.2% (65,131)
After (10/1/93 to 12/21/96)	18.3% (991)	81.7% (4,439)	20.7% (22,211)	79.3% (85,066)
Decline	17.8%*		13.1%*	
Risk Ratio (before/after)	1.22		1.15	
95% Confidence Interval	[1.14, 1.30]		[1.13, 1.17]	
* $p < .001$	$RR_{NC}/RR_{37} = 1.06$, 95%, CI = .97 to 1.15			

Prior to enactment of the 0.08% law, 22.2% of drivers involved in a fatal crash in North Carolina had an estimated BAC of 0.10% or greater. That declined to 18.3% in the 39 months immediately following enactment of the lower BAC limit, a decline of 17.8% ($p < .001$). The risk ratio for alcohol involvement at this level before vs. after enactment of the law is 1.22, with a 95% confidence interval of 1.14 to 1.30. There was a somewhat smaller decrease in alcohol involvement at this level in the other 37 states, from 23.8% to 20.7%. This 13.1% decrease is also statistically significant ($p < .001$). The before-after risk ratio for these 37 states is 1.15, with a 95% confidence interval of 1.13 to 1.17. The direct comparison of the change in these states vs. North Carolina, given by the ratio of these two risk ratios, is 1.06. The 95% confidence interval for this ratio is .97 to 1.15, indicating again that the difference in declines between North Carolina and the other states is not statistically significant.

The changes in the percent of persons with estimated BAC above 0.10% are nearly identical to the changes in persons having any alcohol (BAC above 0.01%). Both measures provide the consistent finding that the decline in drivers with a positive BAC, or a high BAC, in North Carolina was slightly greater than in the other states, but not significantly so.

Police-reported Alcohol Involvement

A fairly direct measure of alcohol involvement in crashes is the investigating officer's report of whether there is evidence of alcohol use by a driver. Although police officers appear to be quite good at determining whether a driver has been drinking, a variety of factors can interfere with their ability to accurately determine alcohol use. Perhaps the greatest problem is the difficulty in determining low levels of alcohol use, for which there are few obvious indicators. Another problem is that factors at the crash scene, for example, the need to deal quickly with seriously injured persons, may inhibit the officer's ability to fully assess whether a driver has been drinking. Nonetheless, this is an indicator that is commonly used to measure whether alcohol is involved in a crash. Table 9 presents results of the analysis of this variable for North Carolina and the 37 other states.

Table 9. Police-reported (PR) alcohol involvement 1991 - 1996, North Carolina vs. 37 comparison states.

	North Carolina		Other 37 States	
	PR-Alcohol	**No Alcohol**	**PR-Alcohol**	**No Alcohol**
Before (1/1/91 to 9/30/93)	17.6% (731)	82.4% (3,430)	19.8% (16,953)	80.2% (68,561)
After (10/1/93 to 12/21/96)	13.4% (725)	86.6% (4,705)	17.1% (18,325)	82.9% (89,125)
Decline	24.0%*		14.0%*	
Risk Ratio (before/after)	1.32		1.16	
95% Confidence Interval	[1.22, 1.41]		[1.14, 1.18]	
* $p < .001$	$RR_{NC}/RR_{37} = 1.13$, 95% CI = 1.03 to 1.25			

Prior to enactment of the 0.08% law, police officers reported that 17.6% of drivers in fatal crashes in North Carolina had been drinking. That declined to 13.4% in the 39 months immediately following enactment of the lower BAC limit, a rather dramatic decline of 24%. The risk ratio for police-reported alcohol involvement before vs. after enactment of the law is 1.32. There was a smaller decrease in police reports of alcohol involvement in the other 37 states (14.0%). The before-after risk ratio for these 37 states is 1.16. The ratio of these changes between North Carolina and the other states is 1.13, indicating a significantly greater decline in North Carolina than in states that did not have an 0.08% BAC limit.

It is instructive to look at the changes in police-reported alcohol involvement by quarter for the period 1991 through 1996 shown in Figure 10.a. It is apparent that although a simple before-after comparison of the proportions of drinking drivers in crashes reported by police suggests a decline following implementation of the 0.08% BAC limit in North Carolina, that is an inappropriate conclusion. The reduction in police-reported alcohol involvement in North Carolina relative to the other states began in the second quarter of 1992, 18 months prior to implementation of the lower BAC limit, and approximately a year before legislation to lower the limit was introduced in the North Carolina General Assembly. During 1991, police reports of alcohol involvement in North Carolina fatal crashes were nearly the same as in the 37 states that did not reduce their BAC limits. It is that high rate, rather than a decrease following enactment of the 0.08% BAC limit, that produces a significantly greater decline in North Carolina than in the other states from the 33 months prior to the 0.08% law to the 39 months following its implementation.

Figure 10a

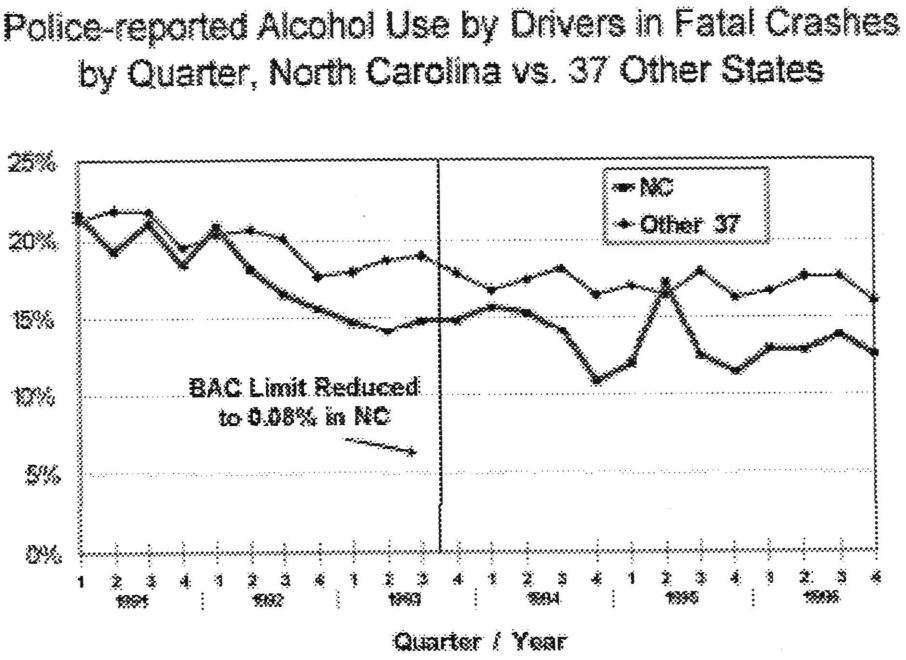
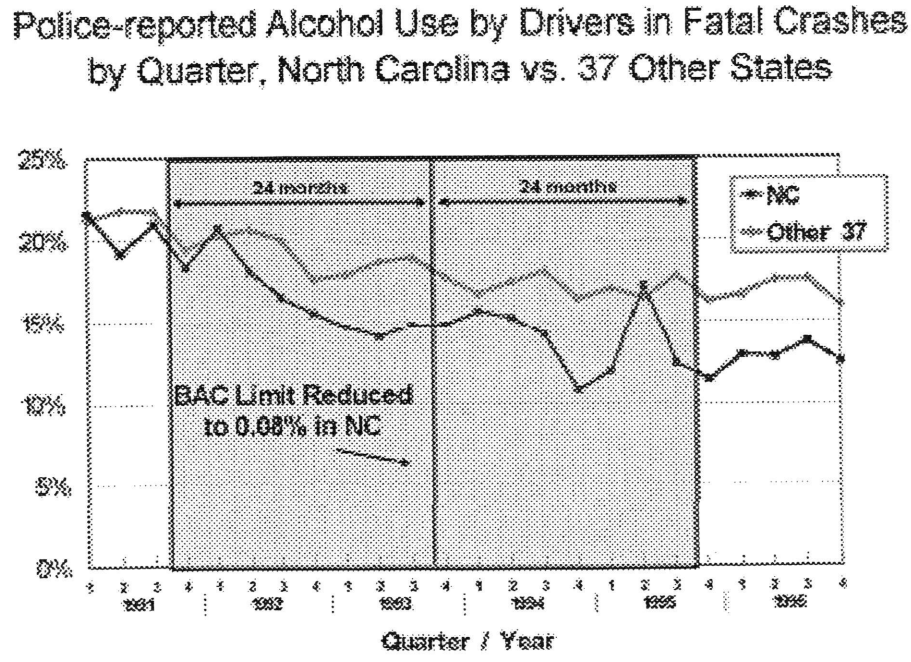


Figure 10b



Clearly there was a change in alcohol involvement, as reported by police officers. However, in view of its timing, it is not reasonable to believe that the change resulted from the lower BAC limit. The divergence between North Carolina and the other states occurred prior to the law. Selection of a different time period for analysis – for example, 24 months prior to and 24 months following enactment of the lower BAC limit – more accurately conveys what occurred prior to the new law (see Figure 10.b.). These before-after time periods are also matched for seasonal effects–covering identical months of the year. The ratio of relative risks comparing North Carolina to the other states for this four year period is 1.07 [.95, 1.20]. That is, there appeared to be a somewhat greater decline in police-reported alcohol use by drivers in fatal crashes, but the difference is not statistically significant.

Another pertinent consideration here is that the North Carolina "Booze-It-and-Lose-It" program was implemented in November, 1994. This effort included the conduct of 3,185 sobriety checkpoints throughout the state between November, 1994 and July, 1995, in conjunction with extensive media coverage of this enforcement activity. The dip in the percent of police-reported alcohol involvement in crashes shown in Figure 10 is coincident with the period during which the Booze-It-and-Lose-It program was at the peak of activity.[12] It is not possible to include the effects of this program in the simple before-after analyses reported here, as was done with earlier time-series analyses. However, it is clear from other time-series analyses (Foss & Stewart, 1998) that there was a reduction in alcohol-involved fatal and serious injury crashes for approximately eight months as a result of the Booze-It-and-Lose-It program. Hence, some of the post-1993 decline in alcohol-involvement in fatal crashes may be attributable to this program. That further undermines our confidence in the effect of the 0.08% BAC limit.

Single Vehicle Nighttime Crashes

Prior to development of the algorithm to estimate alcohol involvement for individual drivers involved in fatal crashes, it was common practice to use surrogate or proxy measures of alcohol involvement. That was a crude way of accomplishing what the estimation procedure does in a more statistically sophisticated fashion. Because crashes that occur at night are more likely to involve alcohol, and those that are single-vehicle crashes are even more likely to be alcohol-related, the incidence of such crashes has been used as an indicator of the extent of drinking-driving. Table 10 presents results of the analysis of single vehicle nighttime (8 p.m. to 4 a.m.) crashes among drivers over age 21 for North Carolina and the 37 other states.

Prior to enactment of the 0.08% law, 16.6% of fatal crashes in North Carolina were single vehicle nighttime crashes. That declined to 15.0% in the 39 months immediately following enactment of the lower BAC limit, a decline of 9.6%. The risk ratio for SVN to other type crashes before vs. after enactment of the law is 1.11. There was a nearly identical decrease in SVN crashes in the other 37 states, from 17.0% to 15.2%, a decline of 10.4% ($p < .001$). The before-after risk ratio for these 37 states is 1.12. The ratio of these changes between North Carolina and the other states is .99, indicating a virtually identical decline in SVN crashes.

[12] However, there is no apparent explanation for the sharp increase during the 2nd quarter of 1995. That increase reflects only 15 cases out 456 crashes, and does not appear nearly so dramatic in other measures of alcohol involvement.

Table 10. Drivers in single vehicle nighttime (SVN) crashes 1991 - 1996, North Carolina vs. 37 comparison states.

	North Carolina		Other 37 States	
	SVN	**Other**	**SVN**	**Other**
Before (1/1/91 to 9/30/93)	16.6% (691)	83.4% (3,470)	17.0% (14,513)	83.0% (71,001)
After (10/1/93 to 12/21/96)	15.0% (815)	85.0% (4,615)	15.2% (16,320)	84.8% (90,957)
Decline	9.6%†		10.4%*	
Risk Ratio (before/after)	1.11		1.12	
95% Confidence Interval	[1.01, 1.99]		[1.10, 1.14]	
† $p < .05$ * $p < .001$	$RR_{NC}/RR_{37} = .99$, 95% CI = .90 to 1.09			

Single Vehicle Nighttime Male Driver Crashes

Another, somewhat more refined, proxy measure of alcohol involvement is a single vehicle nighttime crash by a male driver. Table 11 presents results of the analysis of these crashes for North Carolina and the 37 other states.

Table 11. Drivers in single vehicle nighttime male (SVN-M) driver crashes 1991 - 1996, North Carolina vs. 37 comparison states.

	North Carolina		Other 37 States	
	SVN-M	**Other**	**SVN-M**	**Other**
Before (1/1/91 to 9/30/93)	12.7% (530)	87.3% (3,631)	13.7% (11,712)	86.3% (73,802)
After (10/1/93 to 12/21/96)	11.7% (633)	88.3% (4,797)	12.1% (12,988)	87.9% (94,289)
Decline	8.5%‡		11.6%*	
Risk Ratio (before/after)	1.09		1.13	
95% Confidence Interval	[.99, 1.20]		[1.11, 1.16]	
‡ $p < .01$ * $p < .001$	$RR_{NC}/RR_{37} = .97$, 95% CI = .87 to 1.08			

Prior to enactment of the 0.08% law, 12.7% of fatal crashes in North Carolina were single vehicle nighttime male driver crashes. That declined to 11.7% in the 39 months immediately following enactment of the lower BAC limit, a decline of 8.5%. There was a somewhat greater decrease in SVN-M crashes in

the other 37 states (11.60%). The ratio of these changes between North Carolina and the other states is .97 [.87, 1.08], indicating a non-meaningful difference in these changes.

Estimated Alcohol Involvement

In its examination of the first five states that reduced their BAC limit to 0.08%, the NHTSA used a variable described as 'estimated alcohol,' which was based on three factors: Police-reported alcohol involvement, evidence of a previous alcohol violation on the driver's record, and a positive measured BAC value. The report of this analysis does not give a detailed explanation of how this variable was created. We attempted to conduct a similar analysis as follows: "Estimated driver alcohol use" was considered to be positive if the driver had one or more DWI convictions on his/her record, *or* if there was an alcohol-related charge, *or* if the results of an alcohol test registered a BAC of ≥0.01%. Table 12 presents results of the analysis of these crashes for North Carolina and the 37 other states.

Table 12. Drivers' estimated alcohol involvement in fatal crashes 1991 - 1996, North Carolina vs. 37 comparison states.

	North Carolina		Other 37 States	
	Yes	**No**	**Yes**	**No**
Before (1/1/91 to 9/30/93)	25.0% (1,041)	75.0% (3,120)	24.7% (21,155)	75.3% (64,359)
After (10/1/93 to 12/21/96)	20.4% (1,110)	79.6% (4,320)	21.9% (23,458)	78.1% (83,819)
Decline	18.3%*		11.6%*	
Risk Ratio (before/after)	1.22		1.13	
95% Confidence Interval	[1.15, 1.30]		[1.12, 1.15]	
* $p < .001$	$RR_{NC}/RR_{37} = 1.08$, 95% CI = 1.00 to 1.17			

Prior to enactment of the 0.08% law, 25.0% of drivers in fatal crashes in North Carolina were estimated to have been drinking. That declined to 20.4% in the 39 months immediately following enactment of the lower BAC limit. For the other 37 states, estimated drinking declined by 11.61%. The ratio of these changes between North Carolina and the other states is 1.08, indicating a greater relative decrease in estimated alcohol involvement for North Carolina. Again, however, inspecting this variable for 24 months prior to and following the lowered BAC limit suggests that the change seen above results not so much from the effects of the law as from the fact that drinking-driving in North Carolina was comparable to that in the other states in 1991 and early 1992, but then declined relative to other states during the 18 month period prior to enactment of the 0.08% limit. Comparing only the 48 months immediately surrounding the reduction of the BAC limit, the ratio of relative risks is 1.05 [.95, 1.15], a non-significant ($p > .20$) difference.

Summary of Before-After Analyses

Table 13 provides a summary of the findings of the various analyses reported above. For completeness it also includes analyses for the 48 month period October 1, 1991 - Sept. 30, 1995. The 48-month period

was examined to more closely parallel the periods reported in the initial analyses by NHTSA (1994) and to equalize seasonal effects in the before-after periods. The only two measures that show a significantly greater decrease in North Carolina than in the states that retained a BAC limit of 0.10% during 1991-1996 are police-reported alcohol involvement and estimated alcohol involvement.[13] Considering analyses of time periods more proximate to the change in the North Carolina BAC limit, and taking seasonality into account, these findings disappear.

Table 13. Summary of findings from FARS data, North Carolina vs. 37 other states, 72- and 48-month analysis periods

Criterion Measure	Analysis Period			
	1991-96 (33 months before, 39 months after)		48 Months (24 mos. before, 24 months after)	
	Ratio of RRs	95% CI	Ratio of RRs	95% CI
Alcohol > 0.01%	1.06	.98, 1.14	1.04	.94, 1.14
Alcohol > 0.10%	1.06	.97, 1.15	1.02	.92, 1.13
PR-Alcohol	1.13	1.03, 1.25	1.07	.95, 1.20
SVN	0.99	.90, 1.09	0.97	.92, 1.16
SVN-M	0.97	.87, 1.08	0.93	.81, 1.06
Est. Alcohol	1.08	1.00, 1.17	1.05	.96, 1.15

Comparison of North Carolina with other states

North Carolina has a reputation for being tough on drinking drivers as is reflected in the comprehensiveness of its DWI laws. It was one of only three states to receive an A- rating by MADD in its recent review of state DWI laws. In addition, beginning in late 1994, North Carolina implemented an extensive high visibility DWI enforcement program (Booze-It-and-Lose-It), which resulted in 3,185 DWI checkpoints being conducted throughout the state between November of 1994 and July, 1995. For these and perhaps other reasons, it may be that North Carolina is an atypical state in terms of drinking-driving.

It is difficult to know whether any characteristics on which a state may differ from others with respect to traffic safety laws or programs is a meaningful one – a factor that should be taken into account when deciding whether any findings from that state should be generalized to other states. We can, however, examine whether various indicators of drinking-driving are dramatically different in North Carolina when compared to the rest of the nation. To address this issue, Table 14 compares North Carolina with the 37 states on each of the six criterion measures examined above prior to enactment of the 0.08% law. It is clear that there are some statistically meaningful differences. For example, 1.7% fewer drivers involved in fatal crashes in North Carolina between 1991 and 1993 had a high BAC ($\geq$ 0.10%); 2.3% fewer were reported by the investigating officer to have been drinking. On the other hand, there were negligible and non-significant differences on several other measures.

[13] It is important to keep in mind that these are not independent findings, since police-reported alcohol involvement is one of the elements of the 'estimated alcohol' measure.

In sum, although there are some statistically significant differences between North Carolina and other states, the magnitude of these differences is relatively small. Hence, it would not appear that during the early 1990s North Carolina was so atypical with respect to drinking-driving, that we should hesitate to generalize findings from this or other studies of drinking drivers, to the U.S. in general.

Table 14. Comparison of North Carolina with 37 comparison states on six measures of drinking-driving in fatal crashes for 1991 - 1993.

Measure	NC	37 States	Difference	z
BAC Over .01%	24.1%	27.9%	-3.8%	5.54*
BAC Over .10%	22.0%	23.7%	-1.7%	2.65*
Police-Reported Alcohol	17.4%	19.7%	-2.3%	4.11*
SVN	16.3%	16.8%	-0.5%	0.88
SVN-M	17.1%	18.2%	-1.1%	1.57
Estimated Alcohol	24.8%	24.5%	0.2%	0.35

*Note. z-test for difference of proportions. $p < .01$

❑ CONCLUSION

There appears to have been little clear effect of the lower BAC limit in North Carolina. Survey data indicate that the general public believes the new law was well-publicized. Although awareness of the new lower limit was not particularly high nearly 18 months after the law took effect, frequent drinkers did evidence a substantial degree of awareness that the law had changed and about what the new BAC limit was. As is typical in North Carolina, enforcement of the lower limit was vigorous and strict. Hence, it appears that the most likely explanation for the lack of a demonstrable effect of the lower BAC limit is that the drinking-driving population in North Carolina at the time the lower limit took effect was simply unresponsive to this change. Whether that is because, following a substantial reduction in drinking-driving behavior, the remaining drinking-drivers in North Carolina represented a 'hard core' that cannot be affected by such broad policies, or that this particular policy simply does not have the potential to measurably affect drinking drivers in general, is unknown.

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Appendix A

Detailed presentation of stochastic time series models fit to various types of alcohol-related North Carolina crashes as summarized in Table 3 .

Note. The models for percent of alcohol-related fatal or serious injury crashes (table 3.b.) contain no stochastic components. Hence, these reduce to simple regression models. These models also contain no seasonal factors. As a result residual autocorrelations are only computed through lag 14, and, hence, Q(14) is presented for these models rather than Q(15) as is reported for other series. Similarly since no seasonal patterns were found, no value of R^2_S is computed for these models.

Table 3. Parameters for logit models of various indicators of alcohol-involved North Carolina crashes, 1991 - 1995.

3. a. PERCENT OF CRASHES INVOLVING ALCOHOL – all levels of severity

Components of Model:

- Stochastic level, trend, seasonal
- Autoregressive term at lag 7,
- Number of weekend days per month

Intervention (1)	*estimate*	*s.e.*	*t-ratio*	*p-value*
Shift in level	-.038	.038	-1.007	.320
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 2.26	R^2 = .941	
		Q(10) = 6.88	R^2_D = .679	
		Q(15) = 10.64	R^2_S = .549	

Intervention (2)	*estimate*	*s.e.*	*t-ratio*	*p-value*
Change in trend	.001	.009	.168	.866
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 1.98	R^2 = .940	
		Q(10) = 8.88	R^2_D = .673	
		Q(15) = 14.09	R^2_S = .541	

3. b. PERCENT OF CRASHES INVOLVING ALCOHOL – severe and fatal crashes only.

Components of Model:

- Fixed level, fixed trend

Intervention (1)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Shift in level	.023	.058	.390	.698
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = .442	R^2 = .759	
		Q(10) = 7.00	R^2_D = .470	
		Q(14) = 7.86		

Intervention (2)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Change in trend	-.0001	.003	-.017	.986
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = .426	R^2 = .758	
		Q(10) = 7.13	R^2_D = .468	
		Q(14) = 8.09		

Table 3. Results for Logit Models (Continued)

3. c. PERCENT OF CRASHES OCCURRING AT NIGHT – all levels of severity

Components of Model:

- Stochastic level, trend, seasonal
- Autoregressive term at lag 4
- Number of weekend days per month

Intervention (1)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Shift in level	-.022	.022	-1.033	.308
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 3.25	R^2 = .760	
		Q(10) = 5.88	R^2_D = .694	
		Q(15) = 11.26	R^2_S = .432	

Intervention (2)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Change in trend	.001	.003	.305	.762
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 3.63	R^2 = .733	
		Q(10) = 5.72	R^2_D = .659	
		Q(15) = 12.03	R^2_S = .368	

3. d. PERCENT NIGHTTIME CRASHES – serious and fatal crashes only

Components of Model:

- Fixed level, fixed trend, stochastic seasonal
- Number of weekend days per month

Intervention (1)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Shift in level	.050	.040	1.240	.222
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 3.26	R^2 = .610	
		Q(10) = 7.68	R^2_D = .633	
		Q(14) = 11.15	R^2_S = .446	

Intervention (2)	*estimate*	*s.e.*	*t-statistic*	*p-value*
Change in trend	.003	.002	1.075	.288
		Residual Autocorrelations	*Goodness-of-Fit*	
		Q(5) = 2.30	R^2 = .611	
		Q(10) = 8.58	R^2_D = .633	
		Q(15) = 12.48	R^2_S = .447	

SENATE TASK FORCE ON ALCOHOL RELATED MOTOR VEHICLE ACCIDENTS AND FATALITIES

December 11, 1998

Alexander J. Menza, Esq.
Chairman

Declan J. O'Scanlon, Jr.
Vice Chairman

VI. FINDINGS AND RECOMMENDATIONS OF THE TASK FORCE

A. Blood Alcohol Concentrations--Legal Limit

The Task Force considered many facts in investigating the question of whether New Jersey should reduce the statutory blood alcohol concentration (BAC) threshold above which it becomes illegal to operate a motor vehicle from .10 to .08 percent.

After careful consideration of the testimony, scientific studies and experiences of other states and countries, and vigorous debate, the Task Force concluded that changes to the BAC level without substantial additions and changes in public education, enforcement and treatment will not achieve the real goal of decreasing death and disability and lessening the huge societal costs from DWI.

Fifteen states have adopted .08 percent BAC as the *per se* legal blood alcohol limit. Those states are: Alabama, California, Florida, Hawaii, Idaho, Illinois, Kansas, Maine, New Hampshire, New Mexico, North Carolina, Oregon, Utah, Vermont and Virginia. Vermont classifies a BAC of .08 as a traffic offense and .10 as a criminal offense. In 1998, legislation establishing .08 as the legal limit was also pending in Alaska, Connecticut, Iowa, Kentucky, Louisiana, Maryland, Minnesota, Missouri, Nebraska, Rhode Island, South Carolina, Tennessee, Washington and West Virginia. Federal legislation (P.L.105-178) that provides $500 million in incentives to states that voluntarily adopt a .08 BAC limit was signed by President Clinton on June 9, 1998.

Great Britain, Canada, Switzerland, Australia and Austria use the .08 standard, while the measure of intoxication in Finland, the Netherlands and Norway is .05. Sweden has set a BAC limit of .02.

The Task Force found that much of the source material and testimony presented was contradictory and subject to a wide range of interpretations, as it was when the Senate Law and Public Safety Committee held a hearing on S-1411.

Blood Alcohol Concentrations Studies

There are conflicting studies regarding the effect of laws lowering the BAC threshold. Some studies have concluded that lowering the measure of intoxication to .08 BAC reduces alcohol related injuries and fatalities. Other studies by equally credible authorities present conflicting findings.

California enacted .08 BAC legislation on January 1, 1990; six months later, the state also enacted an administrative license revocation law. A study of the effect of California's .08 law was conducted by the National Highway Traffic Safety Administration (NHTSA) after both laws were implemented. The study found a 12 percent reduction in alcohol related motor vehicle fatalities. The study also found that publicity concerning the two laws was intermingled, so the reduction in fatalities could have been the result of implementation of either or both of the laws.[6]

But a 1995 study conducted by the California Department of Motor Vehicles found that the state's .08 BAC law could not be linked to any significant decreases in the direct measures of alcohol involved crashes.[7] An impact was observed, however, on some of the indirect measures, such as fatal and severe injury nighttime and bar closing hour accidents, as well as fatal and injury bar closing hour and single vehicle nighttime male accidents. The authors wrote that the study "demonstrated qualified evidence of a significant general deterrent effect associated with the implementation of an administrative *per se* (APS) license suspension law in California and somewhat less support of such an effect associated with California's 0.08 BAC *per se* limit law."[8]

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[6]The Effects Following the Implementation of an 0.08 BAC Limit and an Administrative Per Se Law in California (Washington, D.C.: National Highway Traffic Safety Administration, 1991), pp. xv-xvi.

[7]Patrice N. Rogers, The General Deterent Impact of California's .08% Blood Alcohol Concentration Limit and Administrative Per Se License Suspension Laws (Sacramento, California: Department of Motor Vehicles, September, 1995) p.87.

[8]Ibid.

A multi-state study on the effect of .08 BAC laws was conducted by Ralph Hingson, a professor at Boston University, who testified before the Senate Law and Public Safety Committee and the task force.[9] Hingson's analysis compared the first five states that adopted .08 with five nearby states that retained .10 as the legal blood alcohol limit. The study found that as a group the states that lowered the limit to .08 experienced a 16 percent reduction in fatal crashes where the drivers' BAC was .08 or higher. The analysis also showed an 18 percent reduction in fatal crashes where the BAC was at .15 percent or higher. The study concluded that if all 50 states adopted .08 percent BAC laws, 500 to 600 fewer fatal crashes throughout the nation would occur each year. The authors noted, however, that all five of the .08 states also had administrative license revocation laws during the study, three of which were implemented within one year of the state's adoption of the .08 law. They stated that this restricted their ability to separate the effects of .08 laws from administrative license revocation laws.

A study performed by Robert Scopatz for Data Nexus, Inc. for the American Beverage Institute disagreed with the Hingson study. That study replicated the Hingson study and found that the choices made in the selection of comparison states and in the presentation of data in that study affected its results. Scopatz concluded that there was no statistical support for concluding that .08 BAC laws had any effect on driver behavior as expressed in the probability of a drunk driver becoming a fatality in a motor vehicle crash.[10]

A NHTSA study of the same first five states with .08 BAC laws found significant reductions

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[9]Ralph Hingson, Timothy Heeren and Michael Winter, "Lowering State Legal Blood Limits to 0.08%: The Effect on Fatal Motor Vehicle Crashes," American Journal of Public Health. 86(9) (1996):1297-1299.

[10]Robert A. Scopatz, Analysis of 1975-1993 Fatal Crash Experience in States with .08% Legal Blood Alcohol Levels, Report to the American Beverage Institute (College Station, Texas: Data Nexus, Inc., 1997) p.9.

in alcohol related crashes in four of the five states examined, which ranged from four percent in California to 20 percent in Vermont.[11]

In New South Wales, Australia, after the BAC threshold was lowered to .05 from .08, a reduction in fatal crashes was observed, but only on Saturdays, by 13 percent. However, when random breath testing was introduced two years later, fatal crashes were immediately reduced by almost 20 percent over all and 30 percent during holiday periods.[12]

Impairment

Alcohol acts directly on the brain and affects its ability to function. These effects are quite complex, but they are similar to a general anesthetic. As consumption of alcohol increases and BAC rises, the motor functions of the body are affected, which in turn affects driving-related skills. Judgment is the first function to be affected, and decision making becomes impaired. In addition, operating a motor vehicle requires simultaneous attention to several tasks, such as using directional signals and steering while being alert to other vehicles, pedestrians and road hazards. Studies have shown that one of the most pronounced effects of alcohol is on these divided attention tasks.[13]

Many studies have documented increased risks and impairment at blood alcohol concentrations much lower than .08. Some studies have been done in a conscientious fashion using closed course driving, vehicle simulators, and airplane cockpit simulators. Various studies have demonstrated that divided attentions skills are impaired at BAC's of .015, with impairment

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[11]Delmas Johnson and James Fell, The Impact of Lowering the Illegal BAC Limit to .08 in Five States in the U.S, (Washington, D.C.: National Highway Traffic Safety Administration, April, 1995) pp.8-9.

[12]R. Homell, "Drink-Driving Law Enforcement and the Legal Blood Alcohol Limit in New South Wales," Accident Analysis and Prevention. 26(2) (1994):147-155.

[13]John Brick, Drinking, Driving and Relative Risk: An Evaluation of Existing Data (Yardley, Pennsylvania: Intoxikon International, August 1997).

demonstrably increased at .03, .05, and .06.[14] This is also consistent with the observation of decreased sustained attention span while operating a vehicle while under the influence of alcohol.[15] Similarly, the detection of angular motion (acceleration, deceleration, and turning) is compromised at a mean BAC of .037 and persists even after the BAC returns to zero.[16] This phenomenon of persistent impairment while the BAC decreases is supported by several other studies. Significant impairment is still shown after the BAC reaches zero in both vehicle and aircraft operators, and up to 14 hours after a person had reached a .10 BAC and the BAC had returned to zero.[17] There is also, interestingly enough, a second phase phenomenon, with an increase in sedation in the late phase while the alcohol concentration of the blood is decreasing.[18] This impairment is magnified significantly if

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[14]H. Moskowitz and A. Williams, "Skills Performance at Low Blood Alcohol Levels," Journal of Studies on Alcohol. 46(5) (1985):482-485; V.J. Gawron, "The Effects of Alcohol Dosing on Driving Performance on a Closed Course and in a Driving Simulator," Ergonomics. 31(9) (1988):1219-1244; and L. Ross and J. Mundt, "Multiattribute Modeling Analysis of the Effects of a Low Blood Alcohol Level on Pilot Performance," Human Factors. 30(3) (1988):293-304.

[15] J. Rohrbaugh, J. Stapleton, R. Paraserman, H. Frowela, B. Adinoff, J. Varner, E. Zubovic, E. Lane, M. Eckardt and M. Linnolla, "Alcohol Intoxication Reduces Visual Sustained Attention," Psychopharmacology. 96 (1988):442-446.

[16]H. Tanwu, Y. Watanabe, M. Asai, K. Shimizu, S. Takada and K. Mizukoshi, "Effects of Alcohol Ingestion on Vestibular Function in Postural Control," Acta Otolaryngol (Stockh). 519 (1995):127-131.

[17]T. Roehrs, D. Claiborue, M. Knox, T. Roth, "Residual Sedating Effects of Ethanol," Alcoholism:Clinical and Experimental Research. 18(4) (1994):831-834; T. Roehrs, D. Beare, F. Zorick, T. Roth, "Sleepiness and Ethanol Effects on Simulated Driving," Alcoholism:Clinical and Experimental Research. 18(4) (1994):154-158; J. Yesavage and V. Leirer, "Hangover Effects on Aircraft Pilots 14 Hours After Alcohol Ingestion: A Preliminary Report," American Journal of Psychiatry. 143(12) (1986): 1546; J. Taylor, N. Dolhert, D. Morrow, L. Friedman, J. Yesavage, "Acute and 8-Hour Effects of Alcohol (0.08% BAC) on Younger and Older Pilots' Simulator Performance," Aviation, Space, and Environmental Medicine. (August, 1994):718.

[18]K. Papineau, T. Roehrs, N. Petrucelli, L. Rosenthal and T. Roth, "Electrophysiological Assessment (The Multiple Sleep Latency Test) of the Biphasic Effects of Ethanol in Humans," Alcoholism:Clinical and Experimental Research. 22(1) (1998):231-235.

a person is tired or has had a decreased amount of sleep the night before, whether or not the person feels tired.[19]

The time needed by a driver to identify a presented risk is substantially increased with low doses of alcohol; however, this dosage does not seem to decrease the time needed by the person to cover a closed course. The significance of this is that the person retains the same speed, yet with a decreased ability to observe and respond to a threat. This is particularly noted in younger drivers.[20] It also has been noted that women are more affected at the same blood alcohol concentration and by "high alcohol type" drinks than are their male counterparts.[21]

In 1986, the American Medical Association's Council on Scientific Affairs, in recommending that all states adopt .05 BAC as the *per se* legal blood alcohol limit, stated that there was a "scientific consensus" that deterioration of driving skills begins at .05 BAC or an even lower BAC for certain age groups such as young, inexperienced drivers.[22] Additionally, the U.S. Department of Transportation has adopted a 1987 recommendation of the Transportation Research Board that .04 BAC be the measure of intoxication for commercial drivers. New Jersey law provides for .04 BAC for commercial drivers and zero tolerance for underage drinkers who drive.

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[19]T. Roehrs, D. Claiborue, M. Knox, T. Roth, "Residual Sedating Effects of Ethanol," Alcoholism:Clinical and Experimental Research. 18(4) (1994):831-834.

[20]R. West, J. Wilding, D. French, R. Kemp and A. Irving, "Effect of Low and Moderate Doses of Alcohol on Driving Hazard Perception Latency and Driving Speed," Addiction. 88 (1993):527-532; F. Gengo, C. Gabos, C. Strale and C. Manning, "The Pharmacodynamics of Ethanol: Effects on Performance and Judgment," Journal of Clinical Pharmacology. 30 (1990):748-754; N. Flanagan, P. Strike, C. Rigby and G. Lochridge, "The Effects of Low Doses of Alcohol on Driving Performance," Medical Science Law. 23(3) (1983): 203.

[21]K. Mills, and E. Bisgrove, "Body Sway and Divided Attention Performance Under the Influence of Alcohol: Dose-Response Differences Between Males and Females," Alcoholism: Clinical and Experimental Research, 7(4) (1983):393.

[22]Council on Scientific Affairs, "Alcohol and the Driver," Journal of the American Medical Association. 255(4) (1986):522-527.

The Task Force found that significant impairment can be clinically demonstrated at .05 BAC.

Probability of Crash Involvement

Studies demonstrate that the relationship between BAC and risk of a crash increases steeply and geometrically. The relative risk of becoming involved in a motor vehicle crash is twice as great at .06 BAC than it is for a sober driver. At .10 BAC, the risk is six times greater (see chart in Appendix D).[23]

One study found that a male driver age 25 or over, with a BAC between .05 and .09, has a fatality risk in single vehicle crashes almost nine times greater than a driver at zero BAC. At a BAC level between .10 and .14, for the same male drivers the risk is forty times as high as without alcohol. At .15 BAC or more, it is 600 times higher.[24]

Another study estimated that 91.4 percent of crashes with driver BACs over .10, 43.5 percent of crashes with driver BACs between .08 - .099, and 24.2 percent of crashes with BACs below .08 would not have occurred in the absence of alcohol consumption.[25]

Actual Crash Involvement

Clearly, increases in BAC levels result in increases in driver impairment. The question however, is not so much the degree of impairment, but whether and at what point impairment equates

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[23]John Brick, Drinking, Driving and Relative Risk: An Evaluation of Existing Data (Yardley, Pennsylvania: Intoxikon International, August 1997).

[24]Paul L. Zador, Adrian K. Lund, Michele Fields and Karen Weinberg, "Fatal Crash Involvement and Laws Against Alcohol-Impaired Driving," Journal of Public Health Policy. 10 (1989):467-485.

[25]Ted R. Miller, Diane C. Lestina and Rebecca S. Spicer, "Highway Crash Costs in the United States by Driver Age, Blood Alcohol Level, Victim Age, and Restraint Use," Accident Analysis and Prevention. 30(2) (1998):144.

with injury and death.

A 1994 NHTSA study found that in 23,395,971 crashes where only property damage occurred, 3,913,824 (16.7 percent) of the drivers tested positive for alcohol. Of that number, 3,560,797 (91 percent) had a BAC level over .10. The same study found that in 5,215,931 crashes with injuries, 1,064,404 (20.4 percent) of drivers tested positive for alcohol. Of that number, 812,485 (76.3 percent) had BAC levels above .10[26] (see chart in Appendix E). Another study also found that in the majority of crashes where the driver tested positive for alcohol, the BAC level was .10 or greater.[27] An examination of data for 160 New Jersey drivers with a measurable amount of blood alcohol involved in fatal crashes in 1997 showed that 73 percent (117) had a BAC greater than .10, while 24 percent (38) had a BAC level between .01 and .079. Only 5.6 percent (9) had a BAC level of .08 to .10. An analysis of BAC levels of fatally injured drivers in New Jersey from 1987 through 1997 shows a statistically significant increase in fatalities at .10 BAC and above (see chart in Appendix F).

A review of BAC levels of injured drivers admitted to trauma centers in New Jersey in 1996 showed that of the 2,387 drivers admitted, only 72.6 percent (1,734) were tested for the presence of alcohol in the bloodstream. Of those tested, 27.8 percent (482) tested positive for some level of alcohol. Seventy-seven percent (371) of those who tested positive had a BAC of more than .10. Only six percent (29) had a BAC between .08 and .099.[28]

A review of patients seen at the trauma center at Morristown Memorial Hospital from April,

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[26]NHTSA, The Economic Cost of Motor Vehicle Crashes, p.31.

[27]Ted R. Miller, Diane C. Lestina and Rebecca S. Spicer, "Highway Crash Costs in the United States by Driver Age, Blood Alcohol Level, Victim Age, and Restraint Use," Accident Analysis and Prevention. 30(2) (1998):142.

[28]New Jersey State Trauma Register, American College of Surgeons, New Jersey Committee on Trauma, 1996, Dr. Jeffrey Hammond, Chairman.

1992 through October, 1998, identified 1,903 vehicle occupants and 256 motorcycle occupants. The majority of those patients were drivers--1,364 and 226, respectively. Of the 1,039 motor vehicle drivers who were tested, 806 (78 percent) had no alcohol in their bloodstreams, 13 (1.3 percent) had up to .025 BAC, 24 (2.3 percent) had from .025 to .074 BAC, 10 (one percent) had from .075 to .099 BAC, 31 (three percent) had from .10 to .149 BAC, and 155 (15 percent) had BACs of .15 and higher. As a percentage of the 233 motor vehicle drivers who had some alcohol in their systems, 5.6 percent had BAC levels up to .025, 10.3 percent had BAC levels between .025 and .075, 4.3 percent had BAC levels between .075 and .099, 13.3 percent had BAC levels between .10 and .149, and 66.5 percent had BAC levels of .15 and higher.[29]

These studies clearly demonstrate that most alcohol related crashes and fatalities occur at BAC levels above .10.

Conclusion

1. Significant impairment can be clinically demonstrated at .05 BAC.

2. There is a dramatic increase in crash and fatality rates at levels of .15 BAC and above.

3. The impact of laws that reduce the *per se* BAC level from .10 to .08, in isolation, is inconclusive. Some studies that claim to show conclusively that reducing the legal limit to .08 BAC is effective have confounding factors, such as the implementation of administrative license revocation and major public education and awareness campaigns.

4. The implementation of major public education and awareness campaigns and administrative license revocation have also been shown to have a significant effect in reducing the incidence of DWI offenses. Studies have shown that effect can be greater than changing the legal BAC limit.

5. Nationally, the drunk driving fatality rate has declined over the previous 15 years because

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[29]Alcohol Related Motor Vehicle and Motorcycle Occurrences, 4040 Patients in Trauma Registry from 4/1/92 to 11/1/98, Morristown Memorial Hospital Trauma Registry.

of prevention and enforcement programs and treatment programs for the DWI offender, whether or not in conjunction with a change to .08 BAC.

In order to resolve the .08 issue, the Legislature must understand the facts and the critical elements beyond the isolated question of .08 BAC. The effectiveness of any legislation will depend upon the inclusion of a constant level of public education and awareness of the problem, the presence and public awareness of consistent enforcement, and effective treatment and rehabilitation of those offenders that need it.

Considering the conflicting research materials and testimony at the hearings, the finding of the Task Force and the sociological complexities of this issue, the Task Force is of the opinion that the question of whether to lower the measure of intoxication from .10 to .08 BAC is a policy decision that should be made by elected officials. Therefore, the Task Force makes no recommendation with regard to the BAC level to be adopted.

DATA NEXUS, INC.

ANALYSIS OF 1975-1993 FATAL CRASH EXPERIENCE IN STATES WITH .08% LEGAL BLOOD ALCOHOL LEVELS

REPORT TO THE AMERICAN BEVERAGE INSTITUTE

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Executive Summary

Recent work by Dr. Ralph Hingson (Boston University) comparing states with lowered legal blood alcohol concentration (BAC) limits to states which have not lowered the BAC limit claims a 16% reduction in one class of fatal crashes. Expressed as a nationwide figure, Hingson and his colleagues concluded that between 500 and 600 lives could be saved each year if all states adopted a .08% BAC limit. The method used in the Hingson study relies on a comparison between states and a "meta-analysis" technique for combining data that is not commonly applied to traffic safety research. If the reported effects are reliable, they should pass two tests: within logical boundaries, it should not matter which states are chosen to compare with the ".08% law" states; and, the effect should show up under standard statistical testing. In two studies conducting these reliability tests, our research showed that:

- **The effect depends on which states you chose to compare to the .08% law states.** For example, Hingson compared California (a .08% law state) to Texas (a .10% law state). Picking Arizona (a different .10% law state which meets Hingson's method of choosing "nearby" states) instead of Texas, is enough to eliminate the evidence for an effect of .08% BAC laws even if all other aspects of the study remain the same. Since it could be said that there is no single state that matches California, we also compared it to a combination of three states which closely matched California's land mass, population, population density, and number of fatal crashes. Leaving all other aspects of the analysis the same as that used by Hingson, this change was enough to eliminate the evidence for an effect of .08% BAC laws.

- **Under standard statistical tests, the original state pairs show no effect of .08% BAC laws.** Hingson's method of combining results across five pairs of states is usually only used when the results come from different studies made by different authors under different sets of conditions. If the results of this analysis are reliable, they should be repeated in a more standard approach – treating the data as if they came from one study. When this test is performed, the estimated effect of .08% BA laws is "no effect."

The main conclusions to be drawn are:

1. Hingson's results do not extend beyond the particular state pairs he chose.

2. The results provide no evidence of an effect of .08% BAC laws on the likelihood of a fatal crash involving a drunk driver.

3. Research involving comparisons between states should be verified as reliable before conclusions are drawn. Attached are two reports attempting to do this for the Hingson study. The conclusion of that study is not supported by the evidence.

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INTRODUCTION

Hingson, Heeren and Winter (1996)[1] published results purporting to show that lowering legal Blood Alcohol (BAC) limits to .08% resulted in a 16% reduction in the probability that a fatally injured driver would have a BAC above that level. Their results also show that broadening the picture to include all drivers in fatal crashes (for whom BAC content is known) yields the same result. Hingson, et al. conclude that passing a law caused a sustained decrease in the chance that a driver involved in a fatal crash has a blood alcohol level exceeding the .08% limit.

In a previous replication[3], the following problems were identified with the Hingson, et al. methodology:

1) Comparisons between geographic regions were not verified as valid or reliable.

2) The pre-/post- methodology is not a true experimental design. Using this methodology, it is impossible to rule out the likelihood that some extraneous factor is responsible for the differences observed.

3) Meta-analytic methods for treating the data from five state pairs as if they were separate replications of the study artificially reduced the 95% confidence intervals around the mean — leading to a mistaken conclusion that the 16% drop seen in the Hingson, et al. (1996) study was statistically significant.

4) The results are not robust or repeatable with a different selection of comparison states. Selection of logically valid comparison states completely eliminated any evidence for an effect of the .08% laws in the states that passed them.

At the close of the previous replication, the question remained as to whether just a single change in the selected comparison states would eliminate the effect and under what conditions should we accept a state-to-state comparison as valid.

The follow-up analyses presented here are a replication of the Hingson, et al. (1996) study making a single alteration in the selection of which "state" was paired with California. The reasons for selecting this state pair as the one to change were as follows:

1) Of the state pairs in the original study, only the Maine/Massachusetts pair and the California/Texas pair do not share a border. The distance between California/Texas is much larger than that between Maine and Massachusetts.

2) The California/Texas pair data were closest to the overall effect of 16% as reported by Hingson, et al. (1996).

METHOD

The Fatal Accident Reporting System (FARS) data released on CD-ROM[2] were used throughout this study. Using the same methodology as presented in the original Hingson, et al. study, four of five state pairs were also kept identical to that study. As before, the first member of each state pair was a state that had implemented a legal BAC limit of 0.08%. Only the state or states paired with California were changed in the following replications.

In the first replication, Texas was replaced by Arizona as the state to be compared to California. All other details of the analysis remained the same as in the Hingson, et al. study and the previous replication by this author. This represented an attempt to see if a single change in the particular selections made by Hingson, et al. would disrupt the effect reported in that study.

In the second replication, Texas was replaced by a combination of three states in the comparison with California. The combination was used in an attempt to match, as closely as practical, the size, population, population density and crash experience of California in the comparison condition. The following criteria determined the selection of states.

1) **Select states that have not passed a .08% BAC law (as listed in Table 116 of the 1994 FARS report).** This criteria was deemed important since, in the original study, two of the comparison states had passed a .08% BAC law at some point just following the 1975-1993 study period. Given the legislative process and the high profile of such legislation, it is likely that consideration of these laws was ongoing and widely publicized during the latter part of the study period. It is difficult to determine what affect this might have; however, it is logical to conclude that such a potential confound should be avoided in selecting comparison states.

2) **Select states that had not been used in either the Hingson, et al. study or the previous replication.** The argument put forward by Hingson, et al. requires that the change brought about by passage of a .08% BAC law must be evident in the behavior of drivers in the state which passed the law. As such, it should not matter what state is selected for comparison. In fact, in grouping states (law states versus comparison states), Hingson, et al. make the tacit assumption that pairing states is not crucial to the outcome of the study. In this replication, it was decided that the fairest test would be to select yet another state or states that had not been used in any of the previous analyses. This provides another replication testing the robustness of the .08% law effect.

3) **The overall combination must have population, population density, square miles of land-mass, and overall number of fatal crashes similar to California.** In the previous study, we attempted to reduce geographic differences by choosing, whenever possible, comparison states that bordered the .08% law states. The selection of Arizona as the comparison state in the first follow-up analysis is based on this criterion. In the second follow-up analysis, it was decided that similarity could be measured in other ways. Unfortunately, there are no single states that could form a usable comparison to California based on population, land mass, and crash experience. Instead, it was decided to select a combination of states to provide a close match on these measures, without respect to geographic proximity. The desire was to limit the number of states in the combination, so that the larger, more populous states with the highest number of fatal crashes were to be selected from among the various candidates.

As in the original study[1] and the previous replication[3], two ratios were calculated for each state: one for the period prior to the law's enactment in the law state and a second for the period after the law's enactment. The before and after ratios each represented the proportion of fatal crashes in which a fatally injured driver had a BAC above 0.08% divided by the total number of fatal crashes. The proportional change between the before and after periods was calculated for each state. Finally, the proportional change in the law state was expressed as a proportion of the change in the comparison state. If this last ratio is less than 1.0, the law state had a larger drop in the targeted crash type (or smaller increase) from before to after enactment of the law than did the comparison state. If the ratio is greater than 1.0, the comparison state dropped more or increased less than the law state. If enactment of a 0.08% BAC law has an affect on driver behavior, it is expected that the ratios of law to comparison states would be significantly less than 1.0.

RESULTS

Table 1 displays the results presented in the original Hingson, et al. study. The order of some of the items in the table is changed from the original in order to maintain consistency with that study's Methods section. Note that Tables 1 and 2 as presented are the same as Tables 1 and 2 from the previous replication by this author.

Table 1: Results from Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.78
	Idaho	.15	.22	1.43	
2	Oregon (.08 state)	.29	.24	0.85	0.82
	Washington	.28	.29	1.05	
3	Maine (.08 state)	.26	.22	0.86	0.82
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.19	0.88	0.82
	Texas	.20	.21	1.08	
5	Vermont (.08 state)	.25	.25	1.01	1.45
	New Hampshire	.22	.15	0.69	
	OVERALL				0.84[4]
	TRUE MEAN				0.93[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.
2 The proportional change (PC) is found by 1+(After-Before)/Before.
3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).
4. The overall number as presented by Hingson, et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

Table 2 presents the data from an exact replication of the Hingson, et al. study. The slight differences in the data presented in Table 2 and Table 1 is attributable to the differences in data sets used in the two studies. The original study used data supplied on tape from the Bureau of Transportation Statistics based on the FARS "frozen file" whereas the current replication used data from a more recent FARS data release supplied by the Bureau on CD-ROM.

Table 2: Exact Replication of Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.79
	Idaho	.15	.22	1.41	
2	Oregon (.08 state)	.29	.24	0.84	0.81
	Washington	.29	.29	1.03	
3	Maine (.08 state)	.26	.22	0.86	0.92
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.20	0.91	0.84
	Texas	.20	.21	1.08	
5	Vermont (.08 state)	.33	.28	0.84	1.33
	New Hampshire	.24	.15	0.63	
	OVERALL				0.86[4]
	TRUE MEAN				0.94[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.
2 The proportional change (PC) is found by 1+(After-Before)/Before.
3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).
4. The overall number as presented by Hingson, et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

Note that, in all cases, the data in Table 2 are comparable to those presented by Hingson, et al. In particular, the final Ratio of Change in the replication compares closely to that presented in the original study whether using the "overall" measure (as in Hingson, et al.) or by taking the true mean of the results from the five state pairs.

Table 3 presents a replication of Hingson, et al. changing only Arizona for Texas as the comparison state paired with California.

Table 3: Arizona Paired With California in a Replication of Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.79
	Idaho	.15	.22	1.41	
2	Oregon (.08 state)	.29	.24	0.84	0.81
	Washington	.29	.29	1.03	
3	Maine (.08 state)	.26	.22	0.86	0.92
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.20	0.91	1.15
	Arizona	.16	.13	0.79	
5	Vermont (.08 state)	.33	.28	0.84	1.33
	New Hampshire	.24	.15	0.63	
	OVERALL				0.90[4]
	TRUE MEAN				1.00[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.
2 The proportional change (PC) is found by 1+(After-Before)/Before.
3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).
4. The overall number as presented by Hingson, et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

Note that the overall effect (matching the method used by Hingson, et al. to obtain their estimate of a 16% drop — ratio = 0.84) has changed to .90. More importantly, the true mean of the results across the five state pairs is exactly 1.00. This is exactly the ratio predicted if there is **no effect of .08% BAC laws.**

In the second follow-up study, Texas was replaced by a combination of Michigan, Ohio, and Pennsylvania as the comparison "state" paired with California. Table 4 gives the measures used to determine the closeness of this match to California.

Table 4: Comparison of California and the Three-State Combination of Michigan, Ohio, and Pennsylvania

State Name(s)	Population (1995 est.)	Land Mass (sq. miles)	Population Density	1994 Total Fatal Crashes
California	32,398,000	156,297	207/sq. mile	4,226
Michigan, Ohio, Pennsylvania Combined	32,912,000	142,855	230/sq. mile	4,110
Texas	18,592,000	262,051	71/sq. mile	3,186

Note that despite the differences presented in Table 4 between California and the three-state combination, these differences are much smaller than those between California and Texas on the same measures. Reducing these differences, within reason, was the goal of this follow-up study. Table 5 presents the results of the analysis of the five state pairs when the three-state combination is substituted for Texas as the comparison paired with California.

The results show that the three-state combination eliminates the evidence for an effect of the .08% laws. It is interesting to note that the "overall" measure — the one used by Hingson, et al. (1996) is 0.96 when California is compared to the group of three states. Contrary to the 16% effect of .08% laws stated in the original study, this measure would reduce that estimate to one-quarter of that claimed previously (or about 4%). Again, this measure is not recommended as valid for reasons stated above. It is presented here to provide a basis of comparison to the original study. The better measure to use, the mean of the five state pairs, is 0.98 in this replication. The 95% confidence interval around this mean would, as in all previous replication attempts, include the ratio equal to 1.00. In other words, there is no reason to believe that the ratio is different from what would be expected if there were **no effect of .08% BAC laws.**

Table 5: Three States Paired With California in a Replication of Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.79
	Idaho	.15	.22	1.41	
2	Oregon (.08 state)	.29	.24	0.84	0.81
	Washington	.29	.29	1.03	
3	Maine (.08 state)	.26	.22	0.86	0.92
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.20	0.91	1.04
	Michigan, Ohio & Pennsylvania	.22	.19	0.87	
5	Vermont (.08 state)	.33	.28	0.84	1.33
	New Hampshire	.24	.15	0.63	
	OVERALL				0.96[4]
	TRUE MEAN				0.98[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.

2 The proportional change (PC) is found by 1+(After-Before)/Before.

3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).

4. The overall number as presented by Hingson, et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

CONCLUSIONS

As with the previous replication of Hingson, Heeren, and Winter (1996), the two follow-up analyses presented here fail to support those authors' conclusions. In addition to the findings in the previous study by this author, the two follow-up analyses lead to the following conclusions and recommendations.

1) The between-state comparison methodology should be used with extreme caution. If, as in the four replications here, the results are sensitive to the particular states chosen, the only conclusion to be drawn is that the results are not robust; i.e., they should not be generalized.

2) There is no way to draw causal inferences from the pre-/post- quasi-experimental design. As shown in the four replications, there is ample evidence to believe that extraneous variables were responsible for the results produced in the original Hingson, et al. (1996) study.

3) The meta-analytic method, though well documented and useful in many situations, should not be applied in cases where a more conservative approach is available, or called for, by the nature of the comparisons. As noted in the first point, between-state comparisons should be used conservatively, if at all. Use of an extremely sensitive statistical technique is not a conservative approach. In the present case, its use caused Hingson, et al. (1996) to underestimate the variance in their data and reach a conclusion that further review shows to be unsupported.

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Section II

Potential Problems With the Hingson et al. Methodology

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INTRODUCTION

Hingson, Heeren and Winter (1996)[1] published results purporting to show that lowering legal Blood Alcohol (BAC) limits to .08% resulted in a 16% reduction in the probability that a fatally injured driver would have a BAC above that level. Their results also show that broadening the picture to include all drivers in fatal crashes (for whom BAC content is known) yields the same result. Hingson et al conclude that passing a law caused a sustained decrease in the chance that a driver involved in a fatal crash has a blood alcohol level exceeding the .08% limit.

There are potential problems with the Hingson et al. methodology. These are:

1) Comparisons between geographic regions should be used with caution. There are numerous differences between the states in the Hingson et al study *in addition* to the passage of a law in the ".08 states."

2) The pre-/post- methodology is not a true experimental design. The implication is that it is impossible to determine *causal* relationships when there are no true control groups. As in point #1, it is impossible to rule out the likelihood that some extraneous factor is responsible for the differences observed.

3) Hingson et al's use of "Meta-analytic methods" for estimating standard errors of the dependent measure is likely to underestimate the 95% confidence intervals around the dependent measure. A more conservative view of the data would be that each of the five state pairs furnishes a single value of the dependent variable. The size of the overall effect, logically, is estimated by the mean of those five values. The 95% confidence interval around that mean is a function of the standard deviation calculated based on the same five values.

4) Two of the comparison states used in the original study now have their own .08 laws in place (as per Table 116 of the 1994 FARS report), and thus is it likely that they were at least considering this legislation during the study period. While it is difficult to predict what affect might have had on the outcome, it does raise questions about whether selection of different comparison states — specifically those retaining the BAC legal limit of .10 past the end of the study period — might have on the results. Selection of alternative comparison states is also a way to test the generality of Hingson et al's findings. They chose specific comparison states based on a perception of comparability as well as geographic proximity. If the effect is real, selection of comparison states based on their continued adherence to a .10 level, in combination with geographic proximity, should yield the same results as obtained for the original pairs.

The following is a replication of the Hingson et al (1996) study using first, the same state pairs as were used in the original, and second with a substitute set of comparison states drawn from among those states which have retained the .10% legal BAC limit at least to the end of the study period (data are available from FARS up to 1994).

METHOD

The Fatal Accident Reporting System (FARS) data released on CD-ROM[2] were used throughout this study. Using the same methodology as presented in the original Hingson et al. study, a set of five state pairs were selected for analysis of the change in proportion of drivers in fatal crashes with a BAC above .08%. The first member of each state pair was a state that had implemented a legal BAC limit of 0.08%. The second member of each state pair was a "comparison" state. In the original study, Hingson et al. selected the comparison states based on their geographic proximity to the "law" states, and on their perceived "similarity" to those states.

The current study was designed to perform two replications of the Hingson et al. study. In the first replication, the same state pairs as those used by Hingson et al. were used. This represented an attempt to exactly replicate the original study in order to validate that the same results would be found using the more recent release of FARS data. The second replication used a different set of comparison states paired with the original "law" states. In both replications, the same time durations were used as in the original study. These varied for the different state pairs based on the year and month in which the law was enacted in the "law" state, and the number of years of FARS data available.

For each state, two ratios were calculated, one for the period prior to the law's enactment in the law state and a second for the period after the law's enactment. The before and after ratios each represented the proportion of fatal crashes in which a fatally injured driver had a BAC above 0.08% divided by the total number of fatal crashes. The proportional change between the before and after periods was calculated for each state. Finally, the proportional change in the law state was expressed as a proportion of the change in the comparison state. If this last ratio is less than 1.0, the law state had a larger drop in the targeted crash type (or smaller increase) from before to after enactment of the law than did the comparison state. If the ratio is greater than 1.0, the comparison state dropped more or increased less than the law state. If enactment of a 0.08% BAC law has an affect on driver behavior, it is expected that the ratios of law to comparison states would be less than 1.0.

RESULTS

Table 1 displays the results presented in the original Hingson et al study. The order of some of the items in the table is changed from the original in order to maintain consistency with that study's Methods section.

Table 1: Results from Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.78
	Idaho	.15	.22	1.43	
2	Oregon (.08 state)	.29	.24	0.85	0.82
	Washington	.28	.29	1.05	
3	Maine (.08 state)	.26	.22	0.86	0.82
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.19	0.88	0.82
	Texas	.20	.21	1.08	
5	Vermont (.08 state)	.25	.25	1.01	1.45
	New Hampshire	.22	.15	0.69	
	OVERALL				0.84[4]
	TRUE MEAN				0.93[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.
2 The proportional change (PC) is found by 1+(After-Before)/Before.
3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).
4. The overall number as presented by Hingson et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

Table 2 presents the data from an exact replication of the Hingson et al. study. The slight differences in the data presented in Table 2 and Table 1 is attributable to the differences in data sets used in the two studies. The original study used data supplied on tape from the Bureau of Transportation Statistics based on the FARS "frozen file" whereas the current replication used data from a more recent FARS data release supplied by the Bureau on CD-ROM.

Table 2: Exact Replication of Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	0.79
	Idaho	.15	.21	1.41	
2	Oregon (.08 state)	.29	.24	0.84	0.81
	Washington	.29	.29	1.03	
3	Maine (.08 state)	.26	.22	0.86	0.92
	Massachusetts	.22	.21	0.93	
4	California (.08 state)	.22	.20	0.91	0.84
	Texas	.20	.21	1.08	
5	Vermont (.08 state)	.33	.28	0.84	1.33
	New Hampshire	.24	.15	0.63	
	OVERALL				0.86[4]
	TRUE MEAN				0.94[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.
2 The proportional change (PC) is found by 1+(After-Before)/Before.
3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).
4. The overall number as presented by Hingson et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

Note that in all cases, the data in Table 2 are comparable to those presented by Hingson et al. In particular, the final Ratio of Change in the replication compares closely to that presented in the original study whether using the "overall" measure (as in Hingson et al.) or taking the true mean of the results from the five state pairs.

Table 3 presents a replication of Hingson et al. using a different set of comparison states. These choices were made based on three criteria:

1) The state must be listed as having a .10 legal BAC limit in Table 116 of the 1994 NHTSA Traffic Safety Facts Report (August 1995). This table lists the Administrative and Illegal Per Se BAC levels as of the closing date of the publication. Hence, any state with a listed BAC level of 0.10 had that limit as of

the closing date of the publication. Note that two of the comparison states used in the Hingson et al study (Massachusetts and New Hampshire) are listed in this 1994 table as having a .08 law on the books.

2) The state must be in "close" geographic proximity (preferably bordering) the .08 state.

3) The state must not have been used as a comparison state in the original study.

Table 3: Changed Comparison States in a Replication of Hingson, Heeren & Winter (1996) — Proportion of Fatal Crashes with a Fatally Injured Driver Whose Blood Alcohol was .08% or More, Before and after the Passage of .08% Legislation

Pair No.	State	Before[1]	After[1]	Proportional Change[2]	Ratio of Change[3]
1	Utah (.08 state)	.14	.16	1.11	1.25
	Colorado	..30	.26	0.88	
2	Oregon (.08 state)	.29	.24	0.84	0.71
	Wyoming	.25	.29	1.19	
3	Maine (.08 state)	.26	.22	0.86	0.62
	Rhode Island	.21	.29	1.39	
4	California (.08 state)	.22	.20	0.91	1.15
	Arizona	.16	.13	0.79	
5	Vermont (.08 state)	.33	.28	0.84	0.71
	New York	.25	.29	1.19	
	OVERALL				0.95[4]
	TRUE MEAN				0.89[4]

1 The Before and After ratios are the total number of fatal crashes involving a fatally injured driver with BAC >= .08 divided by all fatal crashes.

2 The proportional change (PC) is found by 1+(After-Before)/Before.

3. The ratio of the changes is found by PC(.08 state)/PC(comparison state).

4. The overall number as presented by Hingson et al. is based on the raw data from each of the states, not on the average of the Ratio of Change.

CONCLUSIONS

In the original study by Hingson, Heeren, and Winter (1996), choices were made in the selection of comparison states and in the presentation of data that affected the results and their interpretation. Changing none of the basic assumptions, but using a more conservative estimator of the effect of .08 legislation resulted in a marked reduction in the size of the effect (compare the "Overall" to the "True Mean" in Tables 1 and 2). Use of the mean is predicated on the logic implied in Hingson et al.'s methodology. Each state pair is, in effect, a replication of the before/after comparison between a .08 state and some other state. Hingson et al. used a measure that was sensitive to the relative amounts of data contributed by each state pair (e.g., the California/Texas pair counted far more than the Vermont/New Hampshire pair by virtue of the number of crashes in the two larger states). Both the Hingson et al. measure and one based on the mean of the five state pairs are presented here in order to facilitate comparison at the conceptual level. The "overall" measure is designed to give some idea of what the multi-state (national?) affect of implementing .08 laws at the state level could be. The mean of the five state pairs gives a truer estimate of the effectiveness of those laws when comparing between members of state pairs, one of which had a .08 law and one of which did not.

Both measures, however, are predicated on the assumption that the comparisons between states (.08 and not) is valid. In order to use these measures to make inferences about the laws' effects, we must be willing to believe that the only important difference between the .08 and comparison state in each pair is the presence or absence of a .08 law on the books. Were this true, the results of the study would not vary substantially if different, logically selected, comparison states were used in place of those from the original study. In fact, however, changing the comparison states had an enormous impact on the results of the study.

In Tables 1 and 2 it can be seen that only one of the five "Ratio of Change" went in the opposite direction of that predicted. (Hingson et al. hypothesized that the ratio of change between .08 and comparison states should be less than 1.0. In Table 3 it may be seen that two of the ratios are now above 1.0. In fact, changing the comparison states caused **3 of the 5** ratios to change direction. One that was above 1.0 dropped in the predicted direction, but two that were below 1.0 in the original study were above 1.0 in the replication with changed comparison states.

Without replicating the Hingson et al. "Meta-analysis" in its entirety, it was not possible to obtain standard errors for the "overall" measures calculated in the present study. Suffice it to say, however, that when the mean of the Ratios of Change was calculated in Tables 1, 2 and 3, the Standard Deviation was high enough so that the 95% confidence limits included the value 1.0 in all cases. In short, there is no statistical support for concluding that the laws had any effect on driver behavior as expressed in the probability of a legally drunk driver becoming a fatality in a traffic crash.

REFERENCES

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