



## Short Communication

# Wake Up America and Save Lives!!! Move the Drunk Driving Blood Alcohol Concentration (BAC) Cut-off to 0.05%!!!

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This paper argues for an established Blood Alcohol Concentration (BAC) cut-off for impaired driving at 0.05%, aka 0.05 g/dl, for drivers in the United States. This argument is backed by scientific evidence collected over many years and multiple countries using crash data and fatality data; we shall provide an example from our own research as well. We will demonstrate that this cut-off can be effectively enforced at the roadside by law enforcement officers, both in terms of breathalyzer use and field sobriety testing. We will note the many national organizations in favor of a BAC at 0.05%, and we will counter the principal arguments raised by groups and individuals that are opposed to the move to 0.05%. We will show how the BAC of 0.05% is consistent with where the rest of the world is headed. Finally, we will argue that BAC 0.05–0.08% should be associated with a lower level of punishment than for driving with BAC > 0.08%, as has been done in several jurisdictions around the world. (Human studies research conducted in accordance with WSU IRB #066716B3E.)

## A brief history of BAC cut-offs in the United States

The first state in the US to put a law in place to criminalize operating a vehicle while intoxicated was New Jersey in 1906; however, the first limit put in place was done by New York in 1910 at 0.15% [1]. The laws and penalties for drunk driving began to become harsher in the 1970s through the 1990s, as

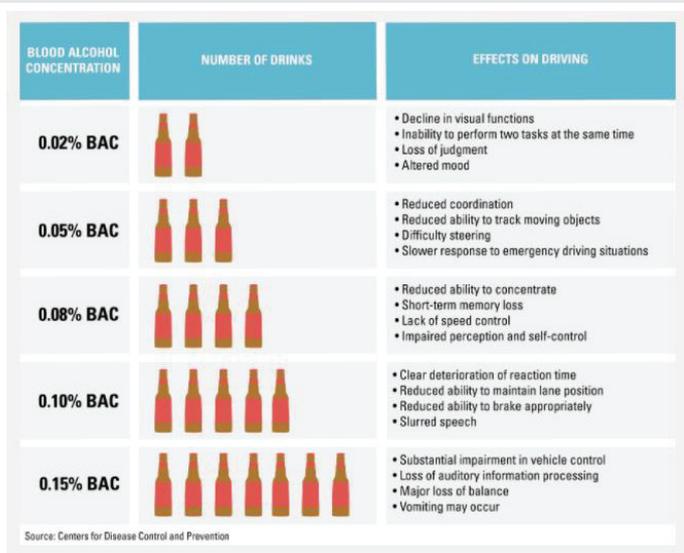
organizations like Mothers Against Drunk Driving (MADD) and Students Against Destructive Decisions (SADD) began to put pressure on the government to create a lower limit [2]. Also, starting in 1982, the US Congress created a set of grant programs that encouraged states to enact stronger and more effective laws for impaired driving. States would receive basic grant funding if they were to set a legal BAC of 0.10%; however, if their limits were set to 0.08% they would receive additional grant funding. The last national effort regarding BAC laws occurred at the turn of the 20th century. In October of 2000 the Department of Transportation's Appropriations Bill was passed by Congress and signed by President Clinton, requiring all states to pass a 0.08% law by 2004 or begin losing highway funding [3]. At the time this bill was passed, more than half of the states had a BAC limit > 0.08% (typically 0.10%); today no state in the US has a legal BAC limit above 0.08%. Recently, Utah has moved to a 0.05% cut-off [4].

## Driving with a BAC > 0.05% is dangerous

There is ample evidence from many sources that a BAC at 0.05%, and sometimes even lower, is dangerous and a safety risk to anyone who may be on the road at the same time. The NTSB website summarized a report of 112 individual studies from NIH/NIAAA, concluding that by the time a BAC = 0.05% is reached most studies show significant impairment [5]. Zador,



et al. (2000) reported that even at a BAC of 0.035%, the relative risk for a fatal single vehicle crash is between 2.6– 4.6 times greater than when at a BAC of 0.00% [6]. As shown in the table below from the CDC, BAC concentrations of 0.05% or higher have significant effects on several measures related to driving safety, including slower responses in emergency situations [7].



In addition, Moskowitz and Fiorentino (2000) reported that 73% of individuals had consistent driving, vigilance, divided attention, and drowsiness impairment at a BAC level of 0.039%, less than half of the 0.08% limit that currently is established across most of the United States [8].

In other countries, reducing the BAC cut-off has reduced crashes and lives lost to drunk drivers. In 1998, Austria decreased the BAC cut-off to 0.05%; this change decreased drunk driving accidents by 9.4% [9]. The National Transportation Safety Board gathered data from the Global Status Report on Road Safety 2015 and WHO World Health Statistics 2015 [10]. As can be seen in Table 1, 2015 data showed that 31% of crash deaths in the United States involved alcohol. By contrast, in Sweden where their legal BAC is 0.02%, only 19% of traffic related deaths involved alcohol. Similarly, in the Netherlands where their limit is 0.05%, they also saw 19% [10]. In the same report the NTSB stated that "...twenty years of international studies have shown that when a country lowers BAC limits from 0.08% to 0.05% alcohol-related fatal and injury crashes decrease between 5% and 10%" [10].

Our research laboratory at Wayne State University has recently developed a public health tool for demonstrating the

**Table 1:** Alcohol-related fatal and injury crashes decrease between 5% and 10%.

Examples	U.S. .08 BAC	Sweden .02 BAC	Netherlands .05 BAC
% alcohol related crash* deaths	31%	19%	19%
Average alcohol consumption (liters pure alcohol per capita)**	9.2	9.2	9.9

\*data from global status report on road safety 2015 \*\*from WHO world Health statistics 2015

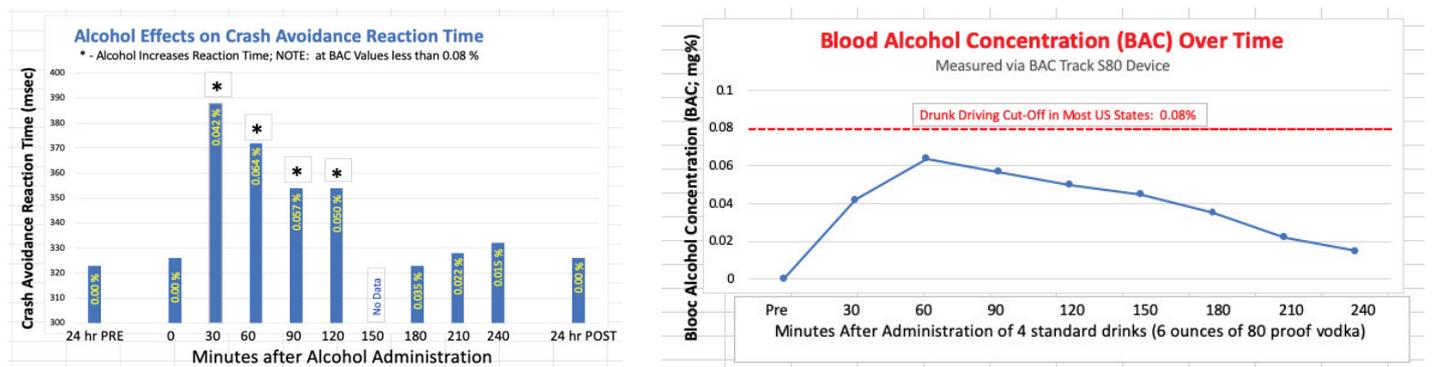
effects alcohol on driving performance. Based on studies using a fixed-base driving simulator [11] and working with Moody Mattan at Brand XR (Orlando, FL), we have created a laptop-based crash avoidance reaction test utilizing a Virtual Reality (VR) headset and a portable gaming chair equipped with a steering wheel and foot pedals. We report here the results of a 'proof of concept' pilot study in a single subject (author RLC). In this two-choice reaction test, the subject drives at a steady speed (70 mph) on a straight roadway. On multiple occasions during this drive, the subject is forced to make an emergency steering response (to the left or the right) to avoid crashing into a stalled car that 'appears instantly' (only 40 meters) ahead in the roadway. The primary dependent variable is the crash avoidance reaction time, measured as the time (in msec) from the appearance of the stalled car until the driver made an avoidance steering response (i.e., turn of > 5 degrees). Reference tests were multiple drives on the day before and the day following alcohol treatment. On the Alcohol Test Day, the subject (BW 200 pounds) drove immediately before drinking, and then at 30-minute intervals after consuming alcohol, in this case 4 'standard drinks' in the form of 6 ounces of 80 proof vodka in juice. We used a portable personal breathalyzer (BA Track S80 model) to determine BAC. Previous studies have demonstrated that this device is a reliable instrument for estimating BAC. In control tests, the typical subject successfully makes the crash avoidance maneuver with an average reaction time of approximately 325 msec. As can be seen in the right panel of Figure 1, this alcohol treatment resulted in a peak BAC of 0.064% at 60 minutes and fell predictably over time. Driving performance was significantly impaired at 30, 60, 90 and 120 minutes post-treatment. Tests at 180 minutes post-treatment and greater did not show a significant effect of alcohol on crash avoidance reaction time. This portable virtual reality simulator program is pretty cool and fun to do, and in the future (i.e., post-COVID-19) we envision using it in public health demonstrations on the hazards of 'buzzed' driving, i.e., BAC 0.05–0.08%.

### Organizations in favor of moving to a BAC 0.05% cut-off

Many national organizations have advocated for lowering the per se level for drunk driving to 0.05% in the US. The 'Road to Zero' coalition includes many public, private and government organizations committed to reducing alcohol-related crashes on the roadway [12] Table 2.

One of the several positions advocated for by this coalition includes moving the BAC cut-off to 0.05% across the US; many of these same organizations were lobbying for a reduction from 0.10% to 0.08% only 20–25 years ago [3]. What has changed their opinions is the weight of the evidence demonstrating the dangers of BAC > 0.05%.

The positions of some organizations are worth noting. MADD has argued that reducing the BAC cut-off would result in a decrease in alcohol-related deaths by 5–18% [13]. The American Medical Association (AMA) goes even farther than 0.05; the AMA "...supports 0.04 percent blood-alcohol level as per se illegal for driving, and urges incorporation of that provision in



**Figure 1:** The effects of alcohol on crash avoidance reaction time in a VR-based driving simulator program. Plotted are the Mean reaction times (in msec) before, and following alcohol treatment (6 ounces of 80 proof vodka). See text for details. The right panel depicts alcohol concentrations measured at various times post-treatment.

**Table 2:** Supporters of Road to Zero Coalition Priority Statement on Alcohol-Impaired Driving.

Organization	Organization URL
AAA	aaa.org
Advocates for Highway and Auto Safety	saferoads.org
American Association of Motor Vehicle Administrators	aamva.org
American Association of State Highway and Transportation Officials	transportation.org
Commercial Vehicle Safety Alliance	cvsa.org
Global Automakers	globalautomakers.org
Governors Highway Safety Association	ghsa.org
Institute of Transportation Engineers	ite.org
Insurance Institute for Highway Safety	iihs.org
Intelligent Car Coalition	intelligentcarcoalition.org
International Association of Chiefs of Police	theiap.org
MADD	madd.org
National Association of City Transportation Officials	nacto.org
National Association of County Engineers	naco.org
National Association of State Emergency Medical Service Officials	nasemo.org
National Safety Council	nsc.org
Vision Zero Network	visionzeronetwork.org

Source: Road to Zero: Safety Priority Statement- Alcohol-Impaired Driving

all state drunk driving laws....” [14]. Internationally, the World Medical Organization, American Medical Organization, the European Commission, the European Transport Safety Council, the World Health Organization, and many more have policies advocating for the lower from 0.08% to 0.05%. Finally, there is also public support, with the AAA foundation reporting that 63% of people in the US are in support of lowering the legal cut-off from 0.08% to 0.05% [15].

### Addressing arguments against moving the BAC cut-off to 0.05%

Next, we shall address several of the arguments against moving the BAC for drunk driving to 0.05%. First, it may be argued that lowering the BAC cut-off for drunk driving to 0.05% will create roadside alcohol detection/quantification problems

for law enforcement agencies. That is not the case. Alcohol is a unique drug of abuse (compared to THC, cocaine, heroin, etc) because (1) it is not very potent, i.e., it takes grams to get drunk, compared to milligrams or even micrograms for most other drugs of abuse and (2) it is highly volatile, so it can be vaporized and measured in exhaled breath. These two qualities make roadside alcohol detection in breath possible (roadside detection and quantitation of other drugs is much more challenging). From the first generation device developed by Emil Brogren nearly 100 years ago, through the second generation “breathalyzer” introduced by Robert Borckenstein in 1954 and its subsequent modifications, scientists and law enforcement agencies have been reliably and accurately estimating blood alcohol concentrations from breath samples at the roadside with relative ease [16]. The devices used most commonly by law enforcement officials today are electrochemical fuel cell breathalyzers; in contrast, the relatively inexpensive (e.g., \$125 each) handheld consumer breathalyzer devices are primarily semiconductor-based [16]. When used appropriately, however, both kinds of devices provide reliable and sensitive BAC estimates [16]. The bottom line is this: whether the BAC cut-off for drunk driving is 0.10, 0.08, 0.05 or even 0.02%, readers can rest assured that the breathalyzer will continue to be a painless and relatively convenient way to get an accurate roadside estimate of BAC, with excellent corroboration when an actual blood-based BAC is determined, i.e., at the Police Station, Hospital, etc. Of course, irrespective of the cut-off level, breathalyzer results are NOT 100% perfect in predicting blood alcohol concentration, so legal proceedings invariably will continue to be dependent upon the results of more reliable blood analyses as conducted by a police agency or a certified toxicology laboratory.

It might also be argued that roadside Field Sobriety Tests (FSTs) will be ineffective if the BAC cut-off is reduced to 0.05%, as NHTSA has stated that officers conducting the FSTs on participants below 0.04% were thought to be above the measurement 48% of the time [16]. In this case, there may be a partial truth here. The most common FSTs [17] really consist of a trio of individual tests: (1) Horizontal Gaze Nystagmus (HGN), (2) One-Legged Stand (OLS) and (3) Walk And Turn (WAT). A study conducted by McKnight in 2002 analyzed the effectiveness of current field sobriety tests at different BAC

levels (ranges). They found that although the OLS and WAT tended to be less sensitive and effective at BAC 0.05–0.08%, the HGN test continued to be a valid measure of alcohol-induced impairment at a BAC of 0.05, 0.08 and 0.10% [18]. This suggests that perhaps the FST process should focus more on the HGN as a measure of impairment. Overall, moving to a BAC cut-off of 0.05% should not prevent law enforcement officers from being able to effectively identify impaired drivers either by FST (emphasizing the HNG test) or BAC via breathalyzer.

It also has been argued that moving the cut-off BAC to 0.05% would result in the courts becoming overwhelmed with lower-level drunk driving cases, i.e., at BAC = 0.05–0.08%. A study by James Fell and Robert Voas refutes this claim [5]. Extrapolating from NHTSA data from Illinois after the BAC was decreased from 0.10% to 0.08%, these authors concluded that although there would be an increase in driving while impaired arrests at a BAC cut-off of 0.05%, this increase would not overwhelm the criminal justice system [5]. It should also be noted that most states currently have ‘DWI Courts’ specifically designed to handle drunk driving offenses and thus reduce the burden on regular court dockets; one of the priorities of the “Road to Zero” coalition is to increase the number of these DWI courts [12].

Much of the resistance to lowering the legal BAC to 0.05% is spearheaded by the American Beverage Institute (ABI), which identifies itself as “...the only organization dedicated to the protection of responsible on-premise consumption of adult beverages...” [19]. Although the ABI acknowledges that a driver at a 0.05% BAC is technically impaired [20], it argues that moving the BAC cut-off from 0.08% to 0.05% would have only a minor effect on the problem of drunk driving, since the vast majority (>70%) of the drunk driving fatalities involve drunk drivers with BAC > 0.15% [20]. Although this figure is correct, the NTSB has estimated that approximately 500–800 lives each year would be saved in the United States if the legal limit was decreased from 0.08% to 0.05%; this figure is not insignificant [10].

The ABI also argues that moving to a BAC cut-off would have a chilling effect on the restaurant and entertainment industries. This argument is perhaps a bit of a moot point in the current COVID-19 environment, but this argument also fails when one recognizes that restaurants and entertainment industries did not cease to exist in those countries that moved to BAC 0.05%. Moreover, as Table 1 demonstrates, 2015 per capita alcohol consumption was comparable in the US, Sweden and The Netherlands, even though the drunk driving BAC was far lower in the latter two countries.

Finally, the ABI has argued “... The current nationally recognized blood-alcohol limit for driving is 0.08 BAC – which would take roughly three drinks for the average male to obtain ... A 120-pound woman will hit 0.05 after having little more than a single drink and a 160-pound man would be considered legally drunk after two...” [20]. The suggestion is that a BAC cut-off of 0.05% is somehow ‘unfair’ to lower weight individuals. It is true that a smaller weight individual would achieve a higher BAC with fewer drinks, but it seems

highly unlikely a 120-pound woman would achieve a BAC > 0.05% after a little more than one drink (or that a 160-pound male would after a little more than two drinks), *unless the ‘a little more’ was in fact another 1–2 drinks*. Moreover, even if that did occur, whether the driver was a 120-pound woman, a 160-pound man or a 300+ pound person of either sex, a person with a BAC > 0.05% would drive like a person with a BAC > 0.05%, i.e., impaired.

### BAC 0.05% is the future

As has been mentioned above, several countries currently operate with BAC cut-offs of 0.05% or lower. The legal limit BAC has been established at 0.05% in Australia, France, Germany, Spain, the Netherlands, and many other countries. In Norway, Sweden, and Russia this limit was moved even lower to 0.02% [5]. Overall, more than 90 countries in the world have adopted a BAC cut-off of 0.05% or lower [5].

In 2018 Utah became the first – and so far, the only – state to set the drunk driving BAC cut-off at 0.05% [21]. (It is perhaps notable that in 1983 Utah was the first state to move from 0.10% to 0.08%). Other states are considering following in Utah’s footsteps. In early 2020, in both Vermont and Hawaii, legislation to reduce the BAC to 0.05% was introduced; both initiatives failed. In 2020 MADD launched a campaign to lower the BAC to 0.05% in Michigan, California, and New York to 0.05% [22]. It is likely that in the near future Utah will not be the only US state with a BAC cut-off at 0.05%.

### The penalty should match the crime

Finally, we are advocating for a tiered level of punishment, whereby BAC > 0.05% but less than 0.08% would receive a less severe penalty than a BAC > 0.08%. This is consistent with the increasing danger associated with BAC > 0.08%. At one level, the idea of a multi-tiered punishment already is in place, since almost every state in the US (all except Alabama, Maryland, Mississippi, Montana, Oregon) has identified a BAC level associated with ‘super-drunk’ drivers (Enhanced Penalty BAC, 0.10–0.20% across the various states), and violations at these ‘super-drunk’ levels are associated with a more severe level of punishment. In Australia, lower level punishments are applied when BAC 0.05–0.08% [23]. In addition, although Canada still has a legal limit for drunk driving at 0.08%, many provinces have implemented a ‘warn range’ for BAC > 0.05% and less than 0.08%, with the penalty being a possible driving license suspension for 1–7 days [5]. A study conducted in British Columbia, where they suspended a license for 3 days for being within the warn range, saw a 40% decrease in alcohol related crash deaths and injuries [5]. In Utah, the Substance Use Advisory Council advocated for a lower level punishment for those driving between the new 0.05% and the old 0.08% [24]. Unfortunately, this system was not adopted, and at the present time, drivers in Utah with BAC > 0.05% alcohol are subject to the same punishments as drivers with BACs up to and including 0.16% (i.e., ‘super-drunk’). We would argue that moving the BAC per se cut-off to 0.05% should be coupled with a lower level of punishment when the BAC is > 0.05% but <



0.08%.

In summary, there is more than ample evidence from multiple sources that BAC > 0.05% adversely and significantly affects driving performance, crashes and fatalities. Based on this evidence, many organizations have advocated for moving the BAC cut-off to 0.05% across the US, a move that has been made by many countries around the world. Many organizations within the US have advocated for the BAC 0.05% cut-off, and we have addressed and effectively rebutted the arguments typically made against moving to a BAC > 0.05% cut-off. Finally, consistent with the evidence, we have argued for the need to create lower levels of punishment when BAC is > 0.05% but < 0.08%. With all of this in mind, it is time for the US (and Canada and the UK) to join the rest of the world and reduce the drunk driving BAC cut-off to 0.05%.

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