persistent the persistent drinking driver is and whether different subgroups are differentially resistant.

REFERENCES

1. Andenaes, J. The Scandinavian experience. In: Social Control of the Drinking Driver. M.D. Laurence, J.R. Snortum, and F.W. Zimring (Eds.). Chicago, Illinois: University of Chicago Press, 1988, 43-63.

2. Beirness, D.J.; Simpson, H.M.; Mayhew, D.R. and Wilson, R.J. Trends in Drinking Driver Fatalities in Canada. *Canadian Journal of Public Health*, 1994, 85, 19-22.

3. Beirness, D.J.; Simpson, H.M. and Mayhew, D.R. Assessment of the Impact of the 1985 Amendments to the Drinking and Driving Section of the Criminal Code of Canada. Ottawa: Justice Canada. 1993.

4. Gjerde, H. and Morland, J. Repeat Offences Among Arrested Drunken Drivers. *Journal of Traffic Medicine*, 1990, 18, 175-178.

5. L'Hoste, I. and Papoz, L. The role played by acute and chronic alcoholism in road accidents: The results of an epidemiological study conducted in France. *In: S. Kaye (Ed.) Alcohol, Drugs and Traffic Safety.* Washington, D.C.: NHTSA, 1985, 841-858.

6. Mayhew, D.R.; Simpson, H.M.; Beirness, D.J. and Warren, R. Drinking and Driving in Canada. *Alcohol, Drugs* and *Traffic Safety - T92*. Cologne: Verlag TUV Rheinland.

7. Mayhew, D.R.; Simpson, H.M. and Brown, S.W. Alcohol Use by Persons Fatally Injured in Motor Vehicle Accidents: Canada, 1992. Ottawa: Transport Canada, 1994.

8. Simpson, H.M. Drinking and Driving in the 1980s: Did Things Really Get Better? Journal of the Alcoholic Beverage Medical Research Foundation, 1993a, 3, 75-78.

9. Simpson, H.M. Decline in drinking and driving crashes, fatalities and injuries in Canada. Paper presented at the Conference on Traffic Safety on Two Continents, Hague, Netherlands, September 22-24, 1993b.

10. Simpson, H.M. and Mayhew, D.R. The Hard Core Drinking Driver. Ottawa: Traffic Injury Research Foundation, 1991.

11. Simpson, H.M.; Mayhew, D.R. and Beirness, D.J. National Survey on Drinking and Driving. Ottawa: Health and Welfare Canada, 1992.

Boston University School of Public Health

Summary

Chronic drunk driving is often exhibited by persons who have not been arrested for driving while intoxicated (DWI). Analyses of ways to reduce this behavior must go beyond analyses of specific deterrence and reeducation and treatment of arrested offenders. This paper reviews environmental interventions to reduce persistent driving while intoxicated.

Several environmental interventions have been demonstrated to reduce driving while intoxicated and related fatal crashes:

• the minimum legal drinking age of 21

increased taxes on alcohol

• server intervention and legislation requiring server intervention training is a condition of alcohol sales licensing

• active enforcement of server training laws targeting alcohol sales outlets

• dram shop legislation

• maintaining state monopoly control over sales of alcoholic beverages

• reducing alcohol outlet density on a geographical and per capita population basis

• lowering legal blood alcohol limits particularly to .00-.02 percent for drivers under 21. Preliminary studies also suggest lowering to .08 percent for adults and .04 percent for repeat offenders can produce some declines in alcohol related fatal crashes.

Problem Chronic Driving While Intoxicated

In 1992 in the United States 1.6 million individuals were arrested for driving after drinking. Although precise estimates are not available, at least 20-30 percent had been previously arrested on the same charge in the past 10 years. Among persons jailed for DWI, more than half had been previously incarcerated for DWI. (Cohen, 1992)

In 1992, 11,359 drivers in fatal crashes had blood alcohol levels above .10 percent the legal level of intoxication in most states. Of drivers in fatal crashes 2,252 (20 percent) had received a citation for driving while intoxicated in the previous 3 years. (U.S. Department of Transportation, 1993) Probably 30 percent or more of drivers in fatal alcohol related crashes have at some point in their lives been arrested for DWI.

Of course, not all persons who frequently drive above the legal limit have been previously arrested. A 1993 statewide

Massachusetts random digit dial survey of adults aged 20 years and older N=1,714 revealed that in the previous month 6 percent drove after drinking 5+ drinks, 3 percent did more than once and nearly 1 percent at least weekly. Yet less than 1 percent were arrested in the previous year. Based on these estimates for every drunk driving arrest there are more than 200 drunk driving trips in that age group.

Among 1,056 16-19 year olds in Massachusetts also surveyed using random digit dialing the same year 4 percent reported driving after 5+ drinks, 3 percent did so more than once, and 2 percent reported driving after 5+ drinks at least once per week. Yet, only one teenager reported being arrested. The rate of arrest for teens per drunk driving trip was substantially lower than among adults 1/600 drunk driving trips.

The clear and inescapable conclusion is that a great deal of chronic repeat drunk driving occurs that does not result in arrests and that many frequent repeat drunk drivers escape arrest altogether.

Environmental Approaches

Because many chronic repeat drunk drivers are never or rarely arrested, strategies to alter repeat driving must look beyond the literature on specific deterrence of convicted DWI offenders. Several types of environmental strategies can be considered. These interventions can reduce persistent impaired driving in two ways. First, they can limit the overall proportion of the population that drives while impaired which in turn reduces the numbers of persons who may become persistent impaired drivers. Second, these approaches may directly limit repeat impaired driving among those who have already driven while impaired.

Minimizing Legal Drinking Age

First, are policies to reduce the availability of alcohol to persons who drive. The General Accounting Office reviewed results from 14 studies meeting their methodologic requirements and concluded that the minimum purchase age of 21 reduced alcohol involved fatal crashes 5-28 percent. (General Accounting Office, 1987) Studies of the minimum alcohol purchase age of 21 have found that this measure reduced fatal crashes among 18-20 year olds by 12 percent and prevents over 800 deaths involving drivers in that age group each year. (National Highway Traffic Safety Administration, 1991)

O'Malley and Wagenaar (1991) found that raising the drinking age was associated with lower rates of drinking not only when individuals were under the age of 21, but also during the ages of 21-25. (O'Malley and Wagenaar, 1991)

Taxes

Between 1975 and 1990 the real prices declined for distilled spirits by 32 percent, wine 28 percent and beer by 20 percent. Chaloupka (1993) has recently summarized the work of Cook 1981, Saffer and Grossman 1987a, 1987b which consistently found that alcohol tax increases can reduce alcohol related traffic fatalities. Of note Cook found that a \$1 increase in state excise tax on distilled spirits lowered both per capita consumption and cirrhosis death rates at the same rate. That means that even heavy chronic addictive drinking likely to be found among persistent drinking drivers can be influenced by tax increases.

Grossman and colleagues (1991) examined motor vehicle fatalities using a time series of annual state cross sections covering the 48 contiguous states from 1982-1988. Three different fatality rates were examined both for the overall population and for young people age 18-20. The effect of the recent 1991 tax increase on alcohol was simulated. They reported that had the 32¢ per six pack tax been present throughout the period, an estimated 1,744 fewer people might have died each year and 671 of those each year would have been 18-20 year olds. They further estimated that if beer tax had been set at 81¢ per six pack from 1982-1988 (based on a tax of 25¢ per ounce of pure alcohol) an estimated 7,142 fewer people of all ages would have been killed annually, 2,187 of whom would be youth and young adults, a considerably greater life saving in the 18-20 year old age group than has been attributed to the minimum legal drinking age of 21.

Server Intervention

The largest single point of departure of alcohol impaired drivers in the U.S. is bars and restaurants (McKnight, 1993). Between 1/3 and 1/2 of intoxicated drivers consumed their last alcohol at these locations based on drivers given alcohol tests in roadside surveys (Palmer 1988 and Foss 1990) and drivers injured in automobile crashes (Santone and Martinez, 1992). Breath tests given patrons leaving bars have revealed that approximately 1/3 have BAL's above the legal limit (Werch 1988, Stockwell, 1992).

Yet servers rarely refuse drinks to intoxicated patrons. McKnight (1991) reported that in more than 1,000 visits to 238 drinking establishments in 8 states research personnel simulating obvious signs of intoxication were refused a drink only 5 percent of the time. In the 1993 Massachusetts survey 14 percent of respondents age 20 and older reported drinking 5+ drinks in the previous month at a bar while 30 percent of them drove after drinking that much at a bar, yet less than 1 percent of them were asked not to drive by a server and only 2 percent of them reported being refused service. During the 1980's server training programs proliferated and in some communities and in some states server training became a condition of licensing.

McKnight divides server training programs into awareness, server and manager programs. Awareness courses seek to persuade community leaders of the need for these courses. Server courses help servers avoid serving alcohol to minors and intoxicated patrons. Management courses discuss ways to enhance hospitality that do not encourage over drinking.

Evaluations of server training have produced mixed results but some studies show they can modify serving practices that help reduce the rate and amount of alcohol consumed by patrons (Salz, 1987) (Russ and Geller, 1987).

The first controlled evaluation of server training was completed by Salz (1987) in a naval base bar in San Diego. Compared to a matched bar which received no server training, the bar that experienced reductions in self reported consumption of customers and actual BAL levels. Geller, Russ and Delphos (1987) and Gliksman and Single (1988) in separate studies found server training yielded more direct interventions with intoxicated customers.

Hennessey (1991) evaluated server training in civilian alcohol establishments in 2 Northern California communities. He found lower BAL's among customers in one community but no effect in others. McKnight (1987) found server training yielded more interventions with customers following training in Michigan but not Louisiana.

The magnitude of change however, is not always large. McKnight (1991) compared 100 establishments in 8 states given extensive server training to 138 establishments that did not receive training. He reported that the rate of refusal of service to researchers simulating intoxication increased only from a baseline of 5 percent to a post training 7 percent while intervention with truly intoxicated patrons from 3 percent to 6 percent.

Holder and Wagenaar (1994) published the first evaluation of mandated server training on a statewide level that examined the effects of the law on single vehicle night time crashes. Oregon in 1985 became the first state to mandate server training. Effective January 2, 1987, all new applicants for beverage service permits were required to successfully complete a state approved server training course. The bill also required all persons holding alcohol retail licenses or applying for new licenses to complete management training programs on the 5 year anniversary when their permit expired resulting in all license holders being trained by 1991. By the end of 1988 36,000 servers and 6,000 owner managers had completed the course and an additional 13,000 new servers completed it each year.

An ARIMA time series analysis comparing Oregon to the rest of the contiguous U.S. states from 1976-1990 indicated

that in the first 6 months of the law SVN crashes declined 4 percent. The decline increased to 11 percent by the end of the first year, 18 percent the end of the second year and 23 percent the end of the third year.

Unfortunately, the authors did not have direct evidence of changes in alcohol server behavior although 68 percent of those who completed the course self reported changes in their behavior (Oregon Liquor Control Commission). This makes it difficult to assess whether all of the substantial 23 percent reduction can be directly attributed to this specific legislation.

Sanctions Against Service to Intoxicated Persons

Active enforcement can enhance the effects of server training laws. All states have either criminal or civil sanctions against serving patrons who are obviously intoxicated. (Holder, 1992) McKnight (1992) found that frequency of service intervention or termination with intoxicated patrons dropped from 84 percent to 47 percent after visits and warnings by law enforcement. It then rose to 58 percent several months later. There was a corresponding drop in the percentage of persons arrested for DUI who came from a bar or restaurant from 32 percent to 23 percent.

Dram Shop Laws

All but seven states recognize some form of server liability either by legislative enactment or by common law principally. These regulations permit persons to sue for damages they may have incurred as a result of service to a minor or intoxicated patron.

Wagenaar and Holder (1991) studied single vehicle night time motor vehicle crashes that resulted in injury or death following major dram shop cases in Texas in 1983 and 1984 and reported declines of 6.6 percent and 5.3 percent respectively when compared in a time series analysis to the rest of the contiguous United States. The reductions occurred when the cases were filed not when the verdicts were reached suggesting pre trial publicity had an impact on server behavior in establishments throughout the state.

State Monopoly vs. Privatized Sales Outlets

Eighteen states have some from of monopoly control. Gruenwald in a recently review (1993) concluded physical availability of spirits is greatest in license states and least in monopoly states. Physical availability of beer is greatest in monopoly states and least in license states and alcoholic beverage prices tend to be greatest in monopoly states.

However, relatively little research has examined the impact of state alcohol sales regulation on alcohol use or related problems. Implementation of liquor by the drink in North Carolina resulted in an increase in spirits sales between 6 and 7 percent. Police reported alcohol related accidents and single vehicle night time accidents both rose 16-24 percent (Blose and Holder 1987, Holder and Blose 1987).

Conversion of Iowa and West Virginia from monopoly to license states (allowing private retail sales of wine and spirits resulted in increases sales of alcoholic beverages in both states (Wagenaar and Holder, 1991, Holder and Wagenaar 1990). Unfortunately, those analyses did not examine the impact of increases sales on alcohol related traffic crashes thus leaving questions about the effects of these policies.

Outlet Density

Gruenwald et. al. have also reported that greater the geographic spread between people and outlets and the lower the ratio of outlets to people the lower the observed sales of alcohol. A state level 10 percent increase in outlet density results in a 4 percent increase in sales of spirits and a 3 percent increase in sales of wine. Research by Rush and colleagues (1986) and Watts and Rabow (1983) suggests the greater physical availability of alcohol is related to higher arrest rates for public drunkenness and drunk driving.

Dull and Giacopassi (1988) examined alcohol control regulation (wet vs. dry) and outlet density in 95 counties of Tennessee. After analytically controlling for population size, percent change in population, urbanization and percent nonwhite they found both outlet density and absence of restrictions on alcohol sales were associated with increased motor vehicle mortality.

Lower Legal Blood Alcohol Limits

There is increasing evidence from four types of studies that blood alcohol concentrations well below the current .10 percent legal standard in most states impair a variety of physiologic responses that in turn impair driver performance.

First, experimental laboratory studies have shown that at .08 percent, a level reached by a 150 pound person consuming four drinks in an hour on an empty stomach, there is:

- reduced peripheral vision
- poorer recovery from glare
- poor performance in complex visual tracking
- reduced divided attention performance
- (Moskowitz and Burns, 1990)

Second, driver simulation and road course studies have revealed poorer parking performance, driver performance at slow speeds and steering inaccuracy (Mortimer and Sturgis, 1975).

Third, roadside observational studies have identified increased speeding and breaking performance deterioration (Damkot et al.1975).

Fourth, in a very important study (Zador, 1991) obtained breath alcohol samples from 2,850 drivers stopped in a national, probability sample survey of 34 localities in 1986. Although participation was voluntary, 92 percent of the drivers stopped provided samples. These breath test results were compared to the breath test results of drivers killed in single vehicle traffic crashes in 1986 in the U.S. Department of Transportation's Fatal Accident Reporting System. Data were taken only from 29 states that test at least 80 percent of fatally injured drivers. To match driver fatalities to the roadside breath testing exposure, crash times, days and roadway types were restricted to those used in the survey.

They found that each .02 increase in BAC limit of a driver nearly doubles the risk of being in a single vehicle fatal crash. For each .02 percent increase in BAC the fatal crash risk rises even more for younger drivers and for female drivers, a finding also reported by Mayhew and Simpson. For drivers under 21, impairment begins with the first drink. But in all age and sex groupings in the study at BAL of .05 to .09 percent, the likelihood of being a fatally injured driver was at least 9 times greater than at zero BAL.

Effects of Lowering Blood Alcohol Limits Lower BAL's for Minors

Twenty-nine states and the District of Columbia have set lower legal blood alcohol limits for young drivers under the age of 21 than for adults.

An analysis of the first 12 states to lower legal blood alcohol limits for youth revealed that during the post law period the proportion of fatal crashes that involved single vehicles at night declined 16 percent among young drivers targeted by those laws while it rose 1 percent among drivers in nearby comparison states. Lowering BAL's to .00 percent or .02 percent (zero tolerance laws) produced a 20 percent greater decline than in comparison states, but no significant reduction occurred in states that lowered to 04 percent-.06 percent relative to comparison states. Based on the magnitude of results observed one can estimate that if all states adopted .00 percent or .02 percent BAL limits for drivers 15-20 at least 375 single vehicle night fatal crashes involving teenage drivers would be prevented each year (Hingson, in press).

Adult Drivers

Of course, it is important to remember that each .02 percent increase in blood alcohol level disproportionately creates greater crash risk for teen drivers than it does for adults. Consequently it is important to study whether lowering legal blood alcohol limits will have as sharp an impact among adults as it does among adolescents.

Evidence is beginning to emerge in the U.S. that lowering BAL among adults to .08, will have some beneficial effect. Australia and New Zealand as well as many European nations have lowered the legal blood alcohol limit to .05. In the United States, 12 states have implemented .08 percent blood alcohol limits, seven within the past year.

California's .08 Law

The largest state to reduce the legal BAC limit is California which lowered it to .08 in January 1990. Six months later California also passed an Administrative Per Se Law that permitted police to administratively suspend a drivers license. A preliminary analysis for the National Highway Traffic Safety Administration (1991), using time series analysis ARIMA modeling (which controlled analytically for mileage driven and economic conditions as measured by unemployment rates) found a 12 percent decline in alcohol related fatal crashes during the first year after the law compared to the previous four. No decline in non alcohol related fatal crashes was observed during the same time period.

Unfortunately, because only one year of post law data were analyzed, and no comparison area was monitored the results must be regarded as preliminary. Further, the effects of the .08 regulation are difficult to separate from the administrative per se provision effects.

Rogers (1994) recently summarized time series analyses examining 36 months of post .08 percent law in California. She did not find any significant effect of the law on trends in night fatal and injury crashes relative to day fatal or injury crashes. Nor did night fatal compared to day fatal crashes decline significantly after the .08 percent law. However, she found a significant reduction in fatal crashes where police indicated a driver had been drinking after the .08 percent law. An analysis of fatal-injury crashes from 2:00 am - 3:00 am immediately after bar closings also revealed a significant decrease.

Maine's .08 percent law and .04 percent for Operating Under the Influence (OUI) Offenders

In August 1988 Maine lowered its legal blood alcohol limit from 10 percent to .08 percent. Maine already has an administrative per se law so the .08 provision was incorporated into that law. Maine also lowered its legal BAL limit to .04 percent for persons with a previous OUI conviction. The first three years after Maine's .08 law were compared to the previous five. New Hampshire and Vermont were examined as comparison states to Maine because they have similar weather, population, and economic conditions as Maine and neither had a .08 law during the time frame of this analyses.

Maine experienced a 19 percent decline in night fatal crashes during the law's first three year while New Hampshire and Vermont actually experienced a 3 percent increase. Night fatal crashes declined from a pre law annual average of 80 to a post law average of 65. In contrast, in New Hampshire and Vermont, the pre law average was 89 and the post law average was 91 (p<.03 based on testing using log linear analysis). In contrast, day time fatal crashes in Maine showed no decline, 126 to 126, after the law was passed in Maine and an 11 percent decline was observed in New Hampshire and Vermont (178 to 158). These shifts in daytime crashes were not significant.

Further, night fatal crashes involving drivers with previous OUI convictions declined 38 percent in Maine during the three post law years while they increased 50 percent in New Hampshire and Vermont, also a highly significant difference (p = .02). To assess whether these findings may have been influenced by differential shifts in mileage driven in Maine relative to New Hampshire and Vermont, we obtained mileage data for each state from the Federal Highway Administration. In both areas travel miles have increased at a comparable rate since 1983, ruling that out as a potential confounding factor.

Finally, according to the Highway Safety Bureau in Maine for the past 10 years 1983 - 1992, the average number of alcohol related traffic deaths each year has declined 35 percent since the Maine lower BAL limits were passed from 112 to 76. The proportion of fatal crashes in Maine that involve alcohol declined from 53 percent during the five years before the law to 37 percent during the four full years after the law.

Taken together, these data clearly show reductions in Maine in alcohol related fatal crashes after the BAL limits for all drivers and OUI offenders were lowered.

Both New Hampshire and Vermont have now also adopted a .08 percent legal standard.

Other Environmental Intervention at the Community Level

Wittman (1993) has identified several other environmental interventions that several communities are currently implementing that can plausibly reduce drinking and persistent drunk driving but for which a body of scientific empirical data have not been collected. These include:

1) Alcohol free public events - fairs or festivities where no alcohol is served (e.g. New Years public celebrations, sport events or rock concerts).

2) Local public ordinances such as beer keg identification laws Purchase of a keg requires a deposit and serial tags affixed to kegs to permit tracing of the purchase of kegs used by minors.

3) Local general ordinances that allow localities to manage drinking in public places or events and to use nuisance abatement procedures against owners of private property who permit AOD use/sales on their property in ways that violate civil and criminal laws.

4) Voluntary agreements - informal agreements and mediation that are a first try effort to resolve differences between parties directly involved in an alcohol or other drug availability problem.

5) Organized collaboration between multiple agencies within city, county, state or federal government to develop an overall cohesive plan to reduce drinking and driving. At the community level such efforts could involve cooperation between police, schools, health, engineering and parks and recreation departments, as well as concerned private citizens and organizations.

A comprehensive 5 year community intervention using the type of organized collaboration described above was recently implemented in Massachusetts to reduce alcohol related fatal crashes (the Saving Lives Program). Task forces of private citizens and public officials from multiple city departments organized school based and public education, publicity about police enforcement, alcohol server training programs, speed watch telephone hot lines, pedestrian safety initiatives and beer keg registration and liquor outlet surveillance to reduce under age drinking. Fatal crashes declined 33 percent during the 5 program years compared to the previous 5, a significantly greater decline than the 12 percent reduction observed in the rest of the state. Fatal crash declines were particularly marked (over 40 percent) among drivers under age 25 and in fatal crashes involving alcohol. Several other community projects with similar organizational design are currently being studied in other areas of the country.

Summary - Environmental Approaches

Some environmental interventions have clearly been demonstrated to reduce persistent driving while intoxicated including raising the minimum drinking age to 21, and active enforcement of that law, increasing taxes on alcoholic beverages, zero tolerance laws for youth and administrative license revocation.

There is also evidence that a number of other interventions will probably reduce persistent driving while intoxicated: lowering legal blood alcohol limits for adults to .08 percent, server intervention programs including legal mandates for server intervention, dram shop laws, lowering alcohol outlet density, monopoly sales of alcohol, improved alcohol outlet management such as requiring sales of food at bars not selling cold beer at gasoline stations or banning happy hours and the use of conditional use permits to regulate location and hours of sale. Community organizing of multiple city departments with the involvement of private citizens is currently being studied and has produced some positive benefits.

Several other types of interventions are plausible and promising but as yet have received minimal research attention: ordinances requiring beer keg registration, alcohol free public events, and lowered legal blood alcohol limits for persons previously convicted of DWI.

Many of these are legal and regulatory interventions at the state level. Others can be implemented at the community level. Active enforcement and education about all these interventions has to also be undertaken at the community level for them to achieve their fullest effects.

REFERENCES

1. Blose, J.; Holder, H.D. Liquor by the Drink and Alcohol Related Traffic Crashes: A Natural Experiment Using Time Series Analysis, *Journal of Studies on Alcohol*, 48(1):52-60, 1987.

2. Chaloupka, F. Effects of Price on Alcohol Related Problems, Alcohol, Health and Research World 17:1999, 46-54.

3. Cook, P.J. The Effect of Liquor Taxes on Drinking, Cirrhosis and Auto Accidents in Moore, M.H. and Gerstein, D.R. eds. *Alcohol and Public Policy: Beyond the Shadow* of *Prohibition*, Washington, D.C. National Academy of Sciences, 1981, pp 225-285.

4. Damkot, D.K.; Perrine, M.W.; Whitmore, D.G.; Todissie, S.R. and Geller, H.A. On the Road: Driving Behavior and Breath Alcohol Concentration Vol. I and II (Technical Report) DOT HS 364 37567.

5. Dull, R.T.; Giacopossi, D.J.; Dry, Damp and Wet: Correlates and Presumed Consequences of Local Alcohol Ordinances, *American Journal of Drug and Alcohol Abuse*, 14(4):499-514, 1988.

6. Foss, R.D.; Voas, R.B.; Bierness, D.J.; Wolfe, A.C. Minnesota 1990 Statewide Drinking and Driving Roadside Survey, Contract No. 525493, St. Paul, Minnesota, Office of Traffic Safety, Minnesota Dept. of Public Safety, 1990.

7. Geller, E.S.; Russ, N.W.; Delphos, N.A. Does Server Intervention Make a Difference? *Alcohol, Health and Research World*, 11:64-69, 1987.

8. General Accounting Office. Drinking Age Laws: An Evaluation Synthesis of their Impact on Highway Safety, GAO/PEMD, 87-100, March 1987.

9. Gliksman, L.; Single, E. A Field Evaluation of a Server Intervention Program: Accommodating Reality, paper presented at the Canadian Evaluation Society Meeting, Montreal, Canada, May 1988.

10. Grossman, M.; Saffer, H.; Chaloupka, F. Alcohol Regulation and Motor Vehicle Mortality, Final Report for Grant No. SRO1AA07593 Rockville, MD National Institute on Alcohol Abuse and Alcoholism, 1991.

11. Gruenwald, P.; Miller, A.; Treno, A. Alcohol Availability and the Ecology of Drinking Behavior, *Alcohol*, *Health and Research World*, 17:39-45, 1993.

12. Gruenwald, P.J.; Ponioki, W.R.; Holder, H.D. The Relationship of Outlet Density to Alcohol Consumption: A Time Series Cross Sectional Analysis, *Alcoholism: Clinical* and Experimental Research, (In press).

13. Hennessy, M.; Seltz, R.F. The Situational Riskiness of Alcoholic Beverages, *Journal of Studies on Alcohol*, 51(5):422-427, 1990.

14. Hingson, R., et.al. Impact of the Saving Lives Program on Alcohol Related Traffic Injuries and Deaths (In review).

15. Hingson, R.; Heeren, T.; Winter, M. Lower Legal Blood Alcohol Limits for Young Drivers, *Public Health Reports* (In press).

16. Holder, H.D. Prevention of Alcohol Involved Traffic Crashes: Research Implications of Alcohol Accessibility, Price and Mass Communication, Prepared for the National Transportation Safety Board Conference on Research Opportunities to Reduce Alcohol Involved Traffic Problems, Irvine, CA, 1992.

17. Holder, H.D.; Blose, J. Impact of Changes in Distilled Spirits Availability on Apparent Consumption: A Time Series Analysis of Liquor by the Drink, *British Journal of Addiction*, 82(6):623-631, 1987.

18. Holder, H.D.; Wagenaar, A.C. Effects of the Elimination of a State Monopoly on Distilled Spirits Retail Sales: A Time Series of Iowa, *British Journal of Addictions*, 85:1615-1625, 1990.

19. Holder, H.D.; Wagenaar, A. Mandated Server Training and Reduced Alcohol Involved Traffic Crashes: A Time Series Analysis of the Oregon Experiences, *Accident Analysis and Prevention*, 26:89-97, 1994.

20. Mayhew, D.R.; Donelson, A.C.; Bierness, D.J.; Simpson, H.M. Youth, Alcohol and Relative Risk of Crash Involvement, *Accident Analysis and Prevention*, 18:273-287, 1986.

21. McKnight, A.J. Development and Field Test of a Responsible Alcohol Service Program Volume 1: Research Findings, Report No. DOT HS 807 221, Washington, D.C., 1987.

22. McKnight, A.J. Factors Influencing the Effectiveness of Server Intervention Education, *Journal of Studies on Alcohol*, 52:389-397, 1991.

23. McKnight, A.J. Server Intervention: Accomplishments and Needs, *Alcohol, Health and Research World*, 17:76-84, 1993.

24. McKnight, A.J.; Streff, F.M. The Effect of Enforcement upon Serving of Alcohol to Intoxicated Patrons of Bars and Restaurants, *Alcohol, Drugs and Traffic Safety*, T92: Proceedings of the 12th International Conference on Alcohol, Drugs and Traffic Safety, Cologne, Germany Varlog TUV, Rheinland, pp. 1296-1302, 1993.

25. Mortimer, R.G.; and Sturgis, S.P. Effects of low and moderate levels of alcohol on steering performance. In: Israelstam S. and Lambert S., eds. *Alcohol, Drugs and Traffic Safety*, Toronto: Addiction Research Foundation, 1975. pp. 329-345.

26. Moskowitz, H.; Burns, M. Effects of alcohol on driving performance. *Alcohol, Health and Research World*, 14:12-14, 1990.

27. National Highway Traffic Safety Administration. *Traffic Safety Facts* 1992, DOT HS 808 022, 1993.

28. National Institute on Alcohol Abuse and Alcoholism. Eighth Special Report to the U.S. Congress on Alcohol and Health, From the Secretary of Health and Human Services. Washington, DC: U.S. Department of Health and Human Services; September 1983.

29. O'Malley, P.; Wagenaar, A.C. Effects of Minimum Drinking Age Laws on Alcohol Use, Related Behaviors and Traffic Crash Involvement Among American Youth, *Journal* of Studies on Alcohol 52(5):478-491, 1991.

30. Palmer, J.W. Minnesota Roadside Survey Alcohol Positive Drivers, *Journal of Traffic Safety Education*, 35(2): 10-13, 1988.

31. Relch, B.R.; Gliksman, L.; Brook, R. Alcohol Availability, Alcohol Consumption and Alcohol Related Damage, The Distribution of Consumption Model, *Journal of Studies on Alcohol*, 47(1):1-10, 1986.

32. Rogers, P. The Long Term Effectiveness of California's Administrative Per Se Law, Second Interim Report, OTS PRoject #AL9101, December 1993. Research and Development Section Program Policy Administration, California Department of Motor Vehicles.

33. Saffer, H.; Grossman, M. Beer Taxes, the Legal Drinking Age and Youth Motor Vehicle Fatalities, *Journal of Legal Studies*, 16(2):351-374, 1987a.

34. Saffer, H.; Grossman, M. Drinking Age Laws and Highway Mortality Rates: Cause and Effect, *Economic Inquiry*, 25:403-417, 1987b.

35. Saltz, R.F. The Role of Bars and Restaurants in Preventing Alcohol Impaired Driving: An Evaluation of Server Intervention, *Evaluation and the Health Professions*, 10(1):5-27, 1987.

36. Santana, J.R.; Martinez, R. Alcohol Purchase and Consumption Site Prior to an Automobile Collision. 4th Proceeding of the Association for the Advancement of Automotive Medicine, Des Plaines, Illinois: The Association, 1992.

37. Stockwell, T.; Rydcon, P.; Giannette, S.; Jankis, E.; Ovendar, C. and Syed, D. Levels of Drunkeness of Customers Leaving Licensed Premises in Perth Western Australia: A Comparison of High and Low Risk Premises, *British Journal of Addiction*, 87:873-881, 1992.

38. U.S. Department of Transportation

39. Wagenaar, A.; Holder, H.D. Effects of Alcoholic Beverage Server Liability on Traffic Crash Injuries, *Alcoholism: Clinical and Experimental Research*, 15:942-947, 1991.

40. Wagenaar, A.; Holder, H.D. A Change from Public to Private Sale of Wine: Results from Natural Experiments in Iowa and West Virgina, *Journal of Studies on Alcohol*, 52:162-173, 1991.

41. Watts, R.K.; Rabow, J. Alcohol Availability and Alcohol Related Problems in 213 California Cities, *Alcoholism: Clinical and Experimental Research*, 7(1):45-58, 1983.

42. Werch, C.E.; Bakema, D.; Ball, M.; Lee, D. Categorizing Blood Alcohol Level and Alcohol Consumption Data in Field Settings Feasibility and Findings, *Journal of Studies on Alcohol*, 49(6):561-566, 1988.

43. Wittman, F. Environmental Approaches to Community Level Prevention of Alcohol and Drug Problems. Presentation to the Center for Substance Abuse Prevention, PEPS Advisory Panel, December 15, 1993.

44. Zador, P. Alcohol related relative risk of fatal driver injuries in relation to driver age and sex. *Journal of Studies on Alcohol*, 52:301-10, 1991.

APPENDIX C4

MEDIA APPROACHES TO THE PERSISTENT DRINKING DRIVER Nancy E. Isaac, Sc.D. Harvard School of Public Health

INTRODUCTION

The media's potential to influence knowledge, attitudes and behavior makes it a natural candidate as a mechanism to address drinking and driving. Although there have been some extensive reviews of mass media approaches (Vingilis & Coultes, 1990; Atkin, 1988; Haskins, 1985), these contain little discussion or empirical data specific to the persistent drinking driver. Nonetheless, there are ways to apply existing knowledge to generate at least a partial picture of how the media may influence this subgroup of people who drink and drive.

While the assumption that persistent drinking drivers constitute a single "target" is an oversimplification, for the purposes of this discussion, we take as the largest common denominator of persistent drinking drivers those individuals who are most likely to be killed in fatal alcohol-involved accidents: young white males of a predominantly blue collar background.

The demographics of this population are favorable as regards exposure to multiple media outlets. The persistent drinking driver target audience is a frequent consumer of television (particularly sports), radio (country & rock), and movies (action, adventure, thrillers).

As to whether or not persistent drinking drivers are a receptive audience amenable to change is much less clear. Evidence that persistent drinking drivers are likely to have antisocial tendencies (Sutker et al., 1980; Donovan & Marlatt, 1982; Argeriou et al., 1985; Harwood & Leonard, 1989) suggests that they will be less susceptible than a general audience to messages that appeal to conscience. Prior studies have also indicated that those who drink and drive are characterized by high risk-taking proclivity and a sense of invulnerability (Jonah, 1986; Lastovicka, 1988; Farrow, 1989; Arnett, 1990), which may limit the impact of safety-based strategies. For that subset of the persistent drinking driver population that is alcohol dependent, their ability to follow instructions to limit their intake ("Know when to say when") is in question.

Laughery and Brelsford (1991) report on relevant characteristics of message receivers in a review of safety communications. The traits associated with non-receptivity to safety messages parallel the profile of persistent drinking drivers: male sex; young; perceives little hazard or risk; and is familiar with the consumer product.

Given this broad picture of persistent drinking drivers as media targets, the remainder of the discussion will briefly review five media strategies and their potential relevance to persistent drinking drivers: 1) public service announcements; 2) depiction of alcohol use in the popular media; 3) news coverage/publicity; 4) alcohol warning labels; and 5) restriction of alcohol advertising.

In addition, an ongoing project at the Harvard Injury Control Center that is particularly relevant to the persistent drinking driver will be briefly described.