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**CIRCULAR**

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**Alcohol and  
Other Drugs in  
Transportation**

*Research Needs and Priorities*

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TRANSPORTATION RESEARCH BOARD / NATIONAL RESEARCH COUNCIL

**Alcohol and Other Drugs in Transportation**  
*Research Needs and Priorities*

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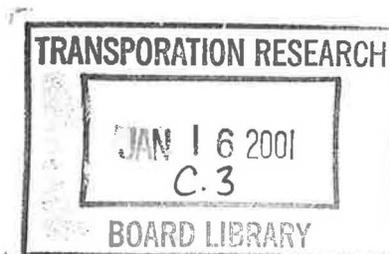
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## Foreword

What do we need to know in order to make further progress in reducing impaired driving and its consequences? This was the central question of the 1999 summer workshop of the TRB Committee on Alcohol, Other Drugs, and Transportation. The workshop brought together committee members and outside experts from the United States and other countries to identify research needs and priorities. The workshop also served as a forum for NHTSA, which is convening a series of expert panels on various topics in developing its strategic plan for behavioral research in traffic safety. It is anticipated that the results of the workshop, presented in this circular, will provide useful ideas for researchers and funders.



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## Overview

This Circular presents ideas from Transportation Research Board's (TRB's) Committee on Alcohol, Other Drugs, and Transportation on the research needed to continue to reduce impaired driving.

It has been 7 years since this Committee undertook such a review and discussion. The results of that July 1992 summer workshop were reported in *Transportation Research Circular 408: Alcohol and Other Drugs in Transportation: Research Needs for the Next Decade*, June 1993. While some of its research needs are still relevant, others are out of date, and new issues have arisen in the intervening years. It is appropriate that the research community provide its best thinking on what research is needed now and will be needed as we enter the new millennium.

Several other factors make this an auspicious time for an informed discussion of research needs. Progress in reducing impaired driving has slowed over the past decade. This means that now, more than ever, good research is needed to point the way to effective methods for continued progress. In addition, impaired driving program funds are increasingly more difficult to find. Without good research, funds will not be allocated in the most effective manner.

Finally, funds for research are equally scarce. It is crucial that these funds be used where they are most needed. For these reasons, the TRB Committee undertook to develop ideas of the research community on what research is needed and on relative priorities among these research needs. The Committee believes that the results, as given in this Circular, will be helpful to funding agencies, public and private, as they allocate scarce research funds effectively.

### How These Research Needs Were Produced

The research needs ideas in this Circular were developed in several steps. First, the Committee agreed at its January 1999 annual meeting to develop the research ideas in a summer workshop to which all Committee members and other interested researchers would be invited. A planning group from the Committee was appointed to plan and structure the process. The planning group decided to organize the discussion and ideas into five close-up areas: the general population, youth, repeat offenders, special populations, and drugs other than alcohol. This organization is far from perfect, and many issues overlap several groups. But it does provide a useful way of thinking about the many issues relevant to impaired driving and of structuring these ideas.

Next, the planning group asked 10 eminent researchers to write background papers, two for each of the five groups. The papers themselves were highly structured: each author was to list his or her top research priorities for the assigned area, with enough background to explain and justify the proposed research. These background papers were circulated to all workshop participants in advance and are included in this Circular.

The workshop itself began with brief presentations by each paper's author followed by general discussion on each of the five areas (see the workshop schedule in the Appendix to this Circular). This discussion allowed all participants to suggest other research needs that had not been addressed in the two background papers.

Following these discussions, the workshop divided into five working groups, one for each area. The working groups considered all research ideas from the two background papers and from the floor, and added other ideas of their own. They selected the most important and reported back these top priority research needs to the full workshop. Reports from each working group are given in the "Research Needs and Priorities" section of this Circular. The workshop then discussed these priorities and again had the opportunity to add other priorities, which also are given in the "Research Needs and Priorities" section.

Finally, the workshop as a whole ranked all research needs presented by the five working groups or added in general discussion. To do this, each workshop participant voted for 10 of the combined research needs. This priority ranking also is given in the "Research Needs and Priorities" section.

The Committee commends these research needs to funding agencies and individual researchers. If we can answer the questions posed here, the knowledge will contribute substantially to progress in reducing impaired driving.

## RESEARCH NEEDS AND PRIORITIES

### General Population

PAUL BOASE

*Transport Canada*

*Facilitator and Reporter*

The General Population working group discussed all 17 ideas presented in the two working papers as well as additional ideas from the general discussion and from working group members. The working group reported out the top 10 to the workshop. These research ideas, in rough priority order from the working group, are labeled G-1 through G-10 and are discussed below. Two additional ideas, G-11 and G-12, were added to the top 10 by the workshop in general discussion. Ideas based on one or both of the two working papers are noted by the lead author's initials and the idea number within that paper: DP-3 is the third idea from David Preusser, Anne McCartt, and Susan Martin and EV-1 is the first idea from Evelyn Vingilis. Additional ideas G-13 through G-26 from the working papers or from general discussion that were not presented in the working group report are listed at the end.

#### **G-1. Study Global Trends in Alcohol-Related Crashes and Fatalities (EV-1)**

Drinking and driving is a worldwide concern. Over the past 20 years, alcohol-related crashes have decreased in many countries or jurisdictions. We do not understand well how much of the reduction is due to individual countermeasures and how much is due to other factors. For example, the United States has attributed much of its substantial reduction in alcohol-related traffic fatalities among youth to its minimum drinking age 21 law. Yet Canada has experienced similar reductions while its minimum drinking age has remained at 18 or 19. This research should use multivariate statistical methods to estimate the effects of different countermeasures (including legislation) as well as broader social and economic influences, and begin to understand why similar countermeasures have different effects in different jurisdictions. Ample data are available for this research.

#### **G-2. Study the Relation Between Enforcement Level and the Public's Perception of Risk**

Laws themselves have little effect unless they are enforced. How much enforcement is necessary to produce wide compliance with traffic laws, especially drinking and driving laws? Several examples illustrate the question's complexity. Per se laws in the United States are widely violated (folk wisdom suggests at least 1,000 impaired driving trips for every arrest) even though drunk driving is the most common charge in many local courts. Some Australian states have reduced drunk driving substantially by very extensive high-visibility enforcement (stopping about one-third of all drivers annually for random breath tests). Zero-tolerance laws have been more effective than their poor enforcement level would suggest. This research should investigate how enforcement level, type, and visibility affect the public's perception of the risk of being stopped. What are the most cost-

effective enforcement levels and methods? The research also should consider how the likelihood of sanctions affect risk perception: if impaired drivers frequently are released with only a warning, how does this affect risk perception and behavior? See also ideas G-6 and G-7.

### **G-3. Study the Effects of Lower Legal Blood Alcohol Content Limits on Crashes, Injuries, and Fatalities.**

Blood alcohol content (BAC) limits vary widely around the world. Analyses of the impact of these different limits on crashes, injuries, and fatalities, controlling for other factors, may provide some perspective for the current debate on 0.08 versus 0.10 laws in the United States. The results can help guide policy decisions and can serve as baseline data when BAC limits change. The research also should compare the effects of per se and administrative laws.

### **G-4. Explore Technology for Identifying and Controlling Impaired Driving Offenders**

The most common technological control method is the alcohol interlock, which some jurisdictions require as a condition of driver license reinstatement for driving while intoxicated (DWI) offenders. A “smart card” driver license, used as a vehicle ignition key and containing personal driver license information, is being demonstrated in prototype. The passive alcohol sensor is an example of technology currently in use to detect impaired drivers. The critical issues are administrative rather than technological. For example, in some jurisdictions interlocks are installed on the cars of fewer than 20 percent of the offenders for whom they are “required.” This research should study these administrative issues. When should the technology be used? For what offenders or in what situations? Who pays the costs? Who should administer the program (courts, motor vehicle administration, etc.)? How should the technology be integrated into existing operations?

### **G-5. Study the Effects of Prescription and Over-the-Counter Drugs and Herbal Remedies on Driving (DP-4, EV-3)**

Many drivers regularly take prescription drugs, over-the-counter (OTC) drugs, or herbal remedies for a variety of health reasons. As the driving population ages, medication use by drivers likely will be even greater. These drugs may enhance or detract from driving performance. But state laws typically fail to appreciate the benefits of these drugs and prohibit driving while under the influence of any drug, even a drug that relieves a medical problem and improves driving performance. This research should investigate when driving after taking a prescription or OTC drug is harmful (with and without an interaction with alcohol). The research should consider methodologies using existing large databases, for example linking medication records (from health maintenance organizations) with driving records (from the department of motor vehicles). See also ideas D-1, D-6, and D-8.

**G-6. Determine the Impact of Not Enforcing an Impaired Driving Law or Not Following Through with Sanctions (DP-3)**

Some laws are rarely or almost never enforced. Some laws are difficult to enforce (zero-tolerance laws are a good example, since youth at positive but low alcohol levels typically provide insufficient evidence of impaired driving to justify stopping their car). Other laws may be legislative “feel good” measures that were enacted with little or no intention of serious enforcement. This research should study the effects on public attitudes and behavior of not enforcing laws. This topic is a special case of idea G-2. As with G-2, the sociological and criminal justice literature may be useful.

**G-7. How Can DWI Enforcement Be Measured?**

In order to address the appropriate level of DWI enforcement (see idea G-2), we must know how to measure it. The only generally available measure is DWI arrests. But this clearly is unsatisfactory. If drunk driving decreases substantially, then the same amount of DWI patrol time should produce fewer arrests. Also, some enforcement methods such as checkpoints produce relatively few arrests but have a high general deterrent value. This research should explore how best to measure DWI enforcement, considering such factors as man-hours, driver contacts, and publicity value in addition to arrests.

**G-8. Compare the Impaired Driving Populations on the Road, Arrested, and in Crashes (DP-1)**

DWI enforcement’s goal is to deter drunk driving. Consequently, DWI enforcement activities and DWI arrests typically occur “where and when the drunks are”—near bars late at night, especially on weekends. But alcohol-related crashes don’t always occur at these times and places, especially crashes involving women or youth. A better understanding of drunk driving travel, arrests, and crashes would help direct DWI enforcement more effectively. This research should compare the three populations and control for other significant factors such as age, gender, rural-urban location, and the like.

**G-9. Study the Driving Behavior of Alcoholics**

Most studies of impaired drivers begin with a driver identified through an arrest or crash and work backward to investigate his or her drinking behavior. This research will take the opposite approach, starting with alcoholics (or other substance abusers) and investigating their driving behavior. Which alcoholics drive? Which are arrested or crash? What are their alternative transportation arrangements? What interventions might reduce or eliminate their driving?

**G-10. How to Communicate Health Messages So That People Will Take Action (DP-6)**

Madison Avenue continually develops new and very effective communications strategies that promote alcohol use. Equally effective strategies are needed to promote healthy practices and to inform the public of the risks presented by drinking and driving. This health communication research should study what should be communicated, to whom, using what media. Should we emphasize individual risk or community norms? How can we best form and change public opinion? What messages work for what populations? How can we emphasize features that the public seems not to know or understand, such as zero-tolerance laws? How can we best develop culturally-appropriate and effective messages for important ethnic groups (see ideas from the Special Populations working group)?

The following ideas were added in general discussion.

**G-11. Study the Effects of Different Alcohol Control Strategies, Including Taxes (DP-9)**

Alcohol sales and access are controlled in many different ways. Each state has an alcohol control agency whose powers and practices vary widely (as just one example, some states sell alcohol through state stores while others license commercial retailers). Community alcohol control activities include zoning restrictions on alcohol outlets, alcohol sales licenses, dram shop and keg registration laws, and "Cops in Shops" and sting operations to prevent sales to minors. There is substantial opposition to any alcohol control activities, so good research is essential to determine the most effective strategies. Further, many alcohol control activities can demonstrate their effects most readily in terms of drunk driving. This research should build on existing results to investigate the effects of different alcohol control strategies and determine how each strategy is best administered and enforced.

**G-12. Study the Etiology, Development, and Natural History of Drinking Drivers (EV-5)**

Strategies to reduce drinking and driving should begin with a thorough understanding of those who drink and drive. We still have much to learn. Who are the drinking drivers? How did they develop? What were their social and environmental influences? What other problem behaviors do they exhibit? This research should link with criminological, sociological, and public health research to provide a broad view of drinking and driving problems and solutions.

The following ideas were not reported out.

- G-13. Study the impact of globalization on alcohol, drugs, and transportation (EV-2).
- G-14. Study the broad effects of health-care system changes (for example, treatment availability, medication changes, shorter hospital stays) (EV-3, see also G-5).

- G-15. Study the role of alcohol in passenger deaths, pedestrian crashes, and injuries in other transportation modes (EV-4; see also S-7, S-8).
- G-16. Study community interventions (EV-7).
- G-17. Study the effects of early intervention through the medical community (EV-8).
- G-18. Determine the awareness and support by the public for specific interventions (DP-2).
- G-19. What are the trends in impaired driving by females? (DP-5, see also S-1).
- G-20. Study other risk-taking behavior by impaired drivers (DP-7).
- G-21. Investigate approaches to reducing low-BAC driving beyond the standard legislation–enforcement–sanction (DP-8).
- G-22. Investigate how highway safety measures produce benefits outside transportation.
- G-23. Investigate how to increase the use of chemical compared to behavioral enforcement methods (per se laws rather than demonstrated impaired behavior).
- G-24. Study alternatives to drinking and driving.
- G-25. Why do people change their drinking and driving behavior? How important is the system of drunk driving laws and enforcement compared to other influences?
- G-26. Can early interventions with young children reduce subsequent drinking and driving behavior (see Y-4)?

## RESEARCH NEEDS AND PRIORITIES

### Youth

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Reporter*

The Youth working group discussed all 16 ideas presented in the two working papers as well as additional ideas from the general discussion and from working group members. The working group reported out the top 10 to the workshop. These ideas are labeled Y-1 through Y-10 and are discussed below. The Youth working group prioritized the ideas as follows: Y-1 through Y-3 are highest priority, Y-4 through Y-6 are next, and Y-7 through Y-10 are lowest. One additional idea, Y-11, was added to the top 10 by the workshop in general discussion. Ideas based on one or both of the two working papers are noted by the lead author's initials and the idea number within that paper: RH-2 is the second idea from Ralph Hingson and BV-7 is the second idea from Bob Voas. Additional ideas Y-12 through Y-20 from the working papers or from general discussion that were not presented in the working group report are listed at the end.

The top tier includes the following:

#### **Y-1. What Features of Zero-Tolerance Laws Are Most Effective? (RH-2 and RH-5, BV-7)**

Several high-quality research studies demonstrate quite conclusively zero-tolerance laws overall have reduced drinking and driving by youth. In many ways this is surprising. The laws differ substantially from state to state: for example, some laws impose criminal sanctions while others use administrative sanctions. Many zero-tolerance laws are not well publicized. And all zero-tolerance laws are difficult to enforce: low-blood alcohol content drivers frequently exhibit few driving behaviors that would prompt law enforcement to make a traffic stop, and the standard roadside sobriety tests do not detect low levels of alcohol well. This research should study why zero-tolerance laws have in fact reduced youth drinking and driving and should study what zero-tolerance law features are most effective. The research also should investigate administrative issues raised by different features: how they help or hinder offender processing, record-keeping, etc., and how these administrative issues affect the law's impact.

#### **Y-2. How Can Communities Be Motivated and Empowered to Enforce Minimum Drinking Age 21 Laws? (BV-2)**

The legal minimum drinking age has been 21 in all states for almost 15 years. But these laws typically are poorly enforced. Underage drinking is not a high police priority, in many

instances because it is not a high community priority. Existing research does indicate that when enforcement is enhanced there is a measurable, and often dramatic, impact on alcohol sales to minors. This research should investigate how communities can be motivated and organized to increase underage drinking law enforcement. It should begin by considering community views, norms, and practices on underage drinking and how to build on these views, norms, and practices to provide greater support for age 21 laws.

### **Y-3. Determine the Most Effective Minimum Drinking Age 21 Law Enforcement Strategies (BV-4)**

Minimum drinking age 21 law enforcement can intervene at several points: with retailers (both on- and off-premise), youth purchasers, parents, and other adults who purchase alcohol for youth. Each point requires very different enforcement techniques, some of which are quite labor intensive. Enforcement at each point can reduce underage access to alcohol. This research should investigate what enforcement types and levels will be most cost-effective in reducing alcohol availability and use by youth.

The middle tier includes the following:

### **Y-4. Relate the Age of Drinking Onset to Adult Drinking and Driving and Study Whether Delaying Onset Has an Effect on Later Drinking and Driving and Other Alcohol Problems (RH-1, BV-1)**

Research indicates that earlier onset of drinking is associated with increased drinking and driving, crashes, and injuries as adults. This suggests that delaying the onset of drinking will have life-long traffic safety and other health benefits. This research should confirm and extend these results to define more explicitly the relation between the age of drinking onset, the amount of drinking, and adult behavior. In addition it should investigate whether delaying the age of drinking onset has an effect on later alcohol problems and, if so, what the most effective strategies for delaying drinking onset are.

### **Y-5. Can Parents, Peers, and Communities Reduce Underage Drinking and Impaired Driving? How Can This Be Done Most Effectively?**

Parents, peers, schools, and communities are major forces in shaping the beliefs and influencing the actions of youth. Some programs attempt to work through them to reduce drinking and impaired driving. Traditional examples include parental involvement in graduated licensing; positive peer influences such as Students Against Drunk Driving; regular health and driver education courses; special assembly or mock crash programs; and substance-free parties in schools and community activities that provide youth with alternatives to drinking or drugs. More recent strategies include programs that promote the involvement of young people as advocates for policy change at the national, state, and local level, such as Mothers Against Drunk Driving's (MADD's) Youth in Action. But most of these programs have not been evaluated. Positive parent and peer influences are believed to be particularly effective. However, there is little hard evidence to substantiate

these beliefs or to determine the best methods to engage parents and peers. This research should study the programs' bottom-line results and determine which program types and features are most effective.

#### **Y-6. Will Addressing Other Risky Driving Behaviors Also Reduce Youth Drinking-Driving Crashes, Injuries, and Fatalities?**

Considerable research shows that drinking and driving is not an isolated behavior but is associated with other risky driving behaviors such as speeding and not using safety belts. This suggests that efforts to reduce some risky behaviors may also reduce others. Law enforcement has followed this theme in combined enforcement campaigns which seek to reduce all traffic violations rather than concentrating on a single activity such as speed. Law enforcement activities such as speed enforcement and seat belt checkpoints could provide opportunities to enforce zero-tolerance laws. Moreover, if traffic is generally slower and smoother, fewer crashes may occur either with or without the presence of alcohol. This research should study the relation between other risky driving behaviors and impaired driving and should investigate the effects on impaired driving of addressing these risky behaviors.

The bottom tier includes the following:

#### **Y-7. How to Reduce Drinking and Impaired Driving Among College Students (RH-6)**

Even though many college students are under the legal drinking age of 21, drinking is rampant at most colleges. As more college students have cars and live off-campus, drinking and driving isn't far behind. Effective methods are needed to reduce drinking and impaired driving by all college students, both under and over age 21. A number of specific interventions have been implemented but in general they have not been evaluated. This research should follow up on promising interventions, determine their critical components, and replicate them to provide convincing evidence of their effectiveness.

#### **Y-8. Determine the Effective Characteristics of Drinking Age 21 Laws (RH-7, BV-4)**

State minimum drinking age 21 laws differ in several important respects. For example, MADD reports that it is not illegal for persons under 21 to purchase alcohol in 18 states, not illegal to consume alcohol in 21 states, and not illegal to have false identification in 10 states. Other potential problems are created by laws that narrowly define "possession" of alcohol and that allow underage persons to sell and serve alcohol. This research should investigate the effects of these different age 21 law provisions on youth alcohol consumption and impaired driving.

**Y-9. Study Alternative Transportation Programs for Youth (BV-6)**

Designated driver and safe ride programs for persons over 21 have been promoted and used throughout the country. These programs for underage youth are controversial because they implicitly condone and may even encourage illegal underage drinking. But informal arrangements are widely used. Youth report they frequently use a designated driver (who may in fact have consumed some alcohol). Parents have informal agreements with their teenage youth that the parents will provide a ride home rather than have the youth drive after drinking or ride with someone else who has been drinking. This research should study whether designated driver and safe ride programs reduce impaired driving. It should determine if these programs encourage drinking, either by sending a message that drinking is normal behavior or by encouraging youth to drink more because they will not be driving. It also should determine whether these programs have different effects on youth and adults.

**Y-10. What Are the Drinking Patterns and Cultures Unique to Youth?  
What Are the Best Intervention Points?**

Youth behave, drink, and drive in quite different ways than adults. For example, they don't drink in bars after work; they drink at the football field on Friday nights. Their reasons for drinking and the needs they satisfy through their drinking also differ. Better knowledge of youth drinking behavior and culture would be very useful in determining the most effective intervention points and designing effective interventions. This research should study youth drinking behavior and culture, distinguishing important subgroups (ethnic, geographical, socioeconomic), and should use this information to suggest effective interventions.

The following ideas were added in general discussion:

**Y-11. Evaluate the Most Effective Components of  
Graduated Licensing Systems (BV-5)**

Graduated licensing describes a method of introducing beginning drivers to driving gradually through a series of increasingly less restrictive phases. These phases typically are a learner's phase when driving is permitted only if accompanied by a licensed adult driver, an intermediate phase when driving alone is permitted under certain conditions, and a fully licensed phase with no restrictions. The specific provisions of each phase differ substantially across the jurisdictions where graduated licensing is used. As one major example, some graduated licensing programs have a curfew that prohibits driving during certain nighttime hours while others do not. This research should evaluate the effects of different graduated licensing provisions. It also should examine how graduated licensing provisions are enforced across jurisdictions.

The following ideas were not reported out:

- Y-12. How to increase the perception that zero-tolerance law violators will be stopped, arrested, and sanctioned. (RH-3)
- Y-13. How to implement mandatory alcohol problem assessment programs for underage zero-tolerance law violators. (RH-4)
- Y-14. How to increase safety belt use among youth. (RH-8)
- Y-15. What is the effect of alcohol advertising, counteradvertising, and other education programs on alcohol consumption by youth? (BV-3)
- Y-16. How do impaired driving sanctions directed at adults (license suspension, vehicle actions, etc.) affect youth? (BV-8)
- Y-17. Would teaching responsible drinking to youth reduce alcohol abuse and impaired driving?
- Y-18. Why have youth nonalcohol traffic fatalities increased while alcohol-involved fatalities have decreased? Is alcohol a causal factor or only a correlate?
- Y-19. Study drugged driving by youth, especially marijuana (see also ideas from the Drug working group).
- Y-20. What lessons can be learned from the campaign against smoking that can be applied to reduce alcohol use?

## Repeat Offenders

SUSAN E. MARTIN

*National Institute on Alcohol Abuse and Alcoholism  
Facilitator and Reporter*

The Repeat Offender working group discussed all 16 ideas presented in the two working papers as well as additional ideas from the general discussion and from working group members. The working group combined features of similar ideas and reported out seven ideas to the workshop. These ideas, in rough priority order from the working group, are labeled R-1 through R-7 and are discussed below. Ideas based on one or both of the two working papers are noted by the lead author's initials and the idea number within that paper: RP-2 is the second idea from Ray Peck and Cliff Helander and DB-1 is the first idea from Doug Beirness. Additional ideas R-8 through R-10 from the working papers that were not presented in the working group report are listed at the end. The working group discussed these ideas and decided that the difficulty of defining "hard-core offender" made it more useful to devise an arrested offender typology that includes as one or several subtypes those that are chronic or repeat driving while intoxicated (DWI) offenders with very high blood alcohol contents (BACs). Thus "hard-core offenders" were included within R-1 and R-4 since their behavior patterns would be identified by longitudinal studies of driving under the influence careers.

### **R-1. Develop and Evaluate a Model First-Time DWI Offender Classification System for Assigning Interventions (RP-2, DB-1, and DB-5)**

A driver's first DWI arrest provides a unique opportunity to prevent subsequent drinking and driving. Courts typically treat all first-time offenders the same. But if persons likely to repeat their drinking and driving can be identified and directed to appropriate sanctioning and rehabilitation programs, then some offenders who would not be affected by standard first-offender sanctions will be prevented or deterred before they become habitual drinking drivers. This research first should develop an objective and workable definition of persons most likely to continue drinking and driving, for use with first-time DWI offenders. Next, the research should develop and evaluate a system for classifying these offenders to determine what interventions will be most effective for first offenders at various recidivism risk levels. In particular, the classification system should include screening, diagnosis, examination of motivation level, and assessment of the offender's driving behavior, criminal risk, and mental status including cognitive function. Using this assessment, the system should recommend if alcohol treatment is appropriate and, if so, should suggest the most appropriate treatment types. While such a system might also be applied usefully to repeat offenders, the first research priority is to develop a system for first-time offenders.

**R-2. Determine the Extent to Which Programs and Policies Have a Specific Deterrent Effect on Repeat Offenders (RP-5, RP-7, RP-8, and DB-7)**

Repeat DWI offenders in different jurisdictions are subject to many different sanctions, programs, and policies that attempt to prevent further drinking and driving. These are directed toward the offenders (DWI courts, “boot camp,” electronically-monitored house arrest, and other special DWI offender incarceration strategies; intensive probation, community service, brief intervention programs and other treatment strategies), or toward their vehicles (immobilization, impoundment, forfeiture, alcohol ignition interlocks, special license plates, license plate revocation, etc.). Some of these measures have been evaluated to some extent while some have not. Additional evaluation is needed on virtually all. This research should go beyond the standard evaluation criterion—has the measure reduced drinking and driving by these offenders—to investigate the next level issues. How does the measure’s effectiveness vary by offender type? How long should the measure be continued? Are some measures best used in combination? What are the practical problems in administering the measure and how can they be resolved? See also idea R-5.

**R-3. Assess the Problem of Drivers Who Do Not Reinstate Their License After Suspension (RP-9)**

Substantial research shows that driver license suspension or revocation is effective in reducing drinking and driving. But this measure has an important consequence. Studies in California show a large proportion of suspended and revoked drivers do not reinstate their licenses when they are eligible to do so. This research should study these persons and their experiences with the motor vehicle licensing system. Questions to be addressed include

- Why do they not reinstate?
- Do they continue to drive without a license?
- Are they insured?
- Do they drink and drive?
- What is their violation and crash experience?
- What are the system-based impediments to relicensure?
- How can these impediments be reduced?

**R-4. Determine the Causes and Correlates of DWI Recidivism (RP-6, DB-4)**

Most research on repeat DWI offenders has been cross-sectional, comparing them with other drivers. We know little about their long-term history. How did they become drinking drivers and repeat offenders. How do many eventually “mature out” of their drinking and driving? This research should conduct long-term longitudinal studies of a large cohort of first time offenders to determine how they developed this behavior and what factors predict or correlate with continued drinking and driving over a long-term driving career. See also ideas R-7 and G-12.

**R-5. Determine the General Deterrent Effects of Countermeasure Programs and Policies (DB-6, RP-4)**

Repeat offenders appear not to have been deterred from drinking and driving either by general public education and awareness messages or by the fear of arrest and sanction. Some research suggests that more targeted messages may have some deterrent effect. Some states are enacting new legislation designed to deter repeat offenders from drinking and driving, for example, by establishing more severe penalties for drivers at a high BAC level. This research should study how best to deter continued drinking and driving among repeat offenders by persuasion or threat. In particular, the research should evaluate the effects of increasing sanction severity as BAC levels increase. See also idea R-2.

**R-6. Develop a National Driver Record and DWI Database (RP-1)**

Research on DWI offenders requires analysis of longitudinal driver record and DWI offender data from numerous states. For this purpose, a multi-state driver record and DWI offender database for research purposes should be established. The database could then be used to conduct studies of DWI offender characteristics and recidivism, to evaluate the effectiveness of countermeasures employed by the participating states, and to produce an annual report along the lines of Fatal Accident Reporting System. In addition, the feasibility should be explored of establishing a national system in which every driver has a single driver's license and a single driver record, similar to the commercial driver license system for interstate commercial drivers. Such a system would greatly facilitate DWI offender research and also would enable states to identify high-risk DWI offenders using an individual's DWI-related records from all states. Current systems for state record linkage, including the National Driver Register and driver license and nonresident violator compacts, are either incomplete or inadequate for these purposes.

**R-7. Examine When and Why Repeat Offenders Stop Driving After Drinking (DB-4)**

Many repeat offenders eventually stop drinking and driving. This research should study the reasons why and should examine how these reasons could be used to reduce drinking and driving by others, or at an earlier age. This idea is part of idea R-4.

The following ideas were not reported out.

- R-8. Determine the optimum length of time for retaining prior offenses when defining repeat offenders. (RP-3)
- R-9. Determine the prevalence of hard-core drinking drivers and their contribution to the alcohol-crash problem. (DB-2)
- R-10. Identify and validate clinically relevant subgroups of hard-core drinking drivers. (DB-3)

## RESEARCH NEEDS AND PRIORITIES

### Special Populations

RUTH SHULTS

*Centers for Disease Control and Prevention  
Facilitator and Reporter*

The Special Populations working group discussed all 18 ideas presented in the two working papers as well as additional ideas from the general discussion and from working group members. Two quite different types of ideas were presented. First were two overriding process ideas that the group strongly believed should be accepted. These are reported first, as it is not appropriate to prioritize them along with the remaining ideas. Second were a substantial number of specific research topics. The working group reported out the top seven to the workshop. These ideas are labeled S-1 through S-7 and are discussed below. Three additional ideas, S-8 through S-10, were added to the top 7 by the workshop in general discussion. Ideas based on one or both of the two working papers are noted by the lead author's initials and the idea number within that paper: FY-1 is the first idea from Francis Yuen and SF-5 is the fifth idea from Sue Ferguson. Additional ideas S-11 and S-12 from the working papers that were not presented in the working group report are listed at the end.

Process ideas supported unanimously by the Special Populations working group were

1. Apply culturally accurate and competent research methods in all research (FY-1, FY-4, and FY-6). Research on traffic safety (and all other) issues involving special populations, whether defined by ethnicity, geography, culture, age, socioeconomic status, or other means, is most useful and relevant when conducted with a full understanding of important population features. The idea urges researchers to recognize the diversity within broadly defined groups, e.g., Native-American cultures that differ widely across the United States. Use accurate data that identify the populations of interest, and use study methodologies that are sensitive to important population characteristics (for example, don't use questionnaires or interviews in English for a population having a different primary language). Above all, the idea urges researchers to involve population representatives in designing, conducting, and reporting the research (see the next idea).

2. Include ethnic participation in all aspects of research (FY-2 and FY-3). While specifically stated in terms of research on ethnic populations, this idea applies equally to research on populations defined by geography, culture, age, or other characteristics. The idea seems an obvious feature of any competent research design but unfortunately it often is violated. Partnership development with special populations should be addressed in research protocols. Participation by population representatives will help define the research questions in a way appropriate to the population; will design the best methods for obtaining accurate information; will avoid population-specific pitfalls that the researchers may not understand; will obtain cooperation from the population being studied; will conduct appropriate demonstration projects; and will report results in accurate, appropriate, and understandable ways. Qualitative research methods, including focus groups and key informants, may be particularly useful in defining the research questions, obtaining culturally specific data, and identi-

ifying appropriate interventions. Finally, when the results are discussed with the population being studied, the population can be engaged as a partner for change.

Research topic ideas reported by the Special Populations working group were

### **S-1. Determine and Understand Differences in Alcohol-Related Crash Rates Across Ethnic Groups and by Gender (SF-1, SF-5, SF-6, and SF-7; DP-5)**

This broad idea is the necessary first step to addressing impaired driving issues for these groups. Research to date has documented impaired driving levels and trends for women and has indicated differences in alcohol-related fatalities among different ethnic and racial groups. To date, though, there has been little research either to control for important other factors (such as socioeconomic status, immigrant status, and geographical location) or to understand the reasons for these differences. This research should first tap existing data sources to describe and quantify alcohol-related crash rates, controlling for other relevant factors, and to monitor trends in these rates. To the extent allowed by the data, the research should examine what situations and circumstances are associated with drinking and driving by these groups and what countermeasures these suggest. These results will help define more specific studies as needed (idea S-2).

### **S-2. Conduct Culturally-Specific Studies Based on the Results (and Gaps) of Idea S-1**

The data available to address impaired driving issues by ethnic group and gender vary substantially. In some instances the data cannot even distinguish the group of interest. In others, the data can describe the problem but do not contain enough detail to control for important factors or suggest reasons for the observed differences. This research should concentrate on the major issues outstanding after existing data have been analyzed. The research may involve new large-scale data collection, innovative linking of existing data sets, or in-depth studies of well-defined populations. Quantitative and qualitative research methods should be employed.

### **S-3. Determine How Drivers Make Decisions About Drinking and Driving (SF-3)**

While proposed by the Special Populations working group, this idea is relevant to all other groups as well. Our knowledge of how drivers make decisions on drinking and driving, both in advance and at the time of drinking, is limited. Our knowledge of how these decisions differ by gender and ethnic group is even more limited. It is clear, though, that social and peer norms and cultural attitudes have a substantial influence. This research should study how drivers' decision processes vary across gender and ethnic groups. How do drivers determine how much they can drink and still drive safely or legally? When do they make these decisions? How can drivers be educated about how to make responsible decisions? This research may require qualitative or ethnographic methods. See also idea S-4.

**S-4. Determine the Knowledge Base of Ethnic and Gender Groups on Drinking and Driving (SF-6 and SF-7)**

This idea is closely related to S-3 above. Research suggests that impaired driving norms and driver understanding of impaired driving laws and sanctions may vary by gender and by ethnic group. For example, what is per se or zero-tolerance laws? What does blood alcohol content (BAC) mean and how many drinks does it take to reach a jurisdiction's BAC limit? Do drivers think their driving skills are impaired at the legal BAC limit? What is the risk of arrest if you drive after drinking? If arrested, what are the likely consequences? This research should study these issues across important ethnic and gender groups, should determine the reasons for critical differences in understanding, and should investigate how to fill in any gaps.

**S-5. Study Differences in Alcohol Assessment and Treatment Effectiveness by Gender and Ethnicity (SF-10)**

Few studies have examined the extent to which alcohol assessment and treatment effectiveness vary by gender or ethnicity. Basic questions include when, where, and by whom alcohol screening should be conducted; how perceived risks and benefits of screening may influence participation; whether screening instruments or procedures are gender or culturally biased in any way; and whether alcohol treatment regimens are equally appropriate across ethnic and gender groups. This research should study these issues first for the most frequently used alcohol screening instruments and treatment regimens when used with ethnic and gender groups at greatest risk of alcohol involvement and impaired driving.

**S-6. Compare Alcohol-Related Crash, Arrest, and Incidence Rates by Ethnic and Gender Groups (SF-2)**

This idea goes beyond the crash rate studies of idea S-1 to investigate how crash rates relate to arrest and incident rates. Impaired driving enforcement has concentrated on white males by targeting the times and places where white males typically drink and drive. If females and other ethnic groups exhibit quite different drinking and driving patterns, then current enforcement practices may have little deterrent effect. This research should compare crash and arrest rates for the different groups and should also compare drinking and driving patterns to the extent that data are available. It should suggest any appropriate changes in enforcement practices to match the observed crash and behavior patterns. See S-9, S-10, and Y-10 for related ideas.

**S-7. Study Passengers Who Ride with Impaired Drivers (SF-4)**

A substantial number of persons injured or killed in impaired driving crashes are passengers in the impaired drivers' vehicles. Different aged passengers raise different issues. Small children cannot intervene to avoid riding with an impaired driver, and they may be unrestrained. Teenagers and adults may not understand the risks posed by impaired drivers or

may not know how to avoid riding with an impaired driver. Information on the prevalence of passengers, by age group, riding with impaired drivers is needed. For children, this research should describe the common circumstances (reason for the trip, relation between child and driver, restraint use, etc.) and evaluate methods to prevent these events. Additional information is needed for adolescent and adult passengers. Were they drunk as well? What was their perception of risk? Did they know and could they use effective methods to avoid riding with the impaired driver? What additional knowledge and skills would be useful?

The following ideas were added in general discussion.

#### **S-8. Study the Role of Alcohol in Pedestrian and Other Transportation Mode Injuries**

Many pedestrians injured in motor vehicle crashes were impaired by alcohol. Alcohol also is an important factor in injuries suffered in other transportation modes (boating and snow mobile riding are two important examples). A better understanding of alcohol's role in these injuries may provide new insight on methods to reduce impaired driving as well as suggesting ways to reduce injuries in other modes. This research should quantify the problem as well as possible using existing data, investigate its underlying causes, and seek prevention methods that address these underlying causes rather than relying on features of the specific transportation mode.

#### **S-9. Study the Issue of Enforcement Profiling Based on Race or Ethnicity.**

Enforcement profiling targets specific racial or ethnic groups for special surveillance by law enforcement. These practices are damaging to law enforcement, to communities, and to traffic safety. Any allegations of enforcement profiling are politically sensitive. Some jurisdictions are studying their enforcement and arrest data to investigate the issue. Objective research using methods that involve the community at every step is needed to determine whether enforcement profiling has in fact occurred and to monitor enforcement activities to make sure that it does not occur in the future. The first priority should be to determine if existing data sources are adequate to detect the practice if it exists.

#### **S-10. Study Drinking and Driving Issues in Rural Areas (SF-9 and SF-10)**

Drinking and driving in rural areas differs in many ways from drinking and driving in urban areas. For example, in rural areas heavy alcohol use is more common, drinkers must travel longer distances to get to bars, there is little or no public transportation, roads are dangerous, police presence is minimal, police may have little incentive to arrest impaired drivers, treatment facilities are few, etc. This research should study how the system of impaired driving laws, enforcement, and sanction operate in rural areas. What changes would improve the system's operation and reduce impaired driving?

The following ideas were not reported out.

- S-11. Improve the Fatal Accident Reporting System data to include ethnicity. (FY-5)
- S-12. Investigate the use and effectiveness of prevention activities for children and youth within ethnic communities. (FY-8)

## RESEARCH NEEDS AND PRIORITIES

### Drugs Other Than Alcohol

J. MICHAEL WALSH

*The Walsh Group*

*Facilitator and Reporter*

The Drugs working group discussed all ideas presented in the two working papers as well as additional ideas from the general discussion and from working group members. The working group reported out 10 ideas to the workshop. They are labeled D-1 through D-10 and are discussed below in the Drugs working group's priority order. Ideas based on one or both of the two working papers are noted by the lead author's initials and the idea number or numbers within that paper: MB-All refers to all ideas from Marcelline Burns and JL-1 is the first idea from John Lacey.

We understand quite well how alcohol impairs drivers and causes crashes. Ample research documents the relations between alcohol levels in breath or blood [measured as blood alcohol content (BAC)] and impaired performance on driving-related tasks and the relation between BAC levels and crash risk. Research also documents the prevalence of alcohol in crash-involved drivers. None of these relations is understood at all well for the dozens of other drugs that can impair driving performance. The first eight ideas address different portions of this basic issue.

#### **D-1. Develop Methodologies and Protocols for Drugged Driving Epidemiology and Risk Assessment; Use the Protocols to Conduct Case and Case-Control Studies (JL-All)**

This first idea addresses the basic issues of estimating the size of the drugged driving problem and estimating the effects of different drugs on crash risk. The basic problem is to develop practical methodologies for conducting this research. The best information on drug presence remains the relatively small-scale and very expensive 1992 Terhune study that assayed the blood of fatally injured drivers. It is not feasible to conduct such blood tests routinely or widely. This research should develop and test creative methodologies for estimating drug presence in drivers and for assessing how drug use affects driving performance and crash risk. For some drugs it may be possible to link a data set containing information on drug use with crash data. If promising methodologies are found, they should be tested and verified in a larger-scale demonstration.

#### **D-2. Develop Noninvasive Drug Detection Technology for Use in the Field**

Alcohol use can be measured easily with portable breath test equipment and can be estimated with a passive alcohol sensor. Current private-sector research on drug detection using saliva, sweat, or urine may provide similar capabilities for other drugs. If successful, drug detection through such means would be considerably less invasive than requiring a blood sample. This research should build on current knowledge to develop inexpensive, easily

used methods for detecting a broad range of drugs. The ideal device would provide rapid results at the roadside.

### **D-3. Research on the Behavioral and Pharmacological Impairing Effects of Drugs (MB-All)**

Current knowledge of how different drugs affect driving performance is limited. This research should concentrate on those drugs most commonly found in drivers (including marijuana, cocaine, and benzodiazepines). As with idea D-1, methodological issues are critical. Experiments in the laboratory or on the test track are slow and expensive at best and may not be practical (for example, human subjects cannot be given high doses of illicit drugs). It may be possible to link information from other sources (for example, medical or police records) with driving records.

### **D-4. Develop a Field Sobriety Test Protocol Combining Behavioral and Toxicological Information for Alcohol and Drugs (MB-All)**

The Standardized Field Sobriety Tests (SFST) are used in the field by many law enforcement officers to provide information on whether a driver is impaired by alcohol. There is no similar field test for other drugs. The closest analog, the Drug Evaluation and Classification procedure, is not suitable for use in the field because it requires special equipment and takes too long to administer. The ultimate goal of this research is to develop an inexpensive, quick, easily administered field procedure to screen for both alcohol and major drug families. At the very least, the research should determine whether the SFST helps indicate the most common drugs (marijuana and stimulants) and should investigate how the SFSTs predictive ability for these and other common drugs might be improved by using other behavioral tasks or toxicological tests.

### **D-5. Explore Secondary Analyses Linking Data on Drug Use and Data from Traffic Crashes, Trauma Files, Department of Transportation Drug and Alcohol Databases for the Different Modes, Criminal Justice Records (Violence), and Medical Claims (JL-1, JL-3, and JL-4)**

This idea approaches the topics of ideas D-1 and D-3 from a different point of view. The prior two ideas begin with specific goals and suggest that analyses of linked databases are one possible way of achieving those goals. This idea begins with the databases and asks what can be learned when they are linked. For example, it has been suggested that it is likely that repeat driving while intoxicated or drugged driving offenders are the same people who are arrested for domestic violence and the same people who frequently are injured and require medical treatment. The research should begin with one or more databases containing information on drug use and one or more databases containing information on outcomes (crashes, injuries, arrests, etc.) that can be linked. The research should then use these linked databases to investigate all appropriate and feasible questions.

**D-6. Develop a Standard Protocol for Evaluating the Effects of New Prescription and Over-the-Counter Drugs on Driving**

The Food and Drug Administration (FDA) reviews data provided by the pharmaceutical manufacturers and approves all new prescription and over-the-counter (OTC) drugs to assure that they are effective and safe. But the FDA does not require any specific information about the possible effects of a new drug on driving. This research should develop a protocol for indicating a new drug's potential effects on driving. If such a protocol is developed, it can be recommended to the FDA for use in the standard drug review methodology. The activities of the International Council on Alcohol, Drugs, and Traffic Safety working group on drugs are directly relevant to this idea. See also idea G-5.

**D-7. Establish Systematic, Periodic Monitoring of Drug Prevalence in Driving (JL-2)**

Drug use patterns vary considerably among persons of different ages living in different areas of the country. New recreational drugs are developed regularly, and different drugs move in and out of fashion. This research would establish a regular method of monitoring the amount of drug use by drivers and the types of drugs that are used. As with several previous ideas, the key issue is to develop a practical methodology. One possibility is to use a periodic survey, such as the current survey of drug use among high school students, either by developing a new survey or by participating in an ongoing survey.

**D-8. Examine the Interaction of Alcohol with Other Drugs, and the Interactions of Multiple Drugs on Driving**

Studies of drug use by drivers show that drugs are frequently used in combination with alcohol. There is little evidence on these interaction effects or on interaction effects of drug pairs. This research should begin by examining the most common alcohol-drug combinations.

**D-9. Examine Methods for Educating Health-Care Professionals and the Public About the Effects of Prescription Medications on Driving**

Many drivers regularly take prescription or OTC drugs. As the driving population ages, medication use likely will increase. Physicians and pharmacists can provide basic information about the effects of these medications on driving if they are given the tools to do so. In addition, the media marketing of pharmaceuticals via television, newspaper, and radio is increasing. This research should study the most effective way of communicating the issues to physicians and pharmacists and through them to their patients. Advertising methods also should be examined as a means of effectively communicating information about drugs that impair driving.

### **D-10. Study the Effects of Different Drug-Related Policies**

In the “war against drugs,” some states have adopted laws or practices that may affect driving. For example, Florida requires a drug and alcohol education course for all new driver license applicants. Some states are considering drug tests for teenage driver license applicants. Eight states have enacted per se laws for driving under the influence of drugs, but these laws differ significantly in how they are defined and enforced. This policy research should evaluate these and other initiatives to determine their effects on driving and on drug use.

## RESEARCH NEEDS AND PRIORITIES

### Overall Research Priorities

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The preceding sections describe research needs in each of the five groups, with rough priorities within each group as determined by working group participants. But most funding agencies are interested in all groups, not just some. Funding decisions must be made by considering priorities across all groups. For this reason, the workshop produced a priority ranking of all ideas reported out by the five working groups and added in general discussion (Table 1).

To produce this ranking, each workshop participant was given 10 votes to cast for the 10 research needs he or she believed to be the most important. Thus, each workshop participant had an equal role in determining this ranking. There were 339 votes cast: 10 each from 34 workshop participants, with 1 vote lost somewhere. The voting immediately followed the five working group presentations and discussion. Participants had the discussion fresh in their minds but did not have the opportunity to consider the more than 50 proposed research needs at length. The rankings thus should be considered as a rough guide to the relative importance of the various research needs, but they are far from a precise ranking.

The ideas are listed in order of the number of votes received. When two or more ideas received the same number of votes, they are listed in alphabetically by group (Drugs, General Population, Repeat Offenders, Special Populations, and Youth) and by idea number within groups. For each idea, the number of votes, the idea number (from the breakout group), and the idea's brief description from the breakout group discussion is given.

#### **Process Ideas**

As recommended by the Special Populations group, two cross-cutting process ideas were accepted unanimously without ranking.

1. Apply culturally accurate and competent research methods in all research, and
2. Include ethnic participation in all aspects of research.

**TABLE 1 Rankings of Research Priorities**

<b>Votes</b>	<b>No. Description</b>
16*	D-3. Research on the behavioral and pharmacological impairing effects of drugs.
16*	D-4. Develop a field sobriety test protocol combining behavioral and toxicological information for alcohol and drugs.
16	R-2. Determine the extent to which programs and policies have a specific deterrent effect on repeat offenders.
15	G-1. Study global trends in alcohol-related crashes and fatalities.
15	Y-10. What are the drinking patterns and cultures unique to youth? What are the best intervention points?
13	D-1. Develop methodologies and protocols for drugged driving epidemiology and risk assessment; use the protocols to conduct case studies.
13	R-1. Develop and evaluate a model first-time driving while intoxicated (DWI) offender classification system for assigning interventions.
13	S-1. Determine and understand differences in alcohol-related crash rates across ethnic groups and by gender.
13	Y-6. Will addressing other risky driving behaviors also reduce youth drinking-driving crashes, injuries, and fatalities?
12	G-8. Compare the impaired driving populations on the road, arrested, and in crashes.
12	S-3. Determine how drivers make decisions about drinking and driving.
12	Y-1. What features of zero-tolerance laws are most effective?
10	G-12. Study the etiology, development, and natural history of drinking drivers.
10	R-3. Assess the problem of drivers who do not reinstate their license after suspension.
10	Y-4. Relate the age of drinking onset to adult drinking and driving and study whether delaying onset has an effect on later drinking and driving and other alcohol problems.
9	D-2. Develop noninvasive drug detection technology for use in the field.
9	G-3. Study the effects of lower legal blood alcohol content limits on crashes, injuries, and fatalities.
8	D-5. Explore secondary analysis linking data on drug use and data from traffic crashes, trauma files, Department of Transportation drug and alcohol databases for the different modes, criminal justice records (violence), and medical claims.
8	G-11. Study the effects of different alcohol control strategies, including taxes.
8	S-4. Determine the knowledge base of ethnic and gender groups on drinking and driving.

*continued on next page*

**TABLE 1 (continued) Rankings of Research Priorities**

8	Y-3. Determine the most effective minimum drinking age 21 law enforcement strategies.
8	Y-11. Evaluate the most effective components of graduated licensing systems.
7	D-10. Study the effects of different drug-related policies.
7	R-6. Develop a national driver record and DWI database
7	S-2. Conduct culturally specific studies based on the results (and gaps) of idea S-1.
7	S-9. Study the issue of enforcement profiling based on race or ethnicity.
6	D-7. Establish systematic, periodic monitoring of drug prevalence in driving.
6	G-2. Study the relation between enforcement level and the public's perception of risk
6	R-4. Determine causes and correlates of DWI recidivism.
6	R-5. Determine the general deterrent effects of countermeasure programs and policies.
6	S-6. Compare alcohol-related crash, arrest, and incidence rates by ethnic and gender groups.
6	Y-2. How can communities be motivated and empowered to enforce minimum drinking age 21 laws?
5	G-4. Explore technology for identifying and controlling impaired driving of-fenders.
4	D-8. Examine the interaction of alcohol with other drugs, and the interactions of multiple drugs, on driving.
4	G-10. How to communicate health messages so that people will take action.
4	Y-7. How to reduce drinking and impaired driving among college students.
4	Y-9. Study alternative transportation programs for youth.
3	D-9. Examine methods for educating health-care professionals and the public about the effects of prescription medications on driving.
3	S-8. Study the role of alcohol in pedestrian and other transportation mode injuries.
2	D-6. Develop a standard protocol for evaluating the effects of new prescription and over-the-counter (OTC) drugs on driving.
2	G-5. Study the effects of prescription and OTC drugs and herbal remedies on driving.
2	G-6. Determine the impact of not enforcing an impaired driving law or not following through with sanctions.
2	S-7. Study passengers who ride with impaired drivers.

*continued on next page*

**TABLE 1 (continued) Rankings of Research Priorities**

1	G-7. How can DWI enforcement be measured?
1	Y-5. Can parents, peers, communities reduce underage drinking and impaired driving? How can this be done most effectively?
0	G-9. Study the driving behavior of alcoholics.
0	R-7. Examine when and why repeat offenders stop drinking and driving.
0	S-5. Study differences in alcohol assessment and treatment effectiveness by gender and ethnicity.
0	S-10. Study drinking and driving issues in rural areas.
0	Y-8. Determine the effective characteristics of drinking age 21 laws.

NOTE: \* Combined votes for D-3 and D-4. The Drug group's ideas D-3 and D-4 were presented as two separate ideas but were linked in voting so the 16 votes received cannot be separated.

## Impaired Driving Research Needs and Priorities

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### INTRODUCTION

During the period 1982 through 1996, the U.S. population increased by 15 percent; the number of licensed drivers increased by 20 percent; vehicle miles driven increased by 56 percent; and the number of nonalcohol-related traffic fatalities increased by 32 percent. Yet, remarkably, the number of alcohol-related fatalities decreased 36 percent, from 25,165 in 1982 to 17,126 in 1996 (Figure 1). This decrease has variously been attributed to broad societal influences such as public attitudes toward drinking and the work of advocacy groups; legal initiatives, including minimum drinking age 21, illegal per se, and administrative license actions; heightened and innovative enforcement, including the use of well-publicized sobriety checkpoints; and public information and education (Ulmer et al., in press). Other factors include an overall decrease in drinking, with a decline of 17 percent in per capita consumption of alcohol from 1977 through 1995 (Williams et al., 1997), and better emergency medical treatment, which saved lives that previously would have been lost.

Decreases in alcohol-related fatalities from 1982 to 1996, ranging up to 60 percent, were experienced by 47 of the 50 states. States with the largest reductions enacted and publicized laws that have been shown to reduce impaired driving. These states also had coordinated and well-publicized enforcement efforts, although they did not necessarily have high arrest rates per population. Finally, these states were more likely to have substantial dedicated funding for enforcement and alcohol treatment, along with strong

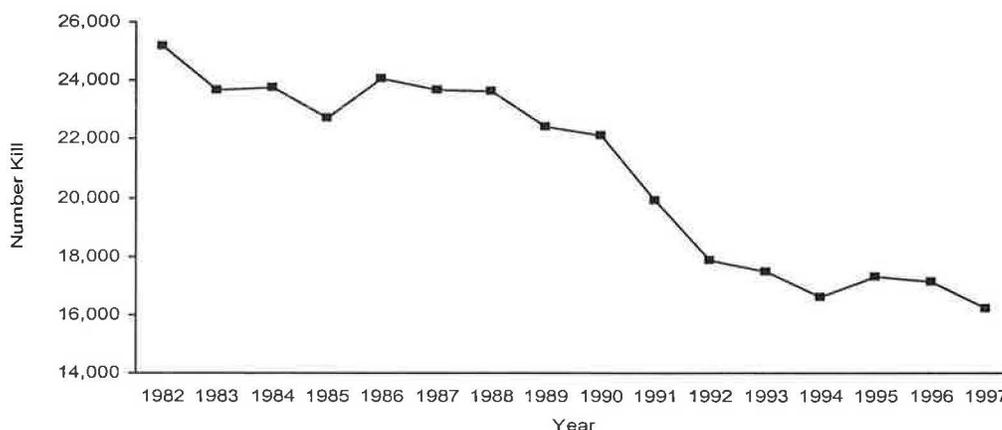


FIGURE 1 Alcohol-related fatalities, 1982-97.

leadership, particularly at critical junctions (Ulmer et al., in press).

The success of the 1980s and 1990s has been remarkable. Still, 16,189 persons died in alcohol-related crashes in 1997. Success beyond this point will likely require additional research to support the development of new initiatives. Where should this research be focused? To what extent should we pursue measures designed to produce further reductions—in drinking and driving among the general population—general deterrence strategies rather than measures focused on members of specific high-risk groups—specific deterrence strategies? Have we achieved most of the potential gains from initiatives directed at the general driving population? Does a more targeted approach offer the greatest likelihood for sizable improvements? While a comprehensive and balanced research and programmatic agenda would include both types of initiatives, it is important to determine the most appropriate balance between the two.

### **Prevention Paradox**

A public health problem can arise, primarily, from a high-risk group consisting of a relatively small number of persons, each at very high risk. Or, a problem can arise from a large number of persons, each at low or moderate risk. Or, both a small high-risk group and a large low/moderate risk group can each contribute to the problem, with the relative contribution of each group dependant both on group size and group risk. When the contribution of the larger low/moderate risk group outweighs the relative contribution of the smaller high-risk group, the situation is referred to as the Prevention Paradox. We argue that the Prevention Paradox pertains to the problem of alcohol-related crashes. That is, although there is substantial evidence that a small proportion of the population is at very high risk for alcohol-related problems, including crash involvement, the proportion of the population at low or moderate risk may be more important because this group is substantially larger and still at significant risk now or in the future. As described by Skog (1999, p. 751) with respect to alcohol-related problems in survey data it has been found repeatedly that only a fairly modest part of alcohol-related problems can be attributed to heavy drinkers. Light and moderate consumers are responsible for the much larger fraction of the problems, as the large number of such drinkers make up for their smaller risk. On the basis of this “prevention paradox,” the claim has been made that the population strategy of prevention is much more likely to produce tangible results than the risk-group strategy.

With respect to problems related to alcohol use or abuse, it has been suggested (Skog, 1999) that when relative risk curves are linear with respect to a salient risk factor found throughout the population, general population strategies will have a greater impact than risk group strategies on reducing the problem. Alternatively, when risk curves are highly convex, then targeting the high-risk group is preferred. However, the degree of curvilinearity needs to be substantial—10 or more times the rate of increase in risk at the upper ends of the scale. With regard to acute alcohol-related problems, relative risk curves for highway crashes are likely to be more linear, while the risk curves for chronic alcohol-related pathologies, such as liver cirrhosis, may be more curvilinear (Skog, 1999).

Consider that positive blood alcohol content (BAC) is a well known risk factor for highway crash involvement. The relative risk for fatal crash involvement associated with BAC levels can be calculated using the “induced exposure” methodology (Preusser et al.,

1998). The induced exposure approach derives from the concept that any driver on the road may be the victim of some other driver's mistake in a multiple-vehicle crash. These not-at-fault driver crash involvement can represent a surrogate for exposure to highway risk. That is, at-fault crash involvement becomes the numerator of a risk ratio, and not-at-fault-crash involvement becomes the denominator.

Based on the induced exposure methodology, Table 1 shows the relative risk of crash involvement for different BACs and different age groups, using 1988-1997 data from the Fatal Accident Reporting System (FARS) for fatally injured drivers of passenger vehicles for whom BAC was known. All calculations use drivers ages 35-49 with zero BAC as the reference group (i.e., this group was assigned risk of 1.00). An at-fault driver was defined as a driver in a single-vehicle crash, excluding crashes involving a pedestrian or a bicycle, or a driver in a multiple-vehicle crash with at least one error indicated on the crash record (i.e., FARS driver level factor numbers 18 through 60).

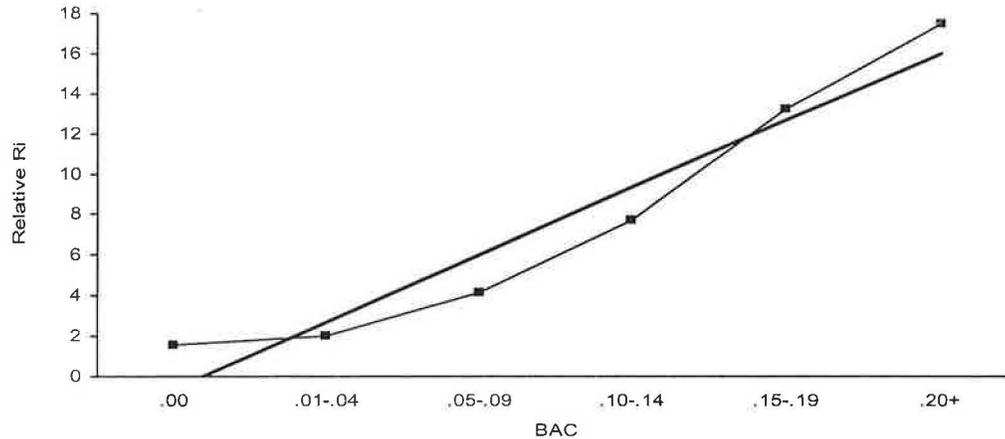
Although induced exposure is a controversial procedure (e.g., De Young et al., 1997) and the calculations use only those drivers with known BAC, Figure 2 depicts an approximately linear relationship between crash risk and BAC, both overall and for most age groups. The results also dramatically convey the strong effects on crash risk for relatively low positive BACs. For example, the relative crash risk for drivers ages 35-49 increases from 1.0 for zero BAC to 1.4 for 0.01 to 0.04 percent BAC, and reaches 2.8 by 0.05 to 0.09 percent BAC. That is, per unit of exposure, drivers ages 35-49 with BACs of 0.05 to 0.09 percent are 2.8 times more likely to die in a motor vehicle crash than drivers of these ages at 0.00 percent BAC. These results, consistent with the Prevention Paradox, suggest that there is value in reducing the number of drinking drivers across the full range of low, moderate, and high BACs.

There are also other, more practical, considerations that support a continued emphasis on general population strategies. Reductions in risk may be more easily achieved and less costly for the larger low/moderate risk group. Drivers not at highest risk may be more susceptible to making the desired behavioral changes. In addition, general population

**TABLE 1 Relative Risk of Crash Involvement by BAC**

Age	BAC					
	.00	.01-.04	.05-.09	.10-.14	.15-.19	.20+
16-20	3.4	4.8	9.1	14.9	27.0	25.8
21-24	1.8	2.8	7.1	10.5	17.8	27.7
25-34	1.3	1.7	3.5	7.6	12.0	16.0
35-49	1.00	1.4	2.8	5.3	11.1	17.2
50-64	1.0	1.0	2.2	4.4	9.1	14.3
65+	2.1	2.1	3.0	4.7	8.2	10.7
All	1.5	2.0	4.2	7.7	13.2	17.5

FARS 1988-1997; fatally injured drivers of passenger vehicles with BAC known (N = 148,720). Risk relative to drivers ages 35-49 at 0.00 percent BAC (e.g., drivers ages 16-20 at 0.00 percent BAC are 3.4 times more likely to be fatally injured in a traffic crash than drivers ages 35-49 at .00 percent BAC per unit of exposure).



**FIGURE 2 Risk by BAC with linear trend line.**

strategies draw individuals who may eventually become high-risk drivers into the system at a point when they may be most receptive to intervention. Possible future research initiatives are listed on the following pages.

### **Determine the Extent to Which the Driving Under the Influence Arrested Population Reflects All Drinking Drivers**

**Problem Area:** An impaired driving [driving under the influence (DUI)] arrest can result from regular patrol activity, a crash investigation, or a special enforcement operation such as a sobriety checkpoint. There are differences in the characteristics of drinking drivers arrested by the various types of enforcement activities. For example, 23 percent of drivers arrested in Charlottesville, Virginia, checkpoints were under the age of 21, compared with only 11 percent of drivers arrested by patrol activity during the same period (Voas et al., 1985). In Connecticut during 1997, 11,747 drivers were arrested for DUI (Connecticut Department of Transportation). Of these, 23 percent were arrested as a result of a motor vehicle crash, while most others were arrested from patrol operations. The crash arrests were significantly more likely than patrol arrests to occur Monday through Thursday during daylight and early evening hours and to involve a higher proportion of younger and older, and female drivers. The crash arrests were also much more likely to involve very high BACs; 41 percent of the crash arrests involved a BAC of 20 percent or greater, versus 30 percent of the patrol arrests.

**We Don't Know:** Are current patrol, crash, and special enforcement methods apprehending the full range of drinking drivers in proportion to their representation in the driver population?

**Research Issue:** What are the similarities and differences among three populations of interest: all drinking drivers, crash-involved drinking drivers, and drivers arrested for DUI?

**Likely Success:** Data for both the arrested and the fatal-crash-involved populations can be obtained. Data for nonfatally injured drivers and for the full population of those who drink and drive, while less complete, are available from household, telephone, and roadside surveys and from hospital admissions.

**Effects:** Comparisons among the three groups will indicate the extent to which the results of current regular, crash, and special enforcement strategies reflect the actual drinking and driving population and the drivers at risk for crashes. Enforcement strategies designed around the full drinking and driving population would likely lead to more arrests of “non-traditional” drinking driving suspects (e.g., more women and youth during daylight and early evening hours) and suspects at BACs that are closer to the legal limit.

### **What Happens When Laws Are Not Consistently or Fully Enforced (e.g., 0.02 or 0.08)? When Sanctions Are Not Imposed?**

**Problem Area:** When people conform to a law because they are deterred by fear of punishment or public exposure or by their adherence to the social norms underlying the law, the law may be effective with little enforcement. However, many laws are not self-enforcing, as is evident with respect to speed limits. The failure to translate the law on the books into action has numerous consequences. For the general public, it undermines respect for the law in general, the specific law, and for those responsible for enforcement; any general deterrent effects are also diminished. As the lack of implementation becomes apparent, there is an erosion in the effects on the target group of likely or actual violators. Such “type 3 errors” (made by evaluators who examine outcome without examining process) also impede our ability to evaluate a law’s effects, especially the long-term effects, and to replicate those effects. For example, assume that a highly publicized new law is demonstrated to have a short-term impact, but that law is not fully or consistently enforced. How can the effects be sustained over time? How can the evaluator separate the effects of the law from the temporary effects of the initial publicity about the law?

**We Don’t Know:** We do not know the extent to which various laws are supported by social norms that are sufficiently valued to deter those who otherwise might drink and drive, or the extent to which people conform to various laws because they are deterred by fear of punishment or public exposure. There may be evanescent deterrent effects as enforcement of a law wanes, suggesting a need for determining an effective schedule of “reinforcers” (including both public information about enforcement and highly visible enforcement).

**Research Issues:** What is the optimal mix of carrots and sticks to assure compliance with drinking and driving laws at minimal cost? What are the short-term and long-term effects of weak enforcement and adjudication/administration? What are the reasons for weak enforcement and adjudication/administration, e.g., costs, lack of judicial and enforcement awareness of or support for the law?

**Likely Success:** Relevant data can be gathered through in-depth process evaluations and long-term evaluation studies.

**Effects:** Most evaluations address the short-term effects of implementing a new law or similar countermeasure. Such implementations are typically accompanied by publicity and an initial flurry of enforcement. Then, we move on, believing that the law is established. However, this may not be the case, particularly in situations where the law is not firmly based in social norms.

### **When Is Driving After Taking a Prescription Drug Harmful (With and Without an Interaction with Alcohol)?**

**Problem Area:** Many drivers take prescribed medications. Many of these “controlled” substances are psychoactive, and thus driving while taking these drugs is specifically prohibited. In Connecticut, for instance, it is illegal to drive while under the influence of any drug or any drug and intoxicating liquor.

**We Don’t Know:** It is hypothesized that at least some people will be better drivers when taking the proper dosage of their medication. Some will be worse drivers. For others the medication will have no effect on their ability to drive safely. For still others, the underlying medical condition is such that they should not be driving with or without the medication. What are the effects of specific drugs? What are the effects of specific drug-alcohol interactions?

**Research Issues:** Hu et al. (1995) found that older drivers taking certain prescription drugs had higher crash rates than older drivers without such prescriptions. But, would the crash rate have been higher still for these individuals if they did not take these prescriptions? Moreover, are higher crash rates a reasonable price to pay, given that the mobility of older persons is directly related to their well-being, quality of life, and longevity (e.g., TRB, 1988)?

**Likely Success:** A drug monitoring “early warning” system to track the driving records of a large sample of drivers with and without prescriptions for certain medications can be accomplished by linking existing data sets.

**Effects:** Those medications associated with lower and “no difference” crash rates would not be further considered. Those medications associated with higher crash rates would be recommended for further research. At least theoretically, a higher crash rate could be caused by the drug, the underlying medical condition which might be worse without the drug, as well as other related factors.

### **What Are the Trends in Impaired Driving by Females?**

**Problem Area:** Women drive fewer miles and drink less alcohol than men; they are cited for driving while intoxicated (DWI) less frequently and involved in fewer alcohol-related

crashes as well. However, they appear to be adopting drinking and driving-related behaviors similar to those of men. While men's alcohol-related fatality rates have fallen, studies of women's crash and fatality rates yield different results. Massie and Campbell's (1995) analysis of FARS data showed large declines in alcohol-related fatalities, except among women ages 25 through 29. In North Carolina, Popkin (1991) found alcohol-related crashes and single vehicle night-time crashes among men declined, while crashes among women increased for all ages except women under 18 years of age. Data from a 1996 roadside survey suggested that the proportions of women at or above 0.05 percent BAC and at or above 0.10 percent BAC increased over 1986 levels (Voas et al., 1998).

**We Don't Know:** What factors account for the drinking, driving, and drink-driving behaviors of women, and do these factors differ from those accounting for these behaviors in men? Are gender-specific predictive models and prevention strategies needed? How are women's alcohol consumption patterns changing? To what extent are these changes affecting risk-taking behaviors, including drinking and driving, or crash-related injuries and fatalities?

**Research Issues:** What are the long-term trends in women's drinking, driving, and drink-driving behaviors and how do these differ from those of men? What are the most effective strategies for preventing and/or reducing DWI injury and fatality risks for women?

**Likely Success:** Trends in women's drinking-driving and crash-related behavior can be determined using archival data and surveys of attitudes and driving behavior.

**Effects:** A better understanding of changes in women's drinking and driving behaviors should lead to more effective prevention and treatment programs designed to reach the majority of the population.

### **Determine the Level of Awareness of and Support for Specific Intervention Strategies Among the General Population**

**Problem Area:** What enhancements of existing strategies or innovative practices will the public accept? The most recent NHTSA survey on attitudes and behaviors (1999) suggests that most members of the public see drinking and driving as a serious problem, and they support zero-tolerance laws for youth, 0.08 or less as the legal limit for adults, and more frequent use of sobriety checkpoints. Most persons also support more severe penalties, including license suspension or revocation, particularly for repeat offenders, although evidence suggests that knowledge of their state's BAC level and actual sanctioning practices is very limited.

**We Don't Know:** The NHTSA surveys have not measured the salience of impaired driving relative to other public policy issues or other highway safety issues. Nor do we know how much the public is willing to pay for increased enforcement, penalties, or treatment for offenders.

**Research Issues:** What will the public accept and what will they more actively support to increase public safety and reduce impaired driving? What strategies can be employed (perhaps adapted from other areas of public policy) to heighten the public's concern with drinking and driving and knowledge about existing policies?

**Likely Success:** Data on the knowledge and attitudes of the public can be gathered through continued and expanded NHTSA and/or the National Institute on Alcohol Abuse and Alcoholism-supported and sponsored surveys and through the use of other self-reported data such as focus groups.

**Effects:** More complete knowledge about the awareness and attitudes of the public will support the development and implementation of more effective initiatives. Public knowledge can also be enhanced through a variety of public education and through a variety of public education and media-based initiatives (see research needs identified in next section).

### **How Can We Increase the Quantity and Effectiveness of Public Information and Education on Drinking and Driving?**

**Problem Area:** Public service announcements (PSAs) often lack the sophistication of alcohol industry messages, are far less frequently broadcast (particularly during prime time), and are less effective than broader information approaches that provide more consistent and coordinated messages. Counter-advertising campaigns, while more effective than PSAs, are limited by the costs of purchasing advertising time, particularly on television. Recent social marketing and community-based strategies include media advocacy, which involves citizens as an important element in altering community norms through their participation in the process of shaping and disseminating public information. Given the findings of the most recent NHTSA survey (1999), indicating large areas of ignorance about the laws related to drinking and driving and the effect of alcohol with respect to BAC, it is clear that innovative messages and media/information dissemination strategies are needed to more effectively reach new generations of drivers, as well as current drivers.

**We Don't Know:** What are the most effective media for reaching various audiences? How can we communicate to the general public? What types of messages succeed and why? What lessons can be gleaned from the findings emerging from several community-based prevention trials regarding the links among community awareness, citizen involvement in shaping norms regarding drinking and driving, and alcohol-related crashes (e.g., Holder et al., 1997)?

**Research Issues:** What messages "work" with which groups and why? How can the safety community harness the Internet and other nontraditional media to provide information and disseminate messages re drinking and driving? How can we mobilize community members and leaders to shape the "news" about drinking and driving?

**Likely Success:** Techniques exist to measure and use rapidly changing communications strategies and technology; media advocacy techniques are emerging as ways to mobilize community members.

**Effects:** This research will likely result in the development of more effective public service messages, media campaigns, and the methods for communicating them.

### **To What Extent Do Different Types of Impaired Drivers Engage in Other Risk-Taking Behaviors?**

**Problem Area:** Considerable evidence indicates that risk-taking behaviors, including drinking and driving, are intercorrelated. Thus, self-reported data indicate that persons who report drinking and driving are also more likely to engage in other risky behaviors. A number of studies have examined the association between sensation-seeking and drinking and driving behavior and most have found a positive relationship. Generally, the association is more pronounced among men than women, and may decline with age (Jonah, 1997). Some results suggest that alcohol may serve as a disinhibitor of risky driving for high sensation-seekers (McMillen et al., 1989). There are studies that show that DUI offenders who also accumulate moving violations are more likely to recidivate, and to be involved in a crash, than DUI offenders without moving violations.

**We Don't Know:** The nature of the relationship between drinking and driving and other high-risk behaviors is not well understood.

**Research Issues:** What is the strength and nature of the relationship between drinking and driving and other risky driving behaviors? Is this relationship uniform among all types of drinking drivers? Can recidivism or crash involvement among DUI offenders be predicted from an offender's history of traffic violations, criminal history, reported sensation-seeking tendencies, or other risk-taking tendencies.

**Likely Success:** Most jurisdictions can provide detailed data on the driving histories of DUI offenders, including citations issued and crash involvement. They also frequently have data on arrests for other criminal offenses. Data on drivers' personality traits, sensation-seeking tendencies, and reported behaviors related to drinking, driving, and drinking and driving can also be gathered.

**Effects:** Deriving a better understanding between drinking and driving and other risky behaviors would be useful in developing both high-risk and general population strategies.

### **Alternative Approaches for the Prevention of Low BAC Driving**

**Problem Area:** It is generally believed that there is no level of alcohol at which it is safe to drive. Laboratory studies have shown impairment at alcohol levels below 0.05 percent BAC. The relative risk shown earlier in Table 1 indicates increased risk for young and middle-aged drivers at levels below 0.05 percent and for all age groups for BACs of 0.05

to 0.09 percent. Regulatory and enforcement countermeasures have limited ability to deal with driving at low BAC levels. Yet, particularly for youth, preventing low BAC driving can substantially reduce crash risk.

**We Don't Know:** Are there alternative ways to prevent persons from driving at low BACs? Possible approaches may include programs designed to change community norms, designated driver programs, peer intervention, alcohol-free events, and education and informational efforts. There may also be technology-based solutions, such as making ignition interlocks standard or optional items in new vehicles.

**Research Issues:** Are there feasible and cost-effective alternative approaches to reduce the incidence of low BAC driving, particularly among youth? Some portion of the population has been persuaded that driving at very low BACs is unsafe; what factors motivated this attitudinal and behavioral change?

**Likely Success:** The likely success of this research is unknown, since it is very much a developmental effort. However, the potential payoffs are large.

**Effects:** Current efforts to reduce low BAC driving have focused on zero tolerance for youth, and some states have laws that specify BAC levels (e.g., over 0.05 percent) for lesser impaired driving charges. Zero tolerance, in particular, has been difficult to enforce because of the problem of detecting drivers in the traffic stream who are both underage and, while they have been drinking, are well below the adult limit. Preventing low BAC driving is seen as a worthwhile goal, which may possibly be achieved using alternative approaches.

### **What Are the Alternative Organizational Structures and Responsibilities of State Alcoholic Beverage Control Agencies, and How Does the Effectiveness of Regulatory Enforcement Vary?**

**Problem Area:** The organizational structure, roles, and responsibilities of alcoholic beverage control agencies vary widely from state to state, as does a state's degree of involvement in the sale of alcoholic beverages and the laws pertaining to the times and conditions of sales. The state agencies enforcing the alcoholic beverage control regulations are an important partner with other government agencies in controlling the availability of alcohol. The enforcement of alcoholic beverage control laws and the imposition of administrative penalties on establishments that sell or serve alcohol illegally represent potentially powerful deterrents. Despite the importance of alcoholic beverage control agencies, however, we have limited comparative data concerning the cost-effectiveness of the many ways in which these agencies are constituted and organized within state government and lack data on the extent to which they cooperate with and depend on local law enforcement agencies.

**We Don't Know:** What are the most successful and cost-effective organizational, operational, and regulatory approaches to the sale or provision of alcoholic beverages?

Which approach, or combination of approaches, results in the highest level of compliance with key regulations, such as dram shop laws and sales to minors? How are the successful organizations being adequately funded? What are the roles and contribution of law enforcement agencies to their effectiveness?

**Research Issue:** What is the relative effectiveness and cost-effectiveness of the various regulatory and organizational approaches that states have adopted to control the sale and provision of alcoholic beverages?

**Likely Success:** It would be feasible to collect detailed information on state laws and regulations pertaining to alcoholic beverage control and information on the organizational structure, resources, etc. Numbers of arrests and citations for beverage control violations would also be available, as would survey data on the extent of drinking and crash data indicating the number of drinking drivers in the respective states. Observational and survey data also could be generated and provide a fuller picture of the role of leadership, policies, and actual practice

**Effects:** A better understanding of the types and effects of regulatory approaches and organizational structures would help states decide critical issues on the regulation, re-regulation and deregulation of the beverage industry. It would also help states organize and fund effective enforcement strategies.

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## **Thinking Outside the Black Box** *Research Priorities for the 21st Century*

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### **INTRODUCTION**

The last quarter of the 20th century signaled the public awakening on issues related to alcohol, drugs and transportation. Indeed in most countries, in the early 1980s drinking drivers represented about half of all fatally injured drivers. The good news is that we have seen a worldwide decline in drinking-driving fatalities, although in recent years some countries have plateaued or even shown increases (Sweedler, 1997). Thus, if we could speak to eras and public agenda issues, we would have to say the 1980s was the era of drinking-driving prevention.

However, the 1990s have brought new issues, new social problems and impaired driving has become more of a back burner issue. Recently, TRB sponsored a workshop entitled "Combating Impaired Driving in an Era of Diminished Resources and Shifting Priorities." The purpose was to identify strategies to rekindle interest in impaired driving. Yet, in many ways we have come as far as we can within the context of legislation, enforcement, adjudication, and sanctioning of impaired driving. Certainly in Canada, for example, there is no evidence that enforcement of impaired driving will become a priority any time soon (Jonah et al., 1997).

If there is one criticism of research in the alcohol, other drugs and transportation field that is that we have cast our net too narrowly. We have not looked at the larger picture and we have not used the research of other fields to advance our own knowledge base and to develop more innovative interventions as much as we could. In other words, there has been little that has been substantially new in our field in the last 20 years. A colleague recently stated to me that this field is "boring" and indeed it is. In 1983, as guest editor of a special issue of *Accident Analysis and Prevention* on drinking driving countermeasures, I wrote in the Introduction: "by and large, we have not been adventuresome in our research, nor have we been particularly hasty in learning from our past mistakes" (Vingilis, 1983, p. 405). I feel very much like one of my long-since retired colleagues, Dr. Wolf Schmidt, who commented after reviewing one of the papers for the 1983 *Accident Analysis and Prevention* special issue: "I have learned a lot from reading it, but feel disappointed that so little has been achieved since I last worked in the field. But this seems to be a general feeling and may simply mean that I am getting old" (Vingilis, 1983, p. 405).

Alcohol, other drugs and transportation, as a discipline, crosses many other disciplines; sociology, psychology, criminology, epidemiology, public health, etc. Yet, we have not milked the advances made in these other disciplines for our own use. In sociology multivariate modeling techniques are ever advancing, and are allowing for the development of sophisticated models to explain trends and behavior. In criminology and psychology, research is continuing on the development of a thorough understanding of devi-

ant behavior and the testing of various interventions. The addictions field is similarly developing a psycho-sociobiological model of addictions and is testing various multiple modality treatments. Clearly, if there is to be a key theme for research in the next decade, it should be to start thinking outside of the alcohol, drugs and transportation black box. So I am challenging the alcohol, other drugs and transportation research community to start casting wider nets. The following are some key areas, within the epidemiological, experimental and program/policy development, evaluative fields that need to be addressed if we are to further our knowledge and understanding related to alcohol, other drugs and transportation.

### **Epidemiology**

There are five epidemiological research priorities, four of which reflect “emerging trends,” that should be addressed in the future. Three are “situation-related” issues associated with global trends and the two are “person-related.”

### **Global Accident Trends**

**Problem Area:** We have observed trends in reductions of drinking-driving fatalities, plateaus and in some jurisdictions, increases. We still do not have the conclusive research to explain the variations within countries and across countries.

**What We Don’t Know:** We cannot assess how much variance is accounted for by individual jurisdictional countermeasures and how much is due to other factors. For example, the United States experienced reductions in alcohol-related fatalities among youth, which has been attributed to the 21-year drinking age. Yet, Canada experienced virtually the identical downward trend among their youth—indeed slightly greater reductions. However, the drinking age has remained at 18-19, depending on the province. This Canadian paradox, in relation to the American minimum drinking age laws, is but one example of a trend that begs inquiry.

**Research Issue:** Conduct multivariate analyses, using techniques such as structural equation modeling or other techniques, in order to develop a more comprehensive understanding of the determinants of fatality trends. Furthermore, test whether or not the models developed are transferable to other jurisdictions, in terms of the fit of the models and the strength of the associations found.

**Likelihood of Success:** Will depend on the quality and quantity of data available, and on the ability to model the trends with predictors. Votey and Shapiro (1983) had modelled highway accidents in Sweden, Mann and Smart have modelled American and Canadian consumption, mortality and accident trends, but few others have followed suit. Although there are clear limitations with modelling techniques, they still represent additional sources of knowledge by which to develop a more comprehensive understanding of trends. The likelihood of success is quite high.

**Effects:** The “French paradox” of why the French have lower cardiovascular disease than North Americans, despite the seemingly higher intake of fatty foods, etc., has been shattered, and has shed light on both the disease process and intervention approaches. Similarly, comparative analyses should shed light on variations and trends in impaired driving fatalities.

The bottom line is that we have not as yet, developed any models to assess and predict trends in traffic fatalities in general, and in impaired driving fatalities, specifically. Clearly, any research that would move away from a theoretical approach to fatality trends and attempt to understand them, would allow for enhanced planning and programming.

### **Impact of Globalization**

**Problem Area:** Probably no sector is experiencing a greater impact from free trade and globalization than the transportation sector. The transportation sector is a key infrastructure element necessary for globalization (Mather, 1993). Three major consequences of free trade agreements relating to the transportation sector have injury implications.

1. Free or liberalized movement of goods, services, capital and (in the case of common markets) labor.
2. Deregulation of the transportation industries.
3. Standards and legislative harmonization.

**What We Don't Know:** We have no understanding of whether or not the above three consequences are having an impact on alcohol, drugs and transportation. For example, “homogenization” of alcohol consumption trends has been occurring in the European Union (EU), whereby higher consuming countries have been lowering their alcohol consumption, while lower consuming countries have been increasing their consumption. Is “homogenization” occurring among jurisdictions in North America, and if so, how is it playing out with regards to trends in drinking-driving fatalities?

**Research Issue:** This them is related to the previous issue of developing models to understand international patterns and trends in alcohol-related collisions. Collaborative, international research questions on the impact of global forces could be developed and investigated. Numerous questions exist. For example, cross-border traffic has been increasing dramatically, yet, we have no information on how frequently drivers convicted of driving while intoxicated (DWI) or other serious traffic-related offenses in cross-border jurisdictions, have their convictions registered with their local department of motor vehicles. Is it an issue of concern? Is it an increasing trend? Vingilis et al. (1998) in a review paper, have identified a number of research issues related to globalization. They include issues related to the commercial transportation and alcohol control policy sectors. For example, the trucking industry, because of increased international competition, has been lobbying to increase the driving hours of long-distance commercial truck drivers, which, if passed, could hypothetically increase stimulant use. Jurisdictions with tighter alcohol control policies, such as minimum pricing policies, are being challenged as having unfair trade practices. Reductions

in alcohol prices could see increases in alcohol consumption which could affect road safety. These are issues that need monitoring and research.

**Likelihood of Success:** Other disciplines have been engaging in international research projects. The EU has been engaged in collaborative research and the fact that this workshop is being sponsored by both American and Canadian sectors, speaks to the possibility of increased joint research programs.

**Effect:** Trend data have shown us, that worldwide declines have occurred in drinking-driving fatalities. However, we have little understanding for why these worldwide changes occurred. All research in the political and economic fields have been pointing to the diminution of nation-state powers and increases in global pressures. It will be important to monitor the impact of globalization on road safety. Rather than “thinking globally and acting locally,” we have been thinking locally and may eventually have to begin acting globally. Without understanding the big picture, we will be limited in our future capacity to intervene successfully to reduce alcohol, other drug and transportation problems.

### Health-Care System

**Problem Area:** During the past two decades, Western countries have experienced large increases in health care expenditures, which account for between 6 to 14 percent of a country's gross domestic product. Concerns over cost escalation in the past 5 years have driven virtually every country in the Organization for Economic Development to launch major reforms of its health care systems (Evans, 1993). In recent years, health ministries and departments have become interested in injury prevention, in no small measure because of the health-care costs equated with injuries. For example, in Canada, injuries have jockeyed for second and third place in terms of total health-care costs. When these economic burden data came out, injury prevention began to appear in public health documents.

However, health-care restructuring, managed care, the aging population, advances in medical technologies and pharmaceuticals could have impact on injuries. Reducing hospital days of stay, day surgeries, and deinstitutionalization of the chronically ill and frail elderly means that many more of the general public are using transportation under the influence of medicinal drugs. For example, in Ontario, the average senior citizen has an average of 38 prescriptions filled a year.

Another emerging, managed health care problem related to cost-cutting, is the reduction of alcohol and drug abuse programs. McLellan et al. (1996) write that based on findings from the National Institute on Drug Abuse's Drug Abuse Treatment Outcome Study, “there has been a systematic deterioration in the number, range, professionalism and duration of treatment services that are available to patients for the treatment of alcohol and drug problems” (p. 8).

**What We Don't Know:** The mobility of health-compromised, medicinal drug-using, individuals has not been examined to any extent, despite its emerging trend. In fact, de Gier (1993) estimates that at least 10 percent of all people injured or killed in road crashes

were taking some type of psychotropic medication that may have been a contributory factor, a problem which could be exacerbated with the aging population and changing health-care practices. With regards to alcohol and illicit drugs, the impact that reductions in alcohol and drug treatment services could have on impaired driving is unknown.

**Research Issues:** Within the health-care sectors are a number of emerging trends that need attention. Changing health care practice effects, such as day surgeries and de-institutionalization, the elderly, and the impairing properties of medicinal drugs are important areas of research and intervention. Similarly, it would be important to monitor the trends between reduced treatment availability and impaired driving fatalities. Mann and Smart have conducted regression analyses on the impact of increased treatment and Alcoholics Anonymous membership as factors in traffic fatalities (Mann et al., 1988; Mann et al., 1996).

**Likelihood of Success:** These are straightforward epidemiological issues to tackle.

**Effects:** These emerging trends need to be monitored for planning and intervention purposes.

### **Pedestrians**

**Problem Area:** Related to the issues mentioned above of elderly, medicinal impairment, de-institutionalization, etc., one could anticipate a greater number of pedestrians who are impaired by drugs and/or alcohol.

**What We Don't Know:** We have little information available on the role of alcohol and other drugs in pedestrian casualties.

**Research Issue:** To gather alcohol and drug information on pedestrian casualties, with eventual case-control studies.

**Likelihood of Success:** Basic epidemiological issue.

**Effects:** We will have a better understanding of the prevalence of alcohol and drug use among pedestrians, which could lead to interventions, if needed.

### **Etiology of Impaired Driving**

Although I have been asked to address the "general public" as opposed to "special populations," I feel some preamble regarding the concept of general public is needed. One of the problems that has existed in the past is that interventions, both preventive and rehabilitative, generally have been developed on some belief that impaired drivers represent the "general public." For example, many, if not most, DWI rehabilitation programs have been developed with the assumption that offenders have reasonably normal personalities, normal cognitive processes, middle-class lifestyles and values, are well employed and

have stable lives, with no other problems, except maybe some problem drinking. Interestingly, the Addiction Research Foundation (ARF) of Ontario treatment research historically had just such types of exclusion criteria of co-morbid personality disorders, learning disorders, unstable lifestyles, multiple drug use, etc. Unfortunately it meant that only 4 percent of all clients seeking treatment at ARF were eligible for their research studies. Clearly this had serious implications for the generalizability of their research findings. Traffic safety interventions may be suffering from the same lack of appropriateness. Donovan, Jonah, Wilson and others have engaged in some exploration of DWI offenders and Wells-Parker has studied the differential effects of sanctions of DWI offenders with different demographic characteristics. But more research is needed to understand thoroughly impaired drivers (Donovan and Marlatt, 1982; Jonah, 1986; Wells-Parker et al., 1990; Wilson and Jonah, 1985).

**Problem Area:** Research suggests that the “general public” does not engage in much impaired driving. Rather impaired drivers represent a subset of individuals, at risk for numerous problems. There are personality factors, environmental factors, economic factors, etc., that play major roles in the development of health-compromising behaviors, such as alcohol abuse, and risk-taking and deviant behaviors, such as impaired driving. For example, antisocial behavior in childhood has been linked to alcohol problems in adolescence and adulthood. Adolescents who have been abused or traumatized are at risk for alcohol problems. Indeed a certain proportion of “the hard-core” impaired drivers are probably sociopathic personalities. Educational status and literacy tend to be lower. Researchers tend to forget that based on the latest international surveys, 44 percent of Americans and 32 percent of Canadians aged 16-25, read at the level 1-2 literacy level, meaning that they are functionally illiterate (Dasgupta, 1996). The illiteracy rate is even higher for older citizens. Furthermore, those who have difficulty with reading and absorbing basic information are not the “general public” but are over-represented among those with lower income, education, employment status, and particularly among those who are involved in deviant activities. In other words, those individuals most likely to be DWIs are also of similar profile to low literacy, low comprehension, citizens. Yet, programs are developed and evaluated based on the mistaken belief that DWIs are the “general public” who can read, write, comprehend, and act accordingly.

Furthermore, recent research from the alcoholism field and some initial work Dr. Mann has done at ARF with DWIs indicated that drug abusers and DWIs seem to be over-represented with learning disabilities, attention deficit, hyperactivity disorder and other possible neurological problems. As long as we assume that DWIs are simply the “general public” with weak moral fibre, we probably will not develop the types of interventions that could be appropriate.

**What We Don't Know:** We do not have a thorough understanding of impaired drivers—“etiology,” “development” and “natural history” of the behaviors. Nor do we have a good understanding of co-morbid, problem behaviors.

**Research Issues:** To develop a comprehensive and thorough understanding of impaired drivers and driving within the broader context of etiology, natural history, and co-morbid

problem behaviors. In addition, importance should be placed on studies examining social and environmental issues related to both impaired driving and mortality. In recent years, the criminological, sociological and public health fields have been exploring the importance of “social capital” and other broad determinants of health, such as poverty and income disparity, on morbidity and mortality. For example, Kawachi et al. (1997) in a cross-sectional ecologic study on social capital, income inequality and mortality, based on data from 39 states, found that poverty played a major role in explaining state variations in deaths due to unintentional injuries. Yet, these broader, environmental factors have been rarely investigated by traffic safety researchers.

**Likelihood of Success:** Other disciplines have been exploring these issues already. Unfortunately, our field has not kept abreast of the research and innovations to the same extent.

**Effects:** Most DWIs are not fine upstanding citizens with no problems who just happen to drink and drive. Rather they have problems with alcohol, drugs, and more often than not, engage in other criminal activities. Understanding the etiology of deviant behaviors, such as impaired driving, should lead to innovative preventive and treatment approaches.

## EXPERIMENTS

### Medicinal Drugs and Driving

I will not belabour this issue because it is being addressed by Drs. Burns and Jones, but in light of some of the emerging trends discussed above, more research is needed to understand the relationship between various medicinal drugs and impairment.

## PROGRAM/POLICY DEVELOPMENT AND EVALUATION

There are three general areas in program/policy development and evaluation where we could cast a wider net to broaden our scope of understanding and to engage in more innovative programming initiatives.

### Prevention: Early Intervention Programs

To date, much of our prevention activities and research has focussed on public or school-based education, or on alcohol control policies, such as server intervention. Yet, the research of Jessor (1987) and others has indicated that impaired driving, is but one of many risk-taking activities of troubled youth. Interventions that start early, and focus on ameliorating the development of problem behaviors, if successful, should impact on all deviant activities, including risky and impaired driving. Clearly there is the need for collaborative research activities in developing and evaluating innovative interventions.

**Problem Area:** Certain childhood behaviors, psychiatric disorders, parenting styles, family environments, peer relationships, expectancies, and trauma have been linked to alcohol

problems in adolescence and adulthood. Various interventions have been developed to reduce these risk factors. For example, schools have developed social skills and violence prevention programs. Communities and public health units have introduced effective parenting programs, home-visiting programs, head-start programs, and so on.

**What We Don't Know:** Few of these programs have been evaluated for their impact of subsequent health-compromising and risk-taking behaviors. Thus, we do not know if various programs can reduce overall problem behaviors, including impaired driving.

**Research Issue:** To conduct large-scale, longitudinal research on the impact of various promising interventions to reduce problem behaviors.

**Likelihood of Success:** Evaluation research is a challenge, at the best of times. To engage in longitudinal research, with large sample sizes and adequate methodology, will require the sustained commitment of funders and researchers. It would be important that alcohol, other drugs and transportation research be part of larger studies which measure a wide-range of lifestyle behaviors. In this way, we could develop a better understanding of prevention of at-risk behaviors, including impaired driving.

**Effects:** Early intervention programs can be highly successful in reducing problem behaviors. For example, a long-term follow-up of the randomized controlled trial of children enrolled in the Head-Start program called High/Scope Early Childhood Enrichment Program, from the 1960s in Ypsilanti, Michigan, found that the intervention group continued to do better than the control group in a number of ways. Although Head-Start programs were deemed to be a failure in their initial evaluations because the intervention children did not maintain their I.Q. advantage over the controls once both groups entered primary school, the evaluation by Schweinhart et al. (1985) found that the intervention adults were significantly more likely to have completed secondary school, to be working, to having reduced criminality, reduced teen childbirth, etc. With the cost-benefit calculation that for every dollar spent in the Head-Start program, \$7 were returned because of reduced social costs.

### **Prevention: Community Interventions**

**Problem Area:** The persistent focus of drinking-driving prevention has been on changing behavior of individuals with less consideration on the environment that shapes the behavior. The importance of the inter-relationship of the individual and the environment is chronically ignored (Vingilis and Mann, 1986). Social forces, cultural patterns, economics, values, and norms are generally not included in many equations of drinking-driving prevention.

As Wallack (1984) writes, the linear analytic-reductionist method of searching for a simple cause of public health problems has led to research comparing individuals with "the problem" with individuals who do not have the problem. The research invariably concludes that the problem individual has too little or too much of something and programs can therefore be developed that will give individuals what he/she needs. As many

suggest, this approach of only defining the problem as within the individual is popular because it clearly indicates the direction of research, programming, and policy (Vingilis, 1987; Wallack, 1984). It is politically and economically safe because the problem has been placed only on the individual and not on the money making products, industries, and systems that support impaired driving.

As Wallack (1984) and Mosher (1985) write, the strong focus on the individual is particularly salient in the United States, where the market-justice concept which emphasizes individual responsibility and the pursuit of self-interest so solidly based on traditional American ideals further supports the belief that impaired driving is a matter of individual responsibility. Yet, community-based initiatives can be powerful tools.

**What We Don't Know:** Community/jurisdictional policies that reduce the availability of alcohol and drugs should, theoretically, reduce impaired driving. Furthermore, successful programs that reduce drug use, violence and other problem behaviors could possibly have spin-off effects in reducing other delinquent behaviors, such as impaired driving.

**Research Issue:** Graduated licensing, alcohol pricing, physician medical prescriptions for less impairing psychotropics are all examples of interventions to reduce availability of alcohol, drugs and driving. Other broader interventions, such as early childhood interventions, violence prevention programs, and alcohol and drug prevention programs need to be evaluated for broader outcomes, such as impaired driving.

**Likelihood of Success:** Collaboration and "piggy-back" research are possible in community-based initiatives. Pairing up with large-scale interventions and evaluations would be the answer.

**Effect:** To reduce deviant behaviors, including impaired driving, a sustained multifactorial approach is more successful than any single approach. As impaired driving is part of a larger behavioral and environmental system, research is needed to understand the bigger picture.

### **Early Intervention: The Medical Community**

**Problem Area:** The medical community, particularly in Canada has become interested in moderate drinking, alcoholism, screening, early intervention and treatment. Numerous medical journals have dedicated issues to the topic. For example, the Canadian Family Physician in April 1997 published a special issue on moderate drinking and health. Definitions of moderate drinking are debated, and the epidemiologic evidence of the relationship between drinking and a range of positive and negative consequences, including the association with physical illness, accidents and violence, with adverse social consequences and with all-cause mortality is presented. For example, Ashley et al. (1997) present some health risks related to moderate drinking, including motor vehicle casualties. However, the mention of accident risk in relation to discussions of moderate drinking is not the norm among the medical community. In a study in the same journal, Herbert and Bass (1997) surveyed general practitioners and their patients on how they define early at-

risk alcohol intake. The patients' defined limits for a 75-kg man was 2 drinks per day and 11 drinks per week; doctors' estimate was 1.5 drinks per day and 9 drinks a week. Furthermore, both groups were asked under which situations people should completely avoid alcohol: driving ranked at the top, above pregnancy, taking medication, and medical condition. However, only 55 percent of patients and 58 percent of doctors felt that alcohol should be completely avoided while driving. Thus, the good news is that drinking and driving is most unacceptable; the bad news is that a sizeable minority finds that it is acceptable. Importantly, 85 percent of patients and 97 percent of doctors think doctors should ask about drinking behavior; yet only 42 percent of these patients recalled ever being asked how much they drank.

There still is a lack of awareness of medicinal drugs and impairment.

**What We Don't Know:** What effect increased medical early at-risk detection and interventions could have on reducing alcohol consumption and thus, impaired driving. Research on smoking cessation has shown positive results with physician inquiry and intervention. Medicinal drugs and impairment is an emerging issue, as was described above.

**Research Issue:** Working more closely with the medical community on a variety of alcohol and drug related interventions and evaluations.

**Likelihood of Success:** Probably will require sustained effort to effect change.

**Effects:** Physicians in a number of Canadian provinces must, by law, report to their provincial Ministry of Transportation, any patients who have conditions which could impair their driving. Clearly alcoholism and drug abuse are conditions that should be reported. Furthermore, doctors could be held negligent, where patients with the above mentioned problems were involved in motor vehicle collisions. Finally, physicians are an untapped source of assessment and intervention.

## CONCLUSIONS

The above research priorities move beyond the focus on specific alcohol-other drugs and transportation questions. This is not to deny that there is value in conducting research on specific alcohol and drug-related transportation issues. However, I suggest that the research in our field has been too linear reductionist, with the consequence that at times, we have missed the forest for the trees. For example, drinking and driving is not a pressing hot topic for the general public today, and we simply cannot go back to re-kindle the single issue interest on the topic that occurred in the early 1980s. Rather, it is critical that we read the current Zeitgeist and consider analysing emerging trends. Furthermore, we need to think of new innovative interventions that tap into the Zeitgeist and to collaborate and piggy-back on other interventions designed to enhance positive behaviors among our society. For example, increasing youth violence is a major concern for Americans, while in other countries, such as Canada, youth violence has been diminishing. The behaviors of seriously at-risk youth are manifested in many ways, including alcohol and drug use and driving. Thus, compartmentalization of problems behaviors for intervention and research purposes seems unwise,

unless we have evidence that they are indeed compartmentalized in society. As a discipline, we may have needed to be inward-looking to consolidate our knowledge-base within our own area. However, the time is now right, with the excellent foundation, we have in the field of alcohol, drugs and transportation, to broaden our research questions.

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## BACKGROUND PAPER

# Research Needs to Reduce Underage Drinking and Driving and Related Motor Vehicle Crash Involvement

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## INTRODUCTION

This paper will focus on research questions that if answered will help delay early onset of drinking, the amount of drinking by persons under 21, the frequency of driving after drinking by persons under 21, and alcohol related traffic deaths involving persons under 21.

In 1997, 2,209 persons age 15-20 died in alcohol related traffic crashes (NHTSA, 1998). Alcohol is also involved in 3,000-4,000 other deaths in that age group including homicides, suicides, drownings, falls, acute alcohol poisoning, or alcohol and other drug overdoses.

All states have made it illegal to sell alcohol to persons under 21 and for persons under 21 to drive after drinking. The proportion of high school seniors who reported drinking in the past year declined from 88 percent in 1980 to 75 percent in 1997. The proportion who reported drinking in the past month decreased from 72 percent to 51 percent (O'Malley, 1999).

Since 1982, alcohol related traffic deaths among 15-20 year olds have declined 59 percent. Still traffic deaths remain the leading cause of death among 15-20 year olds, and 35 percent of traffic deaths in that age group involve alcohol (NHTSA, 1998).

## RESEARCH QUESTIONS

### How to Delay Age of Drinking Onset Among Persons Under Age 21

Persons who began drinking at earlier ages are more likely to develop alcohol dependence during their lifetime (Grant, 1998). Subsequent analyses of the National Alcohol Longitudinal Epidemiologic Survey we have conducted indicate that earlier onset of drinking is significantly associated with

- Drinking 5+ drinks per occasion at least weekly in the past year;
- Drinking to intoxication at least weekly in the past year;
- Driving a motor vehicle after drinking too much ever and in the past year;
- Being in a motor vehicle crash because of drinking ever and in the past year; and
- Being unintentionally injured under the influence of alcohol ever and in the past year (Hingson et al., in review).

These relations were significant even after analytically adjusting for age, gender, education, marital status, and race. This suggests that delaying onset of drinking among

persons under 21 will have traffic safety and other injury prevention benefits that extend into adult life. The relations were significant both with respondents above and below age 21.

**We Don't Know:** We don't fully understand the extent to which more strict enforcement of laws prohibiting sales of alcohol to minors will decrease underage drinking, the percentage of teens who begin drinking before age 14, and the percentage of persons under 21 who drive after drinking.

**We Do Know:**

1. Males, younger persons, those who were never married, and those who have less education are more likely to begin drinking at earlier ages (Hingson et al., in review).

2. Buyers who appear to be under age 21 can successfully purchase alcohol from licensed establishments in 50 percent or more of their attempts (Forster et al., 1994, 1995; Preusser and Williams, 1992). An analysis of purchase attempts by youth appearing to be less than 21 revealed that liquor stores were more likely to sell to them than bars. Most youth obtain alcohol through social contact with persons over 21 (Wagenaar et al., 1996). For every 1,000 minors arrested for alcohol possession, only 130 establishments that sell alcohol to them have actions taken against them, and only 88 adults who purchase alcohol for minors face criminal penalties (Wagenaar and Wolfson, 1994).

3. Heightened enforcement of drinking age laws can reduce youth access to alcohol. Preusser (1994) found dramatic reductions in alcohol sales to minors, from 59 percent at baseline to 26 percent 1 year later, following an enforcement campaign involving 3 sting operations in which underage males attempted to purchase alcohol. Storeowners were informed of the initial sting, that additional stings would be conducted, and of the potential penalties for selling to minors. Teen drinking and driving after drinking was not studied. Wagenaar et al. (in press) in a multicomunity initiative organizing action through public institutions such as city councils, schools, enforcement agencies, private merchants, business associations, and the media found that the intervention communities experienced a 17 percent increase in liquor outlets checking age identification, and a 24 percent decrease in sales to potential underage buyers. There was a 20 percent reduction in the proportion of teens who tried to buy alcohol and a 7 percent reduction in consumption. The latter two reductions approached statistical significance ( $p = 0.07$  and  $p = 0.06$ ). Effects of the program on the frequency of driving after drinking by persons under age 21 were not reported.

**Research Issue:** If states and communities implement programs to monitor compliance of bars and liquor stores with laws about selling alcohol to minors, will that reduce

- Percentage of teens who begin drinking before age 14,
- Percentage of teens who drink heavily, and
- Percentage of teens who drive after drinking heavily?

**Likelihood of Success:** It is likely programs that monitor compliance will reduce the proportion of teenage alcohol purchase attempts that result in sales to minors. Smaller reductions in the proportion of teens who begin drinking at an early age, teenage drinking, and driving after drinking are expected.

**Other:** If reducing sales of alcohol to minors does reduce early onset of drinking, the percentage of teens under 21 who drink, and who drink and drive, laws requiring compliance checks on underage alcohol purchase could be pursued similar to the Synar Amendment that require states conduct such checks on underage tobacco purchase attempts.

### **How to Increase Awareness of Zero-Tolerance Laws**

Studies of zero-tolerance laws have demonstrated clear effectiveness in reducing alcohol related traffic deaths among drivers under 21 (Hingson et al., 1994; Blomberg, 1992; and Voas et al., in press). The greatest effects are for drivers age 16. In the 1997 Harvard School of Public Health National College Survey, one-third of college students under age 21 in states with zero-tolerance laws thought they could drink two or more drinks and drive legally. Those who held this belief were significantly more likely to report driving after drinking and after 5+ drinks than those who believed it illegal to drive after any drinking (Hingson et al., in review). Blomberg et al. (1992) has demonstrated in Maryland that educational programs can increase the proportion of persons under 21 who are aware it is illegal to drive after drinking. They can also reduce the incidence of alcohol related crashes.

**We Don't Know:** We don't know which of the following strategies are most effective in increasing awareness of zero-tolerance laws

- Driver license exam questions,
- Driver license manual information,
- School based education programs,
- Driver education program information,
- Community based public service advertisement,
- Modification and strengthening zero-tolerance laws, and
- Other.

**Research Issue:** What types of educational programs will be most effective in increasing awareness of zero-tolerance laws?

**Likelihood of Success:** Awareness can be increased. Well designed experimental studies can test the effects of different educational strategies.

**Effects:** Each year new cohorts of teens enter the driving pool. Consequently, educational efforts will need to be ongoing.

### **How to Most Effectively Increase Perceptions Among Drivers Under 21 That Persons That Age Who Drive After Drinking Will Be Apprehended by the Police, Breath Tested for Alcohol, and Lose Their Licenses for Zero-Tolerance Violations**

Despite the passage of the minimum legal drinking age of 21 and zero-tolerance laws, according to the 1995 National Survey of Drinking and Driving Attitudes and Behavior, twice as many drivers under age 21 believe that they are more likely to have a traffic accident after drinking (66 percent) than to be stopped by the police (30 percent). In fact, only one in three believe it is very likely they will be stopped by the police for driving after drinking too much, and only 55 percent believed it was almost certain they would receive punishment if charged. Fewer than 40 percent thought their driver's license would be suspended.

A major problem among law enforcement for youth is they are often not tested for alcohol even if they are drivers in fatal crashes. In 1997, 61 percent of fatally injured drivers age 15-20 in crashes were tested for alcohol, and only 39 percent of surviving drivers that age in fatal crashes were tested (NHTSA, 1998).

At this point, we do not know what proportion of drivers under 21 in states with zero-tolerance laws believe that they will be stopped by the police if they drive after drinking, believe they will have to take blood alcohol tests, and believe that if they score positive, they will have their driver's license suspended.

**Research Issues:** We need to establish (1) what proportion of drivers under 21 in states with zero-tolerance laws believe it is likely that persons their age who drive after drinking will be stopped by the police, breath tested and have their driver's license suspended; and (2) what approaches would be most effective in increasing the perceived likelihood among drivers under 21 that if they drive after drinking, they will be stopped by the police, tested for alcohol, given zero tolerance citations, and have their license suspended.

National surveys could assess these perceptions among drivers under 21. One potentially effective approach to increase these perceptions of enforcement would be to conduct highly publicized sobriety checkpoints where the police use passive alcohol sensors. Pre- and post-check-point surveys of teens in areas where the sensors are used relative to comparison areas could establish whether this enforcement approach changes public perceptions of the likelihood of enforcement and whether that, in turn, reduces the likelihood that drivers under 21 will drive after drinking and be in crashes involving alcohol.

**Likelihood of Success:** Studies of intensive enforcement campaigns using sobriety checkpoints and the passive alcohol sensor have increased perceptions among adult drivers that drunk drivers will be stopped, arrested, and convicted. Data from these studies also identified reductions in driving while intoxicated (Voas et al., 1985).

**Other:** Most police departments have not adopted use of passive alcohol sensors. In some states, there has been minimal enforcement of zero-tolerance laws. Efforts are needed to stimulate and document effects of zero-tolerance law enforcement using passive sensors and sobriety checkpoints.

## How to Best Implement Mandatory Alcohol Dependence/Abuse Assessment Programs for Teen Drivers Convicted for Zero-Tolerance Violations

All states have now adopted zero-tolerance laws. Eighteen states have laws requiring alcohol dependence/abuse screening for persons arrested for driving while intoxicated (DWI). According to general population surveys using DSM-III and DSM-IV criteria, persons 18-21 are more likely than older adults to exhibit symptoms of alcohol abuse and dependence (Hingson, in press). Approximately 40 percent of people with alcohol use disorders (i.e., alcohol abuse and dependence) developed their first symptoms between age 15 and 19 (Helzer, 1991).

**We Don't Know:** We are not aware of optimal instruments to screen for adolescent alcohol abuse and dependence or what treatment/counseling approaches will most effectively reduce driving after drinking among zero-tolerance law violations. Two research issues warrant study:

1. The diagnostic DSM-IV criteria for alcohol abuse and dependence were developed largely from research and clinical experience with adults. The validity of these criteria when applied to adolescents needs to be further assessed.
2. Adolescents who meet the alcohol abuse/dependence criteria may need different counseling and treatment than adults who meet those diagnostic criteria:
  - Should violators of zero-tolerance laws be given the same alcohol treatment and rehabilitation programs as adult driving while intoxicated offenders?
  - Should violators of zero-tolerance laws receive alcohol reeducation, treatment, and group counseling separate from adult DWI offenders?
  - How effective will Victim Impact Panels be in dealing with zero-tolerance violators?
  - Will use of ignition interlock as a condition of probation reduce recidivism among zero-tolerance violators?
  - Would requiring that zero-tolerance offenders not drive after drinking even after they are 21 reduce their DWI recidivism and crash involvement?

**Likelihood of Successful Research:** Several instruments to screen for alcohol abuse and dependence specifically among adolescents have been developed (Martin and Winters, 1998). These include

- The Client Substance Index Short (CSI-S),
- Drug and Alcohol Problem (DAP) Quick Screen,
- Drug Use Screening Inventory,
- Perceived Benefit of Drinking and Drug Use,
- Personal Experience Screening Questionnaire (PESQ),
- Problem Oriented Screening Instrument for Teenagers (POSIT),
- Substance Abuse Subtle Screening Inventory (SASSI),
- Adolescent Alcohol Involvement Scale,
- Adolescent Drinking Index, and

- Rutgers Alcohol Problem Index (RAPI).

Experimental studies could answer questions about what types of treatment and counseling would be most effective for zero-tolerance law violators. A well designed randomized trial would combine several types of data to assess what intervention will best reduce recidivism among zero-tolerance law violators. The data collection should include

- Self-reported data about drinking practices, perceptions of the risks associated with driving after drinking various amounts of alcohol, beliefs about the likelihood of drinking drivers being apprehended, convicted and punished, self-reported drug use, and driving after drinking, as well as perceptions of counseling and education intervention;
- Biochemical markers for drinking and other drug use;
- Department of probation records not only for DWI arraignments but other alcohol related criminal activity; and
- Registry of Motor Vehicle records on traffic crash involvement and rearrest for DWI or zero-tolerance violations.

**Other:** Because 25 states in just the past 3 years have adopted zero-tolerance laws, there is a pressing need to conduct an evaluation that can help inform states across the country regarding these sentencing and treatment questions.

### **How to Strengthen Zero-Tolerance Laws to Achieve Their Maximum Effects**

Zero-tolerance laws forbidding driving after drinking by persons under age 21 have now passed in all 50 states. The laws, however, vary considerably. Some have no license suspension provisions. Others call for administrative license suspension; while still others have criminal per se provisions. The laws also vary in whether they allow for hardship licenses to permit zero-tolerance violators to attend school or travel to work.

**We Don't Know:** We don't know whether

- Criminal per se provisions will increase the effectiveness of zero-tolerance laws,
- Eliminating hardship license provision will increase zero-tolerance law effectiveness, and
- Lengthening the license suspension period will increase the effectiveness of zero-tolerance laws.

**Research Issue:** Have states that passed zero-tolerance laws with administrative license revocation, criminal per se provisions, longer license suspension periods, or no hardship exception experienced greater post-law reductions in the proportion of fatal crashes among drivers under 21 that involve drivers under 21 with positive blood alcohol levels? Which provisions are associated with the greatest decline?

**Likelihood of Success:** It is quite likely that quasi-experimental studies can assess the relative effects of the zero-tolerance law provisions listed above. It is probable that longer license suspensions coupled with Administrative License Revocation will be the most effective provision in further reducing teen alcohol related crash involvement.

**Other:** Research in this area could lead to stronger more effective zero-tolerance laws.

### **How to Reduce Driving After Drinking Among College Students Under Age 21**

Despite the minimum drinking age of 21 and zero-tolerance laws for all drivers under 21, Wechsler et al. (1998) surveyed random samples of students from 116 colleges and universities in 39 states representing a cross section of U.S. higher education in 1993 and again in 1997. In 1993, 15,103 students and in 1997 14,521 students completed self-administered questionnaires. Response rates were 70 percent in 1993 and 60 percent in 1997. Even though college students under 21 were less likely to drive after drinking than those over 21, 15 to 20 percent living in states with zero-tolerance laws reported driving after drinking more than five drinks in the past month. The proportions did not change from 1993 to 1997. In states that had not yet adopted zero-tolerance laws in 1997, 28 percent reported driving after drinking and 11 percent driving after five or more drinks in the past month. These rates of driving after drinking exceed those reported for all drivers age 21 and younger (NHTSA, 1996).

**We Don't Know:** We don't know what are the most effective strategies to reduce driving after drinking and alcohol related crashes among college students under 21.

**We Do Know:** We do know that frequency and quantity of alcohol consumption by persons under 21 is a strong predictor of driving after drinking by persons that age. Further, the literature on interventions to reduce college age drinking reveals that both interventions aimed to change individual beliefs, knowledge, and attitudes as well as environmental changes, such as increases in the minimum alcohol purchase age and decreases in the alcohol content of beer, can reduce drinking. However, a recent review we conducted (Hingson et al., 1997) revealed that no intervention examined in more than one study produced reductions in college student drinking in every study that explored the intervention.

An important impediment to rigorous research on how to reduce driving after drinking among college students under 21 is the absence of information in the U.S. Fatality Accident Reporting System regarding whether drivers and passengers in fatal traffic crashes were college students. Age is recorded but not student or work status. Further, while many studies using survey or other research methods have focused on reducing college student drinking, few focus on driving after drinking.

**Research Questions:** What interventions will most effectively reduce driving after drinking and alcohol related crash involvement among college and alcohol related crash injuries and fatalities? Individually oriented interventions found to reduce college drinking include (for references to this list see Hingson et al., 1997)

- Behavioral Self Management (Garvin et al., 1990);
- Self Monitoring of Drinking Behavior (Garvin et al., 1990);
- 6-Week Cognitive Behavioral Skills Training (Baer et al., 1992);
- Single Session and Individualized Feedback (Baer et al., 1992);
- Cognitive Behavioral Skills Training (Kevlahan, 1990);
- Didactic Alcohol Information Program (Kevlahan, 1990);
- Content Oriented Alcohol Education (Rozelle, 1980);
- Experimental Peer Facilitated Approval (Rozelle, 1980);
- Two-Week Alcohol Education Module Focused on Medical Effects of Alcohol Abuse (Caleekal et al., 1984);
- One Credit Course on Lifestyle (McLaran and Sarris, 1985);
- Cognitive Informal and Affect Instruction and Selected Field Experiences (Dennis, 1977);
- Psychosocial Aspects of Alcoholism Class Combined with Contracted Abstinence (Bleem, 1980);
- Semester Long Drug Education Course (Bailey, 1990); and
- Drinking Expectancy Challenge Intervention (Dorst and Goldman, 1993).

The effects of those interventions on driving after drinking and related crash outcomes warrant study. Several studies of environmental interventions have been funded to reduce driving after drinking in the general population. Their effects on college student drinking and driving among students under 21 warrant study:

- Reduced outlet density,
- Tax increases,
- Server intervention,
- Curfews for young drivers/provisional licenses,
- Zero-tolerance laws, and
- Comprehensive community program interventions such as
  - The Saving Lives Program,
  - Community trials, and
  - Communities mobilizing for change on alcohol;
- Other environmental interventions include
  - Beer keg registration,
  - Use lose laws,
  - Required server training, and
  - Heightened enforcement of alcohol service laws.

On campus environmental police such as dormitory regulation, school conduct codes regarding alcohol, and regulation of alcohol at sporting and social functions need to be examined.

**Likelihood of Success:** Because several individually oriented interventions to reduce college drinking have demonstrated success in doing so in rigorous experimental studies,

it is likely beneficial reductions in driving after drinking and related crashes will be possible. Also, because many environmental interventions have reduced alcohol related fatalities in the general population, it is likely they can in the college population.

### **How to Close Loopholes in Age 21 Legal Drinking Age**

It is illegal in all states to sell alcohol to persons under age 21. Nonetheless, a number of loopholes exist in state laws regarding purchase, possession, and provision of alcohol to minors. In 18 states, it is not illegal for persons under 21 to attempt to purchase alcohol; in one state, it is not illegal for youth to possess alcohol; in 15 states, youth under 21 can legally consume alcohol; and in 10 states, it is not illegal for youth to possess fake age identification (Mothers Against Drunk Driving, 1996).

**We Don't Know:** We don't know what impact closing these loopholes would have on restricting access of persons under 21 to alcohol, the frequency and quantity of their alcohol consumption, and on the frequency with which youth drive after drinking.

**Research Issue:** What is the impact on frequency and quantity of alcohol consumption and frequency of persons under 21 driving after drinking of closing loopholes in the age 21 minimum legal drinking age by making it illegal for those under 21 to

- Have fake age identification,
- Attempt to purchase alcohol,
- Purchase alcohol, and
- Consume alcohol?

**Likelihood of Success:** Quasi-experimental studies comparing states that adopted these laws with states that did not may reveal differences. There are no surveys of adolescents with adequate sample size collected on an annual basis to conduct these analyses on a state by state basis, but it might be possible with studies like the Monitoring the Future Study as was done by O'Malley and Wagenaar (1991). Prospective studies could be developed.

**Effects:** Though the effect of closing any single loophole will doubtfully be as great as that of passing minimum legal drinking age laws (MLDAs) of 21, there may be identifiable benefits.

**Other:** Because most states have most of these laws, additional research information could stimulate other states to pass such legislation.

### **How to Increase Safety Belt Use Among Youth**

In the absence of safety belt laws, persons who drive after drinking are much less likely to wear safety belts in general.

In the 1996 National Occupant Protection Use Survey, the lowest level of safety belt use of any age group was recorded for persons age 16-24, 49 percent compared with 62 percent for all ages (NHTSA, 1997).

Belt use in 1997 averaged 17 percentage points higher in the states with primary enforcement laws, 79 percent versus 62 percent, than in states with secondary enforcement laws (NHTSA, 1999).

A recent analysis in California revealed that passage of primary enforcement produced disproportionate increases in belt use among drivers who drove after drinking.

**We Don't Know:** We don't know the impact of primary enforcement laws on drivers age 15-20 who also drive after drinking. Whether enactment of such laws will

- Increase belt use,
- Permit police to identify unbelted drivers who also are violating zero-tolerance laws,
- Reduce driving after drinking in that age group, and
- Reduce the proportion of fatal crashes involving 15-20 year olds that involve alcohol.

**Research Issue:** Will passage of primary belt laws for all drivers under 21 either as part of laws applying to all ages or as part of graduated licensing:

- Increase belt use among 15-20 year olds;
  - Increase police apprehension of zero-tolerance violators;
  - Decrease driving after drinking by 15-20 year olds;
  - Increase belt use among all 15-20 year olds and those who drive after drinking;
- and
- Reduce the proportion of crashes involving 15-20 year old drivers that are in alcohol related and result in injury or death.

**Likelihood of Success:** Research on this issue can apply established observation, roadside alcohol surveys, and crash analysis techniques to the population of motor vehicle drivers and occupants age 15-20. Results of this research may help strengthen safety belt laws in state that have not yet adopted primary enforcement for youth and adults.

## SUMMARY AND CONCLUSIONS

Considerable progress has been made in the past 15 years in reducing alcohol related traffic fatalities among youth stimulated in large part by the MLDA of 21 and zero-tolerance laws for driver under 21 as well as the considerable publicity that preceded and followed passage of those laws. Safety belt laws have also been demonstrated to reduce alcohol related traffic fatalities among youth (Voas et al., in review).

Nonetheless, research clearly indicates that alcohol produces greater impairment of driving tasks for youth, and each drink increases single vehicle fatal crash risk more for drivers under 21 than above 21 (Zador, 1991). Consequently, we must constantly seek to

identify new approaches to reduce driving after drinking as each year new cohorts enter the driving pool.

Impediments to further reducing alcohol related crashes among youth have parallels to impediments among adults. First, now that all states have adopted MLDAs of 21 and zero-tolerance laws, we need to strengthen existing laws by closing loopholes in the laws and strengthening the certainty and swiftness of enforcement and license suspension. Which provisions will have the greatest effects in further reducing alcohol related traffic fatalities can be evaluated empirically. Parallel issues exist regarding implementation of ALR laws, mandatory treatment laws, vehicle confiscation, and lower legal blood alcohol limits among adults.

Second, issues around how best to educate young people about the laws and foster the belief that the laws will be enforced can also be subjected to empirical evaluation. The effects of different enforcement and educational initiations can be tested. Many of these issues with youth have direct parallels with adults and laws that apply to them.

Recent interest in college drinking problems poses a particularly promising opportunity to use colleges as an additional new organizational structure for change in youth drinking and driving. In the 1990s, comprehensive community interventions such as the Community Trials Program, and the Saving Lives Program (Hingson et al., 1996) as well as Project Northland (Perry et al., 1998) and the Community Mobilization for Change (Wagenaar et al., in press) all demonstrated varying degrees of success in reducing drinking by youth and/or driving after drinking and alcohol related crashes. The underlying principles of community mobilization and collaboration across multiple departments of city government and between the public and private sector may well have applicability in the area of college drinking problems. Colleges and communities must, however, work together to achieve optimal reduction in these problems. Indeed, it is doubtful that substantial progress will be made without this collaboration.

In the past 20 years, much of the regulatory activity around drinking and driving has focused on state level activity. Focus on college drinking problems may also draw more attention to community level interventions such as zoning, regulation of hours and location of sale, establishment of alcohol free zones in communities and on campus. It may also offer an opportunity to involve more young people in policy debate and public education about the laws. Whether activities that involve youth in policy settings and implementation will create more acceptance of and adherence to laws pertaining to them should be an important new research theme for the next decade.

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## **Research Requirements for Underage Drinking and Drinking-and-Driving Prevention**

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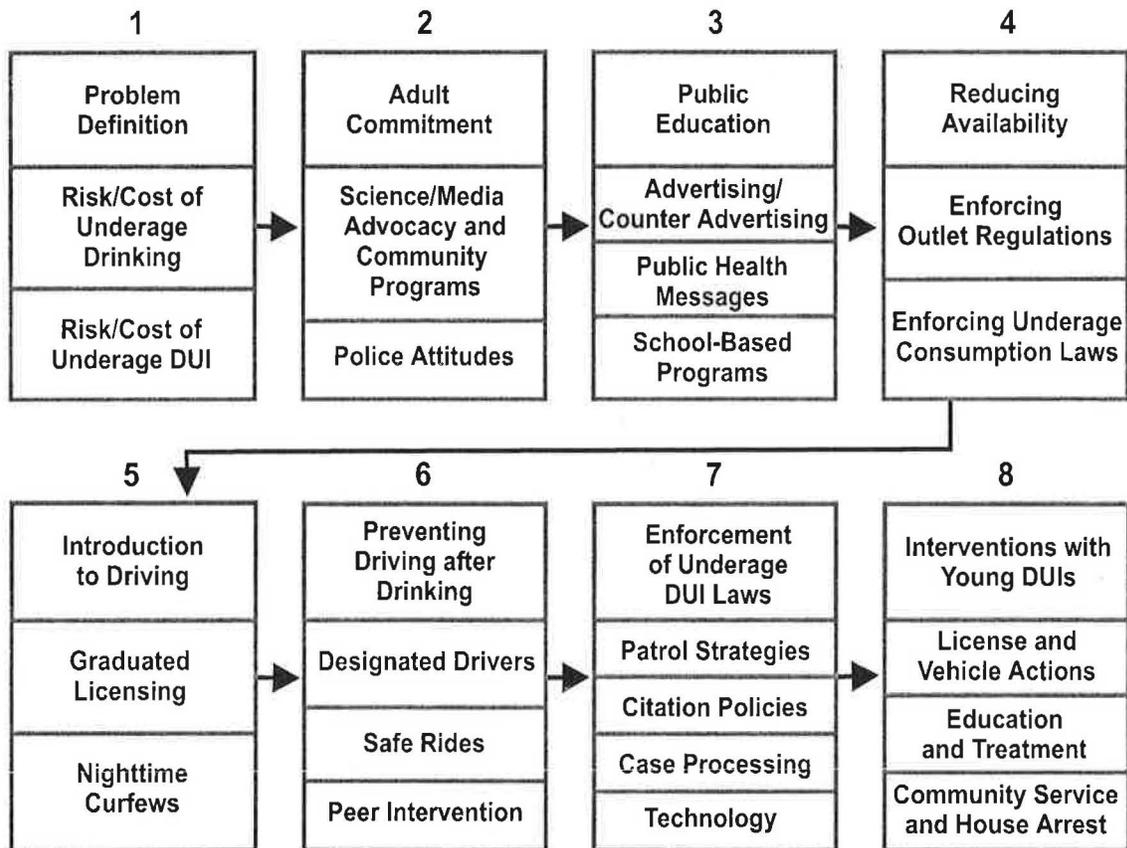
### **GOAL**

To identify the highest priority research studies required to provide public health, traffic safety activists, and government officials with the information required to establish effective programs to reduce underage drinking and drinking and driving.

### **INTRODUCTION**

Before the Surgeon General's Conference on Drunk Driving in 1988 (General Accounting Office, 1989), the field of alcohol and highway safety was fairly well limited to the factors related to impaired driving enforcement of drinking-and-driving laws, adjudication sanctioning, and public information programs related to drinking and driving. Because the minimum legal drinking age laws (MLDAs) have successfully reduced underage highway mortality and morbidity, the alcohol safety research field has expanded to include additional components of the public health field. These components include programs to reduce availability through pricing, modification of the conditions of sale, and the use of zoning regulations to reduce the density of alcohol outlets and exercise some control over their sales policies. As a result, in considering underage drinking and impaired driving, it is necessary to consider a large area of research. To inform this background paper and structure the discussion sessions for the TRB's summer 1999 meetings, it is useful to develop a model into which the research studies reported over the last three decades can be classified. The construction of a model is also useful in directing attention to the users of alcohol safety science. The model should reflect the major operating components of the social/legal system through which society attempts to control underage drinking and drinking-and-driving.

Figure 1 represents an attempt to construct such a system for use in the present report. This model identifies eight major elements of the current prevention system for controlling underage drinking and drinking and driving. The first element encompasses the effort to better identify and understand the underage, alcohol abuse problem and to identify measures useful in evaluating program effectiveness. A second element incorporates the problems and issues related to persuading adults that underage drinking, as well as drinking and driving, is a serious problem and the related problem of recruiting official support for police departments to increase the resources devoted to underage enforcement. A third element includes public education efforts designed to dissuade or deter young people from drinking and driving while impaired. The fourth element includes those programs directed at enforcing underage sales laws with owners of alcohol outlets and enforcing



**FIGURE 1 Eight major elements for controlling underage drinking and drinking and driving.**

underage possession and consumption laws with youths under age 21. A fifth element focuses upon methods for reducing the risk involved in introducing youth into the driving environment. The sixth element draws together those programs that are specifically designed to reduce pressures on drinkers to drive after consuming alcohol. The seventh element covers the strategies and procedures that police use to apprehend underage drinking drivers. And the eighth, and last, component brings together all of those intervention programs that become possible once an offender has been cited and the court or the state gains the authority to control their behavior and administer sanctions designed to prevent recidivism and promote recovery from problem drinking. The research needs in each of these eight elements are outlined in the following sections.

## RESEARCH NEEDS

### Underage Drinking Problem

**Problem Area:** What is known regarding morbidity and mortality related to underage drinking and impaired driving

**What We Know and Don't Know:** That drivers under age 21 are at elevated risk of crash-involvement per mile of exposure is well understood (Zador, 1991; Beirness et al.,

1993; Zador et al., 1999 in press). Recent evidence suggests that age of onset of drinking is an important factor in adult alcohol abuse and adult drinking and driving (Grant, 1998). This conclusion, however, is based on cross-sectional rather than longitudinal data. There is a need to verify Grant's results with longitudinal studies where early drinking is recorded for teenage cohorts and alcohol problems of drinking and driving assessed when the individuals reach adulthood. A review of studies on the costs of underage drinking has recently been issued (Levy et al., 1999, working paper); however, these costs may be underestimated if underage drinking significantly increases mortality and morbidity among adults.

**Research Issues:** The effect of early onset of drinking on adult morbidity and mortality needs to be determined.

**Likelihood of Successful Research:** There are a number of existing data sets that may provide the longitudinal information required.

**Application of Research Results:** A significant factor limiting the resources devoted by governments and police departments to enforcement of MLDA and zero-tolerance laws is the belief that, though underage drinking may be dangerous to youthful binge drinkers, it has relatively small impact on society as a whole compared to street crime and drug use among other adult problems.

**Broader Issues:** A clear demonstration that underage use produces adult morbidity and mortality would provide a stimulus to governmental activity similar to that produced by the knowledge that tobacco addiction begins with underage smoking.

### **Adult Commitment to Reducing Underage Drinking and Impaired Driving**

**Problem Area:** The lack of citizen and official support at the community level for strong efforts to reduce underage drinking and impaired driving.

**What We Know and Don't Know:** At the national level, there has been strong support for laws such as the MLDA and the zero-tolerance law that are designed to reduce underage consumption and impaired driving. At the local level and particularly among police departments, there has been considerably less concern with underage drinking. Enforcement of these laws is often given low priority relative to other law enforcement responsibilities (Voas and Williams, 1986; Preusser et al., 1994; Wagenaar and Wolfson, 1995).

**Research Issue:** How can communities organize to promote increased enforcement of underage drinking laws?

**Likelihood of Successful Research:** Although large numbers of community substance abuse prevention programs have been funded (Robert Wood Johnson, Fighting Back, Center for Substance Abuse and Prevention, Community Partnerships, NHTSA Safe Community Programs), few of these efforts have been adequately evaluated. Recently,

three research projects (Community Trials, Holder et al., 1997a; Communities Mobilizing for a Change on Alcohol Project; Wagenaar et al., 1994; and Saving Lives, Hingson et al., 1996) have provided evidence for the effectiveness of science-based community efforts. This research has also developed initial models for community action (Holder et al., 1997b; Voas et al., 1997a). Additional studies are needed to confirm and expand these models.

**Application of Research Results:** The broad enthusiasm for community projects evidenced by government agency program mandates suggest that effective, validated models of community action will be implemented if they are available. Unless community support can be marshaled to demand stronger enforcement of underage drinking and drinking and driving laws, much of the potential value of this legislation will be unrealized.

### Public Education

**Problem Area:** Mass media efforts to influence underage individuals to reduce consumption and avoid impaired driving.

**What We Know and Don't Know:** There is substantial evidence that advertising sells products. The evidence that it influences underage drinking is more limited (Atkin, 1989; Grube and Wallack, 1994). Overall, there is little evidence that safety campaigns alone have any impact on driving behavior (Wilde et al., 1971). Similarly, the efficacy of school-based programs designed to delay the onset of drinking and reduce problematic consumption has been meager though there is some indication that involving parents may produce some reduction in alcohol consumption.

**Research Issue:** There are several important issues that require additional study:

1. To what extent does advertising and the content of television, movies, and musical entertainment increase underage consumption?
2. What is the efficacy, if any, of counter advertising and of general public health messages in reducing underage consumption?
3. Can a low-cost, effective school-based education program be developed that will reduce underage drinking and impaired driving?

**Likelihood of Successful Research:** Public information efforts occur in a complex media environment, overloaded with messages irrelevant to drinking and drinking-and-driving. Therefore, it has proved to be very difficult, despite considerable expenditure of scientific effort, to demonstrate conclusively that either alcohol advertising significantly increases consumption or that mass media public service messages reduce alcohol problems. At the same time, there is considerable evidence that publicity is an essential element for the successful introduction of new legislation and for the effectiveness of enforcement programs.

**Application of Research Results:** Because of the political success in gaining funds for counter-advertising in the tobacco area, it would appear important to determine where

similar counter-advertising would be effective in reducing alcohol consumption. The \$2 billion national antidrug mass media educational program illustrates the readiness of the public to support public information programs even if there is a lack of evidence for their effectiveness. The current state of knowledge that indicates that mass media campaigns, not linked to specific enforcement or safety programs, are ineffective suggest that the best use of prevention funds is to support media advocacy efforts at the local level where they are closely tied to community prevention activities.

### **Reducing Availability**

**Problem Area:** Laws directed at reducing the availability of alcohol for underage youth fall into two categories: (a) those that target the supplier and (b) those that target youth who illegally purchase and consume alcohol.

**What We Know and Don't Know:** We know that relatively little effort is placed on enforcement of the MLDA's in most communities in the nation, and that the numbered citations of underage users is significantly higher than the numbered citations of outlets for selling to those underage customers (Toomey et al., 1996; Wagenaar and Wolfson, 1995). There is, however, evidence that where enforcement occurs, the ease with which young people obtain alcohol is reduced (Grube, 1997).

**Research Issue:** What type and level of enforcement will produce a high level of refusal to sell to youth under age 21 by off- and on-premises outlets? What laws and enforcement techniques are most effective in deterring underage youth from consuming alcohol?

**Likelihood of Successful Research:** There is substantial reason to believe that well-publicized, energetic enforcement of age-21 sales laws will significantly reduce sales to minors. More problematic is the success of research directed at improving methods for detecting and apprehending underage drinkers. A particularly difficult problem is presented by binge drinking that normally occurs for those under age 21 away from adult supervision.

**Application of Research:** Laws against sales to underage youth and consumption by youth are in place; therefore, any effective measures for reducing sales to minors or for reducing underage drinking are likely to be implemented, providing that the community has been organized to take action and to support enforcement efforts. The effectiveness of any program to reduce sales and underage consumption is highly dependent on the local political will to commit significant resources to that effort. Thus, the success of these measures is dependent on the area "Adult Commitment to Reducing Underage Drinking and Impaired Driving."

### **Introduction to Driving**

**Problem Area:** Reducing risk among novice drivers.

**What We Know and Don't Know:** It is well-established that novice drivers are at particularly high risk for crash involvement whether drinking or not drinking. If drinking, they are particularly vulnerable to impairment. We also know that there is strong evidence that requiring a period of restricted driving to introduce novices to the driving environment appears to reduce crash involvement (Frith and Perkins, 1992; Langley et al., 1996; Preusser et al., 1984). What is less clear is the relative value of the various elements of current graduated licensing systems. For example, there appears to be evidence for the value of a nighttime curfew as a part of the graduated licensing program (Ferguson et al., 1996; Williams and Preusser, 1997). However, McKnight et al. (1983) found that the nighttime curfew in Maryland did not reduce crashes among nighttime novice drivers but did serve to motivate a reduction in daytime crashes in order to qualify for nighttime driving.

**Research Issues:**

1. To what extent are graduated licensing programs that do not include a nighttime curfew effective?
2. To what extent are police enforcing graduated licensing laws?
3. To what extent are current driver education programs effective in reducing alcohol-related crashes among novice drivers?

**Likelihood of Successful Research:** With a general trend for states to enact graduated licensing programs, there should be a number of states applying this concept in different ways. This should offer a good opportunity to evaluate differing provisions in the law.

**Application of Research Results:** Parents tend to strongly support the concept of graduated licensing. Therefore, there is a good chance that effective programs will receive support at both the state and community levels.

**Broader Issues:** There has long been a controversy regarding the effectiveness of driver education in reducing crash risk among novice drivers. In general, it has been difficult to demonstrate that driver education has a safety benefit. It is best justified as a method for training youth to the point where they can begin to operate a vehicle on the roadway. Because high schools are overloaded with educational demands, the provision of driver education within the school remains a controversial subject. Because of the expense, behind-the-wheel training has tended to move out of the high school into private driving schools. Whether the didactic educational materials that remain in driver education programs in the schools have any value needs to be determined.

**Preventing Driving After Drinking**

**Problem Area:** Includes those programs designed to prevent underage individuals who have been drinking from driving.

**What We Know and Don't Know:** Designated driver and safe ride programs have been widely used throughout the country, but separate evaluations for underage drivers have not been conducted. Though Roeper and Voas (1999) have presented evidence that suggests that underage drivers are making greater use of designated drivers than are their adult compatriots, Fell, Voas, and Lange (1997) have presented evidence from roadside surveys that the designated driver concept is widely used. However, those who act as designated drivers and those who use the services of such drivers, use a modified version of the basic concept that allows the designated driver to consume limited amounts of alcohol. Further, designating a driver is frequently postponed to the point where all potential designated drivers have been drinking (Lange et al., 1998). A major issue on which there is almost no data is the question of whether the availability of a designated driver or of a safe ride encourages drinkers to consume more alcohol, thereby making them more vulnerable to other consequences of abusive drinking even if they are protected from drinking and driving. McKnight et al. (1984) found that high school youth were more ready to intervene with their peers who were drinking than were adults.

**Research Issues:** Are designated driver and safe ride programs effective in reducing drinking and driving by underage youth? Do they encourage drinking by sending a mixed message regarding the no-consumption provisions of the MLDA or by encouraging youth, who accept these services, to drink more because they will not be driving? Does peer intervention training result in reduced drinking-and-driving by underage youth?

**Likelihood of Successful Research:** Research on designated driver and safe ride programs will be difficult among underage youth. Although consumption is illegal, youth tend to drink in locations where they are unsupervised (e.g., parks, beaches, or in private homes where parents are absent) and where it would be difficult to provide safe rides or encourage designated driver services. Follow-ups to the original McKnight studies on peer intervention should be possible; however, since these should take place within a school setting.

**Application of Research Results:** The widespread use of the Drug Abuse Resistance Education program and other efforts to discourage drug and alcohol use through classroom programs suggest that a peer intervention program and curriculum that had been shown to be effective would be likely to be adopted in most schools.

**Broader Issues:** The reasonably widespread use of limousines funded by parents for prom graduation and other special high school events is generally unsupported by significant evidence that this procedure reduces alcohol-related crashes. A better test of the value of this activity could be important to parental support for such programs.

### **Enforcement of Underage Driving Under the Influence Laws**

**Problem Area:** Drivers under age 21 in all 50 states are now subject to a 0.02 blood alcohol content (BAC) limit. This area is concerned with (a) the adequacy of these laws, (b)

the level at which they are being enforced; and (c) the extent to which the motor vehicle departments and the courts are imposing the requisite license penalties on youthful offenders.

**What We Know and Don't Know:** We know that there is substantial evidence that zero-tolerance laws work (Blomberg, 1992; Hingson et al., 1994; Hingson et al., 1991). On the other hand, there is considerable evidence that several zero-tolerance laws were hastily drafted and lack critical components that act as a barrier to their enforcement. We are also aware that enforcement of zero tolerance varies significantly between the states.

### **Research Issues:**

1. Are there provisions in the current zero-tolerance laws that make them unenforceable?
2. Are the police enforcing zero-tolerance laws?
3. What patrol strategies are most likely to identify underage drinking drivers?
4. What detection methods are most likely to identify young drivers who have been drinking?
5. What citation policies and court processing methods are most conducive to strong enforcement of zero-tolerance laws?
6. How can police officers be induced to use passive sensing and preliminary testing to enhance zero tolerance enforcement?

**Likelihood of Successful Research:** The variety of current zero-tolerance laws provides significant opportunity to determine the factors that lead to the effective enforcement of this underage drinking and driving law. The principal problem for investigators will be to find police departments willing to try novel procedures for apprehending underage drinking drivers.

**Application of Research Results:** Although all 50 states now have zero-tolerance laws, there should be a significant opportunity to implement changes in these laws that are suggested by the research results. While the interest of police departments in enforcing underage drinking and driving laws is limited by the other priorities they must accommodate, where community support is available, it should be possible to persuade officers to implement new enforcement policies and procedures that show promise of increasing the effectiveness of zero tolerance enforcement.

**Broader Issues:** The enforcement of underage zero-tolerance laws highlights the basic issue confronting law enforcement officers in using chemical tests as the basis for enforcement actions. Low BAC levels in healthy youthful drivers will be difficult to detect because they will not generally appear to be measurably impaired. Almost all current enforcement is based on detecting impairment, therefore the zero-tolerance laws challenge the current driving under the influence (DUI) system by requiring the officer to respond to evidence of drinking rather than evidence of impairment. Ultimately, this

should put pressure on police departments to modify their current DUI arrest policies for individuals under age 21.

### **Intervention with Young DUIs**

**Problem Area:** Once a youthful offender has been identified and cited for a drinking-and-driving offense, there is an opportunity to exercise control over the individual to insure participation in one or three types of programs designed to reduce future drinking-and-driving

1. Incapacitation through license suspension or vehicle impoundment;
2. Educational and/or treatment programs; and
3. Community service or house arrest programs.

**What We Know and Don't Know:** There is ample evidence that suspension of the driver's license is an effective way of reducing recidivism and crash involvement by incapacitating, at least in part, the DUI offender. The negative aspect of this procedure is that it is difficult to enforce the license suspension sanction. As a result, youthful offenders continue to operate vehicles and get in crashes, albeit, at a lower rate than if not suspended. Vehicle impoundment has an effect over and above suspension alone in reducing recidivism (Voas et al., 1997b and 1998; DeYoung, November 1997). Education and/or treatment programs have a 7 to 9 percent impact in reducing recidivism over and above that of license suspension alone (Wells-Parker et al., 1995). Jail and/or community service has been shown to have relatively little effect on recidivism among adult DUIs (Zador et al., 1988; Nichols and Ross, 1989). However, the effect of jail and community service on underage drivers is unknown. House arrest has also been shown to be effective for adult drivers, but its impact on underage drivers is unknown (Jones et al., 1996). Additional attention needs to be given to the impact of systems proven for the adult drivers when applied to drivers under age 21. Relatively how effective is license suspension, vehicle impoundment, educational treatment, community service, or house arrest for this younger group?

**Research Issue:** Determine effectiveness with drivers under age 21 of sanctions demonstrated to impact recidivism and crash involvement of adults.

**Likelihood of Successful Research:** Although the extent to which the new zero-tolerance laws will be enforced in the 50 states is unknown, to the extent that they are effectively implemented, additional numbers of underage drivers should come under the authority of the motor vehicle department or the courts. This should open up opportunities to study the effectiveness of suspension, treatment, and community service with this age group.

**Application of Research Results:** Because of the general concern with underage drinking and drinking and driving, adults are generally willing to see underage drinking drivers

receive reasonable penalties. Thus, it should be possible to implement sanctions shown to be effective in reducing recidivism and crash involvement among youth.

**Broader Issues:** Though national polls such as those conducted by NHTSA suggest that adults are willing to apply reasonable sanctions to underage drivers, it is likely that there will be significant resistance to criminalizing youthful offenders. Thus, it is expected that, ultimately, most states will adopt administrative sanctioning procedures focusing on license suspension rather than treating zero-tolerance citations as if they were an impaired driving offense. This may limit the available sanctions to license suspension and education programs that are generally favored for underage individuals. It is possible, however, that house arrest may be a very effective sanction for underage drivers if adults are willing to see that imposed on this age group. Additionally, the alcohol safety interlock would appear to be an appropriate sanction for young drivers apprehended drinking and driving. The principal issue will be the potential cost of the device and the question of whether the youth has his or her own vehicle or is driving the family vehicle.

## SUMMARY

There are a large number of issues pertaining to underage drinking and drinking and driving that need additional research work. Because potential research areas are so broad, and the availability of federal funds appears to be limited, it is important to develop some priorities to guide funding agencies and investigators interested in entering the underage drinking and drinking and driving field.

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## **Research Needs and Priorities for the Hard-Core Drinking Driver**

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### **INTRODUCTION**

It has been well documented that during the decade of the 1980s, significant reductions occurred in the magnitude of the alcohol-crash problem, not only in the United States but throughout the Western world (Strategic Highway Research Program, 1993). As the magnitude of the problem changed, so too changed our understanding of the complexion of the problem. Attention began to focus on those individuals who persisted in driving after consuming too much alcohol. A series of papers and reports outlined the existence of a relatively small group of offenders who were responsible for a disproportionately large number of serious alcohol-involved roadway crashes (Beirness et al., 1997; Blakey and Associates, 1997; Simpson and Mayhew, 1991; Simpson et al., 1996; Sweedler, 1995; Wilson, 1993). The behavior of this group did not appear to be affected by the plethora of public information and education campaigns. Nor were they deterred by the threat of ever-increasing sanctions. They persisted in driving after consuming large quantities of alcohol—far too many crashed as a result.

Interest in this high-risk group of driving while intoxicated (DWI) offenders has escalated dramatically in the past few years. In many jurisdictions, new programs and policies have been introduced and implemented in an attempt to deal effectively with hard-core drinking drivers. Several others are actively pursuing new measures. Some jurisdictions have gone so far as to explicitly identify the target of their legislation in the name of the bill itself—for example, the Extreme Driving Under the Influence (DUI) Bill in Arizona, and the Persistent Drinking Driver Act in Colorado.

The very nature of the problem leaves little doubt that it is a difficult one to deal with effectively. Solutions need to be based on sound research. And while considerable research in this area has been done, numerous questions remain. This paper outlines some of the most urgent issues that need to be addressed.

### **RESEARCH NEEDS AND PRIORITIES**

#### **Epidemiology**

1. Create a clear, precise, objective and quantifiable definition of the “hard-core drinking driver.”
2. Using the new definition, determine the relative contribution of hard-core drinking drivers to the overall alcohol-crash problem.

## Research

1. Identify and validate clinically relevant subgroups of hard-core offenders.
2. Determine the developmental trajectory of hard-core offenders.
3. Identify signs and symptoms evident at the time of first DWI arrest that are predictive of repeat DWI behavior.

## Evaluation

1. Determine the extent to which countermeasure programs and policies have a general deterrent effect on hard-core drinking drivers.
2. Determine the extent to which programs and policies have a specific deterrent effect on hard-core drinking drivers.

## EPIDEMIOLOGY

### Create an Objective, Quantifiable Definition of the Hard-Core Drinking Driver

Over the past several years, a variety of labels have come into common usage—e.g., “hard-core drinking drivers,” “persistent drinking drivers,” “hardened drunk drivers,” “repeat DWI offenders,” “chronic drunk drivers.” Regardless of the label, at one level most people have some idea of the characteristics of the group to whom the label applies. It is that incorrigible, recalcitrant group of DWI offenders who persist in driving after consuming large quantities of alcohol. They are high-risk offenders who seem relatively resistant to efforts to change their behavior.

Labels are applied for obvious reasons, one of which is to facilitate communication through the economy of language they offer. At the same time, because of their imprecision, labels possess a high degree of connotative meaning and are, therefore, evocative of many different interpretations. This can unintentionally, or otherwise, shape the debate and discussion inappropriately.

The number and variety of labels used to refer to this group to some extent is testimony to the inconsistency and lack of precision regarding who constitute this high-risk group of drinking drivers. The implications for research as well as program and policy developments are twofold. First, in the absence of an objective, quantifiable definition, it is difficult to determine the overall magnitude of the problem caused by this group. Second, the vagueness of the definitions renders it impossible to determine reliably which individual drinking drivers are members of this group.

Since our own research on this problem (Beirnes et al., 1997; Simpson and Mayhew 1991; Simpson et al., 1996) was largely responsible for popularizing the term “hard-core” and for stimulating interest in the problem, we have been very sensitive to the issue of a definition. Indeed, this was discussed thoroughly in a paper a few years ago (Simpson 1995). We have adopted the following working definition of hard-core drinking drivers: they repeatedly drive after drinking, often with high blood alcohol content (BACs), and they seem relatively resistant to changing this behavior (Simpson and Mayhew, 1991;

Simpson et al., 1996). More recently, we have further specified that this group tends to drink frequently and often to excess and may have been previously convicted of a DWI offense (Beirness et al., 1997).

Although this working definition has proved useful in identifying the problem and has been adopted by many others, it continues to suffer from a vagueness that hampers efforts to take the research to the next level.

An objective and quantifiable definition of the hard-core drinking driver would facilitate the direct comparison of research studies and would be particularly beneficial in the development of programs and policies to deal with this high-risk group of offenders. In addition, at a very practical level, establishing criteria would assist in determining which individuals are part of this group and, hence, eligible for the corresponding sanctions and programs.

### **Using the New Definition, Determine the Prevalence of Hard-Core Drinking Drivers and the Relative Contribution of This Group to the Overall Alcohol-Crash Problem**

Vagueness and imprecision in the definition of hard-core drinking drivers has resulted in a wide range of estimates of the size of the hard-core population. For example, most working definitions include a statement about repeated or persistent driving after drinking. Data from a national survey on drinking and driving conducted by the Traffic Injury Research Foundation revealed that 55 percent of respondents who reported driving after consuming “too much” alcohol did so on more than one occasion in the past 12 months and 9.6 percent did so at least monthly (Simpson et al., 1999). Using the reported frequency of the behavior, it was determined that 2.6 percent of the drivers accounted for 85 percent of all impaired driving trips. Although these data provide evidence of the persistence of the behavior, without other evidence—such as the BAC at the time of driving—it is difficult to determine whether or not they should be considered as part of the hard-core.

A repeat conviction for a DWI offense is also evidence of persistent drinking and driving behavior. This is especially true if one considers that for every conviction, the individual has engaged in the behavior on numerous other occasions. And, given that the average BAC among offenders is in the 0.16 to 0.18 range, convictions can be indicative of repeated driving with a high BAC. Again, estimates of the percentage of arrested and/or convicted DWI offenders who have a prior conviction on their record vary widely according to jurisdiction. Data from a survey conducted by NHTSA (Hedlund, 1995), combined with data from an independent survey of states conducted by ourselves (Simpson et al., 1999), indicate that between 10 and 75 percent of DWI offenders are recidivists. The size of the group can be either large or small, depending on where one looks and what criteria are used to define the group.

Diversity in the definition of hard-core drinking drivers has also resulted in variability in estimates of the magnitude of the problem. For example, using BAC as a criterion, roadside surveys indicate that only about 1 percent of all drivers on the road during late night hours have a BAC over 0.15 percent, but among driver fatalities 25 percent have a

BAC of this magnitude. This overrepresentation of high BAC drivers within the fatalities population serves to define them as a high-risk group.

Estimates of the magnitude of the alcohol-crash problem attributable to the hard-core also show considerable variability. Using Fatal Accident Reporting System data it has been determined that about 11 percent of drivers with a positive BAC involved in fatal crashes had been previously convicted of a DWI offense (Hedlund, 1995). In contrast, a study in British Columbia reported that 34 percent of drinking drivers responsible for fatal crashes had a prior DWI conviction on their record (Donelson et al., 1989). In Minnesota, Simon (1992) indicated that 35 percent of alcohol-related fatal crashes involved a driver who had a prior DWI offense.

Estimates of the magnitude of the hard-core drinking driver problem vary on the basis of the definition used to identify the group as well as the type and quality of the information in data systems used to establish the estimates. Both high BACs and evidence of repeat offenses are evidence suggestive of a hard-core offender but neither one alone is sufficient to determine group membership with any degree of certainty. Establishing an objective definition of the hard-core would facilitate the development of more precise estimates of the magnitude of the problem.

At one level, it is probably sufficient to know that the problem is large. In this sense, just about any defensible estimate is sufficient to support the call to action. Nevertheless, more precise estimates of the size of the hard-core population and their overall contribution to drinking and driving problems are critical in the setting of priorities, the development of policy, and the funding of both programs and research. Precise estimates of the magnitude of the problem are also crucial for evaluation purposes—i.e., monitoring changes in the problem so that we can determine when we are being successful.

## RESEARCH

### Identify and Validate Clinically Relevant Subgroups of Hard-Core Offenders

Terms such as “hard-core drinking driver” have the disadvantage of implying a similarity among members of the target group that belies the true heterogeneity of the population. Not all persons who meet the criteria of hard-core drinking driver are necessarily alike. While certain characteristics stand out and can be used to distinguish DWI offenders from other drivers, it would be incorrect and unproductive to ascribe these distinguishing characteristics to all hard-core drinking drivers.

Research has demonstrated that within the population of DWI offenders, various characteristics may be more or less prominent, creating definable subgroups or typologies (Arstein-Kerslake and Peck, 1986; Donovan and Marlatt, 1982; Steer et al., 1979; Sutker et al., 1980; Wells-Parker et al., 1986; Wilson, 1991). Drivers become drinking drivers for a variety of reasons; the reasons for their persistence in drinking and driving are likely to be equally varied. To understand the problem of the hard-core offender, it is imperative that we recognize their similarities and differences.

In the several studies that have identified subtypes of DWI offenders, a variety of populations and methods have been employed. Different approaches to the development of typologies give rise to different subgroups of offenders. Several of these typologies

would appear to describe different subgroups of hard-core drinking drivers. Although there appears to be some degree of overlap among the identified subgroups, there is no consensus that these are the most important, or even the only subgroups within this population.

Further research along these lines is needed to determine the prominent subgroups and the set of characteristics or variables that provide the best differentiation among the subtypes of offenders. Such studies would enhance our understanding of hard-core drinking drivers. In addition, they would facilitate the development of a valid and reliable assessment instrument that could be readily and easily applied to all offenders to help identify hard-core offenders. The greatest value in identifying subgroups of hard-core offenders lies in the implications for rehabilitation. Greater understanding of the characteristics, motivations, and problems of various groups of hard-core offenders would facilitate the development of tailored sanctions and rehabilitation programs.

### **Determine the Developmental Trajectory of Hard-Core Offenders**

Although there have been a number of studies addressing issues concerning hard-core drinking drivers, a good deal of this work has been of a descriptive or comparative nature. In addition, there has been considerable effort directed towards the development of policies and programs for dealing with this high-risk population. Basic research to understand the reasons some people become hard-core drinking drivers and the developmental path they take to get there has yet to be conducted. In addition, we know little or nothing about what happens to hard-core drinking drivers over time. Such research is essential to further our insight into, and understanding of, this problem.

A number of studies have compared repeat DWI offenders with those convicted for the first time (e.g., Bailey and Winkel, 1981; McMillen et al., 1992; Nochajski et al., 1994; Perrine, 1990). These cross-sectional studies typically show that repeat offenders are older, have more nontraffic arrests, are more likely to use drugs other than alcohol, and have more severe alcohol problems. But while the observed differences between groups are informative and interesting, the design of the studies does not permit a direct inference about the contributory role of such factors to repeat DWI behavior. Such differences may have been evident at the time of the first DWI offense or may have developed subsequently. Hence, these factors cannot necessarily be used as good predictors of subsequent DWI behavior.

There is a virtual lack of information about why some offenders continue to drive after drinking even after having been convicted of, and punished for, a DWI offense. Conversely, we don't have a good understanding of why some offenders discontinue their driving after drinking behavior. In attempting to deal effectively with the problem, it would seem that the answers to such questions are critical.

In depth, prospective studies of first-time DWI offenders would provide a wealth of information about the developmental path that facilitates or instigates repeat drinking and driving behavior and ultimately hard-core drinking driver status. Similarly, such studies would provide information about the factors and events that are protective of further drinking and driving behavior.

An extension of this line of research would examine the developmental trajectory of hard-core offenders to determine what happens to them and the critical events and factors that instigate or inhibit further drinking and driving behavior.

While it may appear that such research is largely academic, the results can have direct implications for the development of policies and programs for dealing effectively with hard-core drinking drivers. Understanding the factors that give rise to and perpetuate the behavior can be critical in this regard.

### **Identify Signs and Symptoms Evident at the Time of First DWI Arrest That Are Predictive of Repeat DWI Behavior**

For the most part, all first-time DWI offenders are dealt with by the courts in a similar fashion. They are dealt with as a single entity, without regard to their differences. With few exceptions, the sanctions imposed and rehabilitation programs required (if any) are very similar for all offenders. Little attention is paid to the possibility of a repeat offense.

As pervasive as this model may be, attempts to change it date back at least 30 years. The Alcohol Safety Action Projects of the 1970s were an attempt to distinguish among groups of DWI offenders based on the drinking pattern of the offender. Variations of this model are being used in some jurisdictions. Such systems require offenders to be screened or assessed for alcohol problems following conviction. This approach may be successful in identifying and referring for treatment those offenders who are currently experiencing alcohol problems. However, those who have not yet reached the problem drinking stage but are nonetheless at high risk of recidivism are unlikely to be identified and targeted for appropriate rehabilitation programs.

As an alternative, some jurisdictions (e.g., Victoria, Washington) have implemented tiered BAC systems. A higher BAC at the time of arrest leads to more severe sanctions and a requirement for assessment and rehabilitation. Again, using only BAC as the criterion, the possibility of errors in assignment to treatment could be substantial.

What is needed is a screening tool that helps to identify first-time DWI offenders who are at high risk of committing a repeat offense that can be used by the courts to help determine the most appropriate sanctions and ideas for rehabilitation.

The development of such a screening tool requires prospective research on first-time DWI offenders to identify valid and reliable factors that are predictive of repeat DWI offenses.

## **EVALUATION**

### **Determine the Extent to Which Countermeasure Programs and Policies Have a General Deterrent Effect on Hard-Core Drinking Drivers**

Implicit in the working definition of hard-core drinking drivers is the notion that they are unresponsive to widespread public education and awareness messages aimed at deterring driving after drinking behavior. If this is true, it may reflect the fact that they do not see or hear them, they ignore them as irrelevant, or the messages simply don't strike a responsive chord. Whatever the reason, it has led to the perception that hard-core drinking driv-

ers are not affected by public education and awareness programs. The validity of this perception has never been determined.

There is some research, however, that suggests hard-core drinking drivers may be reached with appropriately targeted messages (Isaac, 1995). Taking a market segmentation approach, Isaac indicates that hard-core drinking drivers are frequent consumers of particular types of media—e.g., sports television, rock and country radio, and action/adventure movies. The receptivity of this group to safety oriented messages is, however, unclear. She recommends expanding media messages/strategies based on motivating significant others to intervene with hard-core drinking drivers and using media as an adjunct to enforcement. Other research suggests hard-hitting media messages that focus on specific personal concerns of this high-risk group—their wife/girlfriend, their kids, their pets, their cars (Millward Brown, 1994). The extent to which these types of messages have an effect on the attitudes or behavior of hard-core offenders is not known.

In addition, the fact that hard-core offenders repeatedly engage in driving after drinking behavior suggests that they are undeterred by the threat of arrest or severe sanctions. Nevertheless, an almost universal approach for dealing with the drinking and driving problem has been—and continues to be—the enactment of more stringent laws with more severe sanctions. In recent years, many jurisdictions have taken this approach one step further by introducing new legislation aimed directly at hard-core offenders. These laws may include special charges and more severe penalties for persons with BACs above a specified threshold—e.g., Arizona's Extreme DUI Bill. It is not known whether such laws have any general (or specific) deterrent effect on hard-core drinking drivers.

Research is needed to help understand the nature and extent of general deterrence effects among hard-core drinking drivers. The results of such investigations would provide guidance in the continuation or development of new media messages targeted at this group. In addition, as an increasing number of jurisdictions move to implement legislation aimed at hard-core offenders, it will be important to examine the general deterrent effects of these new legislative efforts.

### **Determine the Extent to Which Programs and Policies Have a Specific Deterrent Effect on Hard Core Drinking Drivers**

A wide variety of approaches have been suggested for dealing effectively with hard-core drinking drivers—e.g., assessment and treatment, vehicle impoundment/immobilization, alcohol ignition interlocks, intensive supervision probation, special DWI facilities. Many examples of these types of programs can be found in jurisdictions throughout North America. Some have even been evaluated. Recently, the National Institute on Alcohol Abuse and Alcoholism issued a special call for applications to study programs for hard-core offenders. Nevertheless, considerably more research is needed to determine the effectiveness of programs in preventing recidivism, to help understand the way in which they impact hard-core offenders, and to provide guidance on how they can be made more effective.

As an illustration, it is generally accepted that alcohol ignition interlocks significantly reduce DWI behavior at least so long as the device is installed in the offender's vehicle. While this finding is encouraging, it provides only a partial answer. Numerous

questions remain. For example, which type(s) of offenders are most likely to benefit from interlocks? Are there offenders for whom interlocks should not be recommended? What is the ideal length of time for the interlock to be installed? Should there be conditions placed on the licenses of drivers to bridge the gap between the interlock and full license reinstatement? Are there ways to make interlocks even more effective? What other programs/sanctions would complement the interlock? Obviously, evaluation research in this area is far from complete.

In addition, as more and more jurisdictions implement a variety of programs and policies for dealing with hard-core offenders, it will be important to examine the interactions between these various programs. Determining the most efficient and effective combination of sanctions and programs for specific groups of offenders is a large undertaking.

It is also important to examine the system effects of various programs and policies—i.e., conduct a process evaluation. For example, in a jurisdiction with a variety of programs for hard-core offenders, an individual may be subjected to screening and/or assessment more than once—and possibly with different results—as they proceed through the system. Not only is this inefficient, it can also lead offenders to believe they are pawns in a complicated bureaucracy. Even the most well meaning programs can prove ineffective when they are not integrated into the existing system and managed efficiently.

Therefore, further evaluation research is needed to determine the effectiveness of the various programs and policies that have been (or will be) introduced to reduce the incidence of recidivism among hard-core drinking drivers—i.e., the specific deterrent effects. Such research should also examine the process involved in the implementation and operation of these programs. The results of such research will provide valuable and essential information on which types of programs and which combinations of programs are most effective in deterring repeat DWI behavior for specific groups of offenders.

## **PRIORITIES**

1. Define “hard-core” drinking drivers (1)
2. Determine specific deterrent effect of programs (7)
3. Identify predictors of recidivism (5)
4. Determine magnitude of hard-core problem (2)
5. Identify clinically relevant subgroups (3)
6. Determine developmental trajectory (4)
7. Determine general deterrent impact of programs (6)

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**Repeat DUI Offenders**  
*Analysis of Research Needs and Countermeasure Development Strategies*

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**INTRODUCTION**

An identification of research needs relating to any phenomenon should begin with some consideration of the extant knowledge and related underlying theory. Perhaps even more fundamental is the need for a careful definition of terms and classification attributes. A number of terms have been proposed for characterizing high risk driving under the influence (DUI) offenders, such as hard-core, recalcitrant, chronic, persistent, multiple and repeat. The most common thread underlying these terms is that of chronicity and resistance to treatment or conventional sanctions. The very term "repeat offense" implies a group which has reoffended following sanctions and/or treatments imposed pursuant to a previous DUI conviction.

Although a recidivist-based definition has both intuitive appeal and substantive merit, some cautionary admonition is warranted. The idea of identifying a small group of deviant individuals who are responsible for the majority of a societal problem is often not achievable because it is usually based on a flawed statistical paradigm. Recall, for example, the notion of "accident proneness" which was so attractive 50 years ago until it was recognized that very few accidents in a given time period involved drivers who had accidents in previous years. We are not suggesting that the concept of an identifiable hard-core DUI offender group is as subject as are accidents to large stochastic components, but there is still danger of reification and propagating silver bullet myths by suggesting that a sizable percentage of accidents can be attributable to a small statistically deviant subgroup.

The above objection has been largely circumvented by the definition employed by the Traffic Injury Research Foundation (TIRF) in its hard-core drinking driver program (Simpson et al., 1996). TIRF has proposed that hard-core drinking drivers be defined as all repeat offenders and any first offender with a blood alcohol content (BAC) of 0.15 or above. The problem with this definition is that the great majority of all arrested and convicted DUI offenders would qualify. For example, in California, 70 percent of all DUI offenders would qualify as hard-core. Yet we know from California studies that the majority of first offenders are not convicted of a second offense in the subsequent 7 years and, furthermore, that the rate of recidivism has been steadily declining over the past 10 years.

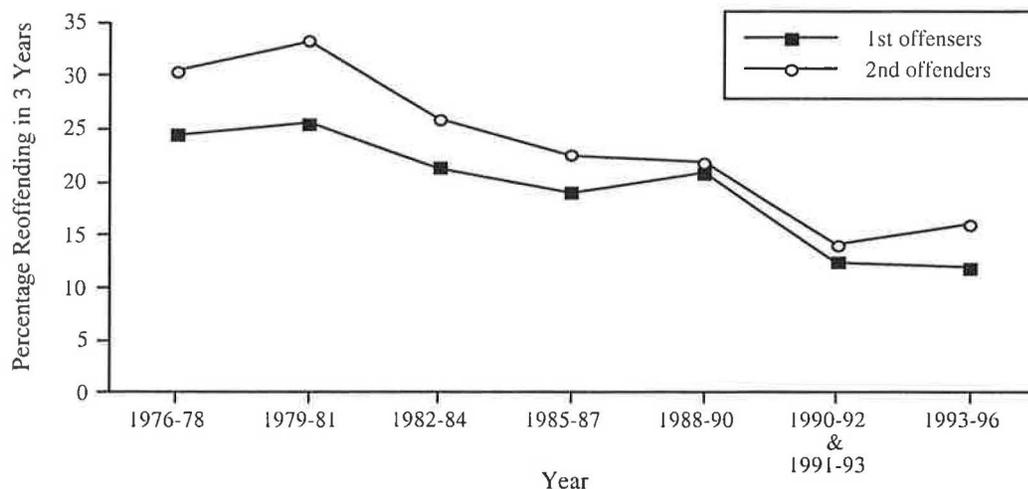
Before presenting a list of prioritized research needs, we would like to briefly summarize what is currently known about repeat DUI offenders and to summarize some relevant findings from a series of California studies. These studies address the following issues:

1. Historical changes in recidivism rates;
2. Long-term recidivism rates and survival curves;
3. Short-term recidivism rates as a function of BAC level and prior number of moving violations;
4. DUI recidivism correlates; and
5. Accident risk as a function of DUI offender characteristics and recidivism status.

Most of the review is based on California studies for two reasons. First, these studies were readily available to the authors. Second, we are not aware of studies and data in other jurisdictions that systematically monitor long-term statewide reoffense and accident rates of DUI offenders.

### HISTORICAL RECIDIVISM TRENDS

The very significant national decline in alcohol-related fatal accidents over the past 10 to 15 years has been documented by numerous investigators. California statistics show a similar decline and, in addition, reveal very substantial reductions in DUI arrests. More relevant to this paper are trends in DUI recidivism rates over time. The data plotted in Figure 1 show the reoffense rates of first and second offenders during the 3 years following a DUI conviction in the previous year. Each 3-year time window represents a 1 percent cross-sectional sample of DUI offenders based on DUI convictions reported to the department of motor vehicles during the 20+ year period covered by these data. The database from which these rates are computed for the years 1976-90 is described in earlier TRB papers by Peck (1993 and 1994). The rates for 1990-1996 are based on data contained in Tashima and Helander (1998 and 1999). These latter data have been adjusted to conform to the reoffense definition used for the earlier data.\*



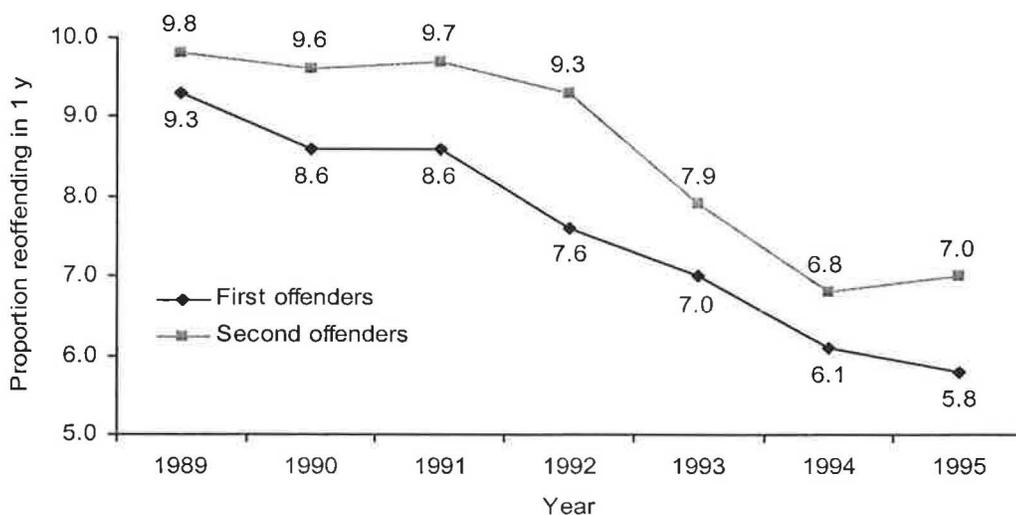
**FIGURE 1 Percentage of DUI offenders reoffending (major convictions) 3 years after conviction.**

\*A recidivism event was defined as conviction for DUI, hit and run, or reckless driving.

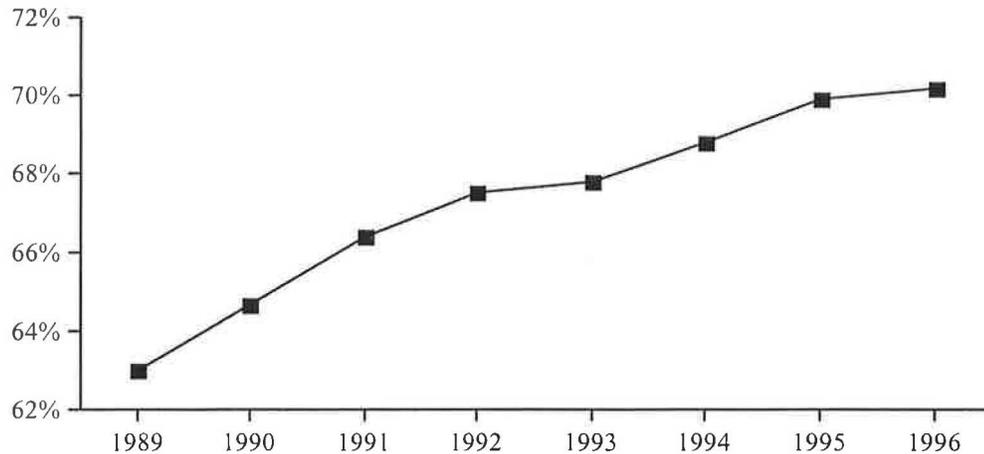
These data show a significant linear decline in the reoffense rates of both first-time and second-time offenders. The data also show a trend toward a proportionally greater reduction in recidivism among second offenders compared to first offenders, which could reflect the increasingly severe sanctions and alcohol treatment program requirements for second offenders in California during this period. The precipitous drop in 1990-92 is probably due to California's imposition of 0.08 percent per se BAC and ALS laws in 1990, which resulted in almost all DUI offenders being subject to a pre-conviction license suspension, in addition to post-conviction sanctions and treatment program requirements. By 1993, these data indicate that the 3-year reoffense rate of first and second offenders has declined by 50 percent and that the rates of the two groups have become very similar. These results tend to refute the commonly accepted assumption that repeat offenders have not been responsive to existing sanctions and countermeasures.

Figure 2 displays more recent data on California recidivism rates for first and second offenders from a report by Tashima and Helander (1998). These data are 1-year reoffense rates over the years 1989-1995; in contrast to the data shown in Figure 1, the data in Figure 2 include alcohol-related accidents and ALS actions, along with major violation convictions, as recidivist events. Again, we see a consistent and almost linear decline in the rates for both groups over this brief 7-year time span. The second offenders consistently have higher reoffense rates, but the magnitude of the differences are very modest.

The preceding data are concerned with the reoffense rate of drivers who have been previously convicted of a DUI offense (either a first offense or a second offense). Since the reoffense rate of convicted DUI offenders has been declining, one would expect to see an increase in the proportion of DUI offenses involving first-time offenders. This inference is confirmed by the data plotted in Figure 3, which shows the percentage of DUI convictions in California involving first offenders during the years 1989-96. As expected, the proportions have been increasing each year, from 63.0 percent in 1989 to 70 percent in 1996.



**FIGURE 2** Proportion of DUI offenders (arrested in 1989-95) reoffending (DUI incidents) within 1 year after conviction.



**FIGURE 3 Percentage of DUI convictions adjudicated as first offenses, 1989-96.**

We need to emphasize that these data do not mean that the absolute rate of first offense DUIs has been increasing and, in fact, we know that the per capita first offense rates have declined in California over this period. However, they have declined at a lower rate compared to previously convicted offenders. As noted above, the most likely explanation for these trends is the specific deterrent effect of the sanctions that are triggered by a DUI conviction (Rogers, 1997; Tashima and Helander, 1999).

### **DUI SURVIVAL/HAZARD FUNCTIONS**

A great deal of insight can be gleaned from an analysis of the average time from a DUI event to the next offense. Figure 4 presents such an analysis for a large sample ( $N = 52,546$ ) of DUI offenders convicted in 1980. After 9 years, we find that 53 percent of these offenders have been reconvicted of a major offense, either DUI or a typically alcohol-related offense such as hit and run or reckless driving. However, the probability of reoffending is highest in the first few years and declines as the survival length increases. If an offender goes 7 years without reoffending, the probability of a subsequent offense is about 4 percent per year, which is only moderately higher than the probability of any driver being convicted of a DUI offense. A subsequent analysis by Peck (1994) suggests that offenders will continue to be at a very slightly increased risk of reoffending until they have remained DUI-free for a period of 15 to 18 years, at which point roughly 60 percent will have reoffended.

It needs to be emphasized that these data are based on the time period 1980-1990. Since DUI arrest rates in California have declined precipitously since 1990, the current rates of recidivism are substantially lower than those shown in Figure 4. In fact, recent California studies (Tashima and Helander, 1998) suggest that the reoffense rate after 7 years has declined by roughly 50 percent and is now in the range of 25 to 30 percent.

In a previous paper, Peck (1994) fitted several mathematical models to these data and found that the reoffense curves could be closely approximated by a linear exponential hazard model in which the noncumulative failure rates decline as linear function of increasing survival time. This is a very simple model, and it can be used to predict the

probability of a reoffense as a function of number of months of offense-free driving since the last offense.

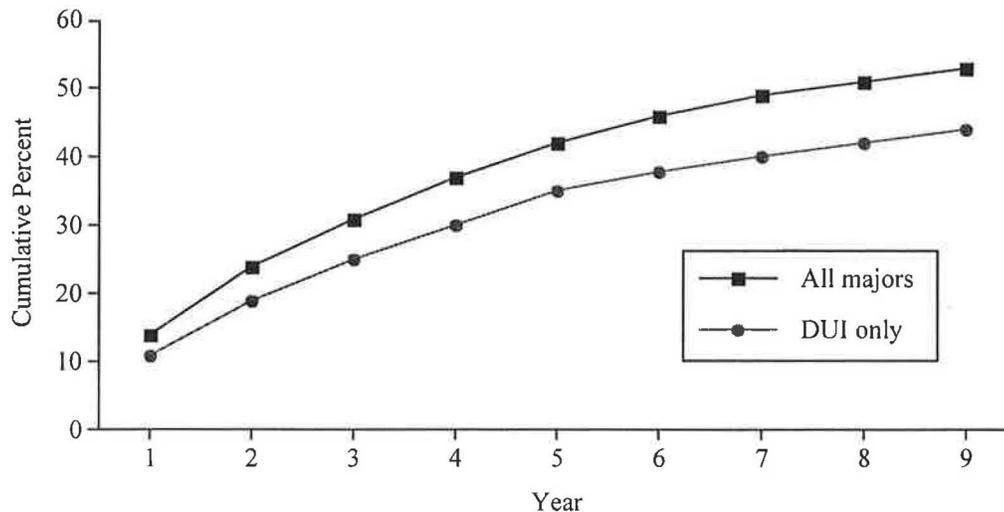
### DUI RECIDIVISM CORRELATES

There have been a large number of published studies aimed at identifying correlates of DUI recidivism. These studies often employ multivariate techniques in constructing equations that differentiate recidivists from nonrecidivists (Peck et al., 1994; Marowitz, 1996; Perrine et al., 1988).

These studies indicate that DUI offenders who reoffend following a DUI conviction or assignment to a treatment program are more likely to

1. Have a very low or very high BAC level,
  2. Be younger,
  3. Be male,
  4. Be unemployed,
  5. Be from lower socioeconomic status and blue-collar backgrounds,
  6. Have more moving and nonmoving violations and accidents in the previous 3 years,
  7. Have a prior history of DUI-related convictions
  8. Have criminal arrest histories,
  9. Be problem drinkers as measured by psychometric tests and clinical assessments,
- and
10. Be single or divorced.

However, the predictive accuracy of the models has not been high. For example, Peck et al. (1994) reported a cross-validity coefficient of 0.209 in predicting recidivism status over a 4-year follow-up period using many of the variables listed above. Although



**FIGURE 4** Length of time between 1980 DUI conviction and subsequent offense (N = 52,546).

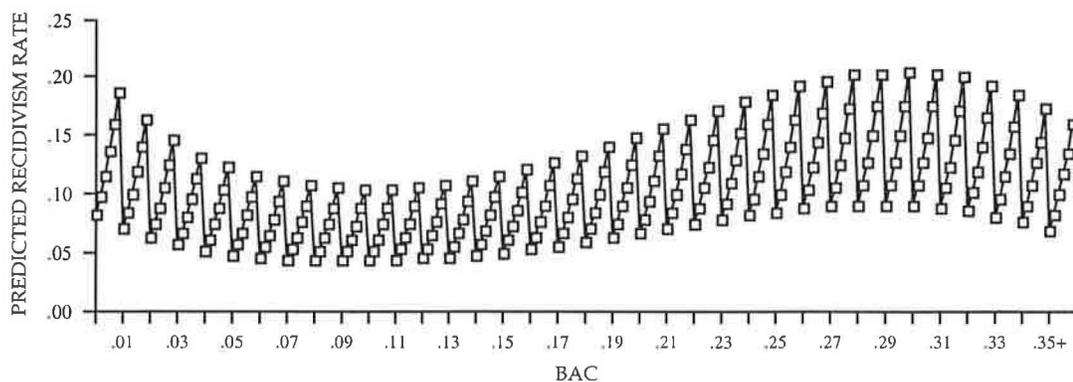
not sufficiently accurate for most purposes in making predictions, the predictive accuracy was substantial for offenders with extremely high predicted reoffense likelihoods, such as offenders in the highest risk decile. Peck et al. (1994) also found a substantial degree of heterogeneity in the accident rates of first offenders. Those in the lowest recidivism risk quartile had accident rates which were only slightly higher than those of the general driving population, whereas first offenders in the highest recidivism risk quartile had accident rates which exceeded the rates of repeat offenders.

Another interesting finding of the above study concerns treatment program compliance. In California, most DUI offenders are required to complete DUI educational and alcohol treatment programs. Peck et al. (1994) found that program compliers could be discriminated from noncompliers much more accurately than recidivists could be discriminated from nonrecidivists. In addition, offenders who were predicted to be noncompliers were over twice as likely to recidivate.

The above study also reported that increased recidivism likelihood was associated with increasing BAC levels (on the DUI conviction) and with an increasing number of nonmajor traffic convictions on the offender's prior driver record. In fact, the number of nonmajor traffic convictions was the single most powerful predictor—a finding which is consistent with numerous other studies in the literature.

More recently, Marowitz (1996) used logistic regression analyses to model how recidivism status was related to BAC level, number of prior moving violations and various demographic and psychometric variables.

Figure 5 shows the relationship between BAC level, the number of nonmajor moving traffic convictions in the preceding 2 years, and the probability of reoffending in the subsequent year. BAC levels are on the horizontal axis and the number of traffic convictions are represented by the six squares plotted within each BAC level. Each square represents a conviction increment, from zero to more than five.



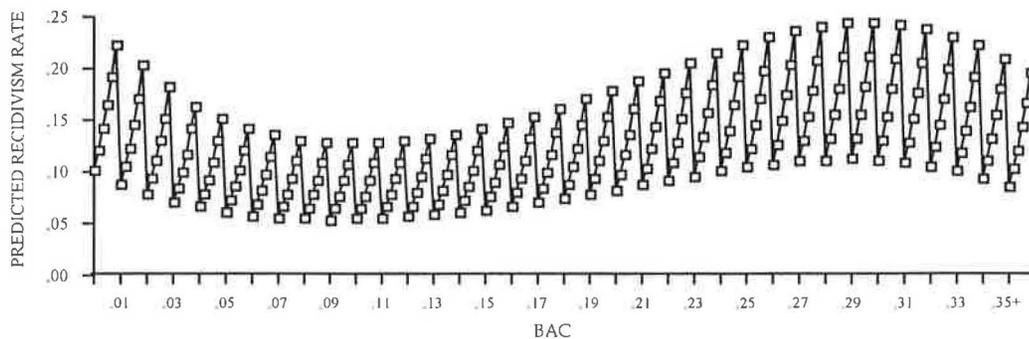
**Note.** Each BAC level has six points associated with it indicating predicted recidivism rates for DUI convictees with 0 to 5+ (reading left to right within each BAC level) prior 2-year total convictions.

**FIGURE 5** Predicted probabilities of DUI recidivism based on BAC, BAC<sup>2</sup>, BAC<sup>3</sup>, and 2-year prior total convictions for first offenders.

The relationship between BAC level and recidivism status is notably nonlinear, requiring a cubic polynomial equation for adequate fit. The recidivism rate is highest for BACs close to zero, declining to its lowest level at 0.08-0.10 and then rising gradually, peaking at a BAC of 0.29. However, within each BAC level, we find a monotonically increasing recidivism risk as a function of the number of moving traffic convictions. In fact, the number of nonmajor moving traffic convictions proved to be a much stronger predictor than did BAC level. The highest risk would be posed by an offender with a BAC of 0.29 and more than five convictions. Such an offender has a 21 percent chance of recidivating in the next year. The lowest risk would be posed by an offender having a BAC of 0.08 and zero moving traffic convictions. Such an offender would have a 4 percent chance of reoffending. Note that an offender with more than five convictions and a BAC of 0.08 has a 11 percent chance of reoffending, which is actually higher than the reoffense probability of DUI offenders with BAC levels of 0.29 and zero moving traffic convictions.

Figure 6 shows the results of the same analyses for second-offenders. Again, we find an almost identical cubic relationship between BAC level and reoffense rate and the same pattern of recidivism variance as a function of the number of nonmajor moving violations. The recidivism risk gradient reaches its highest point for offenders having BACs of 0.29 or 0.30 and more than five prior moving traffic convictions. Such offenders have a 25 percent chance of reoffending in the next 12 months. By contrast, only 5 percent of offenders with BACs of 0.08-0.10 and zero moving traffic convictions would be expected to reoffend. However, the reoffense rate for this moderate BAC group increases to 13 percent among offenders with more than five moving violations in the previous 2 years. Note again that this rate actually exceeds the recidivism rate of DUI offenders with BACs of 0.29 or 0.30 who have zero nonmajor moving violations on their driving record.

The relatively high reoffense rate for offenders with zero or low BAC levels warrants explanation. As Marowitz points out, these low BAC offenders are likely to be drug paired, and the fact that their reoffense rates are high suggests that drug-impaired drivers have a chronicity which is identical to that of hard-core drinkers and alcoholics. Moreover, Marowitz found that BAC levels on their reoffense also tended to be low, which provides further support of the drug impairment hypothesis.



Note. Each BAC level has six points associated with it indicating predicted recidivism rates for DUI convictees with 0 to 5+ (reading left to right within each BAC level) prior 2-year total convictions.

**FIGURE 6** Predicted probabilities of DUI recidivism based on BAC, BAC<sup>2</sup>, BAC<sup>3</sup>, and 2-year prior total convictions for repeat offenders.

## DUI OFFENDER ACCIDENT RISK

The role of alcohol impairment as a major causal factor in accidents, particularly fatalities, has been firmly established. However, the extent to which accident risk varies as a function of the number of DUI offenses on a driver's record is less clear.

Table 1 is taken from an earlier TRB presentation by Peck. This table shows the relationship between the number of major violations on a California driver's record over a 3-year period and accident-involvement rate in the prior 5-year period. As one would expect, the accident rate increases monotonically with increasing number of DUI-related convictions. Drivers with two or more major violations have almost 2.5 times as many accidents as do drivers with 0 majors. In interpreting these rates, it is important to keep in mind that the accidents have been accumulated in a period prior to the major violation convictions.

Table 2, in essence, shows a reversal of the temporal relationship. Here we show the relationship between the number of DUI-related convictions in a 5-year period and accident rates in the subsequent 3-year period. Note that the risk gradient is much flatter than in the previous table and that the relationship is no longer monotonic. The accident rate of repeat offenders is actually lower than that of first-offenders and their relative risk of 1.08 indicates only a slightly inflated risk compared to the general driving population.

This seeming paradox is readily explainable once one realizes that the period for accumulating accident counts is a 3-year period directly following the DUI convictions. Thus, these rates would be attenuated by any effects of the sanctions and license control actions emanating from the convictions. In a sense, the accident rates prior to the DUI convictions represent the intrinsic risk of DUI offenders whereas the subsequent rates represent the residual risk after sanctions have been applied. In California and many states, repeat offenders are subject to more severe court sanctions, longer license control actions, and more intensive alcohol treatment program requirements than are first offenders.

The question arises as to which set of risks is more relevant in formulating policy and identifying research needs. The answer, of course, depends on the question being asked, but a strong case can be made for use of subsequent accident and DUI reoffense rates in developing repeat offender countermeasures and associated research needs.

**TABLE 1 Rate of Prior Total Accidents in 1984-88 by Number of Major Citations in the Subsequent 3-Year Period (1989-91)**

Subsequent major citations (1989-91)	Number of drivers	Mean prior total accidents (1984-88)	Relative risk index (1984-88)*	Percent prior accident-free drivers (1984-88)
0	136,146	0.265	1.00	78.28
1	2,860	0.468	1.77	65.07
2+	479	0.649	2.45	55.74

NOTE: Pearson correlation = 0.063 ( $p < 0.01$ )

\*Represents the relative increase in each group's total accident rate compared to the zero group's total accident rate.

**TABLE 2 Rate of Subsequent Accidents in 1989-91 by Number of Major Citations in the Prior 5-Year Period (1984-88)**

Prior major citations (1984-88)	Number of drivers	Mean subsequent total accidents (1989-91)	Relative risk index (1989-91)*	Percent subsequent accident-free drivers (1989-91)
0	134,531	0.146	1.00	87.15
1	4,119	0.187	1.28	83.95
2+	835	0.158	1.08	86.23

NOTE: Pearson correlation = 0.013 ( $p < 0.01$ )

\*Represents the relative increase in each group's subsequent accident rate compared to the zero group's subsequent accident rate.

It is important to keep in mind that the alcohol-related major convictions in Table 1 and 2 occurred over 10 years ago and predate California's ALS and 0.08 percent per se laws. We know from data presented earlier and from a series of California annual reports by Tashima and Helander (1999) that DUI arrests rates, DUI reoffense rates and alcohol-related accidents have been declining, and the rate of decline increased following enactment of California's ALS and 0.08 percent laws. Since the present paper relates to repeat offenders, it is instructive to consider more recent data on accident rates as a function of the number of priors. Table 3 is taken from a recent report by Tashima and Helander (1999). It displays accident means for the 3-year period following a DUI arrest in 1994. Looking at the total accident column, note that the accident rates decline monotonically and that the rate of 4-time offenders is just one-half that of first offenders. The fatal/injury accident rates (column 2) shows a similar directional pattern, although it is much flatter. Only when the analysis is limited to alcohol-related accidents (column 3) is there any evidence of an increasing rate for multiple offenders, which is highest for those with three offenses in 7 years. However, the increased risk is relatively moderate, with four-time offenders having an alcohol-related accident rate that is only 19 percent higher than that of first offenders.

Again, these data must be viewed in the context of California's DUI control system, which imposes lengthy license suspensions and treatment program requirements on repeat offenders. For example, all DUI offenders convicted of a third or fourth offense would be revoked for at least 3 years. Hence, most or all of the accidents that occurred in the 3-year period covered by these data involved DUI offenders who were revoked. Under a perfect system, the accident rates for these offenders should have been zero.

A frequently asked question in defining target groups relates to "pay off" potential. There are a number of parameters which influence the expected return from a countermeasure allocation, and these are described in a paper on risk management which the first author presented at a 1992 NHTSA-sponsored workshop on target group identification (Peck, 1992). A key parameter to any management model is the expected number of future accidents that could be prevented by concentrating resources or countermeasures on a specified target group. This expected value is bounded by risk the total number of accidents that a given group would be involved in, had additional countermeasures not been employed.

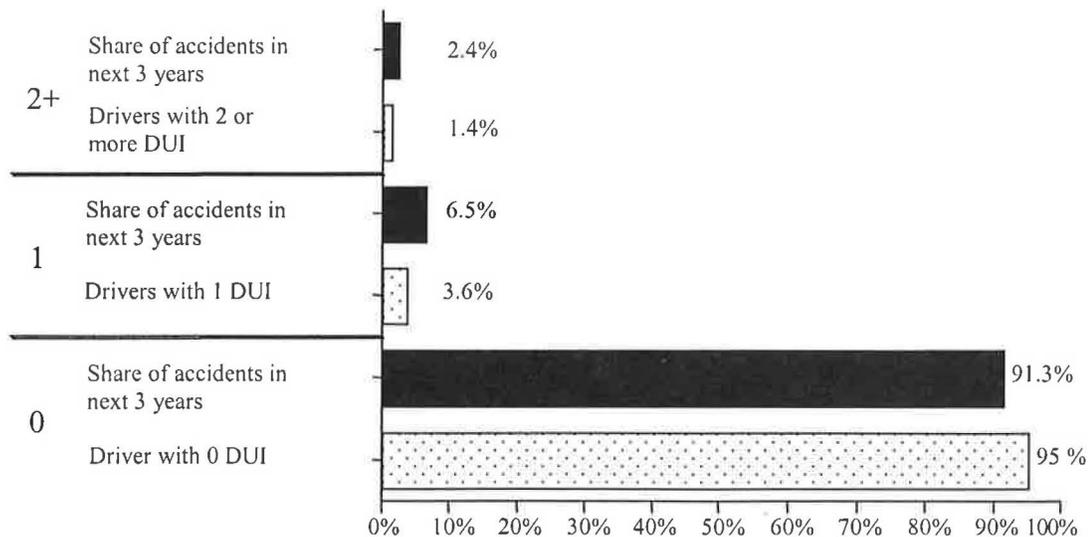
**TABLE 3 Subsequent 3-Year (1995-97) Total, Fatal/Injury and Alcohol-Related Accident Means by Number of Prior DUI Offenses**

DUI offender status	Total accidents	Fatal/injury accidents	Alcohol-related accidents
All	0.1137	0.0391	0.0290
1st DUI	0.1257	0.0416	0.0273
2nd DUI	0.0937	0.0347	0.0316
3rd DUI	0.0743	0.0318	0.0372
4th+ DUI	0.0615	0.0290	0.0325
Non DUI population*	0.165	0.049	0.006

Sex adjusted 3-year accident rate for drivers with no DUIs in prior 7 years for the period 1989-1991.

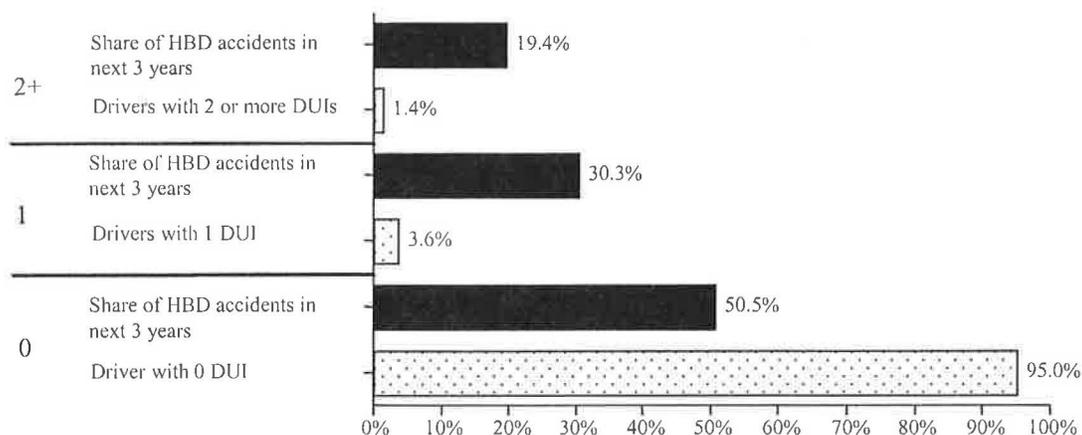
Using longitudinal data from the California Driver Record study and a simple model<sup>†</sup> for estimating accident events from driver involvement frequencies, it is possible to determine how many accidents would be prevented if a given group were effectively removed from the driving population. Obviously, it is never possible to achieve this objective but the analysis provides a theoretical upper bound.

Figure 7 simulates the subsequent accident shares for DUI offenders with one and two DUI convictions in 7 years. The figure compares the number of drivers in those groups with their share of California's accident total in the subsequent 3-year period. These results suggest that effective removal of all offenders with one DUI would eliminate 3.6 percent of the driving population and prevent 6.5 percent of California's accident total. If all repeat offenders were effectively removed, we would eliminate 1.4 percent of all drivers and prevent only 2.4 percent of all accidents. In terms of relative risk, the repeat offenders' accident share is 1.7 times



**FIGURE 7 Percentage of total accidents in the next 3 years (1988-90) involving drivers with different prior 7-year (1981-87) DUI conviction records.**

<sup>†</sup> This procedure is described in technical notes dated April 15, 1985 and June 1999 by R.C. Peck and Michael Gebers, respectively. Copies can be obtained from the author.



**FIGURE 8 Percentage of total accidents in the next 3 years (1988-90) involving drivers with different prior 7-year (1981-87) DUI conviction records.**

higher than population parity. But the net total is very low, particularly when one realizes this is an upper bound and that no countermeasure short of permanent incarceration for the entire 3-year period could ever prevent all, or even most, of these accidents.

Figure 8 portrays the same analysis, but is limited to subsequent accidents known to involve alcohol. Here we find the pay-off potential to be more dramatic, with 30.3 percent and 19.4 percent of the subsequent accidents involving, respectively, first and repeat offenders.

The accident share of repeat offenders in HBD accidents represents a 14-fold overinvolvement, which is much higher than the 1.7 relative risk index for total accidents. Thus, when repeat offenders have accidents, there is a high likelihood that they involve alcohol.

In interpreting the above results, we need to keep in mind that the time period represented is 1984-1991. Since DUI arrests and accidents have declined precipitously since that time, the simulated accident shares would be substantially lower if based on current data.

In an earlier section of this paper, we summarized evidence from a study by Marowitz concerning the predictive power of nonmajor moving violations in predicting DUI recidivism. The fact that an accumulation of moving violations increases the accident risk among DUI offenders has been found by several investigators. In their study of risk DUI correlates, Peck et al. (1994) offered the following observation which is pertinent to the present paper.

The resultant DUI-offender typologies suggest that the two most important dimensions underlying drunk driving are the extent of aggressive unlawful driving (moving and non-moving violations) and severity of the offender's drinking problem. DUI offenders with elevated driver-record point counts were significantly more likely to be involved in subsequent accidents and DUI offenses than were DUI offenders with clear records or average levels of prior traffic convictions and accidents. It may therefore be important to distinguish, as previously suggested by Simpson (1977), between "the problem driver who drinks" and "the problem drinker who drivers." These appear to represent different offender types presenting different levels of traffic safety risk (p. 676).

We would like to illustrate the joint influence of the number of DUIs and moving traffic violations on accident risk, using data from the California Driver Record Study database. Table 4 presents a two-way matrix of accident means over a 7-year period as a function of the number of DUI convictions and the number of nonmajor moving violations in the same period. Looking first at the row and column total means, we see that both variables exert a monotonic effect in increasing accident risk. For DUIs, the largest risk increment occurs in going from zero to one DUI, after which the risk increments are quite modest. Within each DUI level, there is a wide variation in risk depending on the number of moving violations. In general, DUI offenders with more than six moving violations have 2.5 times as many accidents as those with zero violations. Note also that first offenders with more than six convictions have an accident expectancy that is almost twice that of three time offenders with zero moving violations. In fact, first offenders with as few as three moving violations have an accident expectancy that is higher than that of third offenders with zero moving violations.

What are the implications of the above finding? We will address this question briefly in the final section of this paper, but it seems clear that impaired driving is far more risky when committed by drivers who are prone to drive in an unlawful and risky fashion irrespective of any involvement with alcohol.<sup>‡</sup> We believe the “problem driver who drinks” paradigm, as suggested in 1977 by Simpson, may prove to be a more important target group dimension than the “problem drinker” or hard-core DUI offender.

## **ANALYSIS OF RESEARCH NEEDS AND COUNTERMEASURE DEVELOPMENT**

At the outset of this paper, we stated that an analysis of research needs relating to repeat DUI offenders should begin with a consideration of that is known and not known. It is also important to assess the practical payoff potential associated with the new knowledge gained from any research venture. A strategic analysis of the payoff potential associated with a given countermeasure involves the interaction of several parameters:

1. Size of the target group,
2. Accident-risk level of the target group,
3. Responsiveness of the target group to remediation and/or control,
4. Effectiveness and feasibility of the countermeasures, and
5. Delivery system for identifying the risk group and implementing the countermeasure.

It is readily apparent that much progress has been made in reducing impaired driving and alcohol-related accidents both nationally and in California. If the evidence from the California studies can be generalized to the entire nation, major reductions in accident risk and reoffense rates have occurred among both first time and repeat offenders.

In California, all repeat offenders are subject to pre-conviction ALS actions, post-conviction suspensions, and lengthy alcohol treatment programs. A number of evaluations have shown these programs to be effective—a conclusion which is further substantiated by

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<sup>‡</sup> Some of the association between accident risk and number of moving violations could be do to covariation with exposure (miles driven).

the meta-analysis conducted by Wells-Parker et al. (1995). It would appear that these actions have achieved the objective of reducing the accident rate of repeat offenders to below that of first offenders. In addition, analyses of California data indicate that the majority of total accidents and alcohol-related accidents involve drivers with zero prior DUIs. When a prior DUI is evident, it is much more likely to be an offender with only one prior. Although the role of alcohol and repeat offenders would be expected to be higher in fatal accidents, the fact remains that only 4.5 percent of drivers involved in fatal accidents nationally have a DUI on their driving record in the prior 3 years. Of course, this percentage would increase if a longer prior record were used for counting priors, and it is also much higher for fatal accidents involving alcohol.

Given the above, we believe that first-time DUI offenders offer more pay-off potential because there are more of them and it makes more sense to develop and implement countermeasures which deter first time offenders from becoming second offenders. Once a first time offender becomes a second offender, a combination of license suspension and alcohol treatment should be used, perhaps supplemented by ignition interlock after the license suspension has terminated.

The term "hard-core" offender is best reserved for DUI offenders who continue to accumulate accidents and impaired driving incidents while under suspension or revocation and to offenders who drop out and do not comply with treatment program requirements. We believe the term "hard-core" is more applicable to these groups and that these groups also represent problem drinking offenders with exceptionally high risks of recidivism and accident involvement. Having established a general vision of the direction of DUI countermeasure development, we outline below a programmatic research agenda for establishing the necessary empirical foundation.

**Problem:** Studies of DUI offender characteristics, recidivism tracking, process analyses, outcome evaluation, etc. require longitudinal data on large probability samples of drivers and DUI offenders. California is one of the few states that has developed the longitudinal driver record databases for conducting these types of analyses on a continued basis. However, such studies are necessarily representative of only California.

**TABLE 4 Accident Risk as a Function of DUI Citations and 1-Point Citations over a Concurrent 7-Year (1985-91) Period (N = 145,645)**

DUI citations	Total 1-point countable citations							Total
	0	1	2	3	4	5	6+	
0	0.233	0.377	0.482	0.572	0.649	0.757	0.935	0.357
1	0.441	0.556	0.668	0.735	0.841	0.985	1.129	0.628
2	0.557	0.658	0.815	1.078	0.905	1.128	1.283	0.778
3+	0.676	0.784	0.837	0.767	1.379	0.818	1.294	0.817
Total	0.240	0.387	0.496	0.589	0.669	0.779	0.959	0.371

## RESEARCH AGENDA

### Development of a National Driver Record and DUI Offender Database

**Solution:** NHTSA should develop a national driver record and DUI offender database for conducting longitudinal studies of DUI offender recidivism rates, reoffense correlates, countermeasure effects and State or regional variations in countermeasure effectiveness. In addition to this relatively short-term solution, a feasibility study should be conducted on establishing a national single driver license/single driver record system similar to that required for interstate commercial drivers. In addition to greatly facilitating the conducting of DUI research, such a system would enable states to identify high-risk DUI offenders using a record system that has not been compromised by failure to link DUI-related events accumulated in different states. Current systems for state linkage, such as the National Driver Record Register and driver license/nonresident violator compacts, are either incomplete or inadequate for the above purposes

**Payoff:** Not quantifiable at this juncture. However, to the extent that we can identify those offender groups at the greatest risk of crashes and recidivism, we can aid in the development of special countermeasures for these high-risk subgroups and increase the potential payoff of any countermeasure.

### Development and Evaluation of a Model DUI Offender Classification System

**Problem:** Numerous systems and typologies have been proposed and/or developed for classifying and treating DUI offenders. Although research on complex systems for treating alcoholics based on multivariate typologies has not proved encouraging (Project Match Research Group, 1997), a relatively simple customized treatment system may have potential with drunk drivers. Among the candidate dimensions would be age, BAC level, drinking consumption indices and indicators of problem driving, such as moving violations.

**Solution:** Develop and evaluate the efficacy of a system for assigning treatment based on offender characteristics. The simplest system would be to treat all first offenders with high recidivism expectancies as second offenders. A more complex variant would be to develop drug-oriented programs for low BAC offenders.

**Payoff:** An additional 25 percent reduction in the reoffense and accident rate of 25 percent of all first offenders.

### Determine the Optimum Length or Time Window for Defining Repeat Offenders

**Problem:** States currently differ in the driver record retention period used for defining a repeat offender. There are also differences in the extent to which states differentiate between the number of repeat offenses (2 in 7, 3 in 10, etc.). Research is needed to define an opti-

imum time window for considering a DUI as a prior. This optimum time window would be a function of the recidivism expectancy over time.

**Solution:** Longitudinal survival hazard rate studies need to be conducted on the DUI offender populations of a sample of states. Parametric and nonparametric survival models, similar to those developed in California, would be applied to the data in determining at what point a prior DUI offense is no longest predictive of an increased risk of reoffending.

**Payoff:** Not yet quantifiable.

### **Evaluate the Feasibility of a Three-Tier System That Graduates Sanctions Based on BAC Level and Total Traffic Conviction History**

**Problem:** Some states currently have 0.08 percent per se laws and NHTSA is advocating that all states establish 0.08 percent as the maximum permissible BAC level. There is also advocacy for even lower permissible limits. A problem created by lowering BAC limits is that it does not recognize the extreme variance in accident risk and problem drinking magnitude between, offenders at, say, BACs of 0.08 percent and 0.20 percent. The latter offender is much more likely to be an alcohol dependent problem drinker and to represent a much higher accident risk. Similarly, the sanction standard could be modeled to capitalize on the predictive history of an offender's conviction.

**Solution:** Development and evaluation of sanction standards that utilizes BAC and driver record conviction history as a determinants of sanction severity.

**Payoff:** Not yet quantifiable.

### **Perform a Large Scale Evaluation of the Effectiveness of Vehicle-Impoundment and License Plate Confiscation as Sanctions for Hard Core DUI Offenders**

**Problem:** DUI offenders who continue to drive and reoffend after their license has been suspended or revoked are obviously not responsive to traditional sanctions. Evidence from a California study of vehicle impoundment (DeYoung, 1998) is promising, but evidence regarding license plate confiscation is mixed. In any event, these countermeasures need to be more rigorously evaluated with respect to DUI offenders than has been possible to date.

**Solution:** Implement a multistate evaluation of the effectiveness of vehicle impoundment, and other methods of vehicle incapacitation, on reducing DUI recidivism and alcohol-related accidents.

**Payoff:** The California study by DeYoung reported over a 25 percent reduction in accidents among sanctioned offenders. What's more, vehicle impoundment showed the largest reduction (-38 percent) among repeat offenders. The size of the annual target population in California is estimated to be several hundred thousand suspended or revoked DUI offenders.

### **Identify DUI Recidivism Correlates Using a Long Follow-Up Period**

**Problem:** Many recidivism studies have utilized inadequate follow-up periods or have been conducted on nonprobability samples or samples from a single county or region within a state. Analyses of the type performed by Marowitz (1996) need to be done using much longer follow-up periods and, ideally, more than one state.

**Solution:** Perform a multistate recidivism analysis over 5- and 10-year follow-up periods.

**Payoff:** Not quantifiable at this juncture.

### **Develop and Evaluate a System for Reinstating Suspended or Revoked Repeat DUI Offenders on a Probationary Basis Subject to Imposition of Ignition Interlock and, Where Indicated, Other Conditions**

**Problem:** DUI offenders can automatically apply for reinstatement in many states after the suspension term has lapsed and are often reinstated unconditionally. Many of these offenders are probably still at increased risk to reoffend due to drinking problems. A protocol should be developed for assessing risk and determining when reinstatement should be conditioned on installing ignition interlock and/or enrolling in a follow-up treatment program or under the care of a physician.

**Solution:** Develop and initiate the above program on an experimental or demonstration project basis in one or more states.

**Payoff:** Not yet quantifiable.

### **Evaluate the Use of Community-Service Supplemented by Electronically-Monitored House Arrest as an Alternative to Jail**

**Problem:** The DUI statutes of all states impose some jail for DUI offenses, particularly repeat offenders, and the minimum length of jail time generally increases as a function of the number of priors. California studies (Tashima and Helander, 1999) have questioned the effectiveness of jail as a deterrent. It is also frequently the case that jail overcrowding prevents the entire jail sentence from being served, and many courts impose community service as an alternative. An obvious alternative or supplement to jail, which is now feasible, is electronically monitored home confinement. This option would also make longer sentences more feasible.

**Solution:** Perform an experimentally controlled study of a combined community service-home confinement sanction in lieu of jail in one or more states.

**Payoff:** Potential not yet quantifiable.

## Assess the Magnitude and Risk Level of the Permanently Suspended DUI Offender Population

**Problem:** Studies in California (Sadler et al., 1991; Tashima and Helander, 1999) indicate that a large percentage of the suspended and revoked repeat DUI offender population do not reinstate even after becoming eligible for reinstatement of their driving privilege. It is believed that a sizable percentage of the population eligible for reinstatement are never reinstated, at least in California. Among the reasons for nonreinstatement is the inability to meet all of the requirements, particularly the mandatory insurance requirement. The long-term effects of nonreinstatement on traffic safety are not clear, nor is it clear how many of these drivers continue to drive, impaired or otherwise.

**Solution:** Conduct a statistical study of this group in California. The study should include interviews with the identified group.

**Payoff:** Not clear.

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## Research Needs and Priorities in Alcohol-Impaired Driving Among Special Populations

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### INTRODUCTION

Drinking and driving in the United States, although it has been declining in the last two decades is still a substantial problem with 30 percent of the drivers killed in motor vehicle crashes in 1997 having blood alcohol contents (BACs) in excess of 0.10 percent [Insurance Institute for Highway Safety (IIHS), 1998]. However, not all segments of the population are equally at risk of being in an alcohol-related crash. Differences have been noted among for example, male and female drivers, older and younger drivers, and first time and repeat offenders. For example, young drivers younger than 21 not only have shown the greatest decline in the last 15 to 20 years compared with older drivers, but fewer of these younger drivers who are killed in motor vehicle crashes have illegal BACs. Furthermore, among drivers aged 60 and older, very few fatally-injured drivers have BACs in excess of 0.10 percent. It is also recognized that there may be rather specific countermeasures that can be applied effectively to one group that are not applied to others. For example, both Minimum Purchase Age laws and zero-tolerance laws have been shown to be effective in reducing drinking and driving among drivers younger than 21.

More recent focus has pointed to other pervasive differences based on for example, gender, race/ethnicity, and geographic location, for example rural versus urban locations. The focus of this paper is to examine the research needs among special populations, which broadly defined could include different age groups, such as the young and the elderly, women versus men, different racial/ethnic groups, as well as repeat versus first-time offenders, pedestrians, bicyclists, and motorcyclists. Other participants will be addressing research needs among young drivers and repeat offenders and will not be addressed here. The following research proposals are aimed at lessening our gap in understanding of drinking and driving among other segments of the population with the ultimate goal being to devise appropriate countermeasures to address these areas.

### RESEARCH PRIORITIES AMONG SPECIAL POPULATIONS

#### **Why Are More Women Drinking and Driving? What Would Be Appropriate Deterrents?**

**Problem Area:** The percentage of women who are drinking and driving has increased in recent years. Although the percentage of women with high BACs who are fatally injured in motor vehicle crashes is down more than that of men, women are accounting for a greater proportion of all drinking and impaired drivers involved in fatal crashes. In 1982, women accounted for 12.9 percent of drinking drivers, in 1997 they accounted for 16.9

percent. Similar increases among females are found for alcohol-impaired fatal crashes, and average BACs among fatally injured male and female drivers are not much different.

Data from a 1996 national breath survey reported a higher percentage of women than in 1986 now are driving with BACs of 0.05 percent and higher, while at the same time rates among men, although higher overall, are declining (Voas et al., 1998). Also of note in the 1996 survey, among drivers younger than 21, women were found to be drinking as much as men.

The question is, why are more women drinking and driving now than before? There is some evidence that women and men differ in their attitudes toward drinking and driving. For example, Stewart and Sole (1995), in a study of professed drinking drivers, reported differences among men and women ages 21-29 in their decision making regarding whether they would drink and drive. There is little understanding, however, of the underlying reasons for drinking and driving among women (not just those ages), and why this has changed in recent years.

**Research Issue:** Research is needed to discern the conditions under which drinking and driving occurs and doesn't occur for men and women. Are there certain situations that pose the greatest risk of resulting in drinking and driving for women? What factors are important in the decision to drink and drive? What are the deterrents to drinking and driving?

**Likelihood of Success:** Good for providing understanding of attitudes and motivation that lead to drinking and driving; reasonable for suggesting potential means of deterring drinking and driving.

**Effects:** Preliminary data suggest that women, if provided with more appropriate motivation and skills, might be more effectively influenced than men to avoid impaired driving.

**Other:** Currently, no distinction is made in terms of approaches to deterrence for men and women.

### **Gender Differences in DWI Arrest Rates and Recidivism**

**Problem Area:** Although women have much lower rates of driving while intoxicated (DWI) arrest than men there is evidence that DWI arrests are increasing among female drivers both in the United States and around the world (Popkin et al., 1988; Puschel et al., 1989; Shore et al., 1988). Several studies have reported recidivism rates for female offenders that are lower than for men (see Waller and Blow, 1995, for summary), however a study in New York State suggests that not only are DWI arrests increasing for women in that state but more recently recidivism rates for women have come to parallel those of men (Yu et al., 1992).

**Research Issues:** It is clear that drinking and driving among women continues to increase (Voas et al., 1998), yet no recent studies have examined DWI arrest and recidivism rates for female drivers. Studies are needed to determine the incidence of DWI arrests for

women compared with men relative to their drinking and driving rates and alcohol-related crash rates. Also needed are studies to examine whether recidivism rates among women are now closer to those of males.

**Likelihood of Success:** Data may not be readily available in all states. Reasonable likelihood of success in determining recidivism rates if resources committed to tracking down the information.

**Effects:** There has been speculation, because women drinkers traditionally do not come to the attention of police or the courts, that women are able to hide their alcohol problems more effectively than men (Waller and Blow, 1995). Results of this research will have implications for deterrence, enforcement, and rehabilitation programs as they apply to women.

### **How Do Drivers Make Decisions About Drinking and Driving?**

**Problem Area:** Anecdotal evidence, as well as the continuing large numbers of people who drink and drive while impaired, suggest that people do not understand the relationship between how much they drink and resulting BACs. Some research evidence suggests that people typically overestimate their BAC when on the ascending BAC curve, but in the descending phase they typically underestimate BAC (Martin et al., 1991). Thus people's decisions about whether to drink and drive could be affected by where they are in the absorption/elimination stages. It is not well known when the decision to drive is usually made and what cues drinkers are using to make that decision. Are people deciding to drive even though they know they may be impaired or is there a genuine lack of understanding about what BACs people are reaching in a social drinking setting?

There is a need for basic information on what women and men of different racial/ethnic groups believe in regard to alcohol consumption and driving, including what they know about BAC limits and how they judge BAC in relation to the decision to drink and drive. There is some evidence from the 1995 National Alcohol Survey (Caetano and Clark, 1999) that the number of drinks people judged necessary to affect their driving ability ranged from four to eight and were in general higher for Hispanics than others (unpublished data from an ongoing study conducted by SCRI and IIHS also support this finding). However, there is some indication that when asked how many drinks they can have before exceeding the legal limit, that number is much lower. For example, in a national survey conducted by NHTSA (Balmforth, 1998), about two-thirds of respondents reported that it would take three or fewer beers to reach the legal limit.

If there is a large discrepancy in people's judgment about the number of drinks that would render them illegal to drive and the number of drinks needed to be unsafe this may lead them to ignore DWI laws because they think they are safe enough to drive when they are not.

**Research Issue:** Studies are needed to determine how we can better educate the public about how to make responsible decisions about drinking and driving. There is a need for more naturalistic studies of the drinking environment to determine how individuals assess

BAC and what cues they use, recognizing that the cues regarding BAC change as a function of the time that has lapsed since the last drink.

**Likelihood of Success:** Reasonable for determining how people make the decision to drive; reasonable for designing public education efforts. Unclear how effective such efforts will be.

**Effect:** It may not be enough to provide drinkers with a basis to estimate how many drinks they can consume if in reality they base their decision to drive on how they feel at the time. The estimates of how much one can drink and still be legally fit to drive depends on a number of factors that are difficult to quantify, such as body weight, gender, effects of food, time over which drinking is done, and individual alcohol elimination rates. More complete information about how to judge BAC at different points in the absorption and elimination phases could provide the basis for more comprehensive guidelines for drinking drivers.

### **Unrestrained Children in Crashes: What is the Role of Drinking Drivers?**

**Problem Area:** In 1997, more than half of the children younger than 15 years of age who were fatally-injured as passenger vehicle occupants were not using any restraint (NHTSA, 1999). There is evidence that many of these crashes involve drinking drivers. For example, Foss and Margolis (1997) reported that 19 percent of crashes in which a child younger than age 15 was killed involved a drinking driver; this rose to 26 percent when considering only child vehicle occupants. This percentage was even higher when the vehicle in which the child was traveling was older probably reflecting both the lesser crash protection afforded by older vehicles and lower socioeconomic status of those who drive older cars.

A recent study by Baker et al. (1998) reported a higher motor vehicle occupant death rate of children and teenagers per mile driven for Hispanics, and non-Hispanic African Americans compared with non-Hispanic Whites. The authors speculated that these higher death rates might reflect differences in driving behavior among these groups such as in the frequency of drinking and driving. There is also evidence that women, who more often transport children, are now drinking and driving more than before.

**Research Issues:** Studies are needed to understand the situations in which unrestrained children are killed in passenger vehicles. Risk factors that should be examined include the gender, age, and race/ethnicity of the driver in the crash, driver BAC, and number of passengers in the vehicle.

**Likelihood of Success:** Good for determining risk factors; good for designing countermeasures.

**Effects:** Extensive public education and enforcement efforts by NHTSA and the Airbag and Seat Belt Safety Campaign currently are directed toward getting children properly restrained in vehicles. A better understanding of driver behavior in crashes in which unre-

strained children are killed may point to additional enforcement opportunities, such as increased enforcement of DWI laws at the scene of a fatal crash.

### **Resolving the Basis for Differences in Fatal Crash Rates Among Different Ethnic/Racial Groups**

**Problem Area:** Recent studies point to differences in alcohol-related fatalities among different ethnic/racial groups compared with Caucasian Americans. Voas et al., (1999) estimated that although Caucasian Americans comprise the majority of all alcohol-related deaths in the United States, within different ethnic/racial groups, when weighted for age and gender, there is evidence of overinvolvement among some groups and underinvolvement among others. For example, Caucasian and African Americans have similar proportions of alcohol-related crashes, whereas the percentage of Native Americans and Mexican Americans is much higher. Some groups, such as Asian-Pacific Islanders, and Cuban Americans had rates that were lower (Voas et al., 1999). Differences also were reported based on age and role in the crash, whether a driver, passenger, bicyclist, or pedestrian. Leaf and Preusser (1997) also has reported differences in pedestrian death rates among different racial/ethnic groups.

**We Don't Know:** Other factors unrelated to drinking or race/ethnicity may be underlying these findings. There are variations in socioeconomic status among different racial/ethnic groups; for example, Hispanics and African Americans have lower median incomes than non-Hispanic Whites. We know that lower income drivers and passengers wear belts less often and drive older and less safe vehicles. Other factors that may affect motor vehicle death rates include the number of passengers in a vehicle and driving exposure. In particular how far from home drinking occurs and where the driving is done, particularly rural versus urban locations can all have an effect on the findings.

**Research Issue:** Studies are needed that disentangle the effects of drinking and driving, other factors affecting crash outcomes, and social/cultural factors in order to understand what countermeasures might be appropriate. There is a need to look at risk factors for crash involvement as well as risk factors for fatal outcomes when crashes do occur.

**Likelihood of Success:** This is an easier undertaking in the case of fatal crashes as good data on driver BAC exist, but special studies will be needed to collect BACs for drivers in nonfatal crashes.

**Effects:** An examination of the role of factors other than race/ethnicity in motor vehicle crash overinvolvement will allow the design of interventions that are appropriately targeted.

**Other:** There is increasing emphasis on addressing the needs of different ethnic/racial groups when it comes to traffic safety initiatives. We need to be sure that we are addressing the right issue, for example, the extent to which these differences can be ex-

plained by SES rather than race/ethnicity might focus efforts on culturally-sensitive countermeasures directed more at lower income groups.

### **Drinking and Driving Among Mexican-American Males**

**Problem Area:** A recent (as yet unpublished) study of Mexican American and Caucasian American male DWIs (and non-DWI Caucasians and Mexican American controls) has suggested that knowledge of DWI laws, and what is considered an appropriate amount of alcohol that may be ingested before impairment will occur may vary by ethnicity, even when controlling for SES (see also Caetano and Clark). These data also suggest that, at least for the sample in this study, there may be a discrepancy between what people believe the law allows one to drink and the amount that is considered necessary for impairment (see “How do drivers make decisions about drinking and driving?” above).

**We Don’t Know:** The study, which was undertaken in Long Beach, California, is not generalizable and should be replicated in other locations and with other ethnic/racial groups to understand whether these data are representative of Mexican American males throughout California and the United States, and whether similar patterns can be found among other racial/ethnic groups.

**Research Issues:** Are there differences based on race/ethnicity, among the population of DWI offenders and those not arrested for DWI in their knowledge and beliefs about drinking and driving?

**Likelihood of Success:** Replication of this study design should be relatively easy, but will need to be replicated in a number of different locations.

**Effects:** The disentanglement of factors underlying an individual’s decision to drive drunk, will allow programs to be designed that address the important issues. For example, if knowledge about the DWI law were worse among DWI offenders this would point to education as a possible countermeasure.

### **What Can Be Done About the Continuing Overinvolvement in Motor Vehicle Crashes Among Native Americans?**

**Problem Area:** Native Americans have long been recognized as being at a much higher risk of alcohol-impaired crashes both as drivers and pedestrians, yet their overinvolvement remains (Baker et al., 1992; Grossman et al., 1997). Trend data suggest that at least for fatal crashes alcohol-related fatalities have been going down among most ethnic/racial groups but this trend is not as evident among Native Americans. Of concern is that in the last few years the trend seems to be upward (Voas et al., draft report).

**Research Issue:** What are the trends in alcohol-related motor vehicle crashes among Native Americans both fatal and nonfatal. How does this differ for drivers and pedestrians? According to Grossman et al. (1997) there are differences among Native American tribes in

frequency of drinking and motor vehicle crash rates so we need to ensure data collection allow segregation for different tribal groups.

**Likelihood of Success:** Complete data currently do not exist regarding the BAC of Native-American drivers and pedestrians in nonfatal injury crashes. Prospective studies will be needed to address this inadequacy.

**Effects:** Trend data for fatal and nonfatal crashes for both pedestrians and drivers will allow the development of appropriately targeted countermeasures.

### **Alcohol Abuse Assessment and Treatment: Should We Distinguish Among Different Populations?**

**Problem Area:** Fatally injured drivers with very high BACs continue to be a problem in the United States. In 1995, 65 percent of fatally injured drivers in the United States had BACs at or above 0.15 percent. This has not changed much since 1988 with BACs among fatally injured drinking drivers averaging 0.17 and 0.18 percent in 1988 and 1995, respectively (Simpson et al., 1996). To deal effectively with drivers who are identified through the DWI arrest process as having very high BACs, Simpson et al., (1996) recommend assessment and treatment and rehabilitation as an essential need. There is research (Perrine et al., 1989; Simpson et al., 1996) to suggest that the DWI population is a heterogeneous one. There also is a wide array of options available to assess and treat the drinking driver. Lapham et al., (1998) using five alcohol screening instruments, reported that among first offenders there were significant differences in scores based on age, gender, ethnicity, education, and BAC as well as differences based on the type of screening instrument used.

**Research Issues:** Few studies have examined the extent to which differences exist among racial/ethnic groups and by gender in terms of the efficacy of various alcohol assessment and treatment approaches for rehabilitation. We need to establish, for a variety of widely used alcohol assessment instruments, whether there are distinct subgroups in the population that would benefit from a different approach to assessment, and treatment interventions.

**Likelihood of Success:** The choice of instruments used in the DWI assessment can greatly influence the finding that an individual has an alcohol-related problem (Lapham et al., 1997). The degree to which this interacts with gender and/or race/ethnicity is unknown.

**Effects:** If important differences do exist among subgroups of the population who typically drive after drinking with very high BACs there is an opportunity to develop more customized assessment and treatment programs that potentially could be more effective.

### **How Do Drinking Patterns Vary in Different Jurisdictions— Rural versus Urban Locations?**

**Problem Area:** It is well understood that the majority of fatal crashes occur on rural roads, and recent research confirms that most of these crashes involve rural and small-town residents (Blatt and Furman, 1998). There are a number of reasons for overinvolvement in rural areas including road types, higher speed limits, types of vehicles driven, as well as differences in SES, lower belt use and drinking and driving. For example, Blatt and Furman (1998) found rural drivers were overinvolved in crashes in which a child 5 and younger died, were involved in more fatal crashes than any other group for every range of BACs examined from 0.08 to 0.15 percent and higher. And this overinvolvement held both for male and female drivers. Studies of young people suggest that alcohol use is more frequent in rural areas. However, even if alcohol use were no different among young people, the rural setting gives us more cause for concern given the greater distances that need to be traveled for work, entertainment etc, and the scarcity of transportation alternatives.

**We Don't Know:** How does drinking, and drinking and driving vary between rural and urban residents for example, in the frequency and amount of drinking, the location at which the drinking takes place, and miles driven to get home. Also not known is the role of such factors as age, gender, SES, and race/ethnicity in this pattern.

**Research Issues:** We need to investigate drinking and drinking and driving practices in rural and urban communities in the United States to include a sufficient sample of different racial/ethnic groups, including where drinking is usually done, and how drinkers get to and from home. A nighttime roadside survey design would target the most relevant population and allow estimates of BAC.

**Likelihood of Success:** National roadside surveys are an expensive undertaking, but would provide more valid answers to the questions we are asking than other alternatives such as a telephone survey.

**Effects:** An understanding of subgroup differences would allow us to better focus public education and enforcement efforts and suggest appropriate solutions in different communities.

### **Enforcement of DWI in Rural Areas: What Are the Impediments?**

**Problem Areas:** As mentioned above, impaired driving is of particular concern in rural areas. Each year more people are arrested for DWI than for any other offense and DWI is more common in rural areas than among urban populations. According to the UCR, the rate of arrest for DWI in cities of 10,000 population is more than double that in cities of 250,000 or more, and the rates for both suburban and rural counties are much higher than in the larger cities. However, police resources and enforcement are likely to be very different in smaller-town, rural settings than in urban settings.

**We Don't Know:** How does DWI enforcement differ in rural versus urban settings? Are there certain factors that lead to enforcement difficulties and/or potential disincentives to enforcement? We need to know what works well in these settings and what are the disincentives to enforcement. Such disincentives might include for example, fewer police resources in rural areas; longer arrest times because of significant travel time to get to jail, breath, or blood sites; infrequent court schedules in any given court jurisdiction; police, prosecutors, and judges personally acquainted with many DWI offenders.

**Research Issues:** How do police departments in rural jurisdictions differ in their methods of enforcing DWI compared with more urban communities. Are there DWI enforcement methods in one jurisdiction that could be usefully applied in other communities? Studies would involve interviews with police departments in rural and urban communities across the United States.

**Likelihood of Success:** Reasonable in terms of fact finding; reasonable in terms of changing procedures among police officers within different jurisdictions.

**Effects:** Traditionally no distinction has been made regarding enforcement in rural compared with urban communities and guidelines that are developed do not distinguish between these settings. A better understanding of the special concerns regarding police resources and DWI enforcement in rural communities could lead to improved efficiency in DWI enforcement efforts in those communities.

## RESEARCH PRIORITIES

Deciding priorities among such a diverse set of research possibilities was a daunting task. It was a difficult undertaking because the research projects suggested in this paper cover a very wide area including basic research to determine why people drink and drive and how we might affect their decision making, examination of differences in alcohol-related crashes among different racial/ethnic groups, enforcement issues, recidivism, and assessment and treatment of DWI offenders. They also examine different segments of the population. In the final appraisal I chose to rank the projects on three criteria

1. Size of the problem;
2. Whether there would be an obvious countermeasure; and
3. How much is already known in the area of interest.

Each proposal was ranked for each of these criteria and assigned a score of high (score of 1), medium (2), or low (3). Final ranking was based on the total score, with those scoring the lowest being accorded the highest priority. The proposals are listed in order of priority. Alongside each proposal is an indication of the scores.

1. Resolving the basis for differences in fatal crash rates among different ethnic/racial groups. (1, 1, 1)
2. Unrestrained children in crashes: What is the role of drinking drivers? (2, 1, 1)

3. Drinking and driving among Mexican American males? (2, 2, 1)
4. How do drinking patterns vary in different jurisdictions – rural versus urban locations? (1, 2, 2)
5. Why are more women drinking and driving? What would be appropriate deterrents? (3, 2, 1)
6. What can be done about the continuing overinvolvement in motor vehicle crashes among Native Americans? (3, 2, 1)
7. How do drivers make decisions about drinking and driving? (1, 3, 3)
8. Gender differences in DWI arrest rates and recidivism (3, 2, 2)
9. Enforcement of DWI in rural areas: What are the impediments? (1, 3, 3)
10. Alcohol abuse assessment and treatment: Should we distinguish among different populations? (2, 3, 3)

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## Research Needs and Priorities for Ethnic Communities

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### GOAL

To set priorities and ideas for researchers and programs that aim to improve traffic safety among ethnic communities.

### INTRODUCTION

Analysis of the trends in traffic deaths from 1990 to 1994 suggested that all of the major ethnic groups were experiencing some benefits from current safety programs as indicated by a reduction in the proportion of alcohol related fatal crashes. At the same time, significant differences in the extent of the drinking and driving problem between ethnic groups were noted. These differences suggest that, in addition to making standard safety program culturally relevant for each ethnic group, it will be important to prioritize targets within ethnic groups to most efficiently use the resources available for traffic safety campaigns. This presentation summarizes research needs and program ideas from ethnic researchers who participated in February 1999 and May 1999 diversity meetings.

### TOP RESEARCH NEEDS

#### Apply Culturally Competent Research Approaches

Develop and apply culturally competent and sound research approaches, both quantitative and qualitative methods, to gather useful data and to identify appropriate interventions:

- Experimental design;
- Use of focus groups, key informants;
- Research at the local level to ensure involvement by ethnic communities including social institutions and groups (i.e. churches, advocacy groups and centers);
  - Research findings to be used in partnership with ethnic groups and communities to improve traffic safety; and
  - Conduct epidemiologic and ethnographic studies.

**Problem Area and Size:** Current research and data collection efforts may not capture the needed information for developing ethnic specific traffic safety records and programs.

**What We Don't Know:** Traffic safety concerns among different ethnic communities on the local level.

**Research Issues:**

- What are these concerns and how are local statistics different from the national data?
- What kinds of research and intervention approaches are effective?
- Need to obtain culturally specific data.
- Need to sample groups who would otherwise not be included or identified in the sampling.
- Conduct face to face interviews which provide richer data than telephone surveys.
- Identify findings that can be generalized to more communities.
- Ensure support in developing research strategies for interventions based upon findings due to the partnership with ethnic groups in conducting the research.

**Likelihood of Successful Research:** Good chance if supported on the national level and carried out with support from ethnic researchers and communities.

**Application of Research Results:** Have a clearer picture of the traffic safety issues among ethnic communities and a better foundation for appropriate interventions.

**Broader Issues, Political Factors, Etc.:** The data sets themselves could be neutral, the use of these ethnic specific data can be highly political, e.g., profiling by law enforcement, “DWB,” etc.

**Develop On-Going Partnership in Research**

The NHTSA needs to maintain a commitment to enlist the ethnic research community groups in full partnership in all research efforts.

**Problem Area and Size:** Continuous involvement from the ethnic community groups and a commitment from the NHTSA are preferable to periodic consultations or the lack of them from a few ethnic researchers.

**What We Don’t Know:** Will NHTSA be able to formalize their commitment to ethnic communities by allocating or getting resources to support these efforts.

**Research Issues:** How can ethnic communities and ethnic researchers in reality help the research efforts? What kinds of research efforts can be produced? What are the detailed contents of this partnership?

**Likelihood of Successful Research:** Good chance. NHTSA seems to be committed to the cause and there are many ethnic communities and individuals who are interested in improving traffic safety among ethnic and general communities.

**Application of Research Results:** On-going partnership with ethnic communities.

**Broader Issues, Political Factors, Etc.:** Increased involvement from ethnic communities. Increase fiscal and logistic responsibilities for NHTSA.

### **Involve Ethnic Communities as Partners for Change**

Understand and utilize “community” as a full partner for positive changes:

- Research the role and function of “community” in different ethnic groups and their implications for traffic safety;
- Mobilize community for lasting change; and
- Involve community as participants and solutions of any research and intervention efforts.

**Problem Area and Size:** Much has been said on the effectiveness of involvement of ethnic communities. The difficulties in getting involvement from ethnic communities are also recognized. Then, how will this gap be filled?

**What We Don’t Know:** What is a community? Who are the people in the community? Beyond the self-proclaimed community representatives, who are the real community leaders? How can community be part of the change to improve traffic safety?

**Research Issue:** Include more uses of ethnographic and qualitative research approaches to provide useful information.

**Likelihood of Successful Research:** By understanding, involving, and mobilizing ethnic communities, there is good chance for success.

**Application of Research Results:** Tap into the strengths and resources of different ethnic communities to improve traffic safety.

**Broader Issues, Political Factors, Etc.:** In partnership with the ethnic communities, these studies are able to “look into,” but not “look at” the issues of traffic safety among and within ethnic communities. They generate data from, and preferably by, the people of the ethnic communities that can be used to improve the ethnic populations and the general community.

### **Include Ethnic Specific Data**

Encourage studies to include and examine data in the following areas:

- Country of origin of the family (include the rationale—cultural beliefs, values, and behaviors shape attitudes and behaviors of traffic safety);
- U.S.- or foreign born; length of time living in the United States (issues of assimilation and acculturation, status of citizenship);
- Socioeconomic status: family income, employment status, education, etc.;

- Language of choice: English and/or other languages; monolingual or multilingual; and
- Place of residence: urban, suburban, rural, community characteristics, concentration of ethnic communities.

**Problem Area and Size:** Current data do not provide sufficient information on ethnic communities

**What We Don't Know:** Lack of sufficient information to develop ethnic specific data and interventions partly due to the difficulties in gaining access to ethnic communities and information from existing national studies.

**Research Issue:** What are the main contributing factors for traffic safety concerns among and within different ethnic groups.

**Likelihood of Successful Research:** Good chance if supported on the national level and carried out in partnership with ethnic researchers and communities

**Application of Research Results:** Have a clearer picture of the traffic safety issues among ethnic communities and a better foundation for appropriate interventions

**Broader Issues, Political Factors, Etc.:** The data sets themselves could be neutral, the use of these ethnic specific data can be highly political, e.g., profiling by law enforcement, "DWB," etc.

### **Improve Fatal Accident Reporting System Data**

Include as a priority to identify ethnic specific categories for future data collection which may include the desegregation of the Fatal Accident Reporting System (FARS) data. Need to include more detailed information and data including

- Desegregate data of Asian/Pacific Islanders; use California data in order to get perspective for the rest of the country;
- Separate Puerto Rico from national data and have more Puertorican (island) specific studies;
- Age breakdown of children;
- Determine the time, location, and how far from home the crashes occurred;
- Ethnicity of passengers and drivers; and
- Types and results of injuries.

**Problem Area and Size:** Current data do not provide adequate details.

**What We Don't Know:** Insufficient data on different ethnic communities.

**Research Issue:** How to improve FARS to include and to provide the needed data.

**Likelihood of Successful Research:** To be determined.

**Application of Research Results:** Provide vital information for designing ethnic community specific and effective interventions.

**Broader Issues, Political Factors, Etc.:** The data sets themselves could be neutral, the use of these ethnic specific data can be highly political, e.g., profiling by law enforcement, "DWB," etc.

### **Utilize Demonstration Projects and Evaluation Studies**

Engage in demonstration projects and evaluation studies that verify the effectiveness of the proposed interventions and produce valid and reliable (scientific and practical) data regarding the program and problem addressed.

**Problem Area and Size:** The lack of accurate data and "tested" interventions lead to insufficient ethnic specific intervention on traffic safety issues. There is also a lack of available data from all levels and the assessment of existing interventions to determine success or limitations

**What We Don't Know:** Scope and size of the problems and the impact upon communities. What do ethnic communities want to do about these problems?

**Research Issue:** Test working hypotheses that are in partnership with or are generated from the local or ethnic communities and continue to build on the project findings.

**Likelihood of Successful Research:** These are service-based applied research projects. Good chance of success. They may however take several years to complete.

**Application of Research Results:** Identify and apply validated and reliable data and intervention approaches to improve traffic safety.

**Broader Issues, Political Factors, Etc.:** It is a "learning from the field" approach. Ethnic communities collect traffic safety data while services are being provided to the populations. It is likely to gain support from the ethnic communities.

### **Study the Effects of Alcohol Marketing**

Does alcohol marketing decrease traffic safety among ethnic groups and, if so, how can the ethnic communities and NHTSA work together to address the issues?

**Problem Area and Size:** Communities of color have increasingly been the targets for marketing by the alcohol industry. The number of ethnic communities who have reported alcoholic problems have been on the rise in recent years. Many children and youth from

these ethnic communities are environmentally at-risk for their high exposure to alcohol advertisements and the internalization of the “perceived” acceptance of alcohol use.

**What We Don’t Know:** How alcohol marketing targeted at ethnic populations/communities contributed to the traffic safety issues in ethnic communities?

**Research Issue:** Does alcohol marketing decrease traffic safety among ethnic communities and what can the ethnic communities and NHTSA do about that.

**Likelihood of Successful Research:** Good chance to determine the extent of associations. The ability to establish causality remains to be seen.

**Application of Research Results:** Develop counter measures including social marketing, legislative and policy changes at all levels, and other individual and community oriented interventions.

**Broader Issues, Political Factors, Etc.:** It may seem to be a straightforward research question. It is also a highly political question in regard to the debate over users versus manufacturer responsibility, ethnic community targeted marketing, and the ethics of business and policy decisions.

#### **Survey Prevention Efforts for Children and Youth**

Investigate the existence and effectiveness of prevention efforts directed towards youth/children (pre-drivers and new drivers) within ethnic populations/communities.

**Problem Area and Size:** High incidence of new drivers in accidents; determine existing models of prevention for effectiveness and replication within ethnic communities and groups.

**What We Don’t Know:** Insufficient data on such efforts.

**Research Issues:** To identify the difference between/among pre- and new drivers and test the effectiveness of such models.

**Likelihood of Successful Research:** Good chance of support by ethnic groups/communities if efforts prove successful.

**Application of Research Results:** Generate greater participation in diverse communities; make traffic safety more of a priority for ethnic groups; create a stronger partnership.

**Broader Issues, Political Factors, Etc.:** Use this opportunity to highlight the success of community efforts in improving traffic safety among children and youth. Increase community involvement and provide support and encourage for future efforts.

**SUMMARY**

This paper outlines the culturally competent research needs and priorities on traffic safety issues among ethnic communities. The attainment of these identified priorities and needs demand commitments and cooperation from both the NHTSA and the ethnic communities.

Priority Area 1:	Apply Culturally Competent Research Approaches
Priority Area 2:	Develop On-going Partnership in Research
Priority Area 3:	Involve Ethnic Communities as Partners for Change
Priority Area 4:	Include Ethnic Specific Data
Priority Area 5:	Improve FARS Data
Priority Area 6:	Utilize Demonstration Projects and Evaluation Studies
Priority Area 7:	Study the Effects of Alcohol Marketing
Priority Area 8:	Survey Prevention Efforts for Children and Youth

## Research Priorities for Drugs Other Than Alcohol

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### INTRODUCTION

The drug research that is needed for traffic safety purposes can be viewed as having at least two distinct components. The first priority has to be research to establish whether and how potentially impairing drugs affect driving performance. The research needs encompass drugs that have been available for some time, new drugs, and drugs for which the labeling has been changed. Data for those purposes can be obtained from laboratory experiments and field studies.

The second component is research to identify the behavioral signs and symptoms of drug impairment. There is a very large difference between the detection of impairment with sensitive measures in the research laboratory and the detection of impairment with observations of a suspect at roadside. The laboratory and field data are essential for sound policies and legislation, but many of the policies and much of the legislation must be followed by enforcement if there is to be a positive impact on drug-related problems. Traffic enforcement can proceed effectively only if an officer can recognize the signs and symptoms of drug impairment.

The world of drugs, both licit and illicit, changes continually with the result that research inevitably lags behind the usage curve. Also, because research is driven largely by society's perceptions of the illicit drugs which are most problematic, as well as by the pharmaceutical industry's requirement for data for Federal Drug Administration applications, it often proceeds somewhat haphazardly and incompletely. This paper focuses on just some of the mismatch between what is known and what needs to be known.

### ANXIOLYTICS AND ANTIDEPRESSANTS

#### Effects on Driving Performance

Studies of the effects of tranquilizers and antidepressants on driving skills report impairment ranging from minor to serious. Scant research attention has been directed, however, to some of the newer drugs in these categories or to certain conditions of use. An examination of new drugs, including those that claim to be nonimpairing, is important, but further study of some of the older drugs may actually be more important for traffic safety, because they are extensively prescribed and, in some cases, misused.

Examinations of the effects of medicines on driving skills typically begin with acute dose studies with samples of young adults. Those studies are appropriate beginnings, but when they are the entire body of published research, key questions remain unanswered. The current research issues are effects of chronic dosing, effects for patients (as opposed to healthy subjects), and effects for older users. Although difficult and under-researched, these are important topics.

Chronic dosing issues arise for example in connection with performance effects for patients who now have taken fluoxetine (Prozac) for extended time periods. Although acute dose studies reported no significant impairment of driving skills, both the effects on performance and patients' perceptions of the drug's effects may change with continued use. To illustrate the latter, if subjective awareness of the drug's effects fades over time, does a patient's attention to labeling and package insert warnings also fade? Do patients eventually disregard the admonition to avoid alcohol use in combination with the drug?

Traffic safety issues dictate laboratory study of acute and long-term effects of drugs that calm, sedate, or relieve anxiety and depression. These medicines provide enormous benefits for patients, but they differ in impairment potential. At minimum, research can generate data that will allow prescribing physicians and patients to weigh the relative driving-impairment risks of equally efficacious drugs.

### **Signs and Symptoms**

Traffic officers regularly contact drivers who are impaired by prescription drugs. They can perform their duties proficiently in connection with those drivers only if they know the signs and symptoms of abuse levels and of therapeutic doses for drugs that have been shown to impair driving.

The patients who are stopped by officers often do not understand either that a drug poses significant driving risks, or that operating a motor vehicle while impaired by licit (in some jurisdictions) and illicit drugs is prohibited by law. Officers also encounter drivers who have ingested psychoactive drugs, sometimes in very large amounts, for non-medicinal purposes. For example, diazepam and alprazolam are drugs of choice for "highs" and also to augment or offset the effects of illicit drugs.

A current problem for law enforcement is flunitrazepam (Rohypnol), the date rape drug, which is not legal in the United States but is nonetheless available and cheap. "Roofies," as the drug is known on the street, has no odor or taste and cannot be detected in a drink. Within about 10 min of unknowingly ingesting the drug, a victim experiences severe dizziness, disorientation, difficulty speaking or moving, and passes out. Upon awakening, there will be no memory of sexual assault that may have occurred, and by the time the assault finally is recognized, the drug may no longer be detectable in body fluids. Thus, the extent of the problems associated with Rohypnol is unknown. It is a dangerous drug, and police officers urgently need information about it.

## **MARIJUANA**

### **Effects on Driving Performance**

The drug-impaired drivers most frequently detected and examined at roadside by traffic officers are those who are under the influence of marijuana. Although a substantial marijuana literature dates back several decades, the drug and its users have changed during the 1990s, but the potential consequences of those changes for traffic safety are as yet poorly understood. For example, users are beginning at a younger age. The percentage of 8th graders who *ever* used marijuana more than doubled between 1991 and 1997. One worrisome aspect

of that particular change is that because youngsters are smaller in body size, they will get larger active doses than adults when they use the same amount. A larger dose, of course, means greater impairment. Whether age of initiation and duration of marijuana use have an effect on the acquisition and development of complex skills such as driving merits examination.

The increase in the potency of marijuana creates yet another 1990s research issue. Although the tetrahydrocannabinol (THC) content of marijuana now sometimes is higher than 20 percent, and 8 to 10 percent is common, the material used in extant driving research was 3 percent THC (or less). Since high potencies can produce panic attacks, nausea, and fainting, it is not surprising that marijuana-related emergency room visits have increased by 48 percent. Examination of the effects of marijuana, as it currently is used, on driving skills is a research priority.

### **Signs and Symptoms**

Officers are hampered by a lack of data directly relevant to their problems in arresting marijuana-impaired drivers. Prosecutors face a difficult task in meeting the court's requirement for evidence showing beyond a reasonable doubt that a suspect's driving ability was impaired by the drug.

Marijuana users typically exhibit a somewhat unique pattern of signs and symptoms. When a suspect has an odor of marijuana, reddened conjunctiva, rebound dilation, and a high pulse rate, an officer can reasonably conclude the person has used marijuana. Arrest and prosecution problems arise, however, because that may be the extent of reasonable and possible conclusions. The THC content of a blood or urine specimen will bear little relationship to impairment. Users will exhibit rebound dilation, and officers rely on that eye sign, but there are no scientific data to support its validity. On the Standardized Field Sobriety Tests (SFSTs), the user will not exhibit nystagmus, but walking and balance may show impairment. The SFSTs, however, were developed for alcohol, and the criteria for their performance with marijuana are ambiguous at best. At minimum, traffic officers need SFST validation data for marijuana.

## **METHAMPHETAMINE**

### **Effects on Driving Performance**

The current popularity of stimulants creates a need for data about their effects on driving performance. It also creates research problems of method and dosage. Users snort, smoke, or inject large amounts of methamphetamine over extended periods. Laboratory experiments with human subjects, however, are limited by regulation and ethics to acute or short-term, low-to-moderate doses. Such research provides only limited relevant data.

Although speeded responses can be measured with small amounts of a potent stimulant, it is difficult within laboratory restrictions to elicit and measure the aggressive, impulsive, disorganized responses that occur with over-stimulation. The research problem is compounded by the fact that some dose levels and some usage patterns produce severe

impairment during the rebound phase; i.e., when the drug has been eliminated and the user is functioning in a depressed state.

Research as usual will not suffice for methamphetamine. Innovative methods are needed to examine the drug's effects on novice versus long-term users, the effects of acute doses versus runs of several days, the effects of speed versus ice, and the effects during the high versus the down side.

### **Signs and Symptoms**

Detection of a driver's impairment by methamphetamine, or other stimulants, can be very difficult for a traffic officer. Although dilated pupils, rapid pulse, and agitation are excellent clues, they are nonspecific and may be nonexistent at moderate doses in tolerant users. Law enforcement needs laboratory research and systematic documentation of the observations of arrested drivers to establish signs and symptoms of methamphetamine, including SFST performance.

## **DESIGNER DRUGS**

### **Effects on Driving Performance**

A short list of the names of underground chemists' products includes Ecstasy, GHB, Blue Nitro, Firewater, Gamma G, Vitality, and Revivarant. There are other names for the same substances, and there are other designer drugs. Most are created by altering the molecular structure of an existing drug. Although laws now have closed the loophole, the initial intent was to create street drugs not specifically listed as a controlled substance. They are potent, and they are dangerous.

GHB, an odorless and tasteless substance that goes unnoticed in a drink is made from butyrolactone and sodium hydroxide (lye). An Internet site is a sales area for several different companies selling these products with different names in different colors and forms. Typically, they are marketed as a muscle builder or growth hormone (<http://www.cyberstrengthnutr.com/ghstimulators.htm>). The substances produce euphoria, but they can result in coma and respiratory failure with large doses or combined with alcohol.

MDMA or Ecstasy was originally synthesized as a diet pill but was never marketed for that use. It is chemically related to methamphetamine and mescaline, and it acts simultaneously as a stimulant and a hallucinogen. It is reputed to produce sociability and excitement, but these are at the cost of nausea, increased blood pressure, and uncontrollable rapid eye movement. Disorientation, sleeplessness, and paranoia can occur and may persist for weeks after a single dose. In animal studies, the drug has been shown to reduce serotonin by 90 percent for as long as 2 weeks, and to damage neurons.

These drugs, and others like them, are popular with young people, particularly at underground parties. After all-night partying and drug use, drivers clearly would be at risk of being impaired both by fatigue and the effects or aftereffects of the drugs. Research will be extraordinarily difficult, but this recipe for disaster among adolescents and young adults begs for attention.

## Signs and Symptoms

Although some information has accumulated within the ranks of law enforcement, there is no systematic body of knowledge about the signs and symptoms of designer drugs. Forensic labs do not routinely test specimens for most of them. Traffic officers may incorrectly attribute their observations of suspects who have used them to a closely related substance. When that incorrectly identified substance is not detected in a specimen, charges against the suspect probably will be dismissed. The number of these products is growing rapidly, and officers presently are hard pressed to know what to look for or how to recognize what they find.

## HERBAL PREPARATIONS

### Effects on Driving Performance

Combinations of legal and inexpensive herbals are being marketed as sources of a natural high. Ephedra (ma huang) is a primary ingredient in such products as Cloud 9 and Ultimate Xphoria, which promise *cosmic experiences* and *sexual sensations*. Users usually report somewhat less exotic effects, typically saying only that they feel relaxed and sociable.

The Food and Drug Administration has received reports of serious adverse reactions, but at this point in time there are few directly relevant data about effects on driving. Note, however, that ephedrine, which is the principal active ingredient of the herb ephedra, has CNS stimulant properties, and psychoactive properties such as stimulation, by definition, yield both abuse and impairment potential. Since herbal products are increasingly available over-the-counter and appear to be gaining in popularity, there is a need to examine their effects on performance.

### Signs and Symptoms

The state of knowledge and the needs of law enforcement, as described for designer drugs, applies also to herbal preparations.

## SUMMARY (POTPOURRI)

The high priority topics for drug research, as identified by this paper, include anxiolytics and antidepressants, marijuana, methamphetamine, designer drugs, and herbal preparations. The scientific literature lacks data about the effects of these substances on driving performance or lacks data about specific users, doses, and conditions of use.

Although traffic officers' duties include the enforcement of statutes that prohibit driving under the influence of drugs, the research implications of those duties are seldom addressed. An officer's task at roadside can be simple if the driver is obviously intoxicated, but it also can be extremely difficult if the driver is tolerant to the impairing substance, is impaired by multiple substances, or is impaired by a newly developed drug. The

problem is compounded by the fact that body fluids most often do not provide definitive proof of drug impairment.

Ineffective enforcement is counterproductive for traffic safety. Each failure by an officer to detect drug impairment, and each failed prosecution of a drug-impaired driver diminishes the effectiveness of impaired-driving statutes. Research can provide many of the tools that law enforcement officers need.

The human life span is increasing. Although most of us believe that longevity is desirable, we also understand that serious diseases and disorders often are associated with aging. Given the expected age distribution for the next century, we can predict that a significant number of drivers will be experiencing performance losses associated with aging together with the effects of medications. For example, a high blood pressure patient will be prescribed a medicine, which may carry the potential for diminished alertness, and he may take it for the rest of his life. Will there be either acute or cumulative adverse consequences for driving skills? Whether licensing criteria for aging drivers should include drug usage is a question to be answered by research.

The SFSTs have become a valuable tool for traffic officers. Recent field validation studies confirm high rates of correct arrest decisions for alcohol-impaired drivers. Research to validate the test battery for other drug categories, at minimum for stimulants and marijuana, would increase their value at roadside and in the courtroom.

## **Epidemiologic Research Needs for Drugs Other Than Alcohol**

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### **INTRODUCTION**

Epidemiologic research is an essential component of the problem-definition process in traffic safety. For defining the drug-crash problem, this process involves

- Estimating how many crashes involve “drugged” drivers;
- Determining if drugged drivers are more involved (over represented) in crashes than other drivers;
- Determining whether any overrepresentation is due to drug impairment or to some other coincident factor; and
- More detailed definition of drugged-driving and drugged drivers so that effective methods can be devised for dealing with the problem.

The literature suggests that there are enough traffic crashes involving drugged drivers to warrant proceeding to the second step, but without further progress in the second step, it cannot be said that drugged driving is or is not a significant societal problem. In this respect, the state of knowledge about the drug-crash problem is about where the state of knowledge about the alcohol-crash problem was in 1938 when Holcomb conducted his landmark study in Illinois comparing the blood alcohol concentrations of a sample of drivers who were involved in personal injury crashes with a sample of drivers who were not involved in crashes but who had been using the same roads as the crash-involved drivers.

### **BACKGROUND**

Our understanding of the current state of knowledge is based on a recent review of the drug crash literature from 1988 through 1994 that we conducted for the NHTSA. In that review we found that the epidemiologic literature on drugs and driving has continued to grow since 1987. However, nearly all of the new studies are in two areas: drug presence in drivers involved in traffic crashes and drug presence in drivers suspected of drugged driving violations. Only one U.S. study was found that examined drug presence in drivers not involved in crashes, and that study was concerned only with drivers of large trucks. No study assessed drug-crash risk by comparing the drug use of drivers who were involved in crashes with that of a similar group of drivers who were not involved in crashes.

The literature indicates that chemical tests of drivers in crashes were performed most often for marijuana, cocaine, amphetamines, benzodiazepines, and opiates. With respect to fatally injured drivers, the percentage of North American drivers positive for marijuana was in the 7 to 13 percent range. The percentages of each of the other four drugs amounted

to less than 10 percent, except in one study of cocaine in New York City which reported a figure of 14 percent.

The percentage of marijuana-positive North American drivers with nonfatal injuries was greater than that for North American drivers with fatal injuries by a factor of two or more. This is opposite the case for alcohol for which the percentage of involvement in fatally injured drivers is roughly twice that for nonfatally injured drivers. The incidence of the other four drugs did not appear to differ greatly for fatally injured drivers and for drivers suffering non-fatal injuries.

We note that all but one of the North American studies of drugs in nonfatally injured drivers involved drivers who had presented at emergency rooms (usually at a trauma center) and had then been admitted to a hospital. The subjects in the other study (Waller et al., 1995) were not necessarily admitted to a hospital and were drug-positive only about half as often as those who had been admitted to a hospital. This admissions factor may be related to the very high percentage of drug involvement reported in trauma-center studies.

Fatally injured truck drivers (only one study) had higher percentages of marijuana and amphetamines than did the fatally injured car drivers.

Foreign countries varied with respect to the percentages of crash-involved drivers with given drugs. Two British studies and two Australian study found much smaller percentages of drivers positive for drugs of abuse than did a Norwegian study, which in turn, had percentages more in the range of those found in the North American studies.

Only one U.S. study dealt with drugs in drivers using the road but not involved in a crash, and its subjects were tractor-trailer truck drivers at one location in Tennessee. The study found that some 30 percent of the drivers were positive for marijuana, cocaine, or stimulants. By contrast, a much larger roadside survey conducted chemical analyses of the saliva of drivers of vehicles of all types in Germany found less than 5 percent of the drivers to be positive for a similar range of drug types.

Drug-crash risk continues to be an unknown quantity. The single recent North American study (Terhune et al., 1992) addressing risk used the responsibility-analysis approach and found no increased fatal-crash risk associated with marijuana or cocaine alone, but a possible association of multiple drug use with increased crash responsibility. An Australian study also using the responsibility analysis approach found that only alcohol had a statistically significant increased risk of fatal-crash responsibility. The relative risk for cannabis (computed as an odds-ratio with  $p = 0.065$ ) was actually less than one, suggesting a beneficial effect of marijuana use. We note also in passing that the percentage of fatally injured trailer-truck drivers in an eight-state sample who were drug-positive was roughly the same as that found in the Tennessee tractor-trailer truck drivers using the road but not involved in a crash.

The literature did not provide much useful information about drug use among drivers who are stopped or arrested for traffic violations, suggesting "ballpark" estimates for drivers arrested for driving while intoxicated in the 1 to 10 percent range. These studies indicate strongly that relatively high percentages of such drivers who are also suspected of "drugged" driving by the police and are evaluated by drug recognition experts are positive for a number of drugs that could impair driving performance.

In sum, the main reason for this review was to identify and assess recent scientific research that might enable one to make better estimate of the magnitude of the drug-crash problem in the United States. We have found that such research indicates that

- The percentage of drug-positive drivers in crashes is lower than the percentage of alcohol-positive drivers in crashes, but still not negligible.
- The role of drugs as a causal factor in traffic crashes involving drug-positive drivers is still not understood. Drug risk factors are still not known, with some evidence suggesting little or no increase in crash risk at drug levels being detected by current chemical test procedures. Further, such procedures do not enable one to predict whether a driver testing positive for a drug, even at some measured level of concentration, was actually impaired by that drug at the time of crash. This is in sharp contrast to alcohol where blood alcohol content (BAC) measurements can provide a good estimate of impairment.

Another complicating factor is the role of drugs taken in combination with alcohol. Most of the percentages given above are the percentage with drugs alone plus the percentage with drugs in combination with alcohol. For many drugs, a drug in combination with alcohol accounts for a significant percentage of the occurrences of that drug in crash victims. Waller et al. (1995) found that roughly one-half of the occurrences of drivers positive for marijuana, cocaine, and/or opiates had elevated BACs, and that the crashes of drivers testing positive for drugs alone were very similar to the crashes of drivers testing negative for both alcohol and drugs. This adds further doubts about the role of drugs in the impairment of crash-involved drivers, and suggests that it may be much smaller than had been suspected.

Thus, the literature does not allow one to say whether drugged driving is or is not a significant societal problem, although there is some evidence to suggest that if it is, then its magnitude is considerably less than the drunk driving problem.

We recommend that a program of research be undertaken to assess the traffic-crash risk associated with the potentially impairing drugs that appear at this juncture to be the most prevalent in serious traffic crashes in the United States. These drugs are marijuana, cocaine, amphetamines, and benzodiazepines. This research program should compare the drug use of drivers who were involved in crashes with that of a similar group of drivers who were not involved in crashes. The program should concentrate first on fatal crashes and should be of sufficient geographic scope to enable some reasonable assessment of the general magnitude of any drugged-driving problem nationwide to be made. We recognize that such a research program poses some formidable difficulties, especially with respect to drugs in on-the-road, noncrash-involved drivers. Nevertheless, work must begin if further progress is to be made in defining the drug-crash problem in this country.

This paper outlines some critical research needs and priorities for overcoming this barrier to progress in drug-impaired driving research.

## RESEARCH NEEDS AND PRIORITIES

### Measurement and Quantitation of Drugs

**We Don't Know:** The number of fatal-crash involved drivers who are impaired by which drugs.

**Research Issue:** Update the report by Terhune et al. (1992) on the incidence and role of drugs in fatally injured drivers.

**Likelihood of Success:** Very high.

**Effects:** Would provide current information for use in designing risk studies.

**Other:** This research should be conducted periodically.

### Measurement and Quantitation of Drugs

**We Don't Know:** How many noncrash involved drivers are impaired to what extent by which drugs?

**Research Issue:** As a starting point, determine appropriate means of quantitating controlled substances in on-the-road drivers.

**Likelihood of Success:** Good if realistically funded.

**Effects:** Would enable meaningful research on drug-crash risk to begin.

**Other:** Legal constraints, perceived as well as actual, could be crucial to success.

### Magnitude of the Drug-Crash Problem

**We Don't Know:** The relative risk of a drug-related traffic crash of a given level severity (e.g., fatal, injury, property damage).

**Research Issue:** As a starting point, what is the relative risk of a fatal crash associated with various levels of controlled substances?

**Likelihood of Success:** Good for an initial study of a few drugs in one or a few jurisdictions.

**Effects:** Would greatly facilitate the allocation of resources to the entire area of drug-impaired driving.

**Other:** There are many obstacles to overcome, foremost among which is the issue of quantitation of drugs in the field. Varying drug usage patterns over time could also present a problem, necessitating periodic updates of the research. Responsibility analysis has been suggested as alternative approach to risk analysis.

### **Magnitude of the Drug-Crash Problem**

**We Don't Know:** Alternative methods for determining drug-crash risk.

**Research Issue:** Identify risk analysis techniques that could be transferred from other disciplines (e.g., the medical sciences) to obviate the need for obtaining specimens from roadside surveys.

**Likelihood of Success:** Worth a try.

**Effects:** Would greatly simplify the determination of risk, thus leading to a defensible plan for addressing (or not addressing) drug-impaired driving.

**Other:** Would not cost very much and cannot hurt.

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The workshop facilitators and reporters quickly brought order and structure to the many proposed ideas in each working group. Their reports form the heart of this Circular.

Without the assistance of the sponsoring organizations, this workshop would not have occurred. The Committee is profoundly grateful to these organizations, both for their financial support of the workshop and, for the sponsors that fund research, for their commitment to use the resulting priorities in developing their research funding plans. The sponsoring organizations are the Centers for Disease Control and Prevention; the International Council on Alcohol, Drugs, and Traffic Safety; NHTSA; the National Institute on Alcohol Abuse and Alcoholism; the National Institute on Drug Abuse; the National Transportation Safety Board; and Transport Canada.

## APPENDIX A

# Workshop Schedule

Transportation Research Board Midyear Meeting and Workshop  
Committee on Alcohol, Other Drugs, and Transportation  
Irvine, California  
August 19-20, 1999

### RESEARCH NEEDS AND PRIORITIES

#### Thursday, August 19

- 7:00–8:30 a.m. Breakfast at Beckman Center
- 8:30–8:45 a.m. Workshop introduction, other TRB committee business  
*Allan Williams, Chair*
- 8:45–8:50 a.m. Workshop overview  
*Jim Hedlund*
- 8:50–9:00 a.m. NHTSA's goals for the workshop  
*Jim Fell*
- 9:00–9:45 a.m. Research needs: general public  
*David Preusser and Evelyn Vingilis*  
Discussion
- 9:45–10:30 a.m. Research needs: youth  
*Ralph Hingson and Bob Voas*  
Discussion
- 10:30–11:00 a.m. Break
- 11:00–11:45 a.m. Research needs: repeat offenders  
*Doug Beirness and Ray Peck*  
Discussion
- 11:45–12:30 p.m. Research needs: special populations  
*Sue Ferguson and Francis Yuen*  
Discussion
- 12:30–1:30 p.m. Lunch
- 1:30–2:15 p.m. Research needs: drugs other than alcohol  
*Marcy Burns and Ralph Jones*  
Discussion
- 2:30–5:30 p.m. Breakout discussions  
(Discussion groups can break whenever they wish)
- 6:30–8:00 p.m. Reception at the Hyatt Newporter

#### Friday, August 20

- 7:00–8:30 a.m. Breakfast at Beckman Center
- 8:30–9:10 a.m. General public breakout report, general discussion
- 9:10–9:50 a.m. Youth breakout report, discussion

9:50–10:30 a.m.	Repeat offenders breakout report, discussion
10:30–11:00 a.m.	Break
11:00–11:40 a.m.	Special populations breakout report, discussion
11:40–12:20 p.m.	Drugs other than alcohol breakout report, discussion
12:30–1:30 p.m.	Lunch
1:30–3:00 p.m.	General discussion on overall priorities
3:00–3:30 p.m.	Break
3:30–5:00 p.m.	General discussion on funding priorities and funding agency practices

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### **Sponsors**

Centers for Disease Control and Prevention

National Highway Traffic Safety Administration

National Institute on Drug Abuse

Transport Canada

International Council on Alcohol, Drugs and Traffic Safety

National Institute for Alcohol Abuse and Alcoholism

National Transportation Safety Board

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