Filed in District Court
State of Minnesota
8/18/2021 4:25 PM

Exhibit G

POLICY BRIEF
Minnesota House of Representatives
Research Department
600 State Office Building
St. Paul, MN 55155

March 1994

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The 0.08 Alcohol Concentration Limit

One recently proposed DWI countermeasure would lower from 0.10 to 0.08 the "per se" level -- i.e., the legal limit for a driver's alcohol concentration. This policy brief describes that proposal and examines several fundamental questions pertaining to it.

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Introduction

"**Per se level**" refers to the legal limit for a driver's alcohol concentration. This is the level at and above which it is illegal, in itself (i.e., per se), to be driving a motor vehicle. The general **per se level** in Minnesota is 0.10, or one-tenth of one percent of alcohol in the bloodstream. For commercial motor vehicle drivers and airplane pilots the **per se level** is 0.04.

NHTSA is the acronym for the **National Highway Traffic Safety Administration**. While **NHTSA** has little direct authority in controlling drinking driving, it influences states' policies primarily through its qualifying conditions for certain federal incentive grants to states. **NHTSA** is regarded as the chief advocate for lowering the per se limit.

Drinking and driving has long been regarded as a serious public health and public safety issue. In 1992, the most recent year for which data are available, 229 people were killed and 5,837 injured in Minnesota in alcohol-related motor vehicle crashes. These figures represent at least 39 percent of all deaths and at least 15 percent of all injuries due to motor vehicle crashes statewide.[1]

Alcohol-related crashes incur significant social and economic costs. In 1992, alcohol-related fatalities in Minnesota cost an estimated $99,000,000 in lost wages, medical expenses, insurance administration costs, and motor vehicle damage.[2] Significant costs also accompanied the numerous alcohol-related crashes in which injuries or property damage occurred.

One recently proposed and widely debated drinking driving countermeasure would lower the per se level, which is the legal limit for a driver's alcohol concentration (AC), from 0.10 to 0.08. The trend to lower the per se level stems from greater knowledge of the risks associated with drinking and driving and continued public support for tougher drinking driving laws. The findings from recent empirical research on the effects of alcohol impairment on driving suggest that even small doses of alcohol may have a deleterious effect on driving related skills. Numerous studies show that many driving related skills become significantly impaired at or below alcohol concentration levels of 0.08 and some skills become impaired at 0.05 AC or less.[3] Several professional associations and other groups support reductions in alcohol concentration limits to 0.08 or 0.05, including the American Medical Association, National Highway Traffic Safety Administration, National Safety Council, International Association of Chiefs of Police, and Mothers Against Drunk Driving.[4]

Opponents of a reduction in the legal alcohol concentration limit include such representatives of the alcohol industry as the American Beverage Institute (ABI), the National Beer Wholesalers' Association, the Beer Institute, and Miller Brewing. Of these groups, the ABI is arguably the most vocal opponent. These opponents argue that the proposed 0.08 per se level "is arbitrary, unnecessary, and targeted at the wrong population."[5] The ABI asserts that there is no clear empirical evidence suggesting that reduced alcohol concentration standards lead to a reduction in highway fatalities. Furthermore, court records reveal that the majority of drivers convicted of driving while intoxicated have blood alcohol concentration

ABI refers to the **American Beverage Institute**, arguably the most outspoken opponent of lowering the per se level. In this report, "opponents of the 0.08 policy" generally refers to the **ABI**.

Those opposed to lowering the alcohol concentration limit contend that the proposed 0.08 per se level "is arbitrary, unnecessary, and targeted at the wrong population."

The trend to lower the alcohol concentration limit stems from greater knowledge of the risks associated with drinking and driving and continued public support for tougher drinking driving laws.

levels far exceeding the legal limit of 0.10. These drivers also are most often the victims in alcohol-related fatal crashes.

Consequently, those opposed to the more restrictive standard assert that this strategy will affect only the less intoxicated and least dangerous drivers, and that a more effective approach would be to emphasize enforcement policies that target drivers with high alcohol concentration levels, since these drivers represent the greatest threat to public safety and are responsible for most of the costs and damage resulting from alcohol-related crashes.[6] For example, Richard Berman, executive director of the ABI, contends that:

> "increased enforcement, harsher sentences, and intervention programs to identify and treat the problem drinker are the answer to the threat posed by drunk driving."[7]

This policy brief addresses several important questions related to any proposal for lowering the per se limit to 0.08 in Minnesota. The answers to some of these questions are based on the results of several years of empirical research; others are derived from pioneering studies or the "best guesses" of experts. For some questions, there are only assertions and counterassertions about likely effects; such opposing views are presented for the reader's own appraisal.

Scientific evidence of the negative effects of alcohol impairment on driving ability appear to support the reduction of the per se level to 0.08, yet little is known about the practical implications of reducing the per se level for law enforcement agencies and the court system. Thus far, California is the only state to undertake a systematic evaluation of the effects of the change to the 0.08 per se level. The results of that evaluation recently appeared in a controversial report published by NHTSA. Findings from that study are interpreted with caution for this brief due to the recent criticisms and absence of any similar studies.

In policy briefs such as this one, the House Research Department does not take a position or make recommendations. The intent here is to describe the proposed policy as thoroughly and objectively as possible and to discuss the implications of the policy using the best evidence available. It is assumed that the reader will factor this information with his or her other concerns to arrive at a conclusion about the viability of the policy.

How Many Drinks Does It Take To Reach 0.08 AC?

The amount of alcohol that must be consumed to reach an alcohol concentration level of 0.08 is affected by several factors including gender, body weight, ingestion of food, and duration of the drinking episode.

The amount of alcohol that must be consumed to reach an alcohol concentration level of 0.08 is affected by several factors including gender, body weight, ingestion of food, and duration of the drinking episode.[8]

Women usually reach higher peak alcohol concentration levels than men when given identical weight-adjusted doses of alcohol.[9] The intoxicant in alcoholic beverages is ethanol. Ethanol, a water soluble and fat insoluble substance, is distributed throughout the total body water after alcohol is consumed. Thus, the concentration of ethanol in the body is inversely related to an individual's total volume of body water.

The average man is comprised of approximately 58.3 percent water, while the average woman is approximately 48.5 percent water.[10] These figures suggest that the total volume of distribution available in a man and woman of equal weight often is greater in the man, which decreases the man's alcohol concentration level relative to the woman's after each has had the same number of drinks.

The term "**standard drink**" refers to the quantity of alcohol in one 5 ounce glass of wine (12% alcohol by volume), 1 1/2 ounces of spirits (40% alcohol by volume), or a 12 ounce glass of beer (5% alcohol by volume).

For example, a 150 pound man has a total volume of body water of 39.75 kilograms: Multiplying his weight in kilograms (68.18) by his average percent of body water (58.3 percent) yields a total volume of body water of 39.75 kilograms. In contrast, a 150 pound woman who is approximately 48.5 percent water has a total volume of body water of 32.72 kilograms. If each consumes 13.6 grams of ethanol, the amount of ethanol in one standard drink, the concentration of ethanol in the man's body water will be 13.6 ÷ 39.75 = .342. Multiplying this result by .8 corrects for the percentage of body water in blood and yields 27.4 milligrams of alcohol per 100 milliliters of blood, or 0.027 AC. Completing the same calculations for the 150 pound woman shows that her alcohol concentration level after one drink, 0.033, is slightly higher than the man's [(13.6 ÷ 32.72) x .8 = 32.9 milligrams of alcohol per 100 milliliters of blood or 0.033 AC].

Total volume of body water also is responsible for the influence of body weight on alcohol concentration levels as volume of body water increases with body weight.

The ingestion of food also affects alcohol concentration levels. Food in the stomach slows the absorption rate of alcohol and results in a longer period over which alcohol remains in the body.[11] Consequently, a lower peak AC level will be obtained if alcohol is consumed with or after the consumption of food.

A 130 pound woman who consumes two standard drinks will reach a peak alcohol concentration level of 0.077, nearly the proposed 0.08 per se level. If she consumes three standard drinks, the same woman will reach a peak AC level of 0.116, which is beyond the current limit of 0.10.

A fourth important variable in determining alcohol concentration levels is the duration of time over which the alcohol is consumed. As soon as alcohol is ingested, it begins to be metabolized by the body. Thus, other things being equal, the more slowly the alcohol is ingested, the greater the proportion that is metabolized during the drinking session and the lower the drinker's alcohol concentration level.

On average, the rate of metabolism[12] for an adult is 15 milligrams of ethanol per 100 milliliters of blood per hour or 0.015 AC per hour.[13] As shown above, a 150 pound man who consumes one standard drink will reach a peak alcohol concentration level of 0.027. If he does not have a second drink, his AC level will decrease to 0.012 after one hour (0.027 - 0.015 = 0.012). Generally, peak AC levels are reached between 30 and 90 minutes after the last drink is consumed.[14]

The following tables present the estimated alcohol concentration levels over time for a 130 pound woman and a 175 pound man by number of standard drinks. The alcohol concentration levels reported in these tables were computed using the total body water averages and metabolic rate cited above, and assumes the person has not eaten recently.

A 175 pound man may consume three standard drinks and his peak alcohol concentration level will remain below 0.08. If he consumes a fourth drink, his peak AC level will be 0.094, and after one hour his AC level will be approximately 0.08.

Table 1 shows that a typical 130 pound woman who consumes two standard drinks will reach a peak alcohol concentration level of 0.077, nearly the proposed 0.08 per se level. After one hour, her alcohol concentration level will decrease well below this limit. If she consumes three standard drinks, the same woman will reach a peak AC level of 0.116. Her AC level still will be just over 0.08 after two hours provided that she does not consume additional alcohol.

Table 2 reveals that a typical 175 pound man may consume three standard drinks and his peak alcohol concentration level will remain below 0.08. If he consumes a fourth drink, his peak AC level will be 0.094; after one hour, his AC level will be approximately 0.08 provided that he does not have a fifth drink.

Table 1
Estimated Alcohol Concentration Levels by Number of Drinks:
for a 130 Pound Woman

AC Level	Number of Standard Drinks* One	Two	Three	Four	Five
At the peak**	.038	.077	.116	.144	.194
After 1 hour	.023	.062	.101	.139	.179
" 2 hours	.008	.047	.086	.124	.164
" 3 hours	-	.032	.071	.109	.149
" 4 hours	-	.017	.056	.094	.134
" 5 hours	-	.002	.041	.079	.119
" 6 hours	-	-	.026	.064	.104

* The term "standard drink" refers to the quantity of alcohol in one 5 ounce glass of wine (12% alcohol by volume), 1 1/2 ounces of spirits (40% alcohol by volume), or a 12 ounce glass of beer (5% alcohol by volume).
** Peak alcohol concentration level is generally attained within 30 to 90 minutes after the last drink.

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Table 2
Estimated Alcohol Concentration Levels by Number of Drinks
for a 175 Pound Man

AC Level	Number of Standard Drinks* One	Two	Three	Four	Five
At the peak**	.023	.047	.071	.094	.118
After 1 hour	.008	.032	.056	.079	.103
" 2 hours	-	.017	.041	.064	.088
" 3 hours	-	.002	.026	.049	.073
" 4 hours	-	-	.011	.034	.058
" 5 hours	-	-	-	.019	.043
" 6 hours	-	-	-	.004	.028

* The term "standard drink" refers to the quantity of alcohol in one 5 ounce glass of wine (12% alcohol by volume), 1 1/2 ounces of spirits (40% alcohol by volume), or a 12 ounce glass of beer (5% alcohol by volume).
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Can a Person Accurately Judge His or Her Own Alcohol Concentration Level?

There is no practical way for a driver to accurately estimate his or her own alcohol concentration level.

Proof refers to alcoholic strength indicated by a number that is twice the percent by volume of alcohol present. For example, whiskey that is 90 **proof** is 45% alcohol.

There is no practical way for a driver to accurately gauge his or her own alcohol concentration level; the variability in the amount and proof of alcohol in many drinks as well as individual differences in body water to fat ratios and metabolic rates preclude a reliable estimate.[15]

In a 1990 Minnesota roadside survey study of 2,857 randomly sampled drivers, 438 were found to have alcohol concentration levels of at least 0.02.[16] Each was informed that 0.10 AC was the legal limit and was then asked to estimate his or her own AC. The study revealed that drivers with more than 0.05 AC strongly tend to underestimate their AC levels, and that this tendency to underestimate one's own AC increases with consumption. Nearly all of those drivers with ACs of 0.10 or more underestimated their own ACs. Every driver with an AC of 0.15 or more underestimated his or her own AC. Furthermore, underestimations were far more likely among drivers under age 21 than among older drivers.

A study in which experimentally naive subjects were administered different amounts of alcohol also revealed that the ability to estimate one's own alcohol concentration decreases as the quantity consumed increases.[17] Yet another study suggests that the discrepancy between subjective impairment ratings and actual impairment of driving performance appears greatest when alcohol concentration levels are falling.[18] Thus, impaired drivers who wait for a time (even one to two hours) to "sober up" following their last drink, could readily underestimate their continuing impairment.

Accordingly, people most likely to be impaired are the very ones least likely to accurately judge their own alcohol concentration levels. Consequently, some researchers contend that AC tables such as those presented above provide drivers with the best estimate of their AC level and should be carried by anyone who plans to drink any amount of alcohol and drive.[19]

Why the Trend to Lower the Legal Limit?

The regulation of drinking driving is primarily a state responsibility. However, the federal government, through NHTSA, has advocated a number of drinking driving counter-measures, including lowering the alcohol concentration limit to 0.08.

The regulation of drinking and driving is primarily a state responsibility. However, in recent decades the federal government, through NHTSA, has advocated a number of drinking driving countermeasures and incorporated them into a set of qualifications for obtaining certain federal traffic safety incentive funds. One of these qualifications involves lowering the alcohol concentration to 0.08. NHTSA's proposal needs to be understood in its historical context.

Drinking driving laws were difficult to apply before the advent of chemical tests for alcohol because alcohol impairment had to be determined by an officer based upon his or her interpretation of behavioral cues or other physical evidence.[20] The ability to test bodily substances for alcohol came about in the 1940s, prompting legislation allowing police to request these tests for suspected impaired drivers and easing enforcement problems. Prosecuting impaired drivers also became easier as prosecutors were allowed to employ the results of AC tests as evidence of impairment in court.

The early absence of research into the effects of alcohol impairment on driving ability led to the setting of initially quite high alcohol concentration standards of impairment, above which virtually all drivers were expected to be visibly impaired.

The early absence of research into the effects of alcohol impairment on driving ability led to the setting of initially quite high alcohol concentration standards of impairment, above which virtually all drivers were expected to be visibly impaired. In most states, legislatures followed the recommendations of the American Medical Association and established a "presumptive" alcohol concentration limit of 0.15.[21] A presumptive AC limit establishes a point above which a driver is presumed to be impaired, but this presumption can be refuted in court if contrary evidence exists. Many states also set a presumptive limit of 0.05 AC as the limit below which a driver was presumed not to be under the influence of alcohol.

In Minnesota, the first presumptive limits were established in 1955.[22] Similar to the early laws of most states, Minnesota law stipulated that drivers with alcohol concentration levels at or above 0.15 were presumed to be impaired while those with alcohol concentration levels at or below 0.05 were presumed to be unimpaired. Evidence of alcohol concentration levels between these two points was regarded as "relevant" evidence of a driver's impairment.

During the 1960s and 1970s, the results of epidemiological and pharmacological studies increasingly showed a positive relationship between driver alcohol concentration level and crash risk. The results of this research, coupled with improvements in alcohol concentration testing technology,

induced most states to lower their alcohol concentration limits to 0.10.[23] Forty six states also changed the nature of their alcohol concentration laws from presumptive to "per se," making it a crime in itself for a driver to have an alcohol concentration in excess of the legal limit. In Minnesota, the alcohol concentration limit was reduced to 0.10 in 1967[24] and changed from presumptive to per se in 1971.[25]

The movement to reduce the alcohol concentration limit to 0.10 was based on mounting scientific evidence of the effect of alcohol on driving related skills. However, the 0.10 per se standard was still a somewhat arbitrary cutoff.

As stated above, the movement to reduce the alcohol concentration limit to 0.10 was based on mounting scientific evidence of the effect of alcohol on driving related skills. Nevertheless, the 0.10 per se standard was still a somewhat arbitrary cutoff. Little was known at that time about the effect of lower doses of alcohol on driving ability as few studies had examined alcohol concentration levels below 0.10.

Many more-recent studies, however, conclude that the ability to drive generally becomes impaired when drivers attain alcohol concentration levels as low as 0.05.[26] This finding, combined with continued public support for tougher laws against drinking and driving, has helped persuade several state legislatures to further lower their alcohol concentration limits. By 1991, California, Oregon, Utah, Maine and Vermont lowered their per se levels to 0.08. Five additional states–North Carolina, New Mexico, New Hampshire, Florida and Kansas–passed similar legislation in 1993
(Table 3). In addition, more restrictive alcohol concentration standards have been adopted in several foreign countries. Great Britain, Austria, Switzerland, Canada, and most Australian states have set their alcohol concentration limits at 0.08; Norway, Finland, the Netherlands and the remaining Australian states have adopted a 0.05 standard; and Sweden has set its alcohol concentration limit at 0.02 (Table 4).[27]

Many recent research studies focusing on the effects of low doses of alcohol on driving ability conclude that the ability to drive becomes impaired when drivers attain alcohol concentration levels as low as 0.05.

Additionally, 20 states have recently enacted lower alcohol concentration standards for drivers under 21, ranging from a high of 0.07 in Texas to a low of 0.00 in six states.[28] In some states, violation of such law constitutes a full fledged DWI violation. However, Minnesota's law merely provides for administrative license suspension triggered by conviction for violation of the state's underage drinking laws, provided that the person committed the offense while driving a motor vehicle. Thus, unless the youth's alcohol concentration is in excess of 0.10, the offense is not recorded as an actual DWI violation.[29]

Table 3
States with a 0.08 Per Se Policy By Year

State	Year Effective
Oregon	1983
Utah	1983
Maine	1988
California	1990
Vermont	1991
North Carolina	1993
Kansas	1993
Florida	1994
New Hampshire	1994
New Mexico	1994

* Source: National Conference of State Legislatures

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Table 4
Foreign Countries with Per Se Levels Below 0.10 AC

0.09 AC	0.08 AC	0.05 AC	0.03 AC	0.02 AC
India	Australia*	Australia*	Czechoslovakia	Sweden
	Austria	Finland		
	Canada	Iceland		
	Denmark	Japan		
	France	Netherlands		
	Great Britain	Norway		
	New Zealand			
	Sri Lanka			
	Switzerland			

* Most Australian states have set their per se standard at 0.08; the remainder have set it at 0.05.
** Source: NHTSA.

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At What Level of Alcohol Concentration Do Drivers Actually Become Impaired?

Numerous laboratory studies of the pharmacological effects of alcohol and epidemiological analyses of traffic accident data conclude that relatively low alcohol concentration levels significantly impair the ability to drive a motor vehicle.

Laboratory Studies

NHTSA recently conducted a meta-analysis of all laboratory studies of the effects of alcohol on driving related skills.[30] Over 500 studies were located; 177 met the selection criteria employed by NHTSA and were retained for analysis. The results are grouped into nine behavioral categories and summarized below.

Numerous laboratory studies of the pharmacological effects of alcohol and epidemiological analyses of traffic accident data conclude that relatively low alcohol concentration levels significantly impair the ability to drive a motor vehicle.

Divided Attention: Most studies find impairment of divided attention at or below the alcohol concentration level of 0.08; some studies find impairment begins at less than 0.02. This finding is important because driving is a multi task operation requiring a driver to employ several skills simultaneously.

Tracking Performance: Tracking is one of the principal components of driving. Three types of tracking are addressed in the studies reviewed: compensatory tracking, critical tracking, and pursuit tracking. Compensatory tracking involves making inputs to a task to maintain an index at a predetermined position, such as when a driver acts to maintain a vehicle in its lane. Critical tracking is an unstable form of compensatory tracking. Pursuit tracking is more complicated than either compensatory or critical tracking, requiring a control index to be maintained in a constant position relative to another moving index. Most studies of tracking performance find onset of impairment at or below 0.05 AC. Impairment of pursuit tracking, which involves a divided attention situation, occurs at even lower alcohol concentration levels.

Information Processing: Studies of information processing suggest that this skill becomes impaired at or below alcohol concentration levels of 0.08; however, only a few of the studies examined AC levels below 0.05.

Psychomotor Skills: Tasks requiring skilled motor performance and coordination (tasks combining steadiness

or coordination measures with speed and accuracy tasks) are more likely to become impaired at lower alcohol concentration levels than other psychomotor tasks. Skilled psychomotor tasks often become impaired at 0.05 AC, while psychomotor tasks requiring less skill become impaired at higher levels.

Visual Functions: Ocularmotor control, which refers to the control of eye movement, tends to become impaired at alcohol concentration levels of 0.05 or less. Other visual functions, including glare recovery, visual acuity, and flicker fusion, do not appear impaired at low or moderate AC levels.

The majority of laboratory studies of alcohol and driving related skills conclude that most driving related skills become significantly impaired at AC levels below 0.08.

Reaction Time: Complex reaction time (i.e., involving a choice decision) becomes impaired at lower alcohol concentration levels than simple reaction time (i.e, with no choice involved). In general, reaction time is not as sensitive to low AC levels as other types of driving skills. An exception to this finding occurs when accuracy is considered. Most studies including a measure of accuracy find that complex reaction times can become impaired at AC levels of 0.03 to 0.04; in contrast, simple reaction times appear to become impaired at 0.04 or more. Studies not taking accuracy into account find that reaction times become impaired at or above 0.10 AC.

Some critical skills, including tracking ability, reaction time, skilled psychomotor tasks, and ocularmotor control become impaired at AC levels at or below 0.05.

Concentrated Attention: Concentrated attention, measured by fixation in a visual field and peripheral vision, appears to be the driving related skill least impaired by alcohol. No study included in the review found impairment below 0.05 AC and most did not find impairment below 0.08 AC.

Perception: Most studies find little impairment of perception below 0.08 AC. Typically, measures of perception include the distribution in space of eye fixations and the duration of fixation.

Driving (in a simulator or on road driving): The findings from studies employing driving simulators vary considerably; much of this variation stems from the diversity of behavioral demands imposed by the driving tasks. Some studies find that alcohol concentrations as low as 0.03 produce significant impairment of driver performance. Most studies find that AC levels of 0.08 or lower impair a driver's accuracy of steering, braking, speed control, lane tracking, gear changing, and judgements of speed and distance in the driving situation.

The majority of laboratory studies of alcohol and driving related skills conclude that most, but not all, driving related skills become significantly impaired at alcohol concentration levels below 0.08. Some critical skills -- including reaction time, tracking ability, skilled psychomotor tasks, and ocularmotor control -- become impaired at AC levels at or below 0.05.

Table 5
Alcohol Concentration Level at which Various Driving Skills Become Impaired

Driving Related Skill	AC Level at which Skill is Impaired
Complex Reaction Time	0.03
Simple Reaction Time	0.04
Tracking Skilled Psychomotor Tasks Ocularmotor Control	0.05
Divided Attention Information Processing Driving Related Tasks (steering, braking, speed control, lane tracking, gear changing, judgements of speed and distance)	0.08
Concentrated Attention Perception	0.09 to 0.10

* Source: NHTSA review of published findings.

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Epidemiological Studies

After controlling for drinking frequency, their analysis revealed that crash risk among all drivers with alcohol concentration levels of 0.08 or higher was 175 times greater than non drinking drivers.

Drivers who drank only yearly were at the greatest risk of being involved in a crash. At 0.08 AC, yearly drinkers were nearly 1,000 times more likely to be involved in a crash, compared to sober yearly drinkers.

Epidemiology is the study of the occurrence of a phenomenon among naturally occurring subpopulations. Many epidemiological studies employ traffic accident data to examine the relationship between alcohol concentration levels and accident risk. A recent and notable study of this relationship, conducted by Zador,[31] examines the alcohol concentration levels of drivers killed in single vehicle crashes to determine the relative risk of death accompanying different alcohol concentration levels. According to Zador, the risk of being killed in a single vehicle crash relative to drivers who had not been drinking is 11 times greater for drivers with alcohol concentrations between 0.05 and 0.09, 48 times greater for drivers with AC levels between 0.10 and 0.14, and 380 times greater for drivers with AC levels of 0.15 or more. Zador also found that at comparable AC levels the fatality risk is greater among females and drivers under the age of 20 years when compared to males and drivers over 20 years of age. The results of Zador's research suggest that driver fatality risk increases considerably at alcohol concentrations as low as 0.05, and this risk is even higher among certain population subgroups (Table 6).

Table 6
Fatality Risk for Drivers in Single Vehicle Crashes At Various Alcohol Concentration Levels: Relative to Non-Drinking Drivers

AC Level	Fatality Risk
0.05-0.09	11 times greater
0.10-0.14	48 times greater
0.15 or higher	380 times greater

* Source: Zador study, 1991.

Additional epidemiological studies corroborate Zador's findings. A reanalysis of data first evaluated in one of the earliest studies of this kind, the Grand Rapids study,[32] revealed dramatic increases in crash risk accompanying higher alcohol concentration levels as well as increased risk among subgroups of drivers.[33] After controlling for drinking frequency, the analysis revealed that crash risk among all drivers with alcohol concentration levels of 0.08 or higher was at least 175 times greater than non drinking drivers. Drivers who drank three times a week had the lowest crash risk at 0.08 AC; nevertheless, compared to their sober counterparts, these drivers still were approximately 125 times more likely to be involved in a crash. Drivers who drank only yearly were, when drinking, at the greatest risk of being involved in a crash; at 0.08 AC, yearly drinkers were nearly 1,000 times more likely to be involved in a crash, compared to sober yearly drinkers.

In sum, the majority of laboratory studies and epidemiological analyses conclude that the impairment of driving ability often begins at low alcohol concentration levels and increases markedly as the level of alcohol concentration increases.

Summary of the Empirical Research

In sum, the majority of laboratory studies and epidemiological analyses conclude that the impairment of driving ability often begins at low alcohol concentration levels and increases markedly as the level of alcohol concentration increases. However, research does not reveal an alcohol concentration "threshold" at which the impairment of driving related skills begins or below which no impairment is found.[34] The findings from laboratory studies indicate that some driving related skills become significantly impaired at AC levels as low as 0.03 while other skills are relatively unimpaired at AC levels of 0.08 or more.

However, research does not reveal an alcohol concentration "threshold" at which the impairment of driving related skills begins or below which no impairment is found.

Additionally, alcohol consumption does not impair the driving ability of all drivers uniformly. Variables such as age, gender, and driving experience appear to mediate the effect of alcohol concentration level on driving ability; consequently, as little as one drink may impair the driving related skills of some drivers while the skills of others may appear relatively unaffected by such low doses. A few recent studies also suggest that some driving related skills are more impaired when alcohol concentration levels are increasing than when AC levels are decreasing relative to the peak AC reached.[35] Despite these caveats, many researchers cite 0.05 AC level as the point above which most skills and most drivers show signs of impairment.

Would It Be Difficult to Detect Drivers Between 0.08 and 0.10 AC?

Enforcement of alcohol concentration limits depends primarily upon observations of deviant driving. However, some drivers do not exhibit these cues at lower AC levels, making police stops of drivers with lower AC levels unlikely.

Enforcement of alcohol concentration limits depends primarily upon observations of deviant driving, indicating to an officer that a driver might be impaired. These observations form the basis of the reasonable suspicion that police officers are required to have to stop a vehicle. However, some drivers do not exhibit these cues at lower AC levels, making police stops of drivers with lower AC levels unlikely[36] and, in fact, potentially unlawful.[37]

A crude estimate of the likelihood of detecting drivers with low alcohol concentration levels can be derived from the number of alcohol content reports being filed by Minnesota law enforcement officers. Officers are required to file an alcohol content report for each driver stopped and administered a preliminary breath test (PBT), and found to have an AC level just under the legal limit (i.e., between 0.07 and 0.09). In 1992, Minnesota law enforcement officers filed 1,205 alcohol content reports.

For several reasons, this number is an inexact estimate of the ability to detect drivers with alcohol concentration levels between 0.08 and 0.10. First, it includes an alcohol concentration level (i.e. 0.07) that would not be affected by a reduction in the standard to 0.08. Second, officers are not necessarily motivated to detect drivers with ACs in the 0.07 to 0.09 range, since those AC levels are less than the current per se level. Finally, the accuracy of this number is itself uncertain. Police officers are mandated to submit alcohol content reports to the Department of Public Safety, but it is not known how consistently they comply with this mandate. Still, this number is fairly small relative to the roughly 35,000 drinking driving arrests made annually, supporting the belief that drivers with low alcohol concentration levels are difficult to detect.

Would Current Alcohol Measurement Techniques Work with a 0.08 Limit?

The experience of California law enforcement officials following the implementation of the 0.08 standard suggests that law enforcement agencies can adapt to this lower standard with minimal changes.

Once a suspected drinking driver is stopped, police officers rely heavily on the standard field sobriety test (SFST) to develop probable cause to arrest an impaired driver and conduct a preliminary breath test. The SFST currently used by officers is designed to detect alcohol concentration levels of 0.10 or more. Thus, new procedures or techniques must be developed if officers are to detect AC levels as low as 0.08.[38]

The experience of California law enforcement officials following the implementation of the 0.08 standard suggests that law enforcement agencies can adapt to this lower standard with minimal changes. The primary modification that occurred in California was a new scoring system for the SFST. Some California officers also required training to recognize the subtle indications of alcohol impairment.[39]

Alternatives to modifications in the SFST include the use of passive alcohol sensors or greater use of PBTs; both of these alternatives would require additional or modified equipment and training procedures. Nearly all Minnesota law enforcement agencies currently possess or have access to PBT devices. Most of these devices employ a set of colored lights to indicate whether or not a driver's alcohol concentration level is beyond the legal limit. Currently, PBT devices are calibrated to detect three ranges of alcohol concentration levels: 0.003 to 0.055, 0.056 to 0.110, and 0.111 and beyond.[40] Drivers with alcohol concentrations in the last category "fail" the PBT and are arrested and detained for an evidentiary alcohol concentration test using a more sophisticated testing instrument, the Intoxilyzer.

PBT refers to a **preliminary breath testing device**. About the size of a pocket radio, a **PBT** is used to measure a DWI suspect's alcohol concentration level at the roadside. A driver failing the **PBT** test is typically arrested, taken to the police station, and given an evidentiary-quality test using the **Intoxilyzer**, a considerably more sophisticated breath testing device.

According to the Minnesota Bureau of Criminal Apprehension (BCA), PBT devices can be recalibrated to detect lower alcohol concentration levels. However, such recalibration would consume some time of BCA technicians and incur some monetary costs as well.

Current evidentiary breath testing devices accurately measure alcohol concentration levels to as low as 0.001.[41] Thus, law enforcement agencies would not need to change the methods employed to determine alcohol concentration levels after a driver is arrested.

Are Existing Enforcement and Court Resources Sufficient to Implement 0.08?

Opponents of the 0.08 per se level maintain that it would increase the number of DWI arrests and flood an already overburdened court system with new cases. They contend that this would result in an increased likelihood that some more-dangerous offenders would go unpunished, thereby diminishing the deterrent effect of the per se law.

Those opposed to the 0.08 per se level contend that a reduction in the alcohol concentration standard would have an adverse effect on the law enforcement and court systems. They posit that lowering the per se level to 0.08 would increase the number of DWI arrests and flood an already overburdened court system with new cases.[42] They contend that, unless there is a concurrent increase in resources, many apprehended DWI suspects would not be prosecuted or the charges against them would be plea bargained to a lesser charge than DWI; this would result in an increased likelihood that some of the more dangerous offenders would go unpunished thereby diminishing the deterrent effect of the per se law.

In contrast, proponents of lower per se levels suggest that, while tightening the limit would result in some increase in arrests and prosecutions -- at least initially and until the public adapts to the tighter standard -- such an increase probably would not be so dramatic as to overburden the system. Their rationale is that since officers generally must rely on deviant driving as an indicator of alcohol impairment and since there are generally fewer observable signs of impairment at lower alcohol concentration levels, the number of additional arrests would not be great. Support for this premise is generated by data on the AC levels of persons arrested for driving while intoxicated. In Minnesota, the average AC level of drivers apprehended for driving while intoxicated is between 0.15 and 0.18.

The Minnesota Department of Finance anticipates that a change to 0.08 in Minnesota would result in an additional 1,500 alcohol-related driving convictions annually, or a four percent increase.

The California study revealed that misdemeanor DWI arrests increased 11.1 percent in California following adoption of the 0.08 per se level. However, whether this increase was due to the change to the 0.08 limit or to some other factor is difficult to discern, since the simultaneous increase in adult misdemeanor arrests of all types was nearly two percentage points greater than that for misdemeanor DWIs. Furthermore, the increase in misdemeanor DWI arrests varied greatly by jurisdiction -- from a low of 2% to a high of 39% for the 12 jurisdictions examined. Thus, while some increase in DWI arrests in Minnesota could be expected following adoption of the 0.08 per se level, it is difficult to predict the amount of increase.

In its bill analysis for the 1993 legislative session, the Minnesota Department of Finance estimated that a change to the 0.08 per se level in Minnesota would result in an additional 1,500 alcohol-related driving convictions annually, or a four percent increase.

Given the limited experience of other states, such estimation appears to be largely educated guesswork.

The actual result might depend in part on the perceived intent of the change to the 0.08 per se level. The California study noted that at least some law enforcement agencies perceived the new 0.08 per se policy as signalling increased social disapproval of drinking driving, which encouraged them to step up their enforcement activities in various ways, thus possibly explaining the larger increases in some jurisdictions. Such efforts are likely to be self limiting -- i.e., when enforcement and court resource limits are encountered, the stepped up enforcement is likely to be reined in. Any change in DWI arrests is also likely to depend upon the degree of general public acceptance of the tighter per se limit, as well as the extent of eventual adaptation to the lower legal limit by the drinking driving public.

In California, the main impact on the court system of the change to the 0.08 standard was on prosecutors' decisions to file charges. It appears to have increased the certainty of prosecution for DWI at lower alcohol concentration levels.

It is also difficult to predict whether the likely increase in DWI cases would overload the court system. California's experience suggests it would not. Evaluation of California's court records showed no significant changes in the following measures following the implementation of the tighter standard: the proportions of DWI arrestees pleading guilty (95 percent) versus requesting jury trials, convictions, appeals, and sentencing patterns by judges (since California judges, the report notes, typically simply impose the mandatory minimum sentence for DWI). The study also found no significant increase in jail overcrowding.

The California study found that the main impact on the court system was on prosecutors and their decisions to file charges. Prior to the law change, prosecutors were reluctant to prosecute cases as DWI in which chemical tests showed the driver's alcohol concentration level was at or just above 0.10. Typically, drivers arrested for DWI with AC levels of 0.12 or 0.13 and below were charged with the lesser offense of reckless driving. Reduction of the limit to 0.08 led to the lowering of this point at which DWI charges were substituted with lesser charges to approximately 0.10 AC. Thus, the adoption of the 0.08 standard in California appears to have increased the certainty of prosecution for DWI at lower alcohol concentration levels.[43]

Would a 0.08 Limit Divert Enforcement Resources?

Would a 0.08 limit divert enforcement resources from more seriously impaired drivers or unfairly target social drinkers?

The claim by opponents to the 0.08 per se limit that a reduced per se level would affect only the least dangerous drinking drivers is difficult to assess due to the multitude of ways in which one may determine who is a "dangerous" driver. The opponents posit that recent data on fatal traffic accidents shows that the most dangerous drinking drivers are those with alcohol concentration levels exceeding 0.10. Both logic and data tend to support this claim. In 1991, 24 percent of all drivers involved in fatal crashes nationwide had AC levels of 0.10 or more, while only 7.2 percent had lower positive alcohol concentration readings.[44] In Minnesota, these figures were 21 and 8 percent, respectively.[45] Thus, of drinking drivers involved in fatal crashes, the vast majority -- about three-fourths -- have AC levels of 0.10 or more.

Recent data on fatal traffic accidents shows that the most dangerous drinking drivers are those with alcohol concentration levels exceeding 0.10.

Proponents of the 0.08 per se level agree that empirical evidence suggests the less impaired "social drinker" is less dangerous than the more impaired driver, but assert that both are nevertheless dangerous.

Proponents of the 0.08 per se level agree that empirical evidence suggests the less impaired "social drinker" is less dangerous than the more impaired driver, but assert that both are nevertheless dangerous. Both logic and data support this claim, as well. As mentioned previously, many driving related skills are significantly impaired at alcohol concentration levels between 0.05 and 0.08. Further, epidemiological studies show that drivers with AC levels as low as 0.05 are at considerably greater risk of being involved in an accident than drivers who abstain from alcohol.

To the extent that all impaired drivers -- whether above or just below the current per se limit -- are dangerous, it matters somewhat less where the enforcement focus would be placed under the policy of a 0.08 per se level. Nevertheless, given that the most seriously impaired drivers are indeed more dangerous, it is still a valid question to ask whether enforcement resources would be shifted from them to the less seriously impaired drivers.

Among enforcement agencies generally, such a refocusing would seem unlikely, since police must still have probable cause to detect, apprehend and arrest suspected drinking drivers and since, as has already been reasoned, not many drivers with alcohol concentrations in the 0.08 to 0.10 range would be easily detectable in general driving situations. Nevertheless, at enforcement checkpoints -- i.e., DWI roadblocks -- DWI arrests might be expected to include a higher proportion of drivers in the 0.08 to 0.10 range, since that enforcement setting provides more opportunity for detection (e.g., through smell) of the more marginally impaired drivers. However, the relatively high cost

and difficulty of properly administering DWI roadblocks results in only infrequent use of this enforcement technique in Minnesota and most other states.

It seems unlikely that with a change to 0.08 there would be any sizeable shift of enforcement resources toward the less impaired drivers.

For prosecutors and courts, on the other hand, such refocusing could become an unintended consequence of a change to 0.08, but only should they happen to decide to actually prosecute most of defendants with AC readings between 0.08 and 0.10, since defendants with readings just above any legal limit are more inclined to contest their DWI charge. This consequence, however, also seems unlikely in light of the control that prosecutors have in defining the AC level below which they routinely engage in charge reduction through plea bargaining. The California finding discussed earlier suggests that this point will be lowered under a 0.08 per se level policy (perhaps to about 0.10 or 0.11), but it will still exist. Thus, the likely result is that prosecutors will be more able to obtain guilty pleas for defendants in the approximate range of 0.10 to 0.13, without becoming overburdened with actually prosecuting DWI charges based on AC readings in the approximate range of 0.08 to 0.10.

How Many Crashes, Injuries and Fatalities Would Be Averted with a 0.08 Limit?

While it seems reasonable to expect some decrease in alcohol-related traffic crashes, injuries and fatalities from a change to the 0.08 per se level, any estimate of such effects at this time must be regarded as quite tentative.

It is difficult to predict what effect a tightening of the alcohol concentration standard would have on the number of alcohol-related traffic crashes, injuries, and fatalities in Minnesota. In California, the reduction in alcohol-related traffic fatalities following implementation in January, 1990 of the 0.08 per se level was estimated at 12%.[46] However, as the authors of the California study note, it is virtually impossible statistically to apportion that effect between 1) the reduction in the per se level to 0.08, and 2) the implementation of an administrative license revocation law in that state just six months later. They note that, due to the publicity surrounding the simultaneous legislative action on both countermeasures, part of the estimated fatality reduction impact may actually be due to the anticipatory effect of the administrative license revocation law. It is noteworthy that the California study found no corresponding reduction in non-alcohol-related fatalities in California, nor in alcohol-related fatalities nationwide.

The California study also analyzed alcohol-related crash data and, rather surprisingly, found some increase in this measure in two of the four study sites, though not statewide. The study convincingly notes, however, that the measure of alcohol-involvement in the case of non-fatal crashes is based on the subjective judgment of the attending officer rather than on alcohol concentration tests[47] (as used with fatal crashes[48]). It is quite possible that the law itself may have resulted in more conscientious reporting of alcohol involvement, thereby invalidating the use of this measure for evaluating the actual impact of the law. Thus, the finding regarding a 12% reduction in alcohol-related fatalities in California following implementation of the 0.08 per se level could not be corroborated using crash data. Unfortunately, it could not be corroborated using traffic injury data either, since that data was in a form that made it totally unavailable for use in the California study.

Critics of the California study take issue with that study's methodology and findings, and claim that the report offers no evidence to link any reduction in drinking driving deaths to California's 0.08 law.[49] Using a different methodology, the ABI claims that alcohol-related fatalities in California decreased only 6.1% in 1990, compared to a nationwide decrease of 6.3%.[50]

In light of the controversy surrounding the findings of the California study, it seems prudent to be cautious about

generalizing its fatality impacts to other states and situations. Nevertheless, if one were to generalize from California's experience, Minnesota might expect an annual reduction of perhaps 6% in the number of alcohol-related traffic fatalities following the implementation of the 0.08 standard. Based on 1992 figures, this translates to an annual savings of roughly 14 lives and approximately $6,300,000 in social costs associated with the would-be fatalities. Other health and cost savings would accrue from avoided injuries and property damage. While it seems reasonable to expect some decrease in alcohol-related traffic crashes, injuries, and fatalities with a tightening of the per se level, any estimate of such effects at this time must be regarded as quite tentative.

Would Drivers Adapt to the 0.08 Limit by Drinking Less?

Proponents claim that the intent of such legislation is not to decrease the consumption of alcohol but to decrease driving while impaired.

Proponents of the more restrictive alcohol concentration standard claim that the intent of such legislation is not to decrease the consumption of alcohol but to decrease driving while impaired and to prevent traffic accidents, injuries, and fatalities.

Nevertheless, it seems possible that a change to the 0.08 per se level would result in some decrease in alcohol consumption, particularly at drinking establishments and events that involve subsequent driving. The ABI voices this concern, asserting that a change to 0.08 would have a devastating effect on the hospitality industry.[51] However, available data appears to offer little support for this assertion.[52]

As noted, California's 0.08 legislation became effective in January, 1990. Given the strong publicity and high general awareness of the law change among Californians, one would expect any subsequent reduction in alcohol consumption to be rather immediate. Indeed, according to consumption data published by the Beer Institute, per capita wine consumption in California decreased by 6.3% during 1990. However, a closer inspection of the data reveals that such decrease is consistent with the downward trend in wine consumption in that state beginning in 1987 and continuing to the present; in fact the decrease in each of the two years prior to implementation of the 0.08 standard exceeded 9%. The same data source reveals that the consumption of malted beverages (i.e., beer) and distilled spirits (i.e., liquor), which also had been declining in recent years, actually increased very slightly in 1990.

Nevertheless, it seems likely that the sale and consumption of alcohol at drinking establishments and events that involve subsequent driving would in fact decrease.

It may be important to note that the greatest annual decrease in California's per capita consumption of malt beverages (-6.3%), distilled spirits (-14.9%), and wine (-10.5%) occurred in 1991, the second year following implementation of the 0.08 standard. It is reasonable to ask whether such decreases might be due to a delayed effect of the law change. It would seem more likely, however, that such decreased consumption was due to the combined effects of the factors driving the long-term downward trends coupled with a very significant alcohol tax increase in California, effective July 15, 1991.[53]

The inconsistent and weak decline in California's alcohol consumption levels following the change to the 0.08 standard initially seems incongruent with the 12% reduction in fatalities reported in the California study. However, this discrepancy might be explained by an increase in the proportion of adults choosing to drink in their home, rather than elsewhere, or to an

The ABI contends that the impact on the hospitality industry would be devastating, but the data does not appear to support that claim.

increase in the use of designated drivers to avoid driving after drinking. If such behavioral adaptation has in fact occurred, it might indeed result in some loss of business to the server industry without a concomitant decrease in alcohol consumption itself. Supporters of the 0.08 standard suggest that establishments that promote the "designated driver" concept may be less affected, as might those restaurants and bars that serve food and non-alcoholic beverages in addition to alcohol. In general, it seems likely that those businesses offering other products, services, or entertainment besides alcohol would be less affected than those that offer only alcohol.

Would the Public Accept the Lower Legal Limit?

Opponents of a reduction in the per se level suggest that the 0.10 standard is the historical standard for intoxication and changing this standard would be difficult.

Proponents of the 0.08 alcohol concentration limit assert that the public is ready for a tightening of the per se standard.

It seems reasonable to expect that the public's willingness to accept or embrace the 0.08 standard would depend primarily on whether they view it as appropriate and contributing to public safety.

Proponents of the 0.08 alcohol concentration limit assert that the public is ready for a tightening of the per se standard. The limited available data appears to support this claim. A 1988 survey of the Michigan public's attitudes toward various alcohol policies found that a majority (55 percent) of respondents supports a reduction in the per se level to 0.05, a lower and more controversial limit than the 0.08 standard.[54] The primary weakness of that study involves the generalizability of its findings; that is, since the survey was limited to Michigan residents, it is unclear whether the findings apply more broadly.

Proponents of the 0.08 standard also maintain that tightening the standard would draw further attention to the seriousness of driving while impaired and thus would enhance the moral proscription against drinking driving.[55] A reduction in drinking driving depends not only on certain, severe, and swift punishment of offenders but also on public awareness of and attitudes toward drinking and driving. Proponents assert that the public should be made aware that alcohol degrades driving performance at any measurable level, and that legislating a more restrictive per se standard would contribute to educating the public on the dangers of drinking and driving.

Those who oppose a reduction in the per se level suggest that the 0.10 standard is the historical standard for intoxication and changing this standard would be difficult. Supporters of a reduced per se level counter this argument by stating that the public has accepted several changes in drinking driving laws over the last few decades, including the previous reduction in the standard from 0.15 to 0.10 AC.

Minnesotans have enthusiastically embraced a broad range of restrictive and punitive DWI laws and crackdowns during the past 15 years. It seems reasonable to expect that the public's willingness to accept or embrace the 0.08 standard would depend primarily on whether they view it as appropriate and contributing to public safety; that, in turn, would likely depend on their beliefs regarding whether or not drivers are excessively impaired and unsafe at alcohol concentrations of 0.08 and above.

Notes

1. Office of Traffic Safety, 1993. Minnesota Motor Vehicle Crash Facts 1992. St. Paul: Minnesota Department of Public Safety.

2. Ibid.

3. Snyder, M.B., 1991. "Lower Alcohol Levels, Driver Impairment and Crash Risk." Auto and Traffic Safety, 1(1):11-19; NHTSA, 1988. Effects of Low Doses of Alcohol on Driving-related Skills: A Review of the Evidence. Washington, D.C.: SRA Technologies, Inc.; NHTSA, 1992a. Driving Under the Influence: A Report to Congress on Alcohol Limits. Washington, D.C.: U.S. Department of Transportation; Council on Scientific Affairs, 1986. "Alcohol and the Driver." Journal of the American Medical Association, 225(4):522-527.

4. "0.08 Illegal Per Se." Report prepared for NHTSA, 1993. Washington, D.C.

5. "Issue: The Lowering of the Allowable Blood Alcohol Concentration (BAC) from 0.10% to 0.08%." Report prepared for the American Beverage Institute (ABI), 1993, p.1. Washington, D.C.

6. Position statement prepared for individual distribution to policymakers; May 15, 1992.

7. Ibid; Klein, T.M., 1986. "DWI-Are We Off Track?." In Beverage Retailers Against Drunk Driving, eds. Straight Talk About the Drunk Driving Problem, Part 2; Washington, D.C.: American Beverage Institute.

8. Fisher, H.R., R.I. Simpson and B.M. Kapur, 1987. "Calculation of Blood Alcohol Concentration (BAC) by Sex, Weight, Number of Drinks and Time." Canadian Journal of Public Health, 78:300-304.

9. Ibid; Council on Scientific Affairs. "Alcohol and the Driver."

10. Fisher, Simpson, and Kapur, "Calculation of Blood Alcohol Concentration (BAC)."

11. Ibid.

12. The rate of metabolism refers to both how quickly ethanol is absorbed from the intestines into the bloodstream and how quickly it is decomposed by the liver.

13. Fisher, Simpson, and Kapur, "Calculation of Blood Alcohol Concentration (BAC)."

14. Ibid.

15. NHTSA, Driving Under the Influence.

16. Foss, R.D., R.B. Voas, D.J. Beirness and A.C. Wolfe, for the Minnesota Department of Public Safety, 1990. Minnesota Roadside Survey of Drinking and Driving: 1990. Also reported in: Beirness, D.J., R.D. Foss and R.B.Voas, 1993. "Drinking drivers estimates of their own blood alcohol concentrations." Journal of Traffic Medicine, 21:73-78. See also: Beirness, D.J., 1987. "Self-estimates of blood alcohol concentrations in drinking-driving context." Drug and Alcohol Dependence, p.79-90.

17. Mongrain, S. and L. Standing, 1989. "Impairment of Cognition, Risk-Taking, and Self-Perception by Alcohol." Perceptual and Motor Skills, 69:199-210.

18. Gengo, F.M., C. Gabos; C. Straley and C. Manning, 1990. "The Pharmacodynamics of Ethanol: Effects on Performance and Judgement." Journal of Clinical Pharmacology, 30:748-754.

19. Fisher, Simpson, and Kapur. "Calculation of Blood Alcohol Concentration (BAC)."

20. Ross, H. Laurence, 1992. Confronting Drunk Driving: Social Policy for Saving Lives. New Haven: Yale University Press.

21. Ibid.

22. Laws of Minn. 1955, c487, establishing Minnesota Statutes 1955, sec 169.12.

23. Snyder, "Lower Alcohol Levels, Driver Impairment and Crash Risk."

24. Laws of Minn. 1967, sec. 1; Minnesota Statutes 1967, sec. 169.121, subd. 2.

25. Laws of Minn. 1971, c893, sec. 1-3; Minnesota Statutes 1971, sec. 169.121, subd. 1(d).

26. Snyder, "Lower Alcohol Levels, Driver Impairment and Crash Risk."; NHTSA, Effects of Low Doses of Alcohol on Driving-related Skills.

27. NHTSA, "0.08 Illegal Per Se."

28. Digest of State Alcohol-Highway Safety Related Legislation, 11th edition, 1993; National Highway Traffic Safety Administration. NHTSA credits Minnesota with having a zero per se level for youth. This is somewhat an overstatement, however, since Minnesota's new law relating to youth merely provides for administrative license suspension based on conviction for violation of the underage consumption law (MS 340A.503, subd. 1), provided that the person committed the offense while driving a motor vehicle. The period of suspension is 30 days for a first offense and 180 days for a repeat offense. Such a violation is not regarded as a DWI under the state's DWI laws. "Consumption" is defined as both "the ingestion" and the "physical state of having ingested" an alcoholic beverage, other than at home and with a parent's permission.

29. Minnesota Statutes 1993 Supplement, sections 171.173 and 340A.503, subd. 1, clause c.

30. NHTSA, Effects of Low Doses of Alcohol on Driving-related Skills.

31. Zador, P.L., 1991. "Alcohol-related Relative Risk of Fatal Driver Injuries in Relation to Driver Age and Sex." Journal of Studies on Alcohol, 52(4):302-310.

32. Borkenstein, R.F., R.F. Crowther, R.P. Shumate, W.B. Ziel and D.A. Zylman, 1964. The Role of the Drinking Driver in Traffic Accidents. Bloomington, IN: Indiana University Department of Police Administration.

33. Hurst, P.M., D.S. Harte and W.J. Frith, 1991. "A Reanalysis of the Grand Rapids Data." Cited in NHTSA, Driving Under the Influence.

34. NHTSA, Driving Under the Influence.

35. Nicholson, M.E., M. Wang, C.O. Airhihenbuwa, B.S. Mahoney, R. Christina and D.W. Maney, 1992. "Variability in Behavioral Impairment Involved in the Rising and Falling BAC Curve." Journal of Studies on Alcohol, 53(4):349-356.

36. NHTSA, Driving Under the Influence.

37. An arrest for DWI stemming from a police stop not involving the prior observation of deviant driving behavior or some other visible indicator of impairment would be unlawful since it would not be properly supported by "probable cause" for the stop. In the event of a judicial challenge by a defendant, unless probable cause can be demonstrated for the stop, the case would be dismissed and the driver's license reinstated.

38. NHTSA, 1991. The Effects Following the Implementation of an 0.08 BAC Limit and Administrative Per se Law in California. Washington, D.C.: Research and Evaluation Associates; NHTSA, Driving Under the Influence.

39. NHTSA, The Effects Following the Implementation of an 0.08 BAC Limit.

40. According to Robert Mooney, lab technician at the Minnesota Bureau of Criminal Apprehension, most of the PBT devices in use in Minnesota issue results as a "pass", "warning" or "failure", though a few have digital readouts. To compensate for possible measurement variance, the failure level is typically calibrated at 0.11. The dividing point between a pass and a warning is calibrated at half that of the failure point (.11÷2 = .055). If the per se level is changed to 0.08, the dividing point will become 0.04 (or 0.045 if the PBTs are calibrated at .09).

41. Mr. Mooney indicated that any AC reading below 0.003 is reported as zero. He noted that the biggest problem applying to both PBT and Intoxilyzer tests occurs in the situation of less-than-complete exhalation by the suspect. However, he noted that this situation presents the greatest problem at very low AC levels; for the most part, accuracy is not an issue for either device in the vicinity of 0.08 AC or higher.

42. ABI, "Issue: The Lowering of the Allowable Blood Alcohol Concentration."

43. Ibid.

44. NHTSA, 1992. 1991 Alcohol Fatal Crash Facts. Washington, D.C.: National Center for Statistics and Analysis (Research and Development).

45. Office of Traffic Safety, 1991 Minnesota Motor Vehicle Crash Facts 1992.

46. NHTSA, The Effects Following the Implementation of an 0.08 BAC Limit.

47. Of course, in many cases of suspected alcohol involvement in nonfatal crashes, the attending officer is able to obtain an alcohol concentration test for subsequent use in legal proceedings. However, alcohol concentration tests are not required in the case of nonfatal accidents. Thus, the report form, which is the source of data for this measure, is highly dependent on the subjective impressions and sensitivity of the attending officer, which conceivably could have been enhanced by the law change itself.

48. In the case of fatal accidents, investigating officers are both directed and able to be much more thorough in obtaining alcohol concentration tests of drivers. Such data are then centralized nationally in the Fatal Accident Reporting System (FARS) administered by NHTSA, from which they were obtained for use in the California study.

49. ABI, "Has the Emperor No Clothes?"

50. The ABI critique compares the number of fatalities in 1990 to the preceding four year average. Methodologically, this is a questionable approach since, unlike the time-series analysis methodology (i.e., ARIMA modelling) used in the California study, the technique employed by ABI does not take into consideration any pre-intervention trends in the data.

51. ABI, "Issue: The Lowering of the Allowable Blood Alcohol Concentration," p.1.

52. Beer Institute. 1993. "Brewers Almanac."

53. The tax increase, which went into effect July 15, 1991, raised the California alcohol tax from 2 to 20 cents per gallon for beer and wine, from $2 to $3.30 per gallon for distilled spirits of less than 100 proof, and from $4 to $6.60 per gallon for distilled spirits of 100 or more proof. The tax on sparkling wine remained the same.

54. Wagenaar, A.C. and F.M. Streff, 1990. "Public Opinion on Alcohol Policies." Journal of Public Health Policy, 11(2):189-205.

55. NHTSA, Driving Under the Influence.