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 multicommunity 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 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.

REFERENCES

Blomberg, R. D. Lower BAC Limits for Youth: Evaluation of the Maryland .02 Law. DOT HS 808 807. NHTSA, U. S. Department of Transportation, Washington, D.C., 1992.

Fatality Analysis Reporting System. NHTSA, U. S. Department of Transportation, Washington, D.C., 1998.

Forster, J. L., P. G. McGovern, A. C. Wagenaar, M. Wolfson, C. C. Perry, and P. S. Anstene. The Ability of Young People to Purchase Alcohol Without Age Identification in Northeastern Minnesota. *Addiction*, Vol. 89, No. 6, June 1994, pp. 699-705.

Forster, J. L., D. M. Murray, M. Wolfson, and A. C. Wagenaar. Commercial Availability of Alcohol to Young People: Results of Alcohol Purchase Attempts. *Preventive Medicine*, Vol. 24, No. 4, July 1995, pp. 342-347.

Fourth Report to Congress. Effectiveness of Occupant Protection Systems and Their Use. Report DOT HS 809 919. NHTSA, U. S. Department of Transportation, Washington, D.C., 1999.

Grant, B. The Impact of Family History of Alcoholism on the Relationship Between Age at Onset of Alcohol Use and DSM-III Alcohol Dependence. *Alcohol Health and Research World*, Vol. 22, No. 2, 1998, pp. 144-147.

Heltzer, J. E., A. Barnem, and L. T. McEvoy. Alcohol Abuse and Dependence. In *Psychiatric Disorders in America: The Epidemiologic Catchment Area Study* (L. Robins and D. Reiger, eds.) McMillan, New York, 1991.

Hingson, R., T. Heeren, and M. Winter. Lower Legal Blood Alcohol Limits for Young Drivers. *Public Health Reports*, Vol. 109, No. 6, Nov.-Dec. 1994, pp. 738-744.

Hingson, R., J. Berson, and K. Dowley. Interventions to Reduce College Student Drinking and Related Health and Social Problems. In *Alcohol: Minimizing the Harm* (M. Plant, E. Simple, and T. Stockwell, eds.) Free Association Books, London, 1997.

Hingson, R. Substance Abuse Treatment Needs in Massachusetts. Massachusetts Department of Public Health, 1997.

Hingson, R., T. Heeren, A. Jamanka, and J. Howland. Age of Drinking Onset and Unintentional Injury Involvement after Drinking (in press).

Hingson, R., T. Heeren, M. Winter, and H. Wechsler. Effects of Zero Tolerance Laws on Drinking and Driving Among College Students Under Age 21 (in press).

Martin, C. S., and K. C. Winter. Diagnosis and Assessment of Alcohol Use Disorders Among Adolescents. *Alcohol Health and Research World*, Vol. 22, No. 2, Spring 1998, pp. 95-105.

National Survey of Drinking and Driving Attitudes and Behaviors, 1995. Report DOT HS 808 438. NHTSA, U. S. Department of Transportation, Washington, D. C., 1996.

O'Malley, P. M., and A. C. Wagenaar. Effects of Minimum Drinking Age Laws on Alcohol Use, Related Behaviors and Traffic Crash Involvement Among American Youth. *Journal of Studies on Alcohol*, Vol. 52, No. 5, 1991, pp. 478-491.

O'Malley, P. M., and L. D. Johnston. Drinking and Driving Among High School Seniors. *American Journal of Public Health*, Vol. 89, No. 5, May 1999, pp. 678-684.

Perry, C. L., C. L. Williams, S. Veblen-Mortenson, T. Toomey, K. Komro, P. S. Anstine, P. McGovern, J. R. Finnegan, J. L. Forster, A. C. Wagenaar, and M. Wolfson. Outcomes of a Community-Wide Alcohol Use Prevention Program During Early Adolescence: Project North-land. *American Journal of Public Health*, Vol. 86, No. 7, 1996, pp. 956-965.

Preusser, D. F., and A. F. William. Sales of Alcohol to Underage Purchasers on Three New York Counties and Washington D. C.. *Journal of Public Health Policy*, Vol. 13, No. 3, Autumn 1992, pp. 306-317.

Rating the States: A Report Card on the Nation's Attention to the Problem of Alcohol and Other Drug-Impaired Driving, 1996. Mothers Against Drunk Driving, Irving, Tex., 1997.

Research Note. National Occupant Protection Use Survey—1996. Controlled Intersection Study. NHTSA, U. S. Department of Transportation, Washington, D. C., 1997.

Traffic Safety Facts 1997: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and General Estimate System. Report DOT HS 808 806. NHTSA, U. S. Department of Transportation, Washington, D. C., 1998a.

Traffic Safety Facts 1997: Alcohol. Report DOT HS 808 764. NHTSA, U. S. Department of Transportation, Washington, D. C., 1998b.

Voas, R. B., A. E. Rhodenizer, and C. Lynn. Evaluation of Charlottesville Checkpoint Operation. Technical Report Contract DTN No. 2283C05088, NHTSA, Washington, D.C., 1985

Voas, R. B., and A. S. Tippetts. Minimum Legal Drinking Age and Zero Tolerance Laws: Do They Reduce Alcohol-Related Crashes? (In review)

Wagenaar, A. C., D. Murray, J. Gehan, M. Wolfson, J. L. Forster, T. L. Toomey, C. L. Perry, and R. Jones-Webb. Community Mobilizing for Change on Alcohol: Outcomes from a Randomized Community Trial. *Journal of Studies on Alcohol*, (In press).

Wechsler, H., G. W. Dowdall, G. Maener, J. Gledhill-Hoyt, and H. Lee. Changes in Binge Drinking and Related Problems Among American College Students Between 1993 and 1997. Results of the Harvard School of Public Health College Alcohol Study. *Journal of College Health*, Vol. 47, No. 2, Sept. 1998, pp. 57-68.

Zador, P. L. Alcohol Related Relative Risk of Fatal Drive Injuries in Relation to Driver Age and Sex. *Journal of Studies on Alcohol*, Vol. 52, No. 4, 1991, pp. 307-310.