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## APPENDIX D6

### PREVENTION OF ALCOHOL-INVOLVED TRAFFIC CRASHES

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## INTRODUCTION

The purpose of this paper is to review research concerning alcohol access, price and mass communication, and discuss the potential to prevent alcohol-involved traffic crashes. Alcohol access is defined here in a broad manner including forms of alcohol availability, site of purchase and use, type of alcohol, and limitations on availability.

Alcohol policy research has a 20-year history in public health concerned with the effects of alcohol consumption and chronic alcohol problems such as liver

cirrhosis or alcoholism. See reviews by Bruun, et al. (1975), Holder (1987), and Room (1990). However, well-controlled studies which examine the effect of alcohol restrictions on an acute alcohol problem such as alcohol-involved traffic crashes have a much shorter history.

One set of studies (see summaries by U.S. Dept. of Health and Human Services (1981) and Popham, et al. 1976) has concluded that state ABC laws and regulations have little or no effect in holding down per capita consumption and alcohol-related problems. Smart (1977) found positive association between a nine-factor availability score (composed of ABC restrictions) and consumption but concluded the association was spurious after statistically adjusting the data for urbanization and income.

Watts and Rabow (1981) argued that interstate tourism, particularly for Nevada, Vermont, and New Hampshire, as well as the District of Columbia, accounts for much of the association between availability and consumption. But their conclusion was based on results from a 1977 national survey with 1972 state consumption data for a period when the minimum age was changed in 29 states. In a study published later, the same research team found positive links between availability and alcohol-related problems in California (Rabow and Watts 1982). In addition, Colon et al. (1981) found significant association between consumption and two types of composite measures of availability, while controlling for tourism and urban conditions.

A combined cross-sectional and longitudinal analysis of the consumption of distilled spirits by Hoadley, Fuchs, and Holder (1984) found that certain laws and restrictions do reduce distilled spirits consumption.

As indicated earlier, the final model predicted a decrease of about two drinks per person per month if a state were to shift its regulatory laws (including the price of liquor, which is not always subject to regulation) from being relatively loose (ranking twelfth among the 48 [contiguous] states) to being relatively strict (ranking thirty-sixth). This decrease in drinking would cut back the level of consumption in the typical (median) state by nearly one-fourth.

Rush, Gliksmann, and Brook (1986) conducted statistical analyses using linear structural relations applied to a set of county-level data from Ontario, Canada. They found a high positive association between retail availability of alcohol, alcohol consumption, and alcohol-related morbidity and mortality. They concluded from their analyses that government policies that restrict the availability of alcohol will reduce per capita consumption and, indirectly, lower alcohol related

damage.

As a group, these studies, along with cross-cultural analyses from other countries (see Makela et al. 1981; Single, et al. 1981; Single et al. 1984; and DeLint 1980), have provided evidence to support a conclusion that environmental restrictions can affect both consumption levels (which are shown to be related to alcohol-related problems) and alcohol abuse. Room (1984:310) in reviewing studies from the United States and other countries concluded, "The evidence is thus by now compelling that alcohol controls can affect the rates of alcohol-related problems, and that they often particularly affect the consumption patterns of high-risk drinkers."

### TRAFFIC SAFETY AND ALCOHOL AVAILABILITY

The field of traffic safety research which has concentrated on reducing the number of drinking and driving crashes, injuries, and fatalities has primarily emphasized driving decisions, e.g., threat of enforcement, conviction, and sanction if one drinks and drives. There has not been an equal emphasis on drinking prior to (or even concurrent with) driving.

This could be the result of several assumptions. First is the alcoholism assumption, i.e., most crash-involved drivers are heavy, chronic users of alcohol. Therefore, detection through enforcement and routing into treatment is the preferred countermeasure. Changes in retail access to alcohol is therefore assumed to have no effect on these dependent individuals. However, we know that while heavy, dependent drinkers are more at risk of crash per person, they do not constitute the largest population of drivers at risk. This has been called the prevention paradox (see Kreitman 1986). In addition, chronic drinkers have also been shown to be affected by changes in availability. See, for example, Cook and Tauchen (1982).

A second assumption is that changes in alcohol access can only affect alcohol problems related to long-term chronic drinking. (Note that assumption two actually contradicts assumption one.) Research, as reviewed here, has shown results which are contrary to this assumption.

The third assumption is that the tradition of alcohol-involved traffic crash prevention is best served through deterrence, i.e., DUI enforcement and associated sanctions. This appears to be more related to the tradition of highway safety from law enforcement than from a public health and safety perspective.

This section will review some of the published research which addresses the relationship of alcohol

consumption and alcohol availability to traffic safety.

#### *Form of Spirits Availability*

The availability of distilled spirits for on-premise consumption by the individual drink is taken for granted in most states in the U.S. and in most foreign countries. However, the relationship of spirits availability for consumption at on-premise establishments or liquor-by-the-drink (LBD) as a specific form of alcohol availability to alcohol-related problems has gone largely unexplored. Since 1968, nine states in the U.S. legalized the sale of LBD. Studies that specifically evaluated LBD in the U.S. were rare and provided limited information regarding this phenomenon. Bryant (1954) studied the implementation of LBD in the state of Washington, but his findings are confounded by limited time-series data (a long series of observations after the intervention but only one prior), reliance entirely on measures that are particularly sensitive to enforcement and other biases (e.g., public drunkenness arrests), among other problems. Womer (1978) found a minor impact of LBD on consumption in Virginia, but used no control group and felt his analysis was inconclusive. Hoadley, Fuchs and Holder (1984) utilized multiple regression analysis to analyze the impact of state-level regulatory measures on per capita distilled spirits consumption during the period 1955-1980. Their results suggested that the absence of LBD was associated with lower distilled spirits consumption.

The implementation of LBD in North Carolina in 1978 represented an important opportunity to undertake a natural experiment to evaluate the effect of a change in distilled spirits availability on alcohol-involved traffic crashes. With the passage of legislation in that year, counties and cities in North Carolina were authorized to hold referendums on whether to allow LBD. Before this, only "brown-bagging" was permitted (i.e., patrons could bring distilled spirits to licensed restaurants and clubs and purchase ice and "set-ups"); the establishments themselves could sell only beer and wine or non-alcoholic mixes. In those counties and municipalities, implementing LBD, full-service bars now existed for the first time since Prohibition in North Carolina. LBD thus represented a change in distilled spirits availability that is quite specific to on-premise consumption.

The implementation of LBD resulted in major changes in on-premise distilled spirits availability. It resulted in the creation of a new type of drinking environment, increased the number of locations at which distilled spirits could be purchased, altered the mix of the types of establishments where drinking could occur and made distilled spirits more accessible in terms of

hours of sale and convenience. On the other hand, there was a temporary drop in the number of places at which distilled spirits consumption could occur and an effective increase in the price of on-premise consumption. There are two other ways in which LBD may have affected the system of distilled spirits availability which have implications for traffic safety. First, server monitoring and intervention is more feasible under LBD than was the case under brown-bagging. Second, when the LBD legislation was under consideration, some argued that LBD might actually inhibit consumption by replacing generous self-poured drinks with ones measured by a bartender (Popkin, Stewart, and Lacey 1982).

Holder and Blose (1987) conducted an interrupted time-series analyses of counties within the state of North Carolina, U.S., which first permitted such sales in 1978 compared with a comparison set of counties within the state which continued the ban. A quasi-experimental study was conducted to estimate the impact of liquor-by-the-drink (LBD) on alcohol-related traffic accidents in North Carolina counties. Time-series analysis for the period from January 1973 through December 1982 found LBD was associated with statistically significant increases of 16 to 24 percent in both the number of police-reported alcohol-related accidents and in single vehicle nighttime accidents among male drivers 21 years of age and older in counties implementing LBD. No change in alcohol-related accidents was found for non-LBD counties. Single vehicle nighttime accidents involving male drivers under 21 did not change for either the experimental or comparison groups suggesting that only drivers eligible for spirits purchases were affected. Holder and Blose (1987) found that spirits sales rose from between 6 and 7.4 percent. These analyses used a multiple-level design intended to control for a number of threats to the validity of these conclusions.

#### *Increased Minimum Age of Purchase*

At the end of Prohibition, each of the states established a minimum age of purchase or drinking. The states varied in terms of the established legal age, some 18, some 19, some 21. In addition, some states established differential legal ages by beverage, e.g., 18 for beer and wine and 21 for spirits.

During the early 1980s, the U.S. voting age was uniformly dropped to 18 and concurrently a number of states with legal drinking (or purchase) ages above 18 lowered their minimum age to 18 in order to be consistent with the voting age. However, research into the impact of this lowered age suggested that there was a subsequent increase in alcohol-involved traffic crashes

for the newly enfranchised age groups (see research summaries in Wagenaar 1983 and Holder 1987).

This research made public the negative consequences of the lowered age and stimulated a considerable public debate during the late 1980s concerning the appropriateness of a lower legal age. A number of states subsequently increased this minimum age which provided the opportunity for research studies of both lowered and increased minimum age.

The research results took on practical implication with U.S. federal legislation to incentive all states to increase their legal age to 21 for all beverages. This legislation, reluctantly, signed by President Ronald Reagan, called for withholding a portion of federal highway construction funds from states which did not increase their age to 21 by October, 1986. The "grass roots" public support for such legislation came from the national organization of Mothers Against Drunk Driving (MADD) which used both the concern of their members about drunk driving and these research findings to bring considerable pressure to bear for this legislation on the U.S. Congress and the Presidency.

Historically the minimum age of purchase has been used to reduce drinking by the young and to prevent alcohol-related problems, particularly accidents and injuries, involving young people. The effect of changes in the minimum purchase age on youthful drinking and traffic accidents has been extensively researched. Overall, there is evidence that a higher minimum purchase age results in lower per capita consumption (following the conclusions of Maisto and Rachal 1980, which were based on their analysis of a recent national adolescent drinking study). Longitudinal analyses of aggregate sales, of which young purchasers represent a small part, have shown that beer (and sometimes wine) sales are sensitive to changes in the purchase age (Smart 1977; Wagenaar 1983; Douglass and Freedman 1977).

An exception to such findings was Massachusetts, where the level of self-reported alcohol consumption by young people did not change following an increase in the minimum drinking age from 18 to 19 (Hingson et al. 1983; Smith et al. 1984). This exception might be explained by under- or over-reporting, of drinking by the young respondents, a lack of compliance, or a lack of enforcement.

Research findings support the conclusion that higher minimum age of purchase can reduce alcohol-related traffic accidents. The longest time-series analysis of an increased minimum age has been conducted by Wagenaar (1981) and (1987) in Michigan. Michigan is a good state for such analyses, since the greatest population concentrations are sufficiently far from state borders to reduce the "border effect," whereby

under-aged youths cross to lower minimum-age states to purchase alcohol. Wagenaar (1981) found an 18 percent reduction in alcohol-related crashes among young drivers in the first year following a change in the minimum age from 18 to 21. His follow-up analysis to the time-series, carried out four years after the age change, showed a statistically significant 9 percent reduction over the total 5 years (Wagenaar 1987). These findings in Michigan are consistent with those of Filkins and Flora (1981) in an independent analysis conducted in the same state.

Maxwell (1981) found a statistically significant reduction in alcohol-related accidents in Illinois for 18- to 21-year-old drivers following an increase in the minimum age to 21. These findings are confirmed by a nine-state analysis conducted by Williams et al. (1983), in which they found decreases in fatal crashes among young drivers following an increase in the minimum age.

The state with the least reduction in fatal crashes following a one-year increase in minimum age (18 to 19) was Massachusetts. No statistically significant changes in fatal crashes in Massachusetts were found by Hingson and co-workers (1983) for the entire 16- to 20-year-old age group and by the same research team (Smith et al. 1984) for the 16- to 17-year-old group. However, a statistically significant reduction in single-vehicle, nighttime fatalities was found in Massachusetts for 18- to 19-year-olds over the three years following the increase in the minimum age. These outcomes are consistent with findings by Williams et al. (1983) that Massachusetts had the lowest reduction in fatalities of nine states that raised their minimum purchase age. Other states that appear to have a greater level of enforcement of the minimum age and compliance have recorded statistically significant reductions in alcohol-related crash involvement among the age groups most affected by the raised minimum ages. A recent study by Du Mouchel, Williams, and Zador (1987) of 26 states found similar results.

In an adjoining state, New York, which was used as a comparison state for the Massachusetts study by Hingson et al. (1983), an age change from 18 to 19 yielded statistically significant changes in the auto accident rate. Lillis, Williams, and Williford (1987) report nearly a 21 percent decrease in fatal and injury crashes and a 46 percent decrease in self-reported drinking and driving for New York young people following the age change. A recent study of Texas showed that a one-year change in the minimum drinking age affects youthful crashes (Wagenaar and Maybee, 1986).

Taken as a group, such studies of individual states or state groups support a conclusion that a higher minimum

age of purchase has the potential to reduce both youthful consumption (particularly of beer, the beverage of choice of the young) and alcohol-related traffic accidents. The potential reduction appears, like the effects of most restrictions on alcohol availability, to be a function of compliance and enforcement. If compliance is poor, as a result of the lack of diligence by retail establishments in checking identification of lack of enforcement by ABC authorities, the reduction of alcohol-related traffic accidents is less.

Three national studies are worthy of note. An analysis by Cook and Tauchen (1982) found a 7 percent increase in the number of youths killed in automobile accidents associated with a lowering of the drinking age from 21 to 18. A national comparison by the National Highway Traffic Safety Administration (1982) found that higher drinking-age states had lower serious-injury rates.

Grossman, Coate, and Arluck (1987) conducted a national evaluation of the sensitivity of youthful consumption of specific alcoholic beverages to minimum-age changes. Based on their findings, they projected that an increase in the minimum age for the purchase of beer from 20 to 21 would yield a 10 percent drop in the number of youths who drink beer, a 17 percent reduction in those drinking beer two to three times a week, and a 17 percent reduction in the number drinking as many as three to five glasses of beer on a typical drinking day. (For a similar analysis, see Saffer and Grossman 1987b.)

Asch and Levy (1990) in one counter-finding hypothesize that some proportion of traffic deaths among the youngest legal drinkers in a given state (say, 18 year olds before the minimum age was raised) would be due to inexperience with drinking per se, independent of their absolute age. When the drinking age is raised, therefore, it is possible that we would see an increase in deaths among the (now older) inexperienced drinkers (21 year olds). Using data from the Fatal Accident Reporting System (FARS) for the period from 1975 through 1984, the authors employed a covariance model and found that age (a surrogate for drinking experience) was a key variable in predicting fatality.

A report by the National Highway Traffic Safety Administration (Arnold 1985) analyzed traffic-crash data for 13 states that raised their minimum age between 1975 and 1982. The study considered annual figures for driver involvement in fatal crashes among drivers who were affected by minimum-age changes, with those among drivers up to age 23, who were not affected by the law change. Pooled data from all states revealed an average reduction of about 13 percent in fatal-accident involvement; the range was about 6 percent to 19 percent. The U.S. General Accounting Office (1987) completed a review of published research concerning the

impact of drinking-age laws on highway safety. The report concluded:

Raising the drinking age has a direct effect on reducing alcohol-related traffic accidents among youths affected by the laws, on average, across the states. The evidence also supports the finding that states can generally expect reductions in their traffic accidents, both the magnitude of effects depends on the outcome measured and the characteristics of the state.

Decker, Graitcer and Schaffner (1988) found that after Tennessee increased penalties for DUI in 1982 and raised the drinking age to 21 years in 1984, alcohol-related motor vehicle deaths declined by 33 percent among persons aged 15 through 18 years, probably because of publicity. Their results suggest that it may be particularly important to maintain continuous, high-profile anti-DUI programs within high schools. Alcohol-related motor vehicle deaths declined 38 percent among persons aged 19 through 20 years; this effect appears to be attributable to the increase in drinking age and to be durable despite decreased publicity.

A most recent study by O'Malley and Wagenaar (1991), found that a higher minimum-purchase age produced lower numbers of traffic crashes but also lower self-reported drinking. In addition, this preventative effect continues on as young people mature such that lower drinking levels and lower traffic problems involving alcohol can be observed even after young adults reach the legal age of purchase.

#### *Server Intervention*

An alternative intervention is at the primary location of drinking for impaired drivers. Studies of the location of drinking drivers have shown that substantial numbers of such drivers (in some cases the majority) are coming from licensed alcoholic beverage drinking establishments, i.e., pubs, bars, and restaurants (O'Donnell 1985). These findings suggest that prevention interventions at such public drinking establishments could reduce the number of impaired drivers on the road. Mosher (1987), Saltz (1985, 1987), and others have discussed how changes in alcohol beverage serving practices and establishment sale policies could be effective means to reduce the level of intoxication of customers, particularly those who subsequently drive. One means to accomplish such changes is to train servers in techniques to reduce the intoxication level of customers and to intervene in situations of high-risk drinking.

Servers can undertake a number of positive practices including encouraging lower consumption by all

consumers but especially reducing heavy drinking. Servers can assist consumers in spacing their drinking out over time and increasing food consumption in order to slow down the absorption of alcohol. The effect of slowed alcohol absorption or increasing the length of time for alcohol absorption by the body can reduce the blood alcohol level (BAL) of the drinker and their level of impairment.

If the customer is intoxicated, the server can positively intervene by obtaining alternative transportation such as a taxi or non-drinking friends or relatives and/or by asking the customer to remain in the establishment until their BAL has reached a lower and potentially less impaired level (Holder and Wagenaar 1991).

Training can also equip the server to assist the drinker in slowing consumption such as by suggesting food to slow absorption to reduce his/her blood alcohol level and thus their level of impairment. Server training assists pubs, bars, and restaurants in changing serving and pricing policies to reduce the likelihood that customers will leave the establishment impaired. Reviews of the impact of server intervention on customers can be found in Saltz (1989), and Glikzman and Single (1988). Two U.S. states, Oregon and Utah, require that all persons who serve alcohol must have completed such training. One state, Texas, allows licensed establishments to obtain protection against liability suits if their serving employees have completed a state-approved training program.

More recent research studies of server training, Saltz and Hennessy (1990a and b) and Saltz (1988) have demonstrated that server training is most effective when coupled with a change in the serving and sales practices of the licensed establishment. Like the increased minimum drinking age, research into server training has been used to support policies to encourage such training.

Evidence that changes in server practices can affect customer behavior comes from controlled evaluations of beverage server training. Changes in customer drinking behavior (lower number of high volume or intoxicated patrons) have been documented either through use of structured observations of customer consumption (Saltz 1985, 1987; Hennessy and Saltz 1990) or documentation of intervention with intoxicated customers using pseudo patrons (research assistants posing as customers) (Russ and Geller 1987; Geller, Russ and Delphos 1987; McKnight 1987; Glikzman and Single 1988; and Saltz and Hennessy 1990a and 1990b) as well as breathalyzer measures for pseudo patrons (Russ and Geller 1987).

Such research supports a conclusion that changes in server behavior can produce differences in the Blood Alcohol Level (BAL) of patrons leaving licensed establishments and thus the subsequent risk of becoming

involved in a traffic crash or other alcohol-involved problem. The results of this research were summarized by Saltz (1989).

However, such server training studies do not, by themselves, demonstrate that server training reduces alcohol-involved traffic crashes or given to a large number of servers can actually reduce aggregate levels of such crashes. The only state which mandates server training is Oregon. Texas and Utah encourage voluntary training but such training is not required (Holder, et al. in press).

The state of Oregon provides a unique opportunity to examine the research question whether server training provided to a significant percentage of all alcohol servers in a state can reduce alcohol-involved traffic crashes. Prior to the mid-1980s, Oregon established a state-wide requirement that all servers in retail establishments selling alcohol must obtain permits. This permit was good for five years. No special training was required to obtain this permit. In June, 1987, the Oregon legislature passed state bill 726 which required that effective December 1, 1987, all new applicants for a beverage service permit must successfully complete a state approved server training course. In addition, the bill required that all persons holding existing alcohol retail licenses or applying for new licenses must also complete a training program in 1987.

This legislation was modified in July 1987, to require that existing server permit holders were required to complete training only on the five-year anniversary. New server permit applicants must still complete the training as a condition for their initial permit. As a result, approximately 20 per cent of existing permit holders are trained each year beginning in 1988. Thus all servers will be trained within a five-year period, December, 1993.

Responsibility for supervision of the server training and thus the certification of training programs is with the Oregon Liquor Control Commission (OLCC). The one-day training program covers state laws governing the sale and consumption of alcohol, the effects of alcohol on the body and behavior. Trainees are given skills in how to intervene, politely but firmly with a customer who is drinking too much or shows signs of intoxication. The course is provided in about 24 locations throughout the state either at community colleges or through private organizations who are certified by OLCC. Each student must pay a \$20 tuition and a \$13 fee for program administration. The course averages from five to eight hours in length. Each student must pass a written test at the end of the training in order to obtain a new or renewed server license.

Approximately 36,000 servers and 6,000 owners/managers of establishments licensed to sell alcohol completed the course by the end of December

1988 and approximately 13,000 new servers and existing licensed servers seeking their renewal are completing this required training each year.

This time series analysis has demonstrated that when at least 50 percent of the servers of alcoholic beverages in a state and 100 percent of the licensees are trained, there is a statistically significant reduction in alcohol-involved traffic crashes. A similar finding was obtained examining the effect of training for alcohol servers alone. This analysis has controlled for a number of alternative threats to this finding including national trends in fatal crashes which are strongly influenced by driving patterns and economic conditions. Other significant traffic safety programs and legislation were also controlled for.

This finding coupled with demonstrated ability of controlled evaluated server training to alter serving practices sufficiently to reduce the impairment level of customers leaving these establishments strengthen the support for server training as a potentially effective means to reduce alcohol-involved traffic problems. These results provide clear support for the potential of server training when completed by a significant percent (in this study at least 40 percent) of all servers to reduce alcohol-involved traffic crashes. This suggested that server training can be used effectively as a part of a comprehensive set of alcohol counter-measures.

#### *Sanctions Against Service to Intoxicated Patrons*

All U.S. states have either criminal or civil sanctions against serving patrons who are obviously intoxicated. However, the effectiveness of these laws is a direct function of compliance and enforcement. Such compliance has rarely been studied. A recent study by McKnight (1992) found that compliance, expressed as frequency of service intervention or termination, increased by 37 percent after visits and warnings by law enforcement. This was confirmed by a drop (from 31.2 percent to 24.6 percent) in the percentage of persons arrested for DUI who came from a bar or restaurant.

#### *Server or Dramshop Liability*

Legal liability of servers of alcoholic beverages has existed in some states in the U.S. since the 19th century, but only in recent years has its potential for reducing alcohol-involved problems been systematically discussed (Mosher 1979; Mosher 1987; Rinden 1987). Server liability (or dramshop liability) is civil liability faced by both commercial servers and social hosts for injuries or damage caused by their intoxicated or underage drinking patrons and guests. A typical liability suit involves bar A, which serves obviously intoxicated or underage patron B. Patron B leaves the establishment and, while intoxicated, crashes into citizen C on a public highway. Dram shop

liability law permits, within limits, citizen C to sue both bar A and patron B for losses associated with the crash based on the negligent actions of both A and B.

Until the early 1970s, policy makers and opinion leaders of most states did not view commercial servers or social hosts as having responsibility for the harm caused by their patrons or guests. Early dramshop statutes only imposed fines and other penalties on retailers for serving intoxicated or underage persons, or "habitual drunkards." The provisions were not widely used as a basis for lawsuits by the injured victims and state courts did not recognize an independent cause of action under common law. Instead, courts adhered to the "old common law" rule that servers of alcohol could not be held accountable (in a tort suit) for the actions of patrons because the able-bodied customer was responsible for his own actions.

The citizens' movement to prevent drunk-driving in the 1970s dramatically changed the legal landscape. Increasingly, state courts refused to accept the traditional common-law approach, finding instead that retailers could be held liable for serving alcohol to obviously intoxicated or underage persons who subsequently injured others. This "new common-law rule" of third-party liability is based on general concepts of negligence law (see Mosher 1979; Mosher 1987; Rinden 1987) which hold that an alcohol server is responsible for foreseeable harm caused by his negligence.

Under the new common law rule, both the drinker and the retailer are viewed as potential defendants in a dram shop case (in legal terminology, potential "tortfeasors"). Since such liability is predicated on common-law principles of negligence, state courts have the power to adopt the new common law rule as part of their inherent powers without the need for legislative directives. However, state legislatures can set the parameters of common law if they choose. Several states have done so in the server liability area, creating a patchwork of statutory and case law over the 50 states and the District of Columbia.

In a study by Holder et al. (in press), an expert legal panel was used to identify and rate the major legal factors contributing to server liability. As a result, each state was ranked according to its relative level of liability exposure. States which ranked highest in server liability were found to have more publicity about such liability, greater awareness and higher concern among licensed establishment owner/managers, and different serving practices compared to states with lowest liability exposure. As a result, the authors concluded that server liability has a real potential for reducing alcohol-involved problems but additional research is needed.

The level of actual liability in a state appears to be linked to the level of publicity about such liability and to

the awareness of such liability by owners and managers of licensed establishments and thus to differences in self-reported serving practices.

Holder et al. (in press) found that alcohol beverage establishments in high liability states are more aware of their liability than their counterparts in low liability states. Thus, server and manager perceptions match the independent rating of states by legal experts. Respondents from high liability states obtain liability insurance more often, and fewer believe they do not need such insurance. However, liability does not appear to stimulate formal training or underage checking. Establishments in both high and low liability states conduct training and check IDs equally often. Liability does apparently reduce low-price promotions and increase refusals of service to intoxicated patrons. The authors concluded, based upon both the legal analyses and survey data, that server liability laws have the potential to change server behavior and thus reduce risks associated with alcohol use if such laws effectively stimulate responsible alcohol serving practices among licensees.

Wagenaar and Holder (1991) examined effects on the frequency of injuries due to motor vehicle crashes of a sudden change in exposure to legal liability of servers of alcoholic beverages in the state of Texas. A multiple time-series quasi-experimental research design was used, including ARIMA and intervention-analysis statistical models on injury data from 1978 through 1988. The authors controlled for the effects of several other policy changes expected to influence injury rates in Texas, and for broader nationwide changes in injury rates in the 1980s. Results revealed 6.5 percent and 5.3 percent declines in injurious traffic crashes following the filing of two major liability suits in 1983 and 1984.

Server liability is connected to several other policies and practices that may reduce alcohol-impaired driving, such as training of alcoholic beverage servers. Training of servers is intended to increase skills in cutting off obviously intoxicated patrons and, if they are driving, assist them in using alternative transportation. Servers can be trained to notice heavy drinkers, space drinks out over time, and encourage food consumption to reduce average blood alcohol concentrations.

One motivation for establishments to train servers is legal liability resulting from inappropriate serving practices. Many questions regarding the content and effectiveness of server training need to be answered (Saltz, 1989). As effective program components are

identified in continuing research, implementation might be encouraged by permitting alcohol establishments to use good faith efforts to prevent impaired driving as a defense in liability suits.

Future research should examine other states which have undergone dramatic changes in the exposure of licensed establishments to legal liability over the past 20 years. In addition, studies should be undertaken of the actual behavior of specific licensed establishment managers and owners in response to their perceptions of the liability risks in their state. We need more information about the relationship between liability as defined by statutory and case-law, the perceptions of owners and managers about the level of liability, and actual changes in specific serving practices which have the potential to reduce heavy alcohol use and alcohol-impaired driving. The current research clearly indicates that legal liability of alcohol servers should not be reduced without careful attention to compensating actions that should be required of alcohol servers to reduce the risks of morbidity and mortality associated with alcohol misuse.

#### *Low- or Nonalcohol Beverages*

Lower-alcohol beverages have been used in recent years in many countries as a potential means to reduce levels of absolute alcohol consumed, and thus, associated levels of intoxication. These lower-alcohol beverages have been often taxed at lower levels which produces lower prices in countries such as Sweden, Norway, and Finland where such low-alcohol beer is sold in grocery stores rather than in state-monopoly retail stores. This lower taxation has been used in many Scandinavian countries which have encouraged three classes of beer according to their alcohol content and at least two classes of wine. See Österberg (1990) for a summary of these policies.

Low- or nonalcoholic beverages have not met with great success in the U.S. This is likely true because of two factors. First, unlike other countries, there have been no special price incentives (other than no federal and/or state excise taxes according to a classification as an "alcoholic beverage" based on ethanol per volume) which have made such beverages more economically attractive. Low- or no-alcohol beverages in on-premise establishments usually has the same price as regular alcohol beverages. Second, one of the social values of alcohol is its ethanol content which produces a "high" and thus more relaxed social feelings, which is considered desirable by many drinkers. Low or no alcohol beverages do not provide this perceived benefit. No research has evaluated the effects of such beverages in the U.S. drinking environment.



### *Warning Labels*

A recent public policy developed in the United States has been mandating warning labels on alcohol-beverage containers. The required warning level in the U.S. is

"GOVERNMENT WARNING: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects. (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery, and may cause health problems."

No complete evaluation of the effectiveness of this policy has been published. Early documentation of public awareness and public values has been provided by Hilton and Kaskutas (1990). These policies have two objectives. First, these warnings are intended to deter risk of drinking in conjunction with pregnancy or the operation of machinery. Second, warnings could be considered a part of proscriptive and prescriptive norms, described earlier. These warnings do provide a continuous message of warning about the risk of alcohol use in situations of risk. Warnings about the hazards of smoking have been on cigarette packs in the United States for some time and there is considerable evidence of their contribution to reduce levels of smoking. See Office of the Assistant Secretary of Health (1987).

### *Hours and Days of Sale*

Except for their inclusion in several omnibus analyses of variables purportedly related to alcohol consumption rates (Hoadley et al. 1984; Ornstein and Hanssens 1985; Nelson 1988), and the inclusion of these variables in general measures of availability determined by formal laws (Smart 1977; Janes and Gruenewald 1991), studies of the effects of changes in hours and days of sale are notable in the literature for their general absence. The exceptions to this rule are a series of studies conducted by Smith (1987, 1988) on a variety of changes in hours and days of sale made in various cities and states of Australia (see also Lind and Herbert 1982) and one descriptive study of the impact of extended operating hours at Scottish public houses and hotels (Bruce 1980). Although containing a number of rather serious methodological flaws, these studies present some, at least anecdotal, evidence for impacts of changes in hours and days of sale upon a number of alcohol problems.

Smith (1988), for example, presents a study in which the introduction of Sunday alcohol sales in the city of Brisbane, Australia, is related to casualty and reported property damage traffic crashes. Pre-post chi-square tests of problem rates aggregated over two years before and three years after the change in Sunday sales were used

to test whether this change in availability had the expected impact. Estimates of the relative daily rates of problems were constructed by comparing Sunday rates to rates on other days of the week. Similar tests in surrounding comparison communities were used as controls for other possible contemporaneous changes affecting traffic crashes in the geographic area at large. Smith found that the measured relative daily rates did in fact increase in Brisbane, but not in the comparison communities, and that the time of day of these increases reflected the new opening hours of alcohol outlets. As he notes, the striking temporal relationships among these variables strongly suggests that hours and days of sale can have a substantial impact on alcohol-involved traffic crashes. Gruenewald (1991) has observed that these studies suffer from failures to account for contemporaneous alterations in components of the alcohol control system (for example, beverage prices or other aspects of availability) and the degree to which the effect represents an increase in crash rates versus a redistribution of crash rates over time (days of the week).

### *Location and Density of Alcohol Outlets*

The number and concentration of alcohol retail outlets have been suggested to increase consumer convenience, and thereby increase consumer purchasing and thus consumption. Support for this observation has been provided by Colon (1982), as well as for the counter observation that outlet densities are only in response to demand for alcoholic beverages (Ornstein and Hanssens 1985). Restrictions on alcohol availability through formal laws has been a central part of policy efforts in Canada and the United States as well in many other parts of the world (Room 1987; Kortteinen 1989).

Examining cross-sectional state level data, there is some evidence that measures of the density of alcohol outlets may be important in predicting alcohol consumption and problem rates (Parker et al. 1978; Harford et al. 1979; Colon 1982; Colon et al. 1982). However, these studies suffer from serious problems in mis-specification (neglecting sociodemographic and economic variables and possible sources of simultaneity bias) and statistical testing (reliance on multiple testing procedures). More recent studies have been executed at the county (Rush, Steinberg and Brook 1986; Gliksman and Rush 1986) and city (Watts and Rabow 1983) levels. These studies are of importance for their efforts to avoid previous problems in statistically testing for the effects of availability. Using two different cross-sections (49 counties of Ontario, Canada and 213 cities in California) these studies demonstrate stable and statistically significant effects of outlet densities and sociodemographic background variables upon

consumption and problem rates (alcoholism, cirrhosis morbidity and mortality, arrests for public drunkenness, and traffic related fatalities). Of these three studies, all neglect alcohol price effects in local markets and the last neglects income effects upon alcohol consumption.

A critical subset of economic studies have included market variables in their analyses of time series (McGuinness 1983; Walsh 1982), cross-sectional (Schweitzer et al. 1983), and time series cross-sectional (Wilkinson 1987) data on physical availability and consumption. The first two studies, using data from the United Kingdom, suggest that availability measured in terms of outlet densities may be related to consumption rates but are limited by the shortness of the series studied (at most 25 years). The third, a cross-sectional examination of data from states of the U.S., uses a very limited subset of units (34 states) measured on a very large number of variables (up to 20) resulting in loss in statistical power.

The fourth study, based on a relatively large sample of data from 50 states over 5 years, tests the relationship between numbers of outlets and alcohol sales in the context of an analysis of policies to reduce drunken driving. The analysis suggests a small but significant relationship between these variables.

Recent research conducted by Gruenewald et al. (in press) using two-stage least squares (2SLS) analyses and data from all 50 U.S. states found that outlet densities are not only in response to demand but also act to stimulate demand. These findings were limited in their generalizability in that only cross-sectional data were used. Gruenewald et al. (in press, p. 18) concluded: "Great sales of alcohol stimulate more alcohol outlets per capita... In a complimentary manner, increased licensed densities produced upward pressure upon alcohol beverage sales."

There has been increased interest in the United States concerning possible interventions aimed at the local regulation of the densities of alcohol outlets. See work by Curry (1988), Wittman and Hilton (1987), and Wittman and Shane (1988). For example, the state of California, U.S., has limited the number of distilled spirits outlets per 100,000 population for both on-premise and for off-premise sales in each county.

Godfrey (1988) has examined the issue of the endogeneity of availability and consumption in the context of time series data similar to that used in McGuinness (1983) and Walsh (1982). She finds that there is some evidence that outlet densities are related to use (for spirits, wine, and beer) and that use is related to outlet densities (beer). Gruenewald et al. (under

review), directly addressing this potential endogeneity using time series cross-sections of state data from the U.S., show that outlet densities are related to consumption, significantly, and that consumption places upward pressure on alcohol outlet densities. Both of these studies include beverage prices and incomes as covariates. The latter also includes a subset of sociodemographic variables believed to be related to consumption rates and is based upon a relatively substantial data base (114 to 290 time series cross-sectional units).

Although it is clear that some progress has been made toward the adequate determination of the effects of changes in outlet densities upon alcohol consumption and problems, no study has yet been conducted to determine the relative costs and benefits of this approach to alcohol problem prevention. It is of particular importance to determine the extent to which changes in physical availability simultaneously alter changes in consumption and problems. Because of the very high incidence of alcohol related traffic crashes (Evans 1990) and the heavy dependence of U.S. citizens upon the automobile as their primary source of transportation, reductions in outlet densities may have a number of hidden costs, not the least of which is a potential increase in alcohol related traffic fatalities due to increased driving exposure. Given striking differences in routine activities related to the purchase and consumption of alcohol at different outlets (for example, the probability of driving after consuming alcohol when purchasing these beverages at restaurants versus liquor stores), the relative costs and benefits of reductions in outlet densities may vary strongly by outlet type.

## ALCOHOL PRICE

Price has been a historically important part of alcohol problem prevention in many parts of the world. Alcoholic beverages appear to behave in the market like other goods, i.e., as prices decline and/or income increases, then alcohol consumption will tend to increase. A number of studies have estimated this relationship (the elasticity or sensitivity of alcohol consumption to changes in price and income). See, for example, work by Ornstein and Levy (1983), Österberg (1975), Saffer and Grossman (1987a), Levy and Sheflin (1983), and Cook and Tauchen (1982).

The elasticity of alcohol is influenced by many other factors. It has been pointed out that the more restrictive the availability of alcohol, the smaller the influence of

changes in prices and income of consumers will be. See work by Malmqvist (1948), and Huitfeld and Jorner (1972), for analyses of Swedish data and Gruenewald et al. (in press) for recent analyses of U.S. data. A recent summary of U.S. research on alcohol prices is in work by Leung and Phelps (1991).

Grossman, Coate, and Arluck (1987) determined the differential price sensitivity of consumption by young people (16-21 years old), paying special attention to beer, the alcoholic beverage of preference for the young. They concluded that youthful consumption is sensitive to price changes of both beer and distilled spirits and that increases in beer prices are not accompanied by increases in liquor and wine consumption. They found that a 10 cent increase in beer price will result in a 14.8 percent decrease in the number of youthful heavy beer drinkers (3 to 5 drinks of beer per day) and a 30 cent increase in distilled spirits would result in a 27.3 percent decline in the number of youthful heavy liquor drinkers (3 to 5 drinks of liquor per day).

Since the overall consumption of distilled spirits as well as consumption of spirits by heavy drinkers can be demonstrated to be sensitive to price, it is reasonable to hypothesize that other alcohol-related problems will also be price sensitive. Cook (1981) investigated the short-term effects of changes in liquor tax on the auto-accident death rates utilizing the same quasi-experimental design used to investigate the sensitivity of the correlation between liquor consumption and cirrhosis mortality. The same 39 state liquor tax changes used in the consumption study were employed. About 66 percent of the net-change observations for auto fatalities were negative. The probability that 66 percent or more would be negative is less than 4 percent. Therefore, one can conclude that a liquor tax increase tends to reduce the auto fatality rate.

In recent years there has been increasing attention to the public health benefits of increasing tax rates as well. The 1987 *Economic Report of the President* (Council of Economic Advisors, 1987) noted that an increase in the federal excise taxes on alcoholic beverages would reduce mortality rates from alcohol-related causes. The U.S. Department of Education's National Commission on Drug-Free Schools (1990) advocated an increase in alcohol excises as a deterrent to use by youths, and the 1990 report on National Health Promotion and Disease Prevention Objectives advocated such an increase in order to reduce highway fatalities and cirrhosis deaths (U.S. Public Health Service 1990). The Center for Science in the Public Interest has publicized the case for

excise taxes as a health promotion mechanism, and its National Alcohol Tax Coalition, representing 40 groups, has lobbied for a substantial increase on the same basis (Godfrey 1990).

## MASS COMMUNICATIONS AND ALCOHOL-INVOLVED DRIVING

A consideration of mass communications and alcohol-involved traffic problems involves both intentional and unintentional communications. Intentional communication is that which is designed to purposefully affect drinking and driving such as mass media campaigns, [e.g., using Public Service Announcements (PSA's)]. Unintentional communication has an effect on drinking and driving behavior but such effect is unplanned. Two types of unintentional communication are examined here: News Coverage and Alcohol Advertising.

**Public Service Information Campaigns.** These campaigns have become the most frequent types of PSA on television. They are produced by the federal government, the National Association of Broadcasters, and a variety of beverage producers such as Coors and Anheuser-Busch. A discussion of these campaigns is provided by Atkin (1988).

The evaluation of the effects of such purposeful communications is quite sparse. Worden, Waller, and Riley (1975) found that a media campaign conducted in conjunction with enforcement produced significant changes in knowledge, attitudes and related behavior. However, the authors found that the effect decayed rapidly over time. Haskins (1985) in a review of 15 years of mass communication campaigns designed to change drinking and driving behavior concluded that very little had been learned.

Atkin (1986) found in a program evaluation of a parent program to prevent teenage participation in social events where alcohol was available that parents were strongly influenced by a communications program using newspaper stories, radio PSA's and pamphlets. However, Atkin found that the changes in parental awareness resulted in only slight changes in teenage drinking and drinking-driving rates.

Worden et al. (1989) conducted a public information campaign using "BAC Estimation" cards which provided data to drivers about steps to determine one's BAC. These "Know Your Limit" cards were widely distributed in an experimental community. Using roadside survey

and community survey data, the authors found following the campaign only .06 percent of drivers in the experimental community were over the legal limit while 3 percent of drivers were over the limit in the control community.

Atkin (1988, p. 23) concluded following his review of public service information programs for the Surgeon General's Workshop on Drunk Driving that:

In general, mediated drunk-driving campaigns appear to have had relatively little effect on drinking and driving. This lack of significant influence is consistent with studies of related campaigns in the domains of safety belt promotion, substance abuse prevention, and other health practices.

Vingilis and Coultres (1990, p. 69) reviewed two public information campaigns which used mass media only. They found mixed to no effects on traffic crashes across these studies and concluded that the research on campaign effects is very limited in terms of the number of controlled studies and methodological problems. They observed:

We do not have enough information on other factors such as media coverage, penetration, message, etc. and on the potential for behavior change through mass communications campaigns in the drinking-driving field.

However, Atkin (1988) points out that there is increasing evidence of the potential for well-designed information campaigns to have behavioral effect using the principles of social marketing. This is especially true, according to Atkin, when formative research is used to develop campaigns which investigate the most effective sources, message appeals, and channels.

Vingilis and Coultres (1990) reviewed the research evidence on mass media campaigns with other countermeasures, which they observe, is the majority of such purposeful communications programs. For example, mass information campaigns typically accompany the passage of new laws or specialized enforcement programs. Vingilis and Coultres (1990) concluded from their review of such campaigns that the results were mixed, sometimes effects were achieved and sometimes not.

The major intervening factor between mass communications and drinking-driving has been defined as the perceived risk of detection and/or apprehension for drunk driving, not the actual probability of arrest, which is quite low. See work by Ross 1982, Voas 1982,

and Williams and Lund 1984.

This relationship has been confirmed by the research of Jonah and Wilson (1983), Vingilis and Salutin (1980), and Williams and Lund (1984). Because it is the perception rather than the reality of the detection risk which is significant to deterrence, some studies have found that drinking and driving can be manipulated through publicity alone (Mercer 1985; Liban et al. 1985; Vingilis and Salutin 1980; and Lacey et al. 1990).

However, publicity alone has rarely produced lasting changes in safety behavior (Wilde et al. 1971). The best understanding of deterrence effects can be seen as an interaction between mass media information and the personal experience of drivers. Thus Ross (1982) in his report on the British Road Safety Act of 1967, noted that the public was initially lead to believe that the probability of being tested for alcohol and arrested was much higher than it proved to be. He states, "It seems reasonable to me to ascribe (the subsequent reduction in effectiveness of the law) to the gradual learning by U.K. drivers that they had overestimated the certainty of punishment under the law."

Therefore, the difficulty of sustaining behavioral changes resulting primarily from purposeful communication about laws or enforcement establishes a natural decay in this process. Vingilis and Coultres (1990, pp. 74, 75) conclude their review on a rather pessimistic note:

This review suggest first and foremost that there is much rhetoric and little substance on the impact of mass communications campaigns on drinking and driving...Even of those systematically analyzed, the methodological problems preclude definitive statements on overall campaign effectiveness, let alone on what types, media, messages, etc. of campaigns are effective in the drinking-driving field.

#### *Alcohol Advertising*

A number of studies have sought to examine the relationship between alcohol advertising and alcohol consumption. Few, if any, studies have explored a direct relationship between advertising and alcohol-involved traffic crashes. The relationships between alcohol advertising and consumption, in general, and between alcohol consumption and traffic crashes is, at best, an incomplete means to examine the advertising-consumption-traffic crash linkage.

Wagenaar and Streff (1989), using non-linear time series modeling over 10 years (1976-1985), found a strong association between alcohol consumption and single vehicle nighttime fatal crashes. They were found

to lag one month behind a change in alcohol consumption. Colon (1982) found significantly lower single vehicle fatalities in states with more restrictive availability of alcohol, usually spirits and sometimes wine, through the use of state retail monopolies.

Several countries, particularly those with governmental-monopoly retail sales of alcohol have restrictions or outright bans on alcohol advertising. For example, Sweden prohibits advertising of medium- and high-alcohol-content beer and there is a voluntary ban in the United States on distilled-spirits advertising on television. There has been conflicting research results on whether alcohol advertising promotes alcohol use and/or misuse. Summaries of alcohol advertising research can be found in work by Partanen and Montonen (1988), Smart (1988), and Moskowitz (1989). Saffer (1989) reports a pooled-time series over 14 years in 17 countries which suggests that countries which have advertising restrictions or bans have lower levels of alcohol abuse.

Adlaf and Kohn (1989) reanalyzed Strickland's data on drinking students from grades 7, 9, and 11 and found that for these youth: 1) a common factor of abuse was present; 2) frequent intoxication contributed to abuse; 3) peer association had greater effect than advertising. These data were interpreted by the authors as indicating little support for further advertising restrictions.

A full review of the potential effects of advertising on consumption is beyond the intent of this paper. However, an assessment of the effects of advertising bans should have as a background the general effects of advertising. In other words, most certainly if there is no advertising effect, then studies of bans are unnecessary. Perhaps the most complete review of the rationale for postulating advertising effects and of the available literature to that data was by Smart (1988).

Smart observed that the findings of a variety of studies using various research strategies including econometric analyses, experimental exposure studies, and self-reported consumption studies produced mixed and inconsistent findings. A most recent review of econometric studies by Saffer (1991) finds that the relationship of advertising expenditures is weak but that studies are often limited by data (small number of observations) and design (failure to control for confounding variables).

The strongest design for an advertising ban study would be longitudinal, for example, an interrupted time series design. Advertising bans provide for greater variation to exposure than advertising expenditures. In addition, bans most often reflect a public policy choice concerning alcohol advertising and a society's collective disapproval of such advertising.

The earliest published study of advertising bans was

conducted by Smart and Cutler (1976) examining a ban in British Columbia. The ban of all alcohol advertising lasted only 14 months in 1971-1972. Little effect on alcohol consumption was found. A second study by Ogborne and Smart (1980) of a Manitoba ban on beer advertising also found no effects on alcohol consumption. However, as Smart (1988) observed, these were not total bans as only local marketing was banned and all out-of-province advertising continued to be available.

Norway prohibited all alcohol advertising in 1975 and Finland did so in 1977. These bans are of considerable interest as neither country received much foreign television or other media influences. An examination of per capita consumption figures for 1974-84 shows no obvious postban effect. A different comparative approach was taken by Simpson et al. (1985), who examined consumption in two groups of countries for 1972-81: in Hungary, Finland and Norway where advertising was totally prohibited and in Denmark where radio and television advertising was banned and print advertising allowed; and in the Netherlands, Australia and Japan where advertising was unrestricted. Gross inspection of the data shows that per capita consumption varies greatly in both groups and there are no obvious differences. Countries with no advertising did not have lower rates of consumption.

Another study of advertising bans was done by Ornstein and Hanssens (1985). They examine the effect of bans on billboard advertising, bans on consumer novelties and bans on price advertising on beer and spirits consumption in the United States. State data for the period 1974 to 1978 are used. The results show that states that allow price advertising and consumer novelties have higher spirits consumption. They also find that billboard advertising and novelties have no effect on beer consumption while there is some evidence that price advertising increases beer consumption. Wilcox (1985) examined beer sales in Michigan before, during, and after a price advertising ban and found that allowing price advertising and then banning it had no significant effects on total sales of beer.

Saffer (1991) examines the effect of banning broadcast advertising of alcoholic beverages on alcohol abuse. This study contains the first set of estimates, using international data, of the effect of television advertising bans on alcohol abuse. The effect of a ban cannot be estimated using data from one country because the adoption of new advertising bans is an infrequent event and requires many years for adjustment. However, an international data set can be used since there is considerable variation in the use of advertising bans across countries. The data used in this study were a pooled time series from 17 countries for

the period 1970 to 1983. The empirical measures of alcohol abuse were alcohol consumption, liver cirrhosis fatality rates, and highway fatality rates. Cultural factors which influence alcohol use were measured by alcohol production variables and a set of country dummy variables. The empirical results showed that both alcohol advertising bans and alcohol price can have a significant effect in reducing alcohol abuse.

Smart (1988) concluded that advertising bans appear to have little impact on overall sales of alcohol although a total ban has been very difficult to achieve. He observed

Given the global nature of mass media, total advertising bans are almost impossible to achieve. An additional problem is that advertising effects may persist for a long time after a ban has been imposed and hence effects on sales may be long delayed. Perhaps an entire generation never exposed to alcohol advertising would drink less than those exposed to advertising for years and then a ban.

This raises the research question of whether young people are prepared for drinking in the reinforcement of alcohol advertising. This question was addressed in a recent study by Grube et al. (1991) which investigated the relationships among awareness of television beer advertising, drinking intentions, alcohol beliefs, and knowledge about beer brands and slogans. Nonrecursive modeling with latent variables was used to estimate the effects of awareness of alcohol advertising on beliefs, intentions and knowledge and the simultaneous effects of these variables on awareness.

The sample comprised 468 fifth and sixth grade school children from a Northern California community. Data were collected using a combination of self-administered questionnaires and structured interviews conducted in the home. The children were regularly exposed to and moderately aware of beer advertising. They also were moderately skeptical of it. Even so, beer advertising had a significant effect on them. Children who were more aware of beer advertising held more favorable beliefs about drinking and were more knowledgeable about beer brands and slogans. Awareness had an indirect influence on intentions to drink as an adult that was mediated through beliefs. Evidence of reciprocal effects was found also. Specifically, knowledge of beer brands increased awareness of beer advertising. As Grube and Wallack concluded

Considering the effects of beer advertising on children, this study provides direct evidence that

awareness of beer commercials predisposes elementary school children to drinking.... That is, awareness of advertising causes children to be more favorably predisposed to alcohol and drinking.

#### *News Media*

The unplanned news coverage of drinking and driving as well as planned countermeasures are relevant to the research discussion. The potential preventative effects of such news coverage is similar to that of planned public information campaigns, named the public's perceived (as opposed to the actual) risk of being stopped and arrested for DUI.

An excellent example of this relationship is provided by Voas and Hause (1987). A special enforcement program, sponsored by NHTSA, in Stockton, CA, provided for ten extra police patrols dedicated to DUI enforcement which was a ten-fold increase in enforcement capacity. The special enforcement program, which began on January 1, 1976, had no planned public information program but naturally produced considerable coverage in local papers and electronic media beginning in late 1975. During the high coverage phases, alcohol-involved traffic crashes declined by 25 percent. During the next year of the enforcement program, the novelty of the program to the news media declined leading to a subsequent decline in news attention. Even with lower news coverage, crash levels remained 10 percent below baseline during the period of special enforcement. After the enforcement program ended, the crash rate remained at the same level for approximately 6 months (until the motoring public became aware that enforcement patrols were ended) and then trended back to the baseline level. The authors concluded that permanent change must be based upon an increase in the efficiency and effectiveness of enforcement together with public education programs which provide continuing support for the program by enhancing the perceived risk of detection by the police.

Atkin (1988) concludes that the most powerful role (and possible longest lasting effect) of the new media is in setting the agenda for policymakers and the general public.

Thus, news is a means to raise the salience of drunk driving, stimulate public discussion, legitimize the seriousness of the problem, and increase acceptance and support of efforts to prevent the problem.

#### CONCLUSION

The research reviewed here provides a scientific basis for considering prevention interventions which limit the

retail availability and access to alcohol as a strategy to reduce alcohol-involved traffic crashes. While many of these alcohol policy alternatives have been shown to reduce alcohol-involved traffic crashes, these policies are "broad brush," i.e., they impact both drivers and nondrivers. They are not always specifically targeted to the reduction of alcohol-impaired drivers.

Perhaps the best example of a policy which most directly affects drinking before driving is server training and server liability. If the BAC of patrons in bars and restaurants is lowered as a result of server intervention, then drinking and driving is the alcohol-related problem most likely to be impacted. Yet other alcohol problems can also be affected, i.e., violence, falls, burns, etc., which result from alcohol-impairment.

This suggests that efforts to prevent alcohol-involved traffic problems may best be seen as part of a public health perspective on community safety in which drinking and driving plays a major part but other causes of death and injury related to alcohol impairment are also a part as well. This has two advantages. First, strategies such as alcohol regulation are seen as part of total injury prevention, and second, a larger base of public support can be developed.

Environmental alcohol policies have a number of advantages. First, as structural or environmental approaches, they are not dependent upon persuasion and individual driver judgement. Second, they do not necessarily decay over time. For example, perceived risk of detection for DUI has been shown to be a powerful strategy for reducing events of alcohol-impaired driving, but the affect invariably decays over time.

Third, many of the alcohol policy strategies have clear scientific evidence of effect on reducing alcohol-involved traffic crashes. This provides a solid empirical basis for considering such strategies.

Fourth, alcohol policy strategies can work synergistically with more conventional enforcement and judicial strategies. For example, retail establishments can be stimulated to participate in server training by DUI enforcement. In like manner, server intervention with customers can reinforce the preventative aspects of enforcement by reminding customers of their risk and the need to use restraint in their drinking.

## IMPLICATIONS FOR RESEARCH

In many cases, the alcohol prevention policies reviewed in this paper were not designed to specifically reduce alcohol-involved traffic crashes. For example, while traffic crash reduction was a useful measure of success for changes in the minimum drinking age, the reduction

of drinking by young people was a primary target. Alcohol-involved traffic crashes are a desired and a convenient indicator (with the availability of archival crash records with which to construct long time series).

There is clear evidence (as reviewed in this paper) that strategies for alcohol problem prevention affect alcohol-involved traffic crashes. This has been shown in such alcohol policy areas as the minimum drinking age, changes in alcohol availability, alcohol prices, etc. Therefore, there are at least two major research opportunities in the next decade.

First, the challenge is to seek integration. Alcohol-involved traffic safety research needs to become more integrated with alcohol problem prevention research in general. For example, responsible beverage service (RBS) programs can reduce the level of intoxication of patrons leaving licensed beverage establishments. This means that not only are drinking and driving events reduced but likely so are public drunkenness, alcohol-related violence, drinking and drownings, etc. The random breath testing for DUI in Australia has shown an effect on fighting in pubs. Thus alcohol problem prevention research has much to gain and to offer alcohol-involved traffic safety research.

Second, another important future research area is synergism of alcohol-involved traffic safety prevention strategies. Future prevention research should examine the interaction and mutual reinforcement of say DUI enforcement and alcohol sales to minors or RBS, parents training and mobilization, and underage drinking. See discussion by Holder 1991. To date, much of our research has been focused on determining the effectiveness of a single, isolated prevention strategy or counter-measure. This is necessary to determine the efficacy of that single strategy or countermeasure. However, there is reason to hypothesize that the combined effect of two or more strategies can exceed the sum of the two as separate strategies due to their mutual reinforcement.

The effects of increased DUI enforcement have been shown to decay after the driving public develops a more realistic assessment of their actual low likelihood of being detected for drinking and driving. Therefore, it is certainly possible that other strategies such as educational or structural changes in alcohol availability can serve to reinforce enforcement strategies. In short, a major challenge for the future in alcohol prevention research including traffic safety will be to develop strategies and research techniques which can examine the ability of multiple strategies to reduce alcohol-involved traffic safety problems.

Specific research areas which need attention in my

judgment include: (a) effect of alcohol prices on traffic crashes at a local level, (b) effect of increased DUI enforcement (particularly high visibility enforcement) on other alcohol problems, especially violence, and (c) effect of changes at the local level of density and location of alcohol outlets on alcohol-involved traffic problems.

This suggests to me that future traffic research can benefit by comprehensive approaches to countermeasures. This would make alcohol control policies a part of this broad spectrum of strategies available for which research can be of assistance.

The attractive aspect of this proposal is that we do not have to advocate for the inclusion of alcohol availability policies in isolation from enforcement but as part of broad community injury prevention efforts.

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