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Can Progress in Reducing Alcohol-Impaired Driving Fatalities Be Resumed?

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Abstract

Objective—Despite successes in the 1980s and early 1990s, progress in reducing impaired driving fatalities in the United States has stagnated in recent years. Since 1997, the percentage of drivers involved in fatal crashes with illegal blood alcohol concentration (BAC) levels has remained at approximately 20% to 22%. Many experts believe that public complacency, competing social and public health issues, and the lack of political fortitude have all contributed to this stagnation. The number of alcohol-related crashes, injuries, and fatalities is still unacceptable, and most are preventable. The public needs to be aware that the problem presented by drinking drivers has not been solved. Political leaders need guidance on which measures will affect the problem, and stakeholders need to be motivated once again to implement effective strategies.

Methods—The National Academy of Sciences (NAS) Transportation Research Board (TRB) Alcohol, Other Drugs, and Transportation Committee (ANB50) sponsored a workshop held at the NAS facility in Woods Hole, MA, on August 24–25, 2015, to discuss the lack of progress in reducing impaired driving and to make recommendations for future progress. A total of 26 experts in research and policy related to alcohol-impaired driving participated in the workshop. The

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workshop began by examining the static situation in the rate of alcohol-impaired driving fatal crashes to determine what factors may be inhibiting further progress. The workshop then discussed eight effective strategies that have not been fully implemented in the United States. Workshop participants (16 of the 26) rated their top three strategies.

Results—Three strategies received the most support:

1. Impose administrative sanctions for drivers with BACs = .05 to .08 g/dL.
2. Require alcohol ignition interlocks for all alcohol-impaired driving offenders.
3. Increase the frequency of sobriety checkpoints, including enacting legislation to allow them in the 11 states that currently prohibit them.

Five other important strategies included the following: (a) increase alcohol taxes to raise the price and reduce alcohol consumption; (b) re-engage the public and raise the priority of impaired driving; (c) lower the illegal per se BAC limit to .05 for a criminal offense; (d) develop and implement in-vehicle alcohol detection systems; and (e) expand the use of screening and brief interventions in medical facilities.

Conclusions—Each of these strategies is proven to be effective, yet all are substantially underutilized. Each is used in some jurisdictions in the United States or Canada, but none is used extensively. Any one of the three strategies implemented on a widespread basis would decrease impaired driving crashes, injuries, and fatalities. Based on the research, all three together would have a substantial impact on the problem.

INTRODUCTION

The problem

Since 1899, 3.5 million people have died in traffic crashes in the United States, and an estimated 1.6 million people have been killed in crashes involving alcohol-impaired driving, a very significant toll (National Center for Statistics and Analysis 2004). In 2014, about a third (31%) of the 32,675 people killed in traffic crashes involved an alcohol-impaired driver (National Center for Statistics and Analysis 2015, November). In addition, for the past 20 years, law enforcement has arrested approximately 1.4 million drivers annually for driving while intoxicated (DWI) (Federal Bureau of Investigation 2013). Although progress has been made in reducing impaired driving fatalities, they still account for 10,000 deaths annually (Dang 2008; National Center for Statistics and Analysis 2015, August). In addition, if both reported and unreported crashes are included, another 350,000 people are injured and more than 3.5 million property-damage crashes involving impaired drivers occur annually, costing the U.S. society $125 billion each year (Zaloshnja et al. 2013).

Between 1982 and 1997, key impaired driving laws such as administrative license revocation (ALR), lower blood alcohol concentration (BAC) limits for driving, and tougher sanctions for convicted offenders were adopted by most of the 50 states and the District of Columbia (DC) (Fell and Voas 2006). In addition, overall public attention to the problem, enforcement of the DWI laws, and publicity about impaired driving increased. As a result, the proportion of traffic fatalities involving impaired drivers substantially decreased during that period. However, since 1997, progress has stalled (Dang 2008; Fell et al. 2009).

Between 1982 and 1997, the percent of traffic fatalities in the United States that involved an impaired driver (defined as a BAC ≥ .08 g/dL) decreased from 48% to 30%, a 38% reduction in that proportion. However, since 1997, the percent of fatalities involving an impaired driver has remained at 30% to 32%. While the number of alcohol-impaired fatalities has decreased from 12,546 in 1998 to 10,076 in 2013, a 20% decrease, the proportion involving an impaired driver has not changed. This means that non-alcohol-impaired driving fatalities have decreased at about the same rate as alcohol-impaired driving fatalities (from 28,955 in 1998 to 22,643 in 2013, a 20% decrease). This lack of progress over the past 10 or 15 years is similar for Canada and several other countries.

Because many other factors such as improved vehicle and highway safety have reduced fatalities in both sober and impaired driving crashes, it is valid to use non-alcohol-related crashes as a comparison group (Voas et al. 2007). According to the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS), the percentage of all drivers in fatal crashes (fatally injured and surviving combined) estimated to have been illegally intoxicated (BAC ≥ .08 g/dL) decreased from 35% in 1982 to 20% in 1997, a 43% decrease in that proportion. However, since 1997, that proportion has varied only slightly up to the current time (Figure 1). One measure of the recent extent of the problem and the wide variability in each state appears in Figure 2. This figure shows the percentage of drivers in fatal crashes with illegal BAC levels state-by-state averaged over a 5-year period (2002–2006) when the national rate was 21% (which is the same rate in 2013). The percentages range from a low of 12% in Utah to a high of 31% in Montana. The variability within states (e.g., at the county level) is likely to be similar.

Among many reasons for this wide variability in the states (Figure 2) are the strategies used and degree of enforcement for impaired driving. Most states have a good infrastructure of impaired driving laws, so all other factors being equal, states with highly visible, highly publicized impaired driving enforcement programs tend to have lower rates of impaired driving crashes. Georgia is a good example. It has had highly visible, frequent, publicized DWI enforcement conducted throughout the state since the year 2000 (Fell et al. 2008). Georgia now has one of the lowest impaired driving rates in fatal crashes in the nation, which fell from 34% in 1982 (the national rate was 35%) to 17% in 2013 (the national rate was 21%), a 50% reduction in that proportion.

As stated earlier, however, progress in the United States overall has stagnated in recent years. Many experts believe that public complacency, competing social and public health issues, and the lack of political fortitude have all contributed to this stagnation. Alcohol-related crashes, injuries, and fatalities are unacceptable and preventable. The public needs to be aware that the problem has not yet been solved. Political leaders need guidance on which measures will affect the problem, and stakeholders need to be motivated once again to implement effective strategies.

WORKSHOP

The National Academy of Sciences (NAS) Transportation Research Board (TRB) Alcohol, Other Drugs, and Transportation Committee (ANB50) sponsored a workshop held at the

NAS facility in Woods Hole, MA, on August 24–25, 2015, to discuss the lack of progress in reducing alcohol-involved traffic fatalities, identify new strategies and proven strategies that are not widely used, and make recommendations for future progress. The issues are: Why has this stagnation occurred? Have we reached the point where every effective impaired driving countermeasure has already had its full impact on the problem and no further progress can be made? Or can new strategies, together with broader implementation of existing but underused strategies, reduce alcohol-impaired driving crashes, injuries, and fatalities even further?

The organizers of the Workshop conducted a brainstorming session on potential interventions that could resume progress. Experts in each intervention area were contacted. For logistical purposes (a day and a half Workshop) a consensus of eight interventions was reached. A total of 26 experts in impaired driving research and/or policy (see Appendix A for the listing) participated in the workshop. The workshop began by examining the static situation in the reduction in the rate of impaired driving fatal crashes to determine what factors may be related to the problem: economic factors, alcohol consumption, population changes, public awareness, vehicle and roadway advances, etc. The participants agreed that the campaign against drunk driving has lost much of its steam. The workshop then moved on to proven effective, research-based, but not fully exploited methods for curtailing impaired driving. In all, eight research-based programs with the potential to reduce impaired driving crashes were discussed. After the workshop, participants were asked to rate their top three strategies in priority order. Instructions to the expert panel were sent via e-mail as follows: “These are the broad strategies proposed by the meeting’s speakers for resuming progress on reducing alcohol-impaired driving fatalities:

Lower the illegal per se BAC to .05; Impose administrative sanctions for low-BAC offenders (.05–.07); Expand alcohol ignition interlock penetration for DUI offenders; Develop and implement in-vehicle alcohol detection systems – DADSS; Expand use of screening and brief interventions; Expand checkpoints, perhaps by legislation in states that prohibit them; Increase alcohol taxes; Re-engage the public; raise the priority of impaired driving; Other major strategies you heard or that you advocate that are not on the above list.

Here is the assignment for all meeting participants, if you choose to accept it:

List your top three priority recommendations among those described above in priority order. For each, in two or three bullets, or in one paragraph, describe:

1. Why this is a top priority: what is the potential impact and likelihood for success?
2. What is the most important barrier to implementation and how can it be overcome?
3. What do you think would be the key action steps: who would do what?”

A total of 16 of the 26 participants submitted their top three priority strategies. Three participants recommended only one strategy and were excluded. The remaining seven chose not to vote for various reasons (e.g., represented a government agency; represented an

interlock company; etc.). Three points were assigned to each participant's #1 priority strategy, two points to the #2 strategy, and one point for #3. The five topics discussed but not ranked among the top three opportunities to reduce impaired driving crashes are presented in the next section, followed by the three judged to be the best prospects for producing change.

THREE PRIORITY STRATEGIES

The three strategies that received the most points by the workshop participants who voted were:

1. Impose administrative sanctions for drivers with BACs = .05 to .08 g/dL: 20 points
2. Require alcohol ignition interlocks for all alcohol-impaired driving offenders: 17 points
3. Increase the frequency of sobriety checkpoints, including enacting legislation to allow them in the 11 states that currently prohibit them: 15 points

05 Administrative BAC Limit

Background—In May 2013, the National Transportation Safety Board (NTSB), an independent federal agency dedicated to investigating transportation safety issues, publicized a report recommending among other measures that states lower the illegal BAC limit for driving from .08 to .05 g/dL or lower (National Transportation Safety Board 2013). There is sound rationale and strong evidence that this measure will reduce alcohol-impaired driving and save lives. Most industrialized countries around the world have enacted a .05 BAC limit. To date, no state in the United States or province in Canada has adopted this criminal per se statute.

While Canada also has a federal criminal per se law set at .08 g/dL (similar to the United States), all Canadian provinces and territories, except for Quebec, have enacted administrative laws that provide penalties for drivers with BACs ranging from .04/.05 to .08 g/dL. These administrative laws vary by jurisdiction, but the penalties for driving at .05 to .08 BAC generally include short-term loss of the offender's drivers' license, a fine, and possibly impoundment of the vehicle. In British Columbia this administrative law is called Immediate Roadside Prohibition, or IRP, and requires a 3-day license suspension, a $200 fine, and possibly a 3-day vehicle impoundment for a first offense. Studies show that this administrative .05 BAC limit is effective. Moreover, this administrative law has been upheld in the courts.

Evidence of effectiveness—An initial study of the IRP in British Columbia examined drivers in roadside surveys before and after implementation of the 2010 law. Drivers on the roads with BACs > .08 decreased by 59% while drivers with BACs > .05 decreased by 44% after the IRP law was in effect (Beirness and Beasley 2014). Another study of the IRP law in British Columbia showed significant average declines of alcohol-related crashes associated with the adoption of the law: 40.4% in fatal crashes, 23.4% in injury crashes, and 19.5% in

property damage crashes. In contrast, there were no effects on non-alcohol-related crashes (Macdonald et al. 2013). A third study of the British Columbia law found significant decreases in fatal crashes (21%), in hospital admissions (8.0%), and ambulance calls for road trauma (7.2%) associated with the implementation of the .05 BAC administrative law (Brubacher et al. 2014). One Canadian national study showed that there was a significant decrease of 3.7% in fatally injured drivers with BACs ≥ .05 following introduction of these IRP laws. Reductions were also observed for fatally injured drivers with BACs ≥ .08 and ≥ .15 g/dL (Blais et al. 2015).

While it is currently difficult for states to adopt .05 *criminal* per se laws, it may be easier to convince legislatures to adopt *administrative* sanctions for drivers with BACs between .05 and .08, where the sanctions are not as severe and the law serves to get a dangerous driver off the road. There is little doubt that a proposal for an administrative .05 BAC limit would generate sufficient controversy to capture and reinvigorate public attention. By understanding that the risk of apprehension for impaired driving has increased, no matter the type of law, drivers are more susceptible to change their behaviors. Drivers only really need to understand that the risk of apprehension for impaired driving has increased (Ross and Voas 1990) and the impact is immediate. The implementation of .08 BAC limits in the 1980s and 1990s in the United States resulted not only in a reduction in the percentage of fatally injured drivers with BACs at that level but also at high BACs ≥ .20 (Wagenaar et al. 2007).

Barriers to implementation—Administrative license suspension gives police an option for dealing with drivers at BACs below the criminal limit. The process of gathering the evidence required to support a criminal prosecution is very time-consuming, and the officer is frequently frustrated by the prosecutor refusing to proceed on the evidence available or accepting a plea bargain or simply by the ease with which a defense lawyer may obtain a not guilty verdict. This can result in a bias to using the administrative .05 law resulting in a reduction in criminal arrests. Because administrative laws provide for only brief suspensions, a reduction in criminal arrests would place high-risk drivers back on the road much sooner. It would also reduce the opportunity to get impaired driving offenders into treatment programs. In the 1980s, there was interest in the United States in the implementation of administrative impaired driving laws as a mechanism for increasing DWI arrests. Oregon, among other states, enacted an administrative BAC law. Currently some states (e.g., New York, Colorado) have penalties for drivers at BACs lower than .08 g/dL, but the laws are seldom used and there have been no evaluations.

What needs to be done—States need to pass legislation providing for administrative .05 BAC programs similar to the Immediate Roadside Prohibition program in British Columbia, Canada. Once implemented in a couple of states, it should be possible to demonstrate the effectiveness of IRP for reducing impaired driving crashes and determine whether such laws significantly reduce criminal arrests. State Impaired Driving Task Forces or Coalitions can recommend this measure to state legislators.

Alcohol Ignition Interlocks

Background—Alcohol ignition interlock devices require drivers to take and pass a breath test before they can start their cars. The interlock allows DWI offenders to continue to drive while sober, thus maintaining job status and the ability to meet family travel needs, while still protecting the driving public. All states currently have laws requiring or allowing interlocks as a sanction for DWI offenders. These laws provide three methods for managing the interlock program: through the court under criminal interlock laws, through the state motor vehicle departments under administrative interlock laws, and through a combination of the two methods. The number of interlocks in use is currently about 325,000 and is increasing at the rate of 10% to 15% per year (Roth 2013). The implementation of the existing interlock laws varies across states with some states mandating interlocks for all convicted DWI offenders while others mandate their use only for repeat or high BAC (≥ .15 g/dL) offenders. Interlocks are used in other countries as well (e.g., Canada).

Evidence of effectiveness—Substantial evidence shows that the interlock while on the offender's vehicle is more effective than license suspension in reducing DWI recidivism. Meta-analyses (Elder et al. 2011; Willis et al. 2004) indicate that interlocks reduce recidivism by two-thirds while on the vehicle. This has resulted in considerable enthusiasm in the safety community and in state legislatures for substituting interlocks for all or part of the traditional license suspension period through laws that mandate interlocks for all DWI offenders (e.g., Mothers Against Drunk Driving, National Highway Traffic Safety Administration, U.S. Congress Transportation Reauthorization of MAP-21) (U.S. Congress Transportation Reauthorization 2012; U.S. Government Accountability Office 2014).

As a result of this national effort, 25 states have adopted laws mandating interlocks for all convicted first-time and repeat DWI offenders with BAC ≥ .08 g/dL. Thus, the laws in these 25 states cover 100% of drivers convicted of DWI, but in the remaining states some offenders (generally first offenders) are not required by law to install interlocks. This campaign has also increased the adoption of interlocks by motivating states to pass legislation to require interlocks for drivers who receive administrative license revocations (ALR) for arrest breath tests that are over the .08 limit whether or not they are later convicted of DWI in criminal court. In some states, the interlock laws are in direct conflict with ALR laws and many states have shifted the emphasis from hard license suspension to interlocks. ALR laws were credited as one of the measures responsible for the substantial decreases in impaired driving fatalities during the 1980s and early 1990s (Wagenaar and Maldonado-Molina, 2007). There is also a push for legislation lengthening the time on the interlock based on the number of violations the offender accumulates while the unit is on their vehicles.

Barriers to implementation—Three major factors limit the impact of interlocks on impaired driving crashes:

1. Currently, interlocks are only applied to convicted DWI offenders to deter them from repeating their offense (a specific deterrent effect). This is a small group who over the 3-year look-back period in the FARS represent only 3% of drivers in fatal crashes (Lund et al. 2012). To date, there is

little evidence that the threat of having to install an interlock if convicted for DWI is having a general deterrent effect on all drinking drivers.

2. DWI offenders resist interlocks. Administrative interlock programs that offer the DWI offender the opportunity to substitute time on the interlock for some portion of the license suspension program generally only result in about 10% of eligible offenders installing the devices (Voas et al. 2002; Voas and Marques 2003). Only in administrative programs such as that in Florida where installing the interlock is a prerequisite for reinstating the drivers' license do installation rates reach 50% (Voas et al. 2013). Judicial interlock programs, where the judge can make the interlock a provision of probation, achieve higher installation rates because the judge has the power to impose less desirable alternatives (e.g., house arrest) for offenders who refuse to install interlocks (Roth et al. 2009). However, despite the national effort to pass legislation to mandate interlocks for all DWI offenders, only approximately one third of the 1.4 million drivers arrested each year are on interlocks. The low installation rate appears to emanate from three sources: (a) the lack of an alternative to the interlock for offenders without vehicles, (b) judges' decisions that the interlock is not appropriate for the specific offender (National Highway Traffic Safety Administration 2014, May), and (c) poor interlock program management and record keeping (Casanova-Powell et al. 2015, May), which allows many offenders to avoid installing interlocks.

3. Once the interlock is removed from the offender's vehicle, research indicates that recidivism returns to the pre-interlock level and that interlocks do not induce long-term changes in hazardous drinking patterns (Elder et al. 2011; Willis et al. 2004).

There are methods for overcoming to some extent each of these three barriers:

- *Interlocks may become a general deterrent*: Since convicted DWI offenders resist installing interlocks it appears to be a penalty that can deter drivers who are potential offenders. If more states pass laws mandating interlocks for all DWI offenders and succeed in compelling them to install them so that it becomes a standard sanction for the DWI offense, it may act as a general deterrent and impact over-the-BAC-limit driving by individuals who are never arrested. One study in the State of Washington has provided at least some evidence of a general deterrent effect on crashes (McCartt et al. 2013).
- *Enacting more severe alternatives should increase interlock installations:* Initially, the courts or the department of motor vehicles offered the interlock to suspended offenders as an option for driving legally for a portion of their suspension period. Several studies of such optional programs in West Virginia (Tippetts and Voas 1998); California (DeYoung et al. 2005); Alberta, Canada (Voas et al. 1999); and Quebec, Canada (Vézina 2002) revealed that only about 10% of the eligible offenders

installed an interlock. The low penetration of optional interlock programs has led states to enact laws requiring judges to mandate the installation of an interlock. To date, laws mandating interlocks have, with some exceptions (Marques et al. 2010), not been markedly more successful in motivating offenders to install interlocks (Voas et al. 2003). The reasons for this are not entirely clear. Most interlock legislation exempts offenders who can prove they do not own a vehicle or who agree not to drive. Some courts are not well informed about the mandatory legislation, and some have no local interlock providers. Courts have also found the cost of the interlock program to be a barrier for low-income offenders, even though most interlock providers will reduce the price of the program for indigent offenders. There is evidence, however, from studies in Indiana (Voas et al. 2002) and New Mexico (Marques et al. 2010) that a larger proportion of DWI offenders can be pressured into installing units if the alternative is more unpleasant, such as electronically monitored house arrest.

- *Performance on the interlock can be used to extend time on the interlock and delay the rise in recidivism that comes with removal:* The interlock data recorder provides important information for predicting future recidivism (Marques et al. 2003; 2003; Marques et al. 2003), particularly when combined with the prior record of the offender. This has opened up the possibility of, rather than assigning interlock requirements for fixed periods, the offenders can be required to have the interlock on the motor vehicle for a period determined by the interlock breath-test record. For example, offenders might be required to maintain the interlock on the vehicle until they have demonstrated a change in their drinking driving behavior marked by 6 months without recording a positive breath test.

A number of states have adopted compliance-based removal programs, which determine the time on the interlock based on the offender's performance while the unit is on the vehicle. Because performance on the interlock predicts post-interlock recidivism, it can be used as a screening system for offenders who are failing to control their drinking and are in need substance abuse treatment (Beirness et al. 2003; Marques and Voas 1995; Timken and Marques 2001; 2001). There is initial evidence that using that information to mandate treatment while the interlock is on the vehicle results in reduced recidivism following de-installation (Voas et al. 2015, under review). Combining compliance-based removal with treatment may significantly limit the increase in recidivism following interlock removal.

What needs to be done

1. An effort must be made to persuade the 25 states without all-DWI offender laws to enact the necessary legislation including a requirement for mandatory installation for breath test refusal or an ALR offense.
2. An effort must be made to persuade all states to pass legislation specifically providing a strong alternative sanction (e.g., electronic monitoring, continuous alcohol monitoring) for offenders without vehicles and administrative license requirements providing the installation of an

interlock as a prerequisite for reinstatement. For those offenders who drive while suspended, the automated license plate recognition technology available (but not currently used by many law enforcement agencies) might encourage offenders to adopt the interlock rather than risk being caught for driving while suspended. The license plate recognition technology indicates to police when the owner of the vehicle has a suspended license.

3. All states need to enact legislation providing for compliance-based removal and treatment.

Sobriety Checkpoints

Background—Creating deterrence to impaired driving requires that potential impaired drivers believe that there is a substantial risk that they will be apprehended and arrested for such behavior. However, the actual risk in the United States is relatively low. It has been variously estimated to be from 1 in 1,000 impaired driving trips (Zaloshnja et al. 2013) to 1 in 88 impaired driving trips (Zador et al. 2000). Compared to other countries the risk of motorists being checked for alcohol is very low. In the United States, only 29% of motorists reported ever having been checked for alcohol at some time, in marked contrast to Australia where 82% of Australian drivers reported this in 1999. Australia allows and implements regular random breath testing (Williams et al. 2000).

Publicizing enforcement activities is critical to creating deterrence. This requires highly visible enforcement operations. Sobriety checkpoints, where large numbers drivers are stopped and checked for impairment, have been shown to be the most effective procedures for drawing public attention to DWI enforcement efforts. In an effort to support the use of high-visibility sobriety checkpoints in the United States, NHTSA issued guidelines to communities on conducting sobriety checkpoints (Compton 1983; NHTSA, 1990); produced a law enforcement training video on sobriety checkpoints (NHTSA, 1999); and produced a how-to guide for planning checkpoints, setting them up, increasing their visibility, and publicizing them (NHTSA, 2000). More recently, NHTSA published guidelines on low-staff sobriety checkpoints (NHTSA, 2006). Although some law enforcement officers and other officials have been skeptical of the cost-benefit of sobriety checkpoints, at least one study indicated that checkpoint programs can yield considerable cost savings (Miller et al. 1998). The U.S. Supreme Court ruled that checkpoints are constitutional (Michigan Department of State Police et al. v. Sitz et al. 1990); however, they are not conducted in at least 11 states due to legal or other reasons (Insurance Institute for Highway Safety 2015). In six states checkpoints are illegal under the state constitution, in four states checkpoints are illegal by state statute, and in the remaining state there is no authority to conduct checkpoints.

Evidence of effectiveness—Research has indicated that sobriety checkpoints that are well publicized, conducted frequently, and have high visibility deter impaired driving. Studies in the early 1980s found significant decreases in alcohol-related crashes associated with sobriety checkpoint programs (Epperlein 1985; Lacey et al. 1986; Lacey et al. 1986; Voas et al. 1985). Later studies confirmed that frequent, highly publicized checkpoint programs substantially reduced alcohol-related crashes by 10% to 20% (Levy et al. 1990;

Levy et al. 1988; Wells et al. 1992). A demonstration program in Tennessee *(Checkpoint Tennessee)* was sponsored by NHTSA to determine whether statewide crackdowns, conducted in all 95 counties, and sustained enforcement with highly publicized sobriety checkpoints conducted weekly throughout the state would reduce impaired driving. An evaluation of the program analysis showed a 20% reduction in alcohol-related fatal crashes when compared to projected alcohol-related fatal crashes if the program had not been implemented. It was also reported that the effects of the program extended at least 21 months after conclusion of the formal program (Lacey et al. 1999). Stuster and Blowers (1995) contrasted the saturation patrol system with the sobriety checkpoint procedure and showed that the proportion of all crashes involving alcohol declined an average of 28% in four communities that used publicized sobriety checkpoints compared with a 17% decline in communities that used only publicized roving patrols or saturation patrols. There were no differences in the effectiveness of sobriety checkpoint programs with 3 to 5 officers per checkpoint (i.e., low staff) compared to checkpoints conducted with 8 to 12 officers, or for checkpoints that stayed in one location versus those that moved around (Stuster et al. 1995). In another study (Lacey et al. 2006), it was documented that low-staff checkpoints, publicized through earned media approaches, can be conducted weekly in relatively small and rural communities and can reduce alcohol-impaired driving dramatically.

Several studies have reviewed the available literature on checkpoint programs. In a summary of the U.S. literature, Ross (1992) examined nine studies through the early 1990s and concluded, "… the accumulation of evidence supports the hypothesis that checkpoints reduce impaired driving." A second review of the literature on the effectiveness of sobriety checkpoints and random breath-testing in reducing motor vehicle crash injuries was conducted by Peek-Asa (1999). Six studies were reviewed that met the study criteria for evaluating sobriety checkpoints with a control or baseline comparison. All six studies found that sobriety checkpoints were effective in reducing alcohol-related fatalities and injuries. A third review, conducted by the U.S. Preventive Services Task Force, involved a systematic review of the evidence regarding interventions to reduce alcohol-impaired driving (Shults et al. 2001). Fifteen studies on the effectiveness of sobriety checkpoints were summarized, and a meta-analysis was conducted that showed a median reduction of 20% in fatal and injury crashes associated with sobriety checkpoint programs. The CDC authors concluded that these studies "provide strong evidence" that sobriety checkpoints are effective in preventing alcohol-related fatalities and injuries. Visibility and community awareness of these checkpoint programs played a key role in their success.

Barriers to implementation—One barrier to implementation is the fact that sobriety checkpoints are prohibited in 11 states. If the U.S. Supreme Court ruled them legal, some of these states could follow suit. However, even in states where they are allowed, they are underutilized (Governors Highway Safety Association 2015). Law enforcement agencies may not recognize the deterrent effect of sobriety checkpoints and instead see them as complicated, resource-intensive operations that yield relatively few DWI arrests.

What needs to be done—States need to take steps to begin or expand their use of high-visibility enforcement of impaired driving laws. To be effective, these programs need to an

integral part of a prevention effort that is not being implemented intermittently and unfrequently.

In 2013, the NTSB made the following recommendation to the 50 states, the Commonwealth of Puerto Rico, and the District of Columbia:

"Include in your impaired driving prevention plan or highway safety plan provisions for conducting high-visibility enforcement of impaired driving laws using passive alcohol-sensing technology during law enforcement contacts, such as routine traffic stops, saturation patrols, sobriety checkpoints, and accident scene responses" (NTSB, 2013). Perhaps engaging the International Association for Chiefs of Police (IACP) and other law enforcement organizations to support checkpoints might help increase their frequency.

FIVE IMPORTANT BUT NOT Highest PRIORITY STRATEGIES

1. Increase alcohol taxes to raise the price and reduce alcohol consumption

One of the most effective strategies to reduce hazardous consumption is increasing the price of alcohol (Elder et al. 2010; World Health Organization 2010). The rationale for this strategy is that an increase in the alcohol tax (intervention) will lead to an increase in the price of alcoholic beverages. Based on the law of demand, alcohol price increases should reduce demand for alcoholic beverages and subsequently decrease alcohol consumption. Through the use of taxation, state and federal governments can influence the price of alcohol, which affects overall consumption and subsequently alcohol-harm consequences, such as motor vehicle injuries (Elder et al. 2010). A number of studies have found a significant reduction in impaired driving crashes after an increase in the excise tax on alcohol. For example, a recent study in Illinois found that a 2009 increase in the Illinois alcohol excise tax on all alcoholic beverages (beer, wine, and distilled spirits) resulted in a significant reduction of 26% in alcohol-related crashes after the 2009 increase compared to before the increase (Wagenaar et al. 2015). This study used time series analysis and used non-alcohol-related crashes to control for trends and other factors affecting motor vehicle injuries.

Increasing the tax on alcohol is especially relevant considering that the cost of a drink today in relation to per capita disposable income is 25% less than it was in 2000 (Kerr et al. 2013). Increasing alcohol taxes is an effective broad public health strategy that can help to mitigate the increased affordability of alcohol and its negative health consequences (Daley et al. 2012; Nelson et al. 2013). However, as evidenced by the fact that there has been only one federal tax increase over the past 30 years and just a few state alcohol tax increases over the past 10 years, this measure is very difficult to implement.

2. Re-engage the public and raise the priority of impaired driving

Between 1982 and 1992, impaired driving was not only the top road safety issue, it was one of the highest profile social issues. Public outrage over innocent victims of alcohol-impaired driving crashes stimulated by the establishment of Mothers Against Drunk Driving (MADD) led to action at the federal, state, and community levels to reduce impaired driving (Fell et al. 2006). In an era of constantly changing social issues, the longevity of the attention and

concern afforded the alcohol-crash problem was unprecedented. During this period, numerous new and stricter drunk driving laws were enacted by the states, enforcement intensity increased, and substantial reductions in impaired driving fatalities and injuries were achieved. Since then, public attention to the issue appears to have waned and other road safety issues such as distracted driving and drugged driving have captured the public's attention. Media and the public appear to have forgotten the problem of alcohol-impaired driving, perhaps under the illusion that the problem has been solved or at least that it is under control.

Recapturing the public's attention will not be easy. It will require a coordinated strategy centered around "something new." The "something new" needs to be able to capture media and public interest and prompt discussion, debate, and ultimately action. A new law or countermeasure that is somewhat controversial would assist in efforts to ensure the issue is given a high profile. Public awareness and support is instrumental in influencing policymakers to endorse programs or policies targeting alcohol-impaired driving.

3. Lower the illegal per se BAC limit to .05 for a criminal offense

Virtually all drivers are impaired with regard to their driving performance at .05 BAC (Moskowitz et al. 2000), and the risk of being involved in a crash has increased significantly by .05 BAC (Blomberg et al. 2005; Compton and Berning 2015). Lowering the illegal per se limit to .05 BAC is a proven effective countermeasure that has reduced alcohol-related traffic fatalities in other countries (Bartl and Esberger 2000; Brooks and Zaal 1992). A .05 BAC limit is a reasonable standard to set: it is not typically reached with a couple of beers after work or with a glass or two of wine with dinner. The American public supports illegal limits below .08 BAC. Surveys show that most people would not drive after consuming two or three drinks in an hour, which would be .05 BAC or lower for most drivers (Moulton et al. 2010). Most other industrialized nations around the world have set BAC limits at .05 or lower (World Health Organization 2013). Lowering the BAC limit for driving typically reduces drinking drivers in fatal crashes at all BAC levels (BACs > .01; BACs > .05; BACs > .08; BACs > .15) (Wagenaar et al. 2007). The major criticisms of a .05 BAC limit have been addressed (Fell and Voas 2014). It has been 32 years since the first states adopted a .08 BAC limit. Based on the scientific evidence and new studies, it appears to be time to lower that limit to .05 BAC as 100 other countries have accomplished. However, given the struggle to lower the BAC limit from .10 to .08 in the 1990s, this may be politically very difficult.

4. Develop and implement in-vehicle alcohol detection systems

A long-term development program was recently inaugurated by NHTSA, automobile manufacturers, and MADD to develop a system for all cars that can passively sense the driver's BAC and prevent driving if he or she is over the BAC legal limit. The program is called "Driver Alcohol Detection System for Safety" (DADSS 2015; Zaouk et al. 2015) and is currently being funded by NHTSA and most of the motor vehicle manufacturers (http://dadss.org/). If such a vehicle can be produced, it would finally fulfill the objective enunciated over 40 years ago—to build "Cars that Drunks Can't Drive" (Voas 1969). One of these vehicle-based monitors passively detects alcohol in the breath of the driver, making it unnecessary for the driver to blow into an interlock breath tube (Lambert et al. 2006).

Another developed technology measures blood alcohol concentration passively through the skin, providing a substitute for blowing into the interlock (Ennis 2006).

These systems may have value as a method for activating a driver interlock system only when there is evidence of a drinking driver in the vehicle. Thus, the not-too-distant future offers the possibility of equipping all new vehicles with a system that would make impaired driving unlikely (Zaouk et al. 2015). One study estimated that over 15 years, up to 85% of traffic fatalities (59,000) and 88% of non-fatal injuries (1.25 million) attributed to alcohol-impaired drivers would be prevented saving over $342 billion in costs if alcohol ignition interlocks were installed in all new vehicles. However, it remains to be demonstrated that the public will accept the units on new cars, and once they become available, it will require more than two decades for the system to be in all cars on the road.

5. Expand the use of screening and brief interventions in medical facilities

Screening and Brief Interventions with Referral to Treatment (SBIRT) is a comprehensive, integrated, public health approach to the delivery of early intervention and treatment services for persons with substance use disorders, as well as those who are at risk of developing these disorders (Babor et al. 2007). Primary care centers, hospital emergency rooms, trauma centers, and other community settings provide opportunities for early intervention with at-risk substance users before more severe consequences occur. SBIRT involves the three elements of its name: *screening*, which quickly assesses the severity of substance use and identifies the appropriate level of treatment; *brief interventions*, which focus on increasing the insight and awareness of the patient regarding substance use and motivation toward behavioral change; and *referral*, which provides those identified as needing more extensive *treatment* with access to specialty care.

Brief interventions are not intended to treat people with serious substance dependence, but rather to treat problematic or risky substance use. Skillfully conducted, brief interventions are essential to successful SBIRT implementation. The two most common behavioral therapies used in SBIRT programs are brief versions of cognitive behavioral therapy and motivational interviewing, or some combination of the two. There is substantial research on the effectiveness of SBIRT in reducing risky alcohol consumption (Bertholet et al. 2005; Cochran et al. 2015; Kaner et al. 2009; Landy et al. 2015; Ouimet et al. 2013; Patton et al. 2014; Steinka-Fry et al. 2015; Teeters et al. 2015; Whitlock et al. 2004; Wojnar and Jakubczyk 2014).

Two U.S. Preventive Services Task Forces reviewed the literature on this topic and concluded that there is strong evidence for routine screening and brief intervention for reducing risky alcohol consumption in adult primary care but that there is insufficient evidence for effectiveness with adolescents (Moyer and U.S. Preventive Services Task Force 2013; Whitlock et al. 2004). However, in a meta-analysis of over 185 studies by Tanner-Smith and Lipsey (2015), the authors found extensive empirical support for this intervention for adolescents and young adults. Recent national surveys have found most adults are not screened and counseled about alcohol in adult primary care (Hingson et al. 2012; Hingson et al. 2013), particularly young adults ages 18–24, those most likely to exceed low-risk guidelines and meet alcohol dependence criteria in the past year. The literature on SBIRT

lists several barriers to implementation including the time required to ask questions and to counsel, the lack of provider training, treatment and referral resources, and reimbursement difficulties.

A recent publication (Mullen et al. 2015) highlighted the need for a multimodal approach to treatment of DWI offenders who represent a clinical population with high levels of unmet treatment needs beyond the alcohol misuse disorders. The study found that of the adult DWI offenders in a residential or community program, almost 97% met the clinical diagnostic criteria for an alcohol use disorder, 71% were dependent on alcohol, 40% had a diagnosis of marijuana use disorder, 15% had a diagnosis of cocaine use disorder, and 14% for a stimulant disorder. About 50% had multiple DWI arrests, 64% had no health care insurance, 83% were most likely to see medical care in an emergency room, 26% had a psychiatric disorder in addition to substance use disorder (61% of whom were not being treated for the mental health disorders), and 36% had other medical conditions (78% of whom were not receiving treatment for their medical condition). Clearly, the use of SBIRT in a medical facility before a DWI arrest could reduce the above percentages.

The National Institute on Alcohol Abuse and Alcoholism has published a Clinician's Guide on how to effectively screen for risky drinking and provide brief counseling to advise about alcohol. The Affordable Care Act now allows medical financial reimbursement for screening and brief intervention, treatment, and referral for alcohol among adults, but not yet adolescent patients.

CONCLUSIONS

In 2010, a special Transportation Research Board Committee for the Study of Traffic Safety Lessons from Benchmark Nations stated in its chapter on *Prevention of Alcohol-Impaired Driving* that "Widespread implementation of sustained, high-frequency sobriety testing programs in the United States at sobriety checkpoints could be expected to save 1,500 to 3,000 lives annually. However, little progress has been made implementing this. There is also evidence to indicate that lowering the illegal BAC limit to .05 g/L, combined with more intensive enforcement, would reduce fatalities further." In the same chapter it reported that "…ignition interlocks are now recognized as an effective means to reduce recidivism" (Transportation Research Board 2010). The participants of the 2015 workshop agreed with those judgments.

The limited progress on two of these recommendations over the intervening 5-year period highlights the difficulty in implementing them. There is no evidence of any increase in the use of sobriety checkpoints nor have any states enacted a .05 BAC law. On the other hand, the number of interlocks in use in the United States increased by 50% (from 200,000 to 300,000) in just 3 years from 2010 to 2013. This may be due to (a) the strong consensus of the research community and policymakers supporting interlocks, (b) the fact that interlock programs are largely self-supporting because much of the funding is born by the offender, and (c) a lack of strong opposition to interlocks. The enactment of .05 administrative laws and implementation of checkpoints face strong opposition from the hospitality industry based on the concern that either strategy will impact "social drinkers" and reduce alcohol

sales. Achieving these objectives will probably require implementing one of the important strategies identified by TRB workshop participants: re-engage the public to raise the priority of impaired driving. Increasing the public's attention on the drinking driving problem will be a major challenge for researchers, advocates, and policymakers.

Implementation of proven effective strategies such as those outlined in this article is essential if we are to reverse the stagnation of current efforts. Given the continued high proportion of deaths and injuries attributable to alcohol-impaired driving crashes in the United States, this must remain a high priority.

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REFERENCES

Babor TF, McRee BG, Kassebaum PA, Grimaldi PL, Ahmed K, Bray J. Screening, Brief Intervention, and Referral to Treatment (SBIRT) toward a public health approach to the management of substance abuse. Subst Abuse. 2007; 28(3):7–30.

Bartl, G.; Esberger, R. Effects of lowering the legal BAC limit in Austria. In: Laurell, H.; Schlyter, F., editors. Proceedings of the 15th International Conference on Alcohol, Drugs and Traffic Safety - T'2000; May 22–26, 2000. Stockholm, Sweden: International Council on Alcohol, Drugs and Traffic Safety (ICADTS); 2000.

Beirness DJ, Beasley EE. An evaluation of immediate roadside prohibitions for drinking drivers in British Columbia: findings from roadside surveys. Traffic Inj Prev. 2014; 15(3):228–233. [PubMed: 24372494]

Beirness DJ, Marques PR, Voas RB, Tippetts AS. The impact of mandatory versus voluntary participation in the Alberta Ignition Interlock Program. Traffic Inj Prev. 2003; 4(1):24–27. [PubMed: 16801126]

Bertholet N, Daeppen J-B, Wietlisbach V, Fleming M, Burnand B. Reduction of alcohol consumption by brief alcohol intervention in primary care: systematic review and meta-analysis. Arch Intern Med. 2005; 165(9):986–995. [PubMed: 15883236]

Blais E, Bellavance F, Marcil A, Carnis L. Effects of introducing an administrative. 05% blood alcohol concentration limit on law enforcement patterns and alcohol-related collisions in Canada. Accid Anal Prev. 2015; 82:101–111. [PubMed: 26070016]

Blomberg, RD.; Peck, RC.; Moskowitz, H.; Burns, M.; Fiorentino, D. Crash risk of alcohol involved driving: A case-control study. Stamford, CT: Dunlap & Associates, Inc.; 2005.

Brooks, C.; Zaal, D. Effects of a 0.05 Alcohol Limit in the Australian Capital Territory. Canberra, Australia: Federal Office of Road Safety MR 10; 1992.

Brubacher JR, Chan H, Brasher P, et al. Reduction in fatalities, ambulance calls, and hospital admissions for road trauma after implementation of new traffic laws. Am J Public Health. 2014; 104(10):e89–e97. [PubMed: 25121822]

Casanova-Powell, T.; Hedlund, J.; Leaf, W.; Tison, J. Evaluation of state ignition interlock programs: Interlock use analyses from 28 states, 2006–2011. Washington, DC: National Highway Traffic Safety Administration, & Atlanta: Centers for Disease Control and Prevention; 2015 May.

Cochran G, Field C, Foreman M, Ylioja T, Brown CV. Effects of brief intervention on subgroups of injured patients who drink at risk levels. Inj Prev. 2015

Compton, R. The use of safety checkpoints for DWI enforcement. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 1983.

Compton, RP.; Berning, A. Drug and Alcohol Crash Risk. Washington, DC: National Highway Traffic Safety Administration; 2015.

Daley JI, Stahre MA, Chaloupka FJ, Naimi TS. The impact of a 25-cent-per-drink alcohol tax increase. Am J Prev Med. 2012; 42(4):382–389. [PubMed: 22424251]

Dang, JN. Statistical analysis of alcohol-related driving trends, 1982–2005. Washington, DC: National Highway Traffic Safety Administration; 2008. (DOT HS 810 942)

DeYoung, DJ.; Tashima, HN.; Masten, SV. An evaluation of the effectiveness of ignition interlock in California. Paper presented at: 84th Annual Meeting of the Transportation Research Board; January 11, 2005; Washington, DC.

Driver Alcohol Detection System for Safety (DADSS). 2015 http://dadss.org/.

Elder RW, Lawrence B, Ferguson A, et al. The effectiveness of tax policy interventions for reducing excessive alcohol consumption and related harms. Am J Prev Med. 2010; 38(2):217–229. [PubMed: 20117579]

Elder RW, Voas R, Beirness D, et al. Effectiveness of ignition interlocks for preventing alcohol-related crashes: A Community Guide systematic review. Am J Prev Med. 2011; 40(3):362–376. [PubMed: 21335270]

Ennis, M. Impairment detection of Lumidigm's biometric platform. Paper presented at: MADD Technology Symposium; June 19, 2006; Albuquerque, NM.

Epperlein, T. The use of sobriety checkpoints as a deterrent: An impact assessment. Phoenix, AZ: Arizona Department of Public Safety; 1985.

Federal Bureau of Investigation. Uniform Crime Reports. 2013. http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2011/crime-in-the-u.s.-2011/tables/table-29

Fell, JC.; Langston, EA.; Lacey, JH.; Tippetts, AS.; Cotton, R. Evaluation of Seven Publicized Enforcement Programs to Reduce Impaired Driving: Georgia, Louisiana, Pennsylvania, Tennessee, Indiana, Michigan, and Texas. Washington, DC: National Highway Traffic Safety Administration; 2008.

Fell JC, Tippetts AS, Voas RB. Fatal traffic crashes involving drinking drivers: What have we learned? Ann Adv Automot Med. 2009; 53:63–76. [PubMed: 20184833]

Fell JC, Voas RB. The effectiveness of a 0.05 blood alcohol concentration (BAC) limit for driving in the United States. Addiction. 2014; 109(6):869–874. [PubMed: 24898061]

Fell JC, Voas RB. Mothers Against Drunk Driving (MADD): The first 25 years. Traffic Inj Prev. 2006 Sep; 7(3):195–212. [PubMed: 16990233]

Governors Highway Safety Association. Sobriety Checkpoint Laws. 2015 http://www.ghsa.org/html/stateinfo/laws/checkpoint_laws.html.

Hingson RW, Heeren T, Edwards EM, Saitz R. Young adults at risk for excess alcohol consumption are often not asked or counseled about drinking alcohol. J Gen Intern Med. 2012; 27(2):179–184. [PubMed: 21935753]

Hingson RW, Wenxing Z, Iannotti RJ, Simons-Morton B. Physician advice to adolescents about drinking and other health behaviors. Pediatrics. 2013; 131(2):249–257. [PubMed: 23359580]

Insurance Institute for Highway Safety. State court decisions on the constitutionality of sobriety checkpoints. 2015 http://www.iihs.org/iihs/topics/laws/checkpoints.

Kaner EF, Dickinson HO, Beyer F, et al. The effectiveness of brief alcohol interventions in primary care settings: a systematic review. Drug Alcohol Rev. 2009; 28(3):301–323. [PubMed: 19489992]

Kerr WC, Patterson D, Greenfield TK, et al. US alcohol affordability and real tax rates, 1950–2011. Am J Prev Med. 2013; 44(5):459–464. [PubMed: 23597808]

Lacey, JH.; Jones, RK.; Smith, RG. An evaluation of Checkpoint Tennessee: Tennessee's statewide sobriety checkpoint program. Washington, DC: National Highway Traffic Safety Administration; 1999.

Lacey JH, Kelley-Baker T, Ferguson SA, Rider RP. Low-manpower checkpoints: Can they provide effective DUI enforcement for small communities? Traffic Inj Prev. 2006; 7(3):213–218. [PubMed: 16990234]

Lacey, JH.; Marchetti, LM.; Stewart, JR., et al. Enforcement and public information strategies for the general deterrence of DWI: The Boise City, Idaho, experience. Washington, DC: National Highway Traffic Safety Administration; 1986.

Lacey, JH.; Stewart, JR.; Marchetti, LM., et al. Enforcement and public information strategies for DWI general deterrence: Arrest drunk driving: The Clearwater and Largo, Florida experiences. Washington, DC: National Highway Traffic Safety Administration; 1986.

Lambert, DK.; Myers, ME., Jr; Oberdier, L.; Sultan, MF.; Thrush, CM.; Li, T. Passive sensing of driver intoxication. Warrendale, PA: SAE International; 2006 Apr 3–6. (2006-02-1321).

Landy MS, Davey CJ, Quintero D, Pecora A, McShane KE. A systematic review on the effectiveness of brief interventions for alcohol misuse among adults in emergency departments. J Subst Abuse Treat. 2015

Levy D, Asch P, Shea D. An assessment of county programs to reduce driving while intoxicated. Health Educ Res. 1990; 5:247–255.

Levy D, Shea D, Asch P. Traffic safety effects of sobriety checkpoints and other local DWI programs in New Jersey. Am J Public Health. 1988; 79:291–293. [PubMed: 2916713]

Lund, AK.; McCartt, AT.; Farmer, CM. Contribution of alcohol-impaired driving to motor vehicle crash deaths in 2010. Arlington, VA: Insurance Institute for Highway Safety; 2012.

Macdonald S, Zhao J, Martin G, et al. The impact on alcohol-related collisions of the partial decriminalization of impaired driving in British Columbia, Canada. Accid Anal Prev. 2013; 59:200–205. [PubMed: 23792619]

Marques PR, Tippetts AS, Voas RB. The alcohol interlock: An underutilized resource for predicting and controlling drunk drivers. Traffic Inj Prev. 2003; 4(3):188–194. [PubMed: 14522642]

Marques PR, Tippetts AS, Voas RB. Comparative and joint prediction of DUI recidivism from alcohol ignition interlock and driver records. J Stud Alcohol. 2003; 64(1):83–92. [PubMed: 12608487]

Marques PR, Voas RB. Case-managed alcohol interlock programs: A bridge between the criminal and health systems. J Traffic Med. 1995; 23(2):77–85.

Marques, PR.; Voas, RB.; Roth, R.; Tippetts, AS. Evaluation of the New Mexico Ignition Interlock Program. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 2010.

Marques PR, Voas RB, Tippetts AS. Behavioral measures of drinking: Patterns in the interlock record. Addiction. 2003; 98(Suppl 2):13–19. [PubMed: 14984238]

McCartt AT, Leaf WA, Farmer CM, Eichelberger AH. Washington State's alcohol ignition interlock law: Effects on recidivism among first-time DUI offenders. Traffic Inj Prev. 2013; 14(3):215–229. [PubMed: 23441939]

Michigan Department of State Police et al. v. Sitz et al. 429 N.W. 2d 190 (Mich. App. 1988), 88-1897, 496 U.S. U.S.; 1990.

Miller TR, Galbraith M, Lawrence BA. Costs and benefits of a community sobriety checkpoint program. J Stud Alcohol. 1998; 59(4):465–468.

Moskowitz, H.; Burns, M.; Fiorentino, D.; Smiley, A.; Zador, P. Driver characteristics and impairment at various BACs. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 2000.

Moulton, BE.; Peterson, A.; Haddix, D.; Drew, L. National Survey of Drinking and Driving Attitudes and Behaviors: 2008 (Volume II: Findings Report). Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 2010.

Moyer VA. U.S. Preventive Services Task Force. Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: Recommendation statement. Ann Intern Med. 2013; 159(3):210–218. [PubMed: 23698791]

Mullen J, Ryan SR, Mathias CW, Dougherty DM. Feasibility of a computer-assisted alcohol screening, brief intervention and referral to treatment program for DWI offenders. Addict Sci Clin Pract. 2015; 10(1):1–10.

National Center for Statistics and Analysis. 2014 crash data key findings. (Traffic Safety Facts Crash Stats. Report No. DOT HS 812 219). Washington, DC: National Highway Traffic Safety Administration; 2015 Nov.

National Center for Statistics and Analysis. Fact Sheet. Motor vehicle traffic fatalities and fatality rate: 1899–2003. Washington, DC: National Highway Traffic Safety Administration; 2004.

National Center for Statistics and Analysis. State alcohol-impaired driving estimates: 2013 data. (Traffic Safety Facts. Report No. DOT HS 812 188). Washington, DC: National Highway Traffic Safety Administration; 2015 Aug.

National Highway Traffic Safety Administration. Law enforcement training video on sobriety checkpoints. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 1999.

National Highway Traffic Safety Administration. Low-staffing sobriety checkpoints. (DOT HS 810 590). Washington, DC: National Highway Traffic Safety Administration; 2006 Apr.

National Highway Traffic Safety Administration. Saturation patrols and sobriety checkpoints: A how-to guide for planning and publicizing impaired driving enforcement efforts. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 2000.

National Highway Traffic Safety Administration. Screening for risk and needs using the impaired driving assessment. (DOT HS 812 022). 2014 May.

National Highway Traffic Safety Administration. The use of sobriety checkpoints for impaired driving enforcement. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Enforcement and Emergency Services; 1990.

National Transportation Safety Board. Reaching zero: Actions to eliminate alcohol-impaired driving [Safety Report]. Washington, DC: National Transportation Safety Board; 2013.

National Transportation Safety Board. Safety Recommendation H-13-006. 2013. http://www.ntsb.gov/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=H-13-006

Nelson TF, Xuan Z, Babor TF, et al. Efficacy and the strength of evidence of U.S. alcohol control policies. Am J Prev Med. 2013; 45(1):19–28. [PubMed: 23790985]

Ouimet MC, Dongier M, Di Leo I, et al. A Randomized Controlled Trial of Brief Motivational Interviewing in Impaired Driving Recidivists: A 5-Year Follow-Up of Traffic Offenses and Crashes. Alcohol Clin Exp Res. 2013; 37(11):1979–1985. [PubMed: 23895363]

Patton R, Deluca P, Kaner E, Newbury-Birch D, Phillips T, Drummond C. Alcohol screening and brief intervention for adolescents: the how, what and where of reducing alcohol consumption and related harm among young people. Alcohol and alcoholism. 2014; 49(2):207–212. [PubMed: 24232178]

Peek-Asa C. The effect of random alcohol screening in reducing motor vehicle crash injuries. Am J Prev Med. 1999; 16(1S):57–67. [PubMed: 9921387]

Ross, HL. The Deterrent Capability of Sobriety Checkpoints: Summary of the American Literature. Washington, DC: National Highway Traffic Safety Administration; 1992.

Ross HL, Voas RB. The new Philadelphia story: The effects of severe punishment for drunk driving. Law and Policy. 1990; 12(1):51–79.

Roth R. 2013 Survey of Currently-Installed Interlocks in the U.S. 2013. http://www.rothinterlock.org/2013_survey_of_currently_installed_interlocks_in_the_us_revised-12_17_13.pdf.

Roth R, Voas RB, Marques P. A note on the effectiveness of a house arrest alternative for motivating DWI offenders to install ignition interlocks. J Saf Res. 2009; 40(6):437–441.

Shults RA, Elder RW, Sleet DA, et al. Reviews of evidence regarding interventions to reduce alcohol-impaired driving. Am J Prev Med. 2001; 21(4 Suppl):66–88. [PubMed: 11691562]

Steinka-Fry K, Tanner-Smith E, Hennessy E. Effects of Brief Alcohol Interventions on Drinking and Driving among Youth: A Systematic Review and Meta-analysis. J Addiction Prevention. 2015; 3(1):11.

Stuster, JW.; Blowers, MA. Experimental evaluation of sobriety checkpoint programs. Washington, DC: U.S. Department of Transportation, National Highway Safety Administration; 1995.

Tanner-Smith EE, Lipsey MW. Brief alcohol interventions for adolescents and young adults: A systematic review and meta-analysis. J Subst Abuse Treat. 2015; 51:1–18. [PubMed: 25300577]

Teeters JB, Borsari B, Martens MP, Murphy JG. Brief motivational interventions are associated with reductions in alcohol-impaired driving among college drinkers. J Stud Alcohol Drugs. 2015; 76(5): 700–709. [PubMed: 26402350]

Timken D, Marques PR. Support for Interlock Planning (SIP): Participants Workbook. 2001 [Accessed April 20, 2009] www.pire.org/sip/sipmanuals.htm.

Timken D, Marques PR. Support for Interlock Planning (SIP): Providers Manual. 2001 [Accessed April 20, 2009] www.pire.org/sip/sipmanuals.htm.

Tippetts AS, Voas RB. The effectiveness of the West Virginia interlock program. J Traffic Med. 1998; 26(1–2):19–24.

Transportation Research Board. Special Report 300: Achieving traffic safety goals in the United States: Lessons from other nations. Washington, DC: Transportation Research Board of the National Academies of Science, Committee for the Study of Traffic Safety Lessons from Benchmark Nations; 2010.

U.S. Congress Transportation Reauthorization. Public Law 112 - 141: Moving Ahead for Progress in the 21st Century Act or the Map-21, 126 Stat. 405; 2012.

U.S. Government Accountability Office. Washington, DC: U.S. Government Accountability Office; 2014. Traffic Safety: Alcohol Ignition Interlocks Are Effective While Installed; Less Is Known about How to Increase Installation Rates.

Vézina, L. The Quebec alcohol interlock program: Impact on recidivism and crashes. In: Mayhew, D.; Dussault, C., editors. Proceedings of Alcohol, Drugs & Traffic Safety - T 2002: 16th International Conference on Alcohol, Drugs & Traffic Safety, August 4–9, 2002. Vol. 1. Québec City: Société de l'assurance automobile du Québec; 2002. p. 97-104.

Voas R, Tippetts AS, Bergen G, Grosz M, Marques P. Mandating treatment based on interlock performance: Evidence for effectiveness. Alcohol Clin Exp Res. 2015 under review.

Voas, RB. Cars that drunks can't drive. Washington, DC: National Highway Safety Research Center; 1969. (Technical Report)

Voas RB, Blackman KO, Tippetts AS, Marques PR. Evaluation of a program to motivate impaired driving offenders to install ignition interlocks. Accid Anal Prev. 2002; 34(4):449–455. [PubMed: 12067107]

Voas RB, Marques PR. Commentary: Barriers to interlock implementation. Traffic Inj Prev. 2003 Sep; 4(3):183–187. [PubMed: 14522641]

Voas RB, Marques PR, Tippetts AS, Beirness DJ. The Alberta Interlock Program: The evaluation of a province-wide program on DUI recidivism. Addiction. 1999; 94(12):1849–1859. [PubMed: 10717963]

Voas, RB.; Rhodenizer, AE.; Lynn, C. Evaluation of Charlottesville checkpoint operations. (Final Report DOT HS 806 989). Washington, DC: National Highway Traffic Safety Administration; 1985. (Available in hard copy format only from the National Technical Information Service, Springfield, VA)

Voas RB, Tippetts AS, Grosz M. Administrative reinstatement interlock programs: Florida, a 10-year study. Alcohol Clin Exp Res. 2013; 37(7):1243–1251. [PubMed: 23442206]

Voas RB, Tippetts AS, Romano E, Fisher DA, Kelley-Baker T. Alcohol involvement in fatal crashes under three crash exposure measures. Traffic Inj Prev. 2007 Jun; 8(2):107–114. [PubMed: 17497512]

Wagenaar AC, Livingston MD, Staras SS. Effects of a 2009 Illinois alcohol tax increase on fatal motor vehicle crashes. Am J Public Health. 2015; (0):e1–e6.

Wagenaar AC, Maldonado-Molina M, Ma L, Tobler A, Komro K. Effects of legal BAC limits on fatal crash involvement: Analyses of 28 states from 1976 through 2002. J Saf Res. 2007; 38:493–499.

Wagenaar AC, Maldonado-Molina MM, Erickson DJ, Ma L, Tobler AL, Komro KA. General deterrence effects of U.S. statutory DUI fine and jail penalties: Long-term follow-up in 32 states. Accid Anal Prev. 2007; 39(5):982–994. [PubMed: 17854574]

Wells JK, Preusser DF, Williams AF. Enforcing alcohol-impaired driving and seat belt use laws, Binghamton, New York. J Saf Res. 1992; 23(2):63–71.

Whitlock EP, Polen MR, Green CA, Orleans T, Klein J. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults: a summary of the evidence for the US Preventive Services Task Force. Ann Intern Med. 2004; 140(7):557–568. [PubMed: 15068985]

Williams, AF.; Ferguson, SA.; Cammisa, MX. Self-reported drinking and driving practices and attitudes in four countries and perceptions of enforcement. Arlington, VA: Insurance Institute for Highway Safety; 2000.

Willis C, Lybrand S, Bellamy N. Alcohol ignition interlock programmes for reducing drink driving recidivism. Cochran Database of Systematic Reviews. 2004; 18(4):CD004168.

Wojnar M, Jakubczyk A. Brief interventions for hazardous and harmful alcohol consumption in accident and emergency departments. Front Psychiatry. 2014; 5

World Health Organization. [Accessed May 9, 2013] List of countries' BAC limits for driving. 2013. http://apps.who.int/gho/athena/data/GHO/SA_0000001520.html?profile=ztable&filter=COUNTRY:*;BACGROUP:*

World Health Organization. Strategies to Reduce the Harmful Use of Alcohol: Draft Global Strategy: World Health Organization, Sixty-Third World Health Assembly. 2010.

Zador, P.; Krawchuk, S.; Moore, B. Drinking and driving trips, stops by police, and arrests: Analyses of the 1995 national survey of drinking and driving attitudes and behavior. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration; 2000.

Zaloshnja E, Miller T, Blincoe L. Costs of alcohol-involved crashes, United States, 2010. Ann Adv Automot Med. 2013; 57:3–12. [PubMed: 24406941]

Zaouk, A.; Wills, M.; Traube, E.; Strassburger, R. 24th Enhanced Safety of Vehicles Conference. Gothenburg, Sweden; 2015. Driver Alcohol Detection System for Safety (DADSS) - A Status Update.

APPENDIX A

LIST OF WORKSHOP PARTICIPANTS

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Compton, Richard	NHTSA	Director, Office of Behavioral Safety Research
Erickson, Darin	University of Minnesota	Associate Professor
Fell, James	Pacific Institute for Research and Evaluation	Senior Research Scientist
Hedlund, James	Highway Safety North	Principal
Hingson, Ralph	National Institute on Alcohol Abuse and Alcoholism	Director, Division of Epidemiology and Prevention Research
Jonah, Brian	Canadian Association of Road Safety Professionals	President
Kleiner, Bernardo	TRB	Transportation Safety Specialist
Kostyniuk, Lidia	University of Michigan	Research Scientist
Logan, Barry	NMS Labs	Vice President, Forensic Science Initiatives
Marples, Ian	Smart Start Inc.	Vice President, International Operations
Maxwell, Jane	University of Texas at Austin	Research Professor
McCartt, Anne	Insurance Institute for Highway Safety	Senior Vice President, Arlington Research

Name	Affiliation	Position
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Smith, Gordon	University of Maryland School of Medicine	Professor
Smith, Ryan	Virginia Tech Transportation Institute	Sr. Research Associate
Soderstrom, Carl	Maryland Motor Vehicle Administration	Chief, Medical Advisory Board
Teigen, Anne	National Conference of State Legislatures	Program Principal
Traube, Eric	NHTSA	Senior Engineer/Technical Lead
Voas, Robert	Pacific Institute for Research and Evaluation (PIRE)	Senior Research Scientist
Weir, Debbie	Mothers Against Drunk Driving	Chief Executive Officer
Wigle, Diane	NHTSA	Chief, Impaired Driving Division
Zaouk, Bud	DADSS	DADSS Program Manager and Group Director for QinetiQ North America

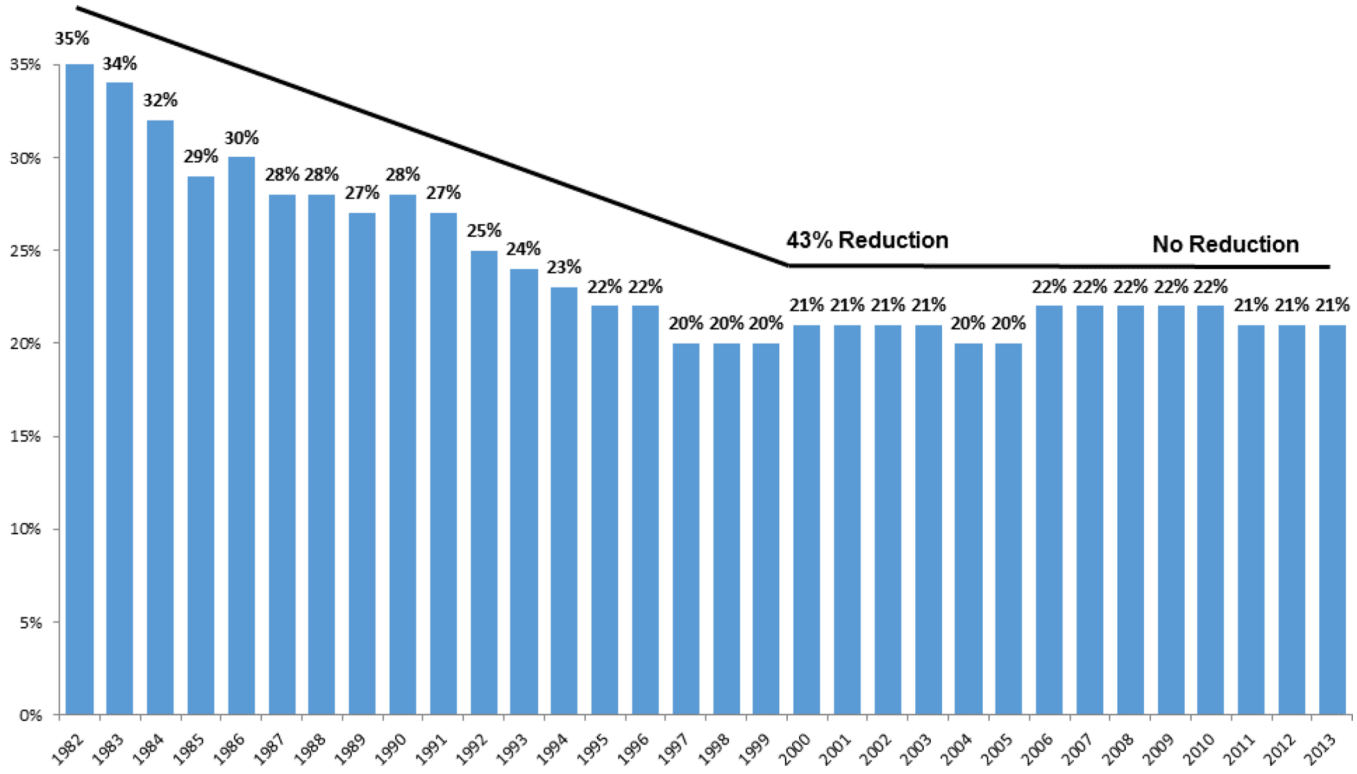

Figure 1.

Proportion of All Drivers Involved in Fatal Crashes Estimated to Have Been Legally Intoxicated (BAC ≥ .08 g/dL), 1982–2013, United States (Source: NHTSA, 2015)

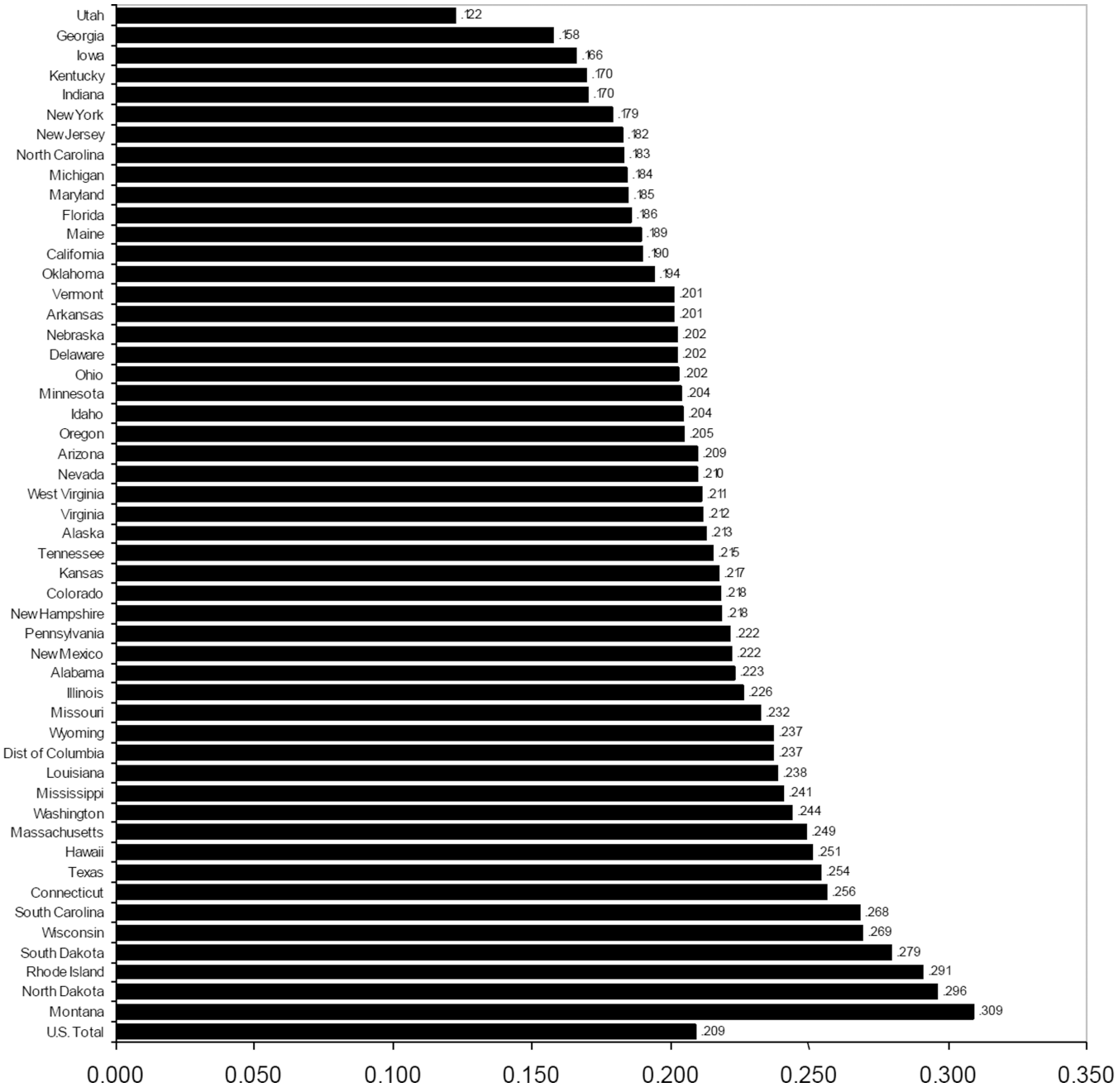

Figure 2.

Percentage of Drivers Involved in Fatal Crashes with BACs ≥ .08 g/dL, 5-Year Average (2002–2006), Ranked by State (Source: NHTSA, 2008)