

Prevention of Alcohol-Related Motor Vehicle Crashes: *Logic Model Documentation*

Pacific Institute for Research and Evaluation (PIRE)

11720 Beltsville Drive, Suite 900

Calverton, MD 20705

Tel: (301) 755-2700

Fax: (301) 755-2799

February 8, 2008

Contributing authors (in alphabetical order):

Johanna D. Birckmayer, Ph.D., M.P.H., Renée I. Boothroyd, Ph.D., M.P.H.,
Karen B. Friend, Ph.D., Harold D. Holder, Ph.D., and Robert B. Voas, Ph.D.

The Logic Models here are a work in progress; no Logic Model is ever complete or final. The goal of this Logic Model is to document the best available research evidence as well as identify gaps or areas in our understanding which need further study or replication in future research. These documents are presented freely for the use of prevention researchers and prevention practitioners, and can be downloaded and reprinted as desired.

PIRE respectfully requests that any uses or distributions of these documents in part or in whole give credit to the Pacific Institute for Research and Evaluation, Calverton, MD.

Table of Contents

I.	Definition.....	1
	Alternative Measurements or Indicators.....	1
II.	Alcohol-Related Motor Vehicle Crash Causal Model.....	8
III.	Documentation of Intermediate Variables, Relationships, and Prevention Strategies....	9
	Driving After Drinking.....	11
	Community Norms about Drinking and Driving.....	21
	Perceived Risk of DUI Arrest.....	28
	Public Awareness of Drinking-and-Driving Enforcement.....	34
	DUI Enforcement.....	37
	Community Activism About DUI Enforcement.....	44
	DUI Enforcement.....	45
	Drinking.....	48
	Drinking and Driving.....	54
	Alcohol Serving and Sales Practices.....	58
	Alcohol Sales and Service—Regulations, Enforcement, and Sanctions.....	65
	Retail Availability.....	72
	Price.....	81
	Community Norms About Drinking.....	88
	Promotion.....	96
	Drinking Context.....	101
	Social Availability.....	105
	Individual Factors.....	110
IV.	References.....	113

I. Definition

An alcohol-related motor vehicle crash is any traffic crash in which at least one driver had been drinking before the crash. Approximately 41% of traffic fatalities result from drinking and driving per year. In 1999, approximately 2.2 million crashes in the United States involved alcohol. Almost 17,000 people die from alcohol-related crashes each year.

Alcohol-Associated Traffic Fatalities. Motor vehicle crashes are the leading cause of injury deaths in the United States, and their incidence appears to be rising. In 1994, the National Highway Traffic Safety Administration (NHTSA, 1995b) registered about 6,490,000 police-reported traffic crashes, of which 36,223 involved one or more fatalities. A total of 41,798 deaths from motor vehicle crashes were reported in 1995 (NHTSA, 1996) and 42,815 in 2002 (NHTSA, 2003).

The number of alcohol-attributable motor vehicle crashes and fatalities declined during the previous decade. NHTSA (2000) reported a 29% decrease in alcohol-related deaths between 1992 and 1999. This drop is consistent with the reduction in alcohol consumption and with increased publicity and enforcement of drinking-and-driving policies in the United States (Greenfield & Henneberg, 2001; Grube & Stewart, 2004; Hingson, Heeren, & Winter, 1999; Office of Applied Studies, 2000).

Alternative 1

Percentage of Fatal Motor Vehicle Crashes That Are Alcohol Related

Justification

Approximately 2.2 million crashes in the United States involved alcohol in 1999. Approximately 41% of traffic fatalities result from drinking and driving. Almost 17,000 people die from alcohol-related crashes each year. Alcohol-related traffic crashes remain the single greatest cause of death among youths and young adults.

Definition

Percentage of fatal motor vehicle crashes (i.e., in which at least one person died) in which at least one driver, pedestrian, or cyclist had been drinking (blood alcohol concentration [BAC] >0.00).

NUMERATOR = ANNUAL NUMBER OF FATAL CRASHES INVOLVING ALCOHOL

DENOMINATOR = ANNUAL NUMBER OF FATAL CRASHES

Data Sources

Crash data from the Fatality Analysis Reporting System (FARS), NHTSA, and U.S. Department of Transportation (DOT)

(NUMERATOR AND DENOMINATOR)

Frequency

Annual

Geographic Levels

National, state, and county

Demographic Categories

Not applicable

Strengths Data on fatal traffic crashes have been systematically collected by NHTSA for many years in every state (though states vary in the number of years in which they have participated in FARS).

Limitations Although considerable effort has been made to obtain the BAC values for all drivers involved in fatal crashes, these data are not complete. NHTSA has therefore estimated the drivers' BACs for cases missing data. The stability of this indicator is directly related to the size of the population in which these fatal crashes occurred. This indicator may therefore be unstable for states that are less populated and for counties that have low numbers of annual fatal crashes.

Alternative 2 Alcohol-Related Vehicle Death Rate

Justification Approximately 2.2 million crashes in the United States involved alcohol in 1999. Approximately 41% of traffic fatalities resulted from drinking and driving. Almost 17,000 people die from alcohol-related crashes each year. Alcohol-related traffic crashes remain the single greatest cause of death among youths and young adults.

Definition Number of vehicle deaths in which at least one driver, pedestrian, or cyclist had been drinking (BAC >.00) per 1,000 population.

$$\text{NUMERATOR} = \text{ANNUAL NUMBER ALCOHOL-RELATED VEHICLE DEATHS}$$

$$\text{DENOMINATOR} = \text{TOTAL RESIDENT POPULATION FOR SAME CALENDAR YEAR}$$

Data Sources Number of alcohol-related vehicle deaths from FARS, NHTSA, U.S. DOT (numerator). Population estimates from the U.S. Bureau of the Census (denominator).

Frequency Annual

Geographic Levels National, state, and county

Demographic Categories Age by gender (of persons killed)

Strengths Data on fatal traffic crashes have been systematically collected by NHTSA for many years in every state (though states vary in the number of years in which they have participated in FARS).

Limitations

Although considerable effort has been made to obtain the BAC values for all drivers involved in fatal crashes, these data are not complete. NHTSA has therefore estimated drivers' BACs for cases missing data. The stability of this indicator is directly related to the size of the population in which these deaths occur. This indicator may therefore be unstable for states that are less populated and for counties that have low numbers of annual vehicular deaths, especially when used for demographic subgroups.

Alternative 3**Percentage of Alcohol-Involved Drivers Among All Drivers in Fatal Crashes****Justification**

Approximately 2.2 million crashes in the United States involved alcohol in 1999. Approximately 41% of traffic fatalities resulted from drinking and driving per year. Almost 17,000 people die from alcohol-related crashes each year. Alcohol-related traffic crashes remain the single greatest cause of death among youth and young adults.

Definition

Percentage of drivers involved in fatal crashes (i.e., in which at least one person died) who were found to have BACs >0.00.

$$\text{NUMERATOR} = \text{ANNUAL NUMBER OF ALCOHOL-INVOLVED DRIVERS IN CRASHES IN WHICH AT LEAST ONE PERSON DIED}$$

$$\text{DENOMINATOR} = \text{ANNUAL NUMBER OF DRIVERS IN CRASHES IN WHICH AT LEAST ONE PERSON DIED}$$

Data Sources

Driver data from FARS, NHTSA, U.S. DOT (numerator and denominator)

Frequency

Annual

Geographic Levels

National, state, and county

Demographic Categories

Age by gender (of driver)

Strengths

Data on fatal traffic crashes have been systematically collected by NHTSA for many years in every state (though states vary in the number of years in which they have participated in FARS).

Limitations

Although considerable effort has been made to obtain the BAC values for all drivers involved in fatal crashes, these data are not complete. NHTSA has therefore estimated drivers' BACs for cases missing data. The stability of this indicator is directly related to the size of the population in which these deaths occur. This indicator may therefore be unstable for states that are less populated and for counties that have low numbers of fatal crashes, especially when used for demographic subgroups.

Alternative 4**Single-Vehicle Nighttime Crashes****Justification**

Research has demonstrated that drivers who are on the road later at night have an increased probability of having been drinking. When a nighttime driver is involved in a crash that only involves his or her vehicle (no pedestrians, no other vehicles, and no animals), the probability that this driver is impaired by alcohol is very high.

Definition

In published research, single-vehicle nighttime (SVN) crashes are frequently used as an indicator to evaluate alcohol policies seeking to reduce traffic crashes (19, 20). SVN crashes occur between 8 p.m. and 4 a.m. and involve only one motorized vehicle. This surrogate has been used in several studies (Hingson, 1987) regarding drunk-driving laws. Heeren, Smith, Morelock, and Hingson (1985) have shown that, for fatal crashes, the SVN measure is closely related to alcohol-related crashes involving drivers with known BACs. For other surrogates (all crashes at nighttime and all crashes involving injury), this measure is relatively conservative. Although crashes with drinking drivers (as reported by the investigating officer) may be a more sensitive indicator of the influence of an enforcement program, use of this surrogate runs the risk of incorporating a *measurement error* in the analysis. Hence, the officer's judgment regarding drinking could be influenced by the training provided as part of the program and/or by the special breath-sensing equipment used in program operations.

As an adjunctive measure, SVN injury crashes can be used as an alternative surrogate to screen SVN crashes to those in which there was at least one injury. Thus, an alternative indicator is the frequency of SVN injury-producing crashes. Injury-producing crashes are those in which at least one vehicle occupant was killed or disabled or received a nondisabling injury, as reported by the police officer at the scene of the crash. Minor (i.e., possible) injuries are typically excluded.

Other surrogates have been used by some investigators, such as all nighttime fatal crashes or drinking-driver crashes if noted on the crash report form by the police officer. Studies based on a significant number of fatal crash drivers who have been tested for BAC levels can provide data on the number of drinking drivers in all alcohol-involved crashes. If the number of drivers in fatal crashes is small (as is often the case for community studies), it is necessary to use crashes with no fatalities where BAC measurement is less frequent. The measure preferred by most traffic researchers, however, is SVN crashes (i.e., those with only one moving vehicle and occurring between 8 p.m. and 4 a.m.).

Data Sources

Each state maintains a computer-based electronic file of every motor vehicle crash. Each record contains sufficient information to

	develop this indicator.
Frequency	Can be developed as often as hourly or as infrequently as annually.
Geographic Levels	Any desired level, down to the local street or neighborhood.
Demographic Categories	Available for all categories as defined for research or evaluation purposes.
Strengths	<p>Previous research has demonstrated that a high proportion of SVN crashes involve a driver who had been drinking alcohol. Consequently, use of SVN crashes as a surrogate for alcohol involvement has become standard practice in the traffic crash studies field (Hereen et al., 1985) and has been used successfully in previous policy evaluation research (Wagenaar & Holder, 1991; Hingson et al., 1987).</p> <p>It has been well established that alcohol is more likely to be involved in crashes that occur at night, particularly on weekend nights, and that single-vehicle crashes are more likely to be alcohol related than other crashes. We will therefore use SVN crashes, a commonly accepted surrogate for alcohol involvement. This category has been shown to include a significant number of alcohol-involved drivers (Richman, 1985; Mounce, Pendleton, & Gonzales, 1988; Hingson et al., 1987) and is sensitive to changes in alcohol use and availability in studies of minimum purchase age (MPA; Wagenaar, 1986a, 1986b), changes in spirits availability (Blose & Holder, 1987), changes in beverage server liability (Wagenaar & Holder, 1991), and changes in patterns of alcohol sales (Gruenewald, Miller, & Treno, 1993a).</p>
Limitations	Obviously, some SVN crashes do not involve alcohol, and some alcohol-involved crashes are not included in the SVN definition. Nonetheless, the classification errors are constant over time, making the SVN indicator most useful for assessing changes over time.

Alternative 5

Police-Reported Alcohol-Involved Crashes

Justification	In most states, the forms used for recording traffic crashes contain a blank for the police office investigating the crash to record if, in his judgment, one or more of the drivers in the crash had been drinking. This judgment may be based upon either formal testing with breathalyzers or simple observation. Thus this information is available and reported by most states as a part of their routine traffic safety reporting and is thus easily available.
Definition	Police report of a crash where at least one driver had been drinking. These are typically reported as <i>alcohol-involved</i> traffic crashes in the aggregate.

Data Sources	State traffic crash records
Frequency	Many states report the aggregate counts of alcohol-involved traffic crashes at least annually and sometimes monthly. Specific analyses would require a separate computer analyses of state crash files.
Geographic Levels	State level and sometimes county level
Demographic Categories	Any category can be obtained via separate computer runs on state crash records.
Strengths	The purpose of any surrogate is to facilitate evaluation of the population-level effects of prevention interventions; it is therefore reasonable to use these law enforcement reports when other data are not available. In practice, though underestimates of the actual level of alcohol involvement are typical, police reports often follow the same trends that are reflected in other more valid estimates of alcohol-involved traffic crashes.
Limitations	<p>This indicator is clearly an underestimate of the number of crashes in which at least one drinking driver was involved (Miller & Blincoe, 1994). The ability of police officers to judge the nature of injuries is limited. Further, a substantial number of crash injuries are not reported to police, particularly the less-severe injuries. Officers also cautiously or conservatively report drivers, pedestrians, or pedalcyclists as having been drinking or as being under the influence. In the absence of test data, if the officer reports that he or she believes the person has been drinking or is under the influence, the crash is also classified as <i>alcohol related</i>.</p> <p>Officers' cautiousness is less a factor in fatal crashes, however, because every effort is made to obtain alcohol test results. For less severe crashes, though, the officer's judgment is all that is available, so alcohol-related nonfatal crashes are almost certain to be considerably underestimated. Sometimes, though rare, an officer reports that a person has been drinking or is under the influence, but the alcohol test is negative. In these cases, the crash is not classified as alcohol related. Police reports can be used to derive an aggregate count of injured occupants (but not to identify specific injury patterns). In Texas, comparisons of police reports with toxicological test results revealed that, in 1983, only 33% of drivers with BACs of .10 or more had alcohol cited as a contributing factor in the crash, whereas the corresponding proportion in 1988 was 81%.</p> <p>NHTSA developed a sophisticated statistical procedure to estimate the actual number of alcohol-related fatalities. The idea that a computerized statistical procedure can accurately make such estimates initially invited skepticism; however, NHTSA developed the procedure with the greatest care over many years. (This procedure was once again improved in 2002.) In Minnesota, for</p>

example, when the two procedures—NHTSA’s estimating procedure and the state’s procedure based on known data—were used, the estimate from NHTSA of the true percentage of alcohol-related fatalities was always higher than, but very close to, the state’s numbers (Minnesota Department of Public Safety, 2002).

This reporting problem is particularly troublesome for the least severe crashes (e.g., property-damage-only crashes) where police may be less attentive in the investigation and the reporting. In some communities, for example, police may not investigate property-damage-only crashes at all, relying instead on reports voluntarily filled out and submitted by the motorist(s); these reports are necessarily suspect regarding the role of alcohol. For nonfatal injury crashes, the reporting problem is less severe but still frequently yields a low estimate.

In the final analysis, trends observed in police-reported alcohol-involved crashes can vary both in the contribution of alcohol in crashes and in the reporting practices

II. Alcohol-Related Motor Vehicle Crash Causal Model

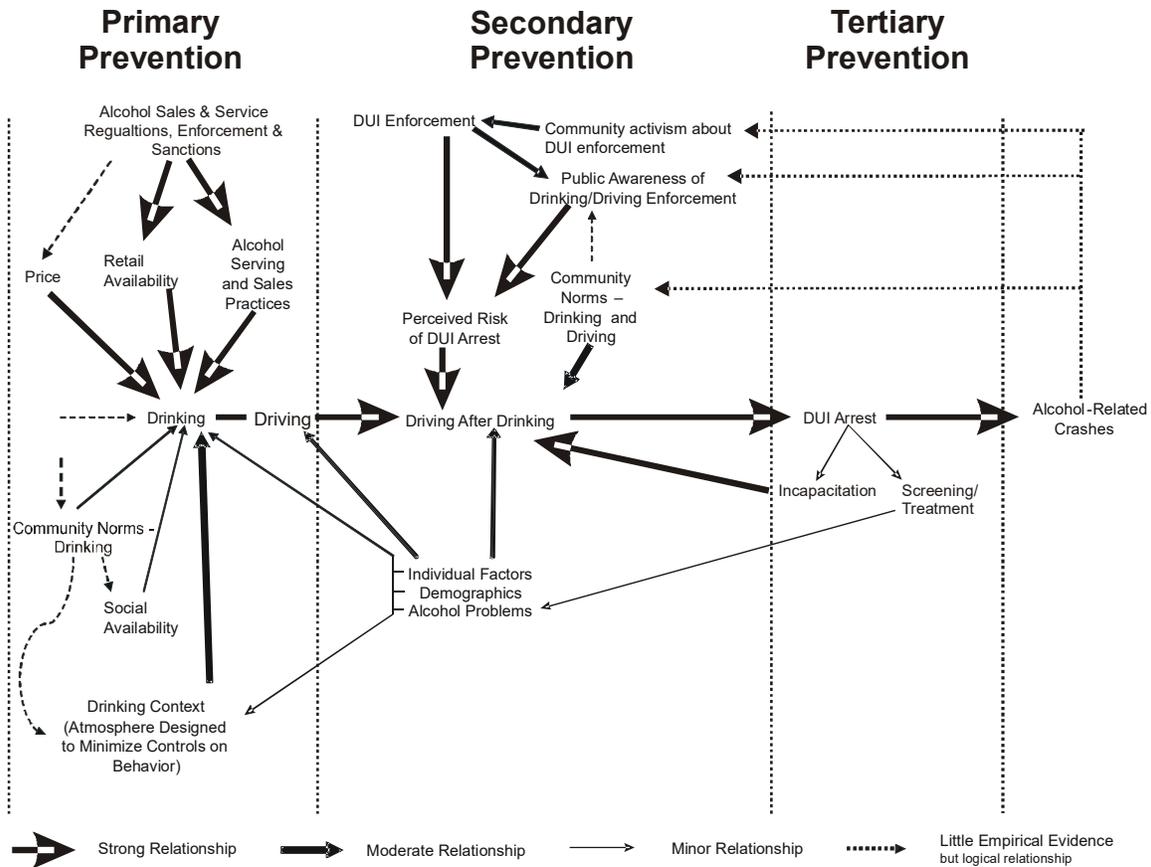


Figure 1. Crash Causal Model

III. Documentation of Intermediate Variables, Relationships, and Prevention Strategies

This section documents each element (problems, intermediate variables, relationships, and strategies) of the causal model shown in Section II. For each intermediate variable, we use the following subsection headings (in bold italics on the left):

Conceptual Definition

This defines the intermediate variable as a concept and sometimes provides a rationale as to why this intermediate variable is included in this causal model.

Measurement

These are the operational definitions for the intermediate variable—that is, the alternative methods, techniques, tools, approaches, and so on to measure this variable and to develop valid and reliable indicators. Data sources may be surveys, archival data, or other sources.

Relationship of the Intermediate Variable to the Problem

This subsection summarizes the research evidence of the relationship of the intermediate variable to the specific Alcohol, Tobacco, and Other Drugs (ATOD) problem being addressed by the causal model. Emphasis is given to published research in peer-reviewed scientific journals. In some cases, there may be no direct empirical evidence of the *intermediate variable* to *ATOD problem* relationship. The relationship is therefore presented in theoretical terms—that is, reasoned argument, based upon other research evidence that can be generalized to the case or situation (research citations are included).

Relationship of the Intermediate Variable to Other Variables

This subsection summarizes the research evidence of the relationship of the intermediate variable being documented to any other variable as shown in the causal model (Section II). Each relationship discussed focuses on the causal, moderating, or mediating relationship toward another variable: for example,

PRICE → DRINKING BUT NOT DRINKING (AS DEMAND) → PRICE.

Any reciprocal relationship is discussed in the documentation of that other variable: for example, drinking (demand for alcohol) and its influence on price are discussed under “Drinking.” Each relationship is presented under a unique, italicized heading on the left (e.g., *Price to Drinking*).

In some cases, direct empirical evidence of the relationship of the intermediate variable to another variable may not exist as shown in the causal model. In these situations, the relationship is presented in theoretical terms—that is, reasoned argument, based upon other research evidence that can be generalized to the situation (research citations are included).

Strategies

This subsection presents the research evidence concerning strategies, interventions, policies, programs, and so on that have been shown capable of affecting this intermediate variable.

Evidence that purposeful changes in the intermediate variable can affect the ATOD problem and evidence of effects on other intermediate variables are summarized or cited. Limitations of the research evidence about effects are also noted: for example, important concerns exist about generalizability to other situations, populations, or settings or if selection biases exist for the population in which the effects were observed. If there is no research evidence of an effect from prevention strategies, this is noted. In many cases, the research evidence that demonstrates a causal or mediating influence of one intermediate variable to the ATOD problem or to other variables in the causal model come from purposeful prevention efforts and will have been noted in previous subsections.

Strength of the Evidence

This subsection describes the strength of the empirical evidence regarding the effectiveness of the strategies to reduce the problem. Little has been done to evaluate evidence strength, so this section only appears in conjunction with a couple of the variables.

Intermediate Variable**Driving After Drinking****Conceptual Definition**

Driving after drinking is an event in which a driver of a motor vehicle was drinking before or while driving.

Measurement

A measure of the quantity of alcohol in a person's blood is called blood alcohol concentration or BAC. Laboratory research has demonstrated that tasks related to driving performance are affected at BAC levels much lower than those normally associated with legal intoxication (Moskowitz & Robinson, 1988). One measure of drinking and driving is the percentage of drivers whose BAC level is > than 0; however, such measures are not routinely collected. Therefore, in surveys of frequency of drinking and driving, self-reports are used.

Alternative Indicator Recommended**Self-Reported Drinking and Driving Among Adults Aged 18 and Older***Justification*

Alcohol consumption impairs a person's ability to operate a motor vehicle safely. Motor vehicle crashes are the leading cause of death for people aged 15 to 19. Approximately 2.2 million crashes in the United States involved alcohol in 1999. Approximately 41% of traffic fatalities result from drinking and driving in that year. Almost 17,000 people die from alcohol-related crashes each year.

Definition

Percentage of adults aged 18 and older who reported driving one or more times in the past 30 days when they have perhaps had too much to drink.

Data Source

Behavioral Risk Factor Surveillance System (BRFSS), Centers for Disease Control and Prevention (CDC)

Frequency

Annual

Geographic Levels

National and state

Demographic Categories

Age, gender, and race/ethnicity

Strengths

The BRFSS provides prevalence estimates of adult use for every state. State-level estimates are typically based on larger samples than the National Survey on Drug Use and Health and may be further broken down by age, gender, and race/ethnicity.

Limitations

The item used to measure this behavior relies on the respondent's somewhat subjective assessment of "perhaps too much to drink." The BRFSS is a telephone survey subject to potential bias due to self-report, noncoverage (households without telephones), and

nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Drinking and Driving Among High School Students

<i>Justification</i>	Alcohol consumption impairs a person's ability to operate a motor vehicle safely. Motor vehicle crashes are the leading cause of death for people aged 15 to 19. Approximately 2.2 million crashes in the United States involved alcohol in 1999. Approximately 41% of traffic fatalities result from drinking and driving in that year. Almost 17,000 people die from alcohol-related crashes each year.
<i>Definition</i>	Drinking one or more times in the past 30 days.
<i>Data Source</i>	Youth Risk Behavior Surveillance System (YRBSS), CDC
<i>Frequency</i>	Biennial
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Grade level, gender, and race/ethnicity
<i>Strengths</i>	The YRBSS is the only national survey that provides state-level estimates on the prevalence of driving after drinking among adolescents. YRBSS estimates are typically based on larger samples than the National Survey on Drug Use and Health and can be further broken down by grade level, gender, and race/ethnicity. Some states also collect YRBSS data for individual communities or school districts, which can be compared with their state-level data.
<i>Limitations</i>	As of 2003, weighted representative samples were only available for 32 states. Not all states participate, and some participating states do not provide representative samples. YRBSS is a school-based survey, so dropouts are not represented. It is also subject to bias due to self-report, noncoverage (refusal by selected schools to participate), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Riding in Vehicle with Drinking Driver Among High School Students

<i>Justification</i>	Alcohol consumption impairs a person's ability to operate a motor vehicle safely. Motor vehicle crashes are the leading cause of death for people aged 15 to 19. There are more than 17,000 alcohol-related traffic deaths per year. Nationally, 30% of students report
----------------------	---

	riding with a drinking driver one or more times in the past month.
<i>Definition</i>	Percentage of students in grades 9 through 12 who report getting into a vehicle within the past 30 days one or more times with someone who has been drinking.
<i>Data Source</i>	YRBSS, CDC
<i>Frequency</i>	Biennial
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Grade level, gender, and race/ethnicity
<i>Strengths</i>	This measure is not limited to students who drive. It may therefore provide a more accurate assessment of the overall prevalence of risk for injury or death due to involvement in an alcohol-related crash. YRBSS estimates are typically based on larger samples than the National Survey on Drug Use and Health and can be further broken down by grade level, gender, and race/ethnicity. Some states also collect YRBSS data for individual communities or school districts, which can be compared with their state-level data.
<i>Limitations</i>	As of 2003, weighted representative samples were only available for 32 states. Not all states participate, and some participating states do not provide representative samples. YRBSS is a school-based survey, so dropouts are not represented. It is also subject to bias due to self-report, noncoverage (refusal by selected schools to participate), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).
<i>Relationship of the Intermediate Variable to the Problem</i>	<p>In the causal model, DRIVING AFTER DRINKING is directly related to ALCOHOL-RELATED MOTOR VEHICLE CRASHES. In turn, community norms about DRINKING AND DRIVING, DRINKING CONTEXT, and INDIVIDUAL FACTORS influence DRIVING AFTER DRINKING.</p> <p>Based upon roadside research (which conducts breath tests from a random sample of motorists, usually at night and on weekends, when drinking drivers are more numerous) in the United States, an estimated 5 to 10% of drivers during nighttime leisure hours have moderate to high blood alcohol levels. These patterns are broadly consistent with overall road fatality rates. When American drivers are asked at random about their personal behavior, 24% admitted to driving in the past year after having four or more drinks (Berger, Snortum, Homel, Hauge, & Loxley, 1990).</p> <p>All countries have the problem of hard-core drinking drivers, characterized by persistent heavy drinking before driving. A surprisingly high percentage of these heavy drinking drivers have no prior drinking-and-driving convictions. For example, only 26%</p>

of all drinking drivers or riders killed in the Australian state of Victoria between 1990 and 1997 had prior offenses, and a similar level exists in the United States (Ross, 1992).

The BAC is a measure of the relative level of alcohol in the driver's blood. Moskowitz and Fiorentino (2000), Vogel-Sprott (1992), and Burns and Fiorentino (2001) provided a summary of laboratory research concerning the effect of the BAC level on motor skills and cognitive processing. Overall, they found what we have come to expect: impairment begins when the BAC is $\geq .01$, or practically after the first drink. Skills such as cognition, perception, and visual function have been shown to be sensitive to alcohol in a wide variety of experimental studies. Additionally, simulator and road tests provide evidence of impairment in divided attention and vigilance tasks, as well as drowsiness with low BAC levels. Researchers already knew that general relationship from the published research. The evidence from traffic studies also confirmed the laboratory results that any departure from a zero BAC increases crash probability. An almost identical conclusion was reached by Helander (2001) who also notes that when the Grand Rapids data of crashes and BAC levels of drivers are corrected for methodological problems, any amount of alcohol in the system of a driver clearly increases the risk of crash.

The BAC level for drivers is a good indicator of motor vehicle crash risk. It has generally been assumed that there is a fixed relationship between the distribution of BACs in drivers using the road at times and places of alcohol-related crashes and the number of such incidents. This is inherent in the risk curves developed by Borkenstein, Crowther, Shumate, Ziel, and Zylman (1974) and others (Zador, 1989; Hurst, 1973) when relating BAC to crash involvement.

There is clear evidence that motor vehicle crash risk increases with alcohol consumption. BACs between .01 and .09 are associated with increased crash risk, and even BACs as low as .02 affect response times to dangerous road situations (West, Wilding, French, Kemp, & Irving, 1993; Zador, 1991). The risk curve relating alcohol consumption to traffic crashes is best represented with an accelerating slope—that is, any drinking is associated with increased crash risk, and the risk increases sharply as consumption increases (Hurst, Harte, & Frith, 1994). Consistent with this finding, Levy and Miller (1995), using data from a large-scale study by Borkenstein et al. (1974), estimated that >100% of crashes involved drivers with a BAC level of .10, 43.5% had BACs between .08 and .099, and 24% had BACs between .01 and .0799.

Research has demonstrated that the relative crash risk of drivers with a BAC = .05 is double the crash risk for a zero-BAC driver; at .08, the risk is multiplied by 10, and at .15 or higher, the relative risk is in the hundreds (Borkenstein et al., 1974). The risk curve is even steeper for serious and fatal crashes, for single-vehicle crashes, and for young people (Jonah, 1986; Mayhew, Donelson,

Beirness, & Simpson, 1986). The many skills involved in driving are not all impaired at the same BAC level. For example, a driver's ability to divide attention between two or more sources of visual information can be impaired by BACs of .02 or lower.

According to Hingson and colleagues (1995), each .02 BAC increase higher than zero places 16- to 20-year-old drivers at greater risk for a crash than older drivers (Hingson et al., 1994, 1995). Roadside surveys indicate that young people are less likely than adults to drive after drinking. Their crash rates, however, are substantially higher than those of other groups (Mayhew et al., 1986), especially at low and moderate BACs. When this is combined with a penchant for risk-taking behavior while driving, such as speeding, along with a tendency both to underestimate the dangerous consequences of such behaviors and to overestimate driving skills, it contributes to the high crash rate among young drivers (Brown & Groeger, 1988; Jonah, 1986). Young drivers are also inexperienced drinkers. Combining the inexperience drinking with inexperience driving substantially increases the risk of crash. In 1994, almost 7,800 drivers aged 16 through 20 were in fatal motor vehicle crashes (NHTSA, 1995). Of these drivers, for whom drinking any quantity of alcohol is illegal, 23% had BACs of .01 or higher, compared with 26% of drivers aged 21 and older (10).

Helander (2001), using data from FARS and a rather high BAC cutoff ($>$ or $<$.010), found that the highest alcohol involvement occurred in drivers slightly older than the legal drinking age. This matches the empirical evidence from general population studies, which have found that average consumption, particularly at drinking events, increases for young people (especially in males) aged 25 and younger, at which time there is an average drop in heavy drinking (although a small percentage continues to drink at high levels beyond age 30).

Alcohol consumption, even at low levels, is also associated with the increased likelihood of being in a fatal crash. In 2000, 1,093,323 crashes involved a driver or a pedestrian with a BAC of .01 or greater, resulting in an estimated 16,792 deaths (Liu & Chen, 2004). NHTSA (1998) estimated that, in 1996, 3,507 traffic fatalities were attributable to drivers with BACs between .01 and .09. Of the U.S. population rate of 15.8 deaths per 100,000 traffic crashes in 1995, 6.5 per 100,000 (41%) involved a driver with a BAC of at least .01 (NHTSA, 1995b). Blincoe and Faigin (1992) estimated that 19.2% of all traffic accidents and 39.7% of traffic fatalities involved alcohol use. Ostrom and Eriksson (1993) found that alcohol was one of the biggest contributing factors in SVN fatal crashes. Fell and Nash (1989) found that alcohol was involved in 80% of fatal crashes that occurred between 8 p.m. and 4 a.m., especially on weekends.

The likelihood of being involved in a fatal accident increases with higher BAC levels. Zador (1991) found that individuals with BAC levels of .02 to .04 were 1.4 times more likely to be in a single-

vehicle fatal accident. This risk was 11.1 times higher for BACs between .05 and .09, 48 times higher for BACs between .10 and .14, and a staggering 380 times higher for BACs of .15 plus. Correcting for police underreporting of alcohol involvement, Miller, Lestina, and Spicer (1998b) reported that 34% of all fatalities in traffic crashes were attributable to alcohol, and 80% of victims in fatal crashes involved a driver with a BAC of at least .10. For young drivers, the association between alcohol use and likelihood of fatal crashes shows an even steeper slope for each increase of .02 BAC.

Relationship of the Intermediate Variable to Other Variables

Associations between DRIVING AFTER DRINKING and COMMUNITY NORMS ABOUT DRINKING AND DRIVING, DRINKING CONTEXT, and INDIVIDUAL FACTORS are summarized in the sections on these variables.

Strategies

Effective strategies for reducing drinking-and-driving events are described in conjunction with other intermediate variables in this section. Several directly related to DRIVING AFTER DRINKING are presented here. Some preventative strategies are directed at enforcement of drinking-and-driving laws on the road, as well as subsequent punishments for convictions. These strategies are discussed under “DUI Enforcement.” Other strategies, required or mandated by courts, are directed at reducing future drinking-and-driving events. These strategies are discussed in the following paragraphs.

Administrative License Revocation

Under administrative license suspensions or revocations for drinking and driving, licensing authorities can suspend licenses more quickly and closer in time to the actual offense without a court hearing. Administrative suspension can occur in 40 of the 50 states in the United States, where the effect on drinking-and-driving accidents is consistently positive, and the mechanism seems to be general deterrence (Ross, 1992; McKnight & Voas, 2001). In a meta-analysis of 46 studies, Zobeck and Williams (1994) found an average reduction of 5% in alcohol-related crashes and a reduction in fatal crashes of 26% associated with administrative licensing revocation. Miller et al. (1998b) concluded that the benefit-to-cost ratio was \$11 per dollar invested when violators receive a 6-month license suspension.

License loss can be effective for both alcohol-related and non-alcohol-related accidents. Offenders with no license suspension recidivate more (McKnight & Voas, 2001; Peck, Sadler & Perrine, 1985; Ross, 1992). Conversely, those offenders receiving longer periods of suspension tend to recidivate less, at least for non-alcohol-related offenses (Hommel, 1981). One study found that as many as three-quarters of disqualified drivers continue to drive while unlicensed (Ross & Gonzales, 1988), but they tend to drive less and to be more cautious, at least while suspended.

Interlock Another approach for high-risk repeat offenders is ignition

- Devices* interlock devices that prevent a vehicle from starting until the driver passes a breath test. In eight studies in the United States, these devices have been shown to be very effective for many alcohol-impaired offenders (McKnight & Voas, 2001). The effects, however, tend to be limited to the period of the court order unless combined with treatment within a case management framework to deal with the underlying problems (DeYoung, Tashima, & Maston, 2005; Marques & Voas, 1995, 1998, 2005).
- Driver License Age Restrictions* Williams (1985) and Williams, Karpf, and Zador (1983) compared U.S. states with different ages of licensing and concluded that between 65 and 85% reductions in 16-year-old driver fatal crash involvement could be achieved by raising the legal driving age to 17. Such laws are unpopular, however, so some states have implemented nighttime curfews for teenage drivers to achieve some of the benefits of delayed licensing. Williams (1985) and his colleagues (Preusser, Williams, Zador, & Blomberg, 1984) have explored the effect of such policies by comparing crash rates for young teenagers (aged 15, 16, or 17, depending on the state) in states with curfew laws with states without such laws. The researchers estimated reductions in the crash involvement of 16-year-old drivers during curfew hours ranging from 25 to 69% and concluded that the laws had very beneficial effects relative to their costs.
- Traffic Safety Education for Young or Inexperienced Drivers* Young drivers (i.e., adolescents aged 16 to 20) are at risk for traffic crashes, including alcohol-involved crashes, because of their limited driving experience and their tendency to experiment with heavy or binge drinking. Traditional countermeasures such as driver training and school-based education programs are either ineffective or have yielded mixed results. The one possible exception is peer intervention, which does seem to produce enduring improvements in intervention behaviors (McKnight & Voas, 2001; Stewart & Klitzner, 1990). Special policy strategies have been formulated to prevent drinking and driving among this age group that appear to have more potential effectiveness than youth education.
- Traffic Safety Education for DUI Offenders* Educational approaches have also been used to reduce driving after drinking. Results indicate that such programs may be successful in increasing intermediate goals, such as readiness to change, but have little influence on DUI recidivism. The Preventing Alcohol-Related Convictions (PARC) program, a novel educational curriculum for first-time DUI offenders, has the ultimate goal of reducing DUI recidivism (Rider et al., 2006). It differs from traditional DUI education and prevention programs in that it does not suggest to DUI offenders that they must abstain from alcohol entirely or must control their drinking to prevent a future DUI. Rather, it teaches students to prevent a future DUI by not driving their vehicles to drinking events. Thus, the emphasis of the curriculum is on controlling driving rather than controlling

drinking to avoid future DUI convictions. The program is currently ongoing throughout the state of Florida. The current randomized study focused on intermediate outcomes relevant for DUI recidivism; specifically, individuals' readiness for change regarding drinking and driving, and their endorsement of a PARC planning and action approach (controlling driving) versus a traditional approach (controlling drinking). Current research has demonstrated that the PARC program is effective in moving participants toward more readiness for change and toward a strategy of planning to avoid driving to any venue in which drinking may occur.

In addition, the effectiveness of an education program may vary according to whether the DUI is acquired by a new or an experienced DUI offender. Socie, Wagner, and Hopkins (1994) studied drivers who were sentenced either to jail or to a certified Driver Intervention Program (DIP) in Franklin County, Ohio, in 1987 after their first drunken driving (DUI) conviction. Because each drunk-driving charge was assigned to one of a pool of 15 judges with widely varying sentencing patterns, there was no apparent bias in subject allocation to the two treatments. For the jailed ($n = 124$) and DIP ($n = 218$) cohorts, they compared the likelihood of subsequent impaired-driving offenses, as evidenced by rearrest for a new alcohol-related driving offense or involvement in a vehicle crash after drinking in the 4 years after the first offense. After controlling for potentially important covariates (such as gender, age, race, BAC, additional charges filed at the time of arrest, and driving history), their logistic regression results indicated that DIP attendees had significantly lower rates of subsequent impaired driving. Drivers who had no prior history of a DUI alcohol-related offense were significantly more likely to display additional impaired driving when jailed as opposed to those enrolled in a DIP (odds ratio [OR] = 2.53, confidence interval [CI] = 1.44, 4.45), whereas those with previous alcohol-related offenses may have fared better in jail (OR = .56, CI = .11, 2.76). Drivers younger than 21 years of age were also at elevated risk for repeat offenses (OR = 2.46, CI = 1.13, 5.35). DIPs appear most effective when used for persons who have not had previous alcohol-related crashes or driving offenses.

Victim Impact Panels A relatively new type of intervention is victim impact panels (VIP; Shinar & Compton, 1995). VIPs are provided to an estimated 400,000 DWI (driving-while-intoxicated) offenders per year by more than 200 Mothers Against Drunk Driving (MADD) chapters in the United States. MADD encourages its activists to serve in peer support roles, without minimizing therapy with professionally educated counselors. Although professionals may not offer the same level of empathy, they are often better prepared to deal with complicated mourning and post-traumatic stress.

The empirical evidence regarding the effectiveness of VIPs, however, is mixed and inconclusive. Anecdotal reports indicate

that DUI offenders are often moved by victims' stories and vow to reform their ways. Some empirical studies also support this assertion (Fors & Rojek, 1999; Police Executive Research Forum). In a meta-analysis of 35 randomized studies of restorative programs (although most not involving drinking drivers), Latimer, Dowden, and Muise (2001) found this process decreased the recidivism of offenders (72% of 32 studies yielded a reduction in recidivism) when compared to more traditional criminal justice responses (i.e., incarceration, probation, court-ordered restitution).

Other studies, however, largely contradict these findings (Shinar & Compton, 1995). Polacsek et al. (2001) examined the influence of MADD VIPs specifically compared to a DWI school. Results showed no significant difference in movement through the stages-of-change, or in recidivism, over the 2-year follow-up period. Wheeler, Rogers, Tonigan, and Woodall (2004) reported similar findings within 2 years between participants attending the VIP and those not attending the intervention on alcohol consumption, drinking-and-driving behavior, or recidivism. In fact, some research suggests that VIPs may actually have the *opposite* effect on recidivism. deBaca, Lapham, Liang, and Skipper (2001) examined re-arrest rates of 6,702 first-time and repeat offenders in New Mexico between 1989 and 1994 following referral to VIPs. Results showed that, after controlling for multiple risk factors, VIP referral was not statistically associated with recidivism for female or male first offenders. In fact, female repeat offenders referred to VIPs were significantly *more* likely to be re-arrested compared with those not referred.

Possible reasons for these inconsistent results may lie in the research designs that were used. These were either panel survey designs or quasi-experimental designs that lacked randomization, and consequent equivalent groups, in their design and analyses. Our investigation uses a randomized control experimental design to assess the effectiveness of two interventions (a DWI school versus a DWI school plus a MADD VIP) that are designed to move DWI offenders through the stages-of-change toward not driving while drunk and to decrease recidivism.

*License
Suspension/
Revocation*

Better outcomes have been obtained with a combination of interventions that serve both to reduce consumption (alcoholism treatment, see strategies under "Drinking") and to decrease opportunities to drive while or after drinking. DeYoung (1997) examined which sanctions work best to reduce drunk driving, including alcohol treatment, driver's license actions, and jail terms to reduce drunk-driving recidivism. This quasi-experimental study examined the relationships between the sanctions that drivers convicted of DUI receive and their subsequent reconviction for DUI, while statistically controlling for pre-existing differences among groups receiving different sanctions. Separate analyses were conducted for subjects having zero, two, or more than two

prior DUI convictions on their driving records. The study analyzed drunk-driving recidivism throughout the state of California. All drivers holding a California driver's license who were convicted of DUI by a California court during 1990 and 1991 were included in the study. A number of demographic, prior personal driving history, and surrogate traffic environment measures were collected and used as covariates in the analyses. Data on subsequent DUI reconvictions and the number of days to first subsequent DUI reconviction were also used as outcome variables in the study. Results of the analyses showed that, for all levels of prior DUI convictions, combining alcohol treatment with either driver's license restriction or suspension is associated with the lowest DUI recidivism rates. Based on this research and the results of prior studies, it can be persuasively argued that combining license actions with alcohol treatment is an effective strategy for combating DUI recidivism.

*Community
Comprehensive
Safety
Strategies*

One recent approach to reducing alcohol-related motor vehicle crashes and the severity of crashes are multifaceted local safety programs that typically mix DUI ENFORCEMENT (see discussion of this variable) and general public information and awareness (see discussion under "Public Awareness of Drinking-and-Driving Enforcement") with enforcement of speeding and seatbelt laws. All of these factors interact in both the risk of a crash (speed coupled with drinking and driving) and the severity of a crash (occupant protection resulting from seatbelt use). One example of this type of community comprehensive safety effort is the Savings Lives Project. The Saving Lives Project conducted in six communities in Massachusetts, was designed to reduce alcohol-impaired driving and related problems such as speeding (Hingson et al., 1996). In each community, a full-time coordinator from the local government organized a task force representing various city departments. Programs were designed locally and involved a host of activities: media campaigns, business information programs, speeding and drunk-driving awareness days, speed watch telephone hotlines, police training, high-school peer-led education, Students Against Drunk Driving chapters, college prevention programs, and other activities. Results of the evaluation indicated that, during the 5 years that the program was in operation, cities that received the Saving Lives intervention had a 25% greater decline in fatal crashes than the rest of Massachusetts (i.e., a 42% reduction in fatal automobile crashes within the experimental communities, a 47% reduction in the number of fatally injured drivers who were positive for alcohol, a 5% decline in visible crash injuries, and an 8% decline in 16- to 25-year-old crash injuries). In addition, there was a decline in self-reported driving after drinking (specifically among youth), as well as observed speeding. The greatest fatal and injury crash reductions occurred in the 16 to 25-year-old age group.

Intermediate Variable

Community Norms about Drinking and Driving

Conceptual Definition

Community norms refer to the level of acceptability or unacceptability of drinking and driving. Thus, community norms are the informal standards that have the potential to influence individual decisions about drinking and driving. Gruenewald (1988) argued that social norms help establish acceptable levels of alcohol use. Markin (1974) argued that although income is a major determinant in consumer purchasing, an individual's motivations, expectations, and aspirations are also important determinants of consumption. For example, seeing news coverage of sobriety checkpoints arresting impaired drivers helps community members understand and accept that drinking and driving are not considered acceptable.

Measures

This intermediate variable can be measured via population surveys in which respondents are asked their strength of agreement or disagreement with statements concerning the acceptability of drinking and driving or directly asked to give a rating of their own approval or disapproval of drinking and driving.

Relationship of the Intermediate Variable to the Problem

COMMUNITY NORMS ABOUT DRINKING AND DRIVING work through other intermediate variables (i.e.,

COMMUNITY NORMS ABOUT DRINKING AND DRIVING → DRIVING AFTER DRIVING → ALCOHOL-RELATED MOTOR VEHICLE CRASHES).

COMMUNITY NORMS ABOUT DRINKING AND DRIVING is also linked to

PUBLIC AWARENESS OF DRINKING/DRIVING ENFORCEMENT.

In turn,

ALCOHOL-RELATED MOTOR VEHICLE CRASHES

has a feedback loop to

COMMUNITY NORMS ABOUT DRINKING AND DRIVING.

Relationship of the Intermediate Variable to Other Variables

Community Norms About Drinking and Driving to Driving After Drinking

The level of acceptability of drinking and driving can influence the decisions by drinkers to actually drive, thus affecting the level of overall driving and drinking in a community. For example, increases (real or perceived) in alcohol-related youth automobile fatalities may result in social pressure to reduce consumption among youth. This pressure may result in increased unacceptability of situations that sanction youth use. In addition, social norms may lead to pressure resulting in the implementation

of formal policies to discourage youth access and consumption as a means to reduce alcohol-related motor vehicle crashes among young drivers.

Some studies have reported declines in nighttime fatal crashes or other measures of alcohol-involved driving that preceded implementation of laws (Hingson et al., 1987; Ross, 1982; Epperlein, 1987). Hingson and Howland (1990) studied the effects of a law passed in Massachusetts in 1982—a time when drinking and driving was being debated nationwide—provided drinking-and-driving defendants the option of accepting a lesser penalty (30 days' license suspension and compulsory education) if they agreed to plead guilty. A decline in nighttime fatal crashes was observed during the year preceding the law, but no further decline occurred following its implementation. Two annual statewide surveys conducted before passage of the Massachusetts law and two conducted after passage of the law provide insight into why nighttime fatal crashes declined before rather than after passage of the new laws (Hingson et al., 1987).

Before passage of the Massachusetts law, the proportion of respondents who thought that alcohol-impaired drivers would be stopped by the police remained unchanged from previous years. But there were declines in the proportion who thought that alcohol-impaired drivers would be charged, convicted, and given automatic license suspension, fines, or jail sentences. At the same time, the proportion of respondents who said that they had asked someone not to drive because that person was drinking too much increased from 23 to 26%; the proportion who said that they had driven after any drinking declined from 46 to 41%; and the proportion who said that they had driven after five or more drinks declined from 14 to 11%.

After the law was passed, the proportion of respondents who reported that they thought alcohol-impaired drivers were very likely to be stopped by the police, be charged, be convicted, and be given automatic fines, license suspension, and jail sentences increased. But the proportion who reported asking others not to drive declined from 26 to 21%, while little change was observed in the proportion of respondents who said they had driven after any amount of drinking or who had driven after five or more drinks.

Hingson and Howland (1990) concluded that, before passage of the law, social pressure not to drink and drive was increasing, and the public's confidence that drinking drivers would be convicted and punished was eroding. Although the public came to believe that enforcement and punishment were more likely after implementation of the law, reported alcohol-involved driving declined only slightly, and nighttime fatal crashes remained steady.

*Community Norms
About Drinking*

The rise of MADD in the early 1980s has been correlated with reductions in alcohol-related motor vehicle crashes. Some have

and Driving to Public Awareness of Drinking-and-Driving Enforcement

attributed this effect (if real) to the influence of MADD on reducing the level of community acceptability of drinking and driving. The stimulus for creating MADD was the low enforcement and inconsistent punishment of drinking drivers, especially those who had been arrested more than once. Before the formation of MADD and subsequent public attention to the victims of drunk drivers, there appeared to be little news coverage of drinking and driving and, consequently, a lack of public awareness or concern about the problem. As some have observed, community members were more concerned about “walking drunk” (public intoxication) than “driving drunk.”

Table 1. Citizen Advocacy Groups and Newspaper Coverage (McCarthy & Harvey, 1989)

	Years									
	78	79	80	81	82	83	84	85	86	87
Citizen Advocacy Groups Formed	3	5	4	24	1109	119	104	89		
News Stories on Drinking and Driving										
Local Newspapers		63	94	223	395	423	411	331	224	163
National Newspapers		17	3	17	81	169	162	76	68	58
Periodicals		3	1	13	35	50	42	36	26	29

Table 1 from McCarthy and Harvey (1989) shows a time correspondence between growth in citizen advocacy groups concerned with drinking and driving and the trends in mass media coverage of the drunk-driving issue derived from selected local and national mass media. Between 1980 and 1984, news media coverage of the topic increased fifty-fold, and more than 400 chapters of local citizens’ groups concerned with reducing alcohol-related driving were formed (McCarthy & Harvey, 1989). After 1984, the formation of grassroots citizens’ groups against drinking and driving began to decline, along with media coverage as measured by the frequency of newspaper stories on the topic (McCarthy & Harvey, 1989).

Whether the trend reflects declining vitality among advocate groups or is responsible for increasing alcohol-related fatalities, as some (Stevens, 1987; Dukakis, 1988) have suggested, cannot be easily determined, but these trends are very suggestive of a relationship. Hingson and Howland (1990) studied the influence of mass media discussions of drinking and driving on alcohol-involved crashes and found modest influence on crash levels.

Alcohol-Related Vehicle Crashes to Community Norms

There are several ways to depict the relationship between the frequency of problem occurrence (in this case, motor vehicle crashes) and community norms about drinking and driving.

About Drinking and Driving

Problem frequency may be directly correlated, so that increased frequency leads to increased concern. An alternate interpretation is that significance to the community helps moderate the relationship between problem frequency and community concern, such that concern will be high only when problem frequency is high and the problem is perceived as significant by community members.

Strategies

The rise of citizen advocacy groups and their influence on news coverage and subsequently the potential of such news coverage to influence public values and acceptability concerning drinking and driving suggest realistic strategies for communities. Public policies are formal codification of social norms regarding acceptable alcohol use. Norms and values, however, exert a strong influence on behavior even when formal detection and punishment are unlikely. Policies include awareness campaigns, media efforts, youth prevention programs, normative education, family-oriented programs, and rehabilitation programs for impaired drivers. Research has demonstrated that efforts to influence norms and offer information regarding consumption have been successful in changing social attitudes to make risky alcohol use socially unacceptable and to promote responsible consumption (Giesbrecht & Greenfield, 1999; NIAAA, 1995; Wallack & DeJong, 1995). Following are a series of strategies that involve communication and education.

Media Advocacy

Media advocacy refers to the strategic use of news media by those seeking to advance a social or public policy initiative. Unlike specifically designed public information campaigns, media advocacy works directly with the local news outlets (radio, television, newspapers, and magazines) to increase local news attention to a specific public health problem and solutions therefor. Media advocacy encompasses a range of strategies aimed at reframing public debate of issues (Wallack, 1990; Wallack, Dorfman, Jernigan, & Thembia, 1993). In this context, consistent with the name, the mass media are used to bring attention to a specific alcohol problem, to advance the importance of one or more specific policies designed to reduce the problem, to put pressure on decision makers who can make policy or change existing policies, and to bring about a desired policy change.

Unlike health education or other uses of public communication, media advocacy generally is not used simply to change individual behavior directly. Individuals may, however, change their behavior as a result of new information or new awareness achieved as a part of media attention to high-risk drinking and related problems. For any issue to come forward to the public agenda, it must be brought to the attention of community members. An effective means to accomplish this is through the local news media. Thus, local media news and feature coverage are often an important part of local prevention tactics. This may take the form of a major news event, which does not subject the media reporters to a public relations

campaign that seeks to shape their slant or approach to the issue. Rather, media advocacy brings the issue to the media's attention by providing local activities, events, or "happenings" that can be covered by news reporters. This can also include providing local data about local problems or giving national news local relevance. Although this use of the news media is an important part of public communications, it may or may not be the only way to communicate with people about a particular issue. For example, organizing a set of supporting speakers at the city council is a form of public communication that supports or opposes a policy action that the council may be considering. Holder and Treno (1997) found in a three-community prevention trial that purposeful training of local advocates followed by purposeful application of the tools and techniques of media advocacy increased local news coverage of alcohol-related problems, especially drinking and driving, with a subsequent change in public support of action to reduce drinking and driving.

*Public Education
and Mass
Communication
Campaigns*

Mass communication campaigns are often used to increase public awareness and information about specific public health problems. The research evidence has repeatedly demonstrated that public education campaigns alone can increase public awareness and the level of information level but have little to no effect on behavior. As Holder (1994) concluded, mass communication alone is not sufficient to reduce alcohol-involved trauma.

The most positive effect of media campaigns has been shown by Worden, Waller, and Riley (1975) and Flynn, Worden, Secker-Walker, and Pirie (1994), who evaluated a media campaign designed to deter smoking initiation. Flynn et al. (1994) reported that students in grades 10 through 12 who were exposed to a media campaign were less likely to have smoked in the previous week than those who only received the school-based program. Bauman, LaPrelle, Brown, Kock, and Padgett (1991) randomly assigned media markets in the Southeastern United States to receive one of three media campaigns or no campaign. One campaign used radio only and focused on expected health and social consequences of smoking. A second campaign used the same radio spots but added a contest in which young people wrote about why they would not smoke. The third campaign added television to the radio and contest components. Surveys of 12- to 14-year-olds from communities in each condition did not indicate any effects on smoking behavior from the campaigns.

Flay et al. (1995) compared the effectiveness of a school-based social resistance curriculum alone with that same program plus television programming designed to encourage parent-child interactions about tobacco use, the television intervention alone, and two control conditions. Follow-up assessments in grades 7, 8, 9, and 12 did not find that the media affected adolescent smoking.

Giesbrecht and Grube (2003) reviewed research on the effects of media designed to reduce alcohol use or its related problems. The

types of media they reviewed included public service announcements, news coverage of alcohol issues, and counteradvertising. They cited a single study of the effects of public services announcements about drinking during pregnancy that showed increased awareness of the dangers of drinking while pregnant. The study, however, did not have a control group that did not receive the media. These authors suggest that news coverage could have an effect on both individual drinking behavior and public policymaking, but there seem to be no experimental evaluations of the effects of different types of news coverage. Counteradvertising is designed to directly counter the persuasive appeal of advertising for a product. It includes warning labels on alcohol containers and advertisements. Giesbrecht and Grube (2003) cite only one experimental evaluation of the effects of warning labels. Snyder and Blood (1992) randomly assigned college students to see six advertisements for alcoholic products, either with or without the U.S. Surgeon General's warning. The warnings had no effect on perceptions of the risk of drinking; they actually made the products more attractive. MacKinnon, Pentz, and Stacy (1993), in a survey of a national sample of youth, found increases in self-reported awareness and exposure to and memory of the labels after they were required, but they found no substantial changes in alcohol use or beliefs about the risks targeted by the warning. Derzon and Lipsey (2002) did a meta-analysis of 72 evaluations of media campaigns designed to discourage adolescent substance use. They estimated modest effect sizes (i.e., alcohol use—53 to 51%, tobacco use—37 to 35%, and marijuana use—24 to 22.5%).

There are two major disadvantages of public information campaigns: cost and duration. Professional campaigns are costly to design and to produce, especially if space and time are purchased in local media. An alternative has been public service ads that local televisions must air as a part of their continued licensing requirements from the Federal Communications Commission in the United States. Although providing free time, such PSAs are costly to produce and require professional expertise to be attractive. In addition, PSAs are aired by the local television station whenever the station deems desirable. This often means that PSAs are shown on television during times when other paying advertisements are not being aired (i.e., usually late at night or in the early morning hours). These times have the lowest viewer coverage of all television periods. The second limitation is that, because public information campaigns are costly, they are used infrequently and have short duration and lower replication.

Most communities simply do not have sufficient funds to mount one such campaign, much less frequent or regular public information campaigns. Holder and Treno (1997) concluded that planned mass media campaigns are most effective as reinforcers of specific environmental efforts to reduce high-risk drinking in general and drinking and driving in particular but that are

insufficient in themselves. Friend and Levy (2002) conducted a comprehensive review of tobacco mass media campaigns. Results suggested that well-funded and implemented mass media campaigns targeted at the general population and implemented at the state level, in conjunction with a comprehensive tobacco control program, are associated with reduced smoking rates among adults and youth. Studies of youth-oriented interventions specifically have shown more mixed results, particularly for smaller, community-level media programs, but they indicate strong potential to influence underage smoking rates. The scale and duration of expenditures, the content of ad messages, and other tobacco control policies are aspects of media programs that may help explain differences among study results. In particular, tobacco control policies that are implemented during the campaign often make it difficult to identify the specific influence of media campaigns alone.

*Education for
Young or
Inexperienced
Drivers*

Young drivers (aged 16 to 20) are at risk for traffic crashes, including alcohol-involved crashes, because of their limited driving experience and their tendency to experiment with heavy or binge drinking. Traditional countermeasures, such as driver training and school-based education programs, are either ineffective or have yielded mixed results, with the possible exception of peer intervention that seemingly produces enduring improvements in intervention behaviors (McKnight & Voas, 2001; Stewart & Klitzner, 1990). Special policy strategies have been formulated to prevent drinking-and-driving among this age group that appear to have more potential effectiveness than youth education.

***Strength of the
Evidence***

Changing community norms to help prevent drinking and driving is essential but is not a sufficient part of a comprehensive prevention strategy for reducing alcohol-related motor vehicle crashes. Based upon the evidence of actual effects on crashes, the key to success appears to be purposeful use of local news about the problem of drinking and driving, the importance and success of enforcement to deter actual drinking and driver, and finally complementary strategies to change community norms about drinking and driving. The evidence concerning planned mass media campaigns and professional public education suggests that such strategies alone are unlikely to reduce either drinking and driving or alcohol-related motor vehicle crashes.

Intermediate Variable**Perceived Risk of DUI Arrest****Conceptual Definition**

Perceived risk of DUI arrest is the expected likelihood of a driver who has been drinking to be arrested by the police. PERCEIVED RISK OF DUI ARREST is directly related to enforcement of drinking-and-driving laws. Like other behaviors, an irregular reward/punishment schedule is more likely to elicit behavior change than a consistent one because the *perception* of risk remains high, even when the reward/ punishment is not immediately forthcoming. Thus, actual and perceived risk of arrest may or may not overlap. For example, if selective breath-testing checkpoints are set up for several days in a row, drivers may assume that risk of arrest is still high after the daily enforcement ceases, at least for a short time. Both the level of publicity and the visibility of enforcement may influence motorists' behavior and their perception of risks.

Measures

The primary way to measure this variable is via general population surveys of drivers (or all persons 16 years and older). Respondents can be presented with a 10-point scale to indicate the likelihood that they would be arrested if they drove when they had had too much to drink. The scale can run from 0 (no chance or zero probability) to 9 (certainty or 100% probability).

Relationship of the Intermediate Variable to the Problem

PERCEIVED RISK OF DUI ARREST influences

ALCOHOL-RELATED MOTOR VEHICLE CRASHES

by mediating the relationship between drinking and driving behavior (i.e.,

DRINKING → DRIVING AFTER DRINKING,

which is mediated by

PERCEIVED RISK OF ARREST → ALCOHOL-RELATED MOTOR VEHICLE CRASHES).

In turn,

PERCEIVED RISK OF DUI ARREST

is heavily influenced by

DUI ENFORCEMENT

and

PUBLIC AWARENESS OF DRINKING/DRIVING ENFORCEMENT.

Relationship of Intermediate Variable to Other Variables

*Perceived Risk of
DUI Arrest
Mediating the
Association
Between Drinking
and Driving After
Drinking*

Voas, Holder, and Gruenewald (1997) have presented a causal model of the relationships between DUI enforcement and public attention (awareness) to enforcement and changes in perceived risk (see Figure 2). Voas et al. (1997) confirmed the causal relationship between drinking and driving (measured in two ways) and alcohol-related motor vehicle crashes. They conducted analyses over 5½ years using quarterly time series of data available from three experimental sites examining the relationships between self-reported drinking and driving, BACs at roadside, and single-vehicle nighttime crashes. Roadside survey data were collected through random roadside stops of drivers on Friday and Saturday nights (alternating weekends each month) throughout the study. A roadside survey is not for DUI enforcement. Rather, it is a random stopping of motorists on weekend nights for a 5-minute interview and collection of a breath sample. In this analysis, both the self-reported drinking and driving and the independently collected BAC roadside data were consistent, and both predicted a decline in alcohol-related motor vehicle crashes.

This study confirmed the hypothesized relationship of perceived risk of arrest to reported drinking and driving across six communities with different levels of DUI enforcement and enforcement publicity. It supports the generally accepted hypothesis (Gibbs, 1975; Ross, 1984) that it is the perception of risk rather than the actual risk of arrest that affects drinking-and-driving behavior. Perceived risk of arrest is, of course, only one factor influencing drinking-and-driving behavior. Peer attitudes, the availability of alternatives to drinking, and the perceived risk of injury (Berger & Snortum, 1986; Andenaes, 1988) are among the other factors influencing drinking and driving. Perceived risk of arrest, however, is the principal intermediate measure that can be directly influenced by an enforcement program (i.e., the greater the perception of risk, the fewer driving-after-drinking events).

One study (Holder et al., 1997) has demonstrated that as the perceived risk increases (controlling for other factors), alcohol-involved motor vehicle crashes decline. The full study (described below) shows the causal link described above. The researchers found that increasing the perceived risk of DUI arrest was associated with reductions in single-vehicle nighttime injury crashes in three experimental communities compared to the control communities over 5 years.

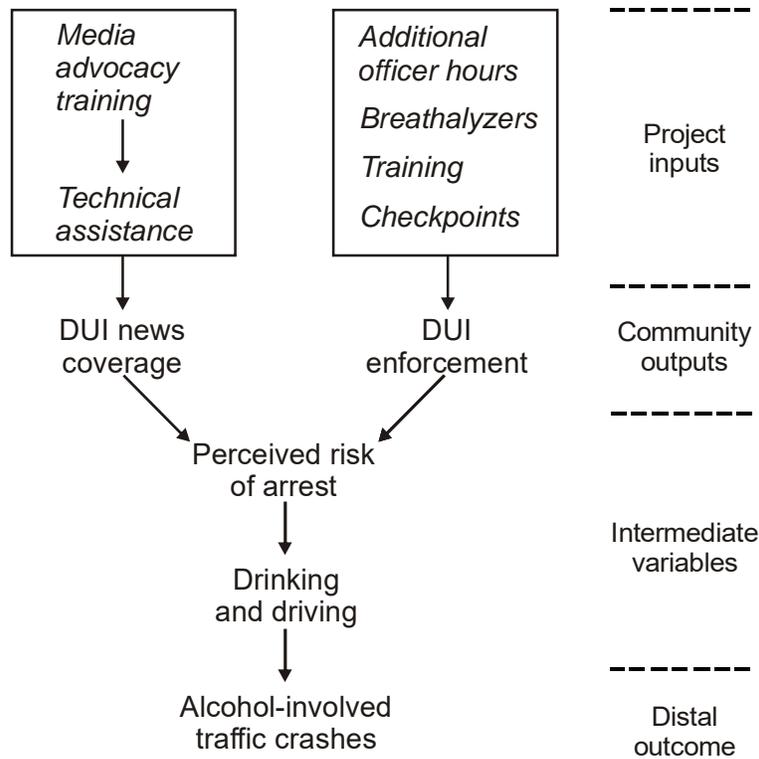


Figure 2. Public Awareness of Drinking-and-Driving Enforcement

Strategies

Enforcement and public awareness of enforcement activities are key elements in the effectiveness of most policies to prevent alcohol-related drinking and driving and associated crashes. The deterrent effect of alcohol policies is influenced by the drinkers’ perceived likelihood of being detected if they drive (i.e., the probability of enforcement and the swiftness with which punishment is imposed [e.g., Ross 1982]). Severe penalties for many alcohol offenses are seldom enforced and thus generate only a modest deterrent effect.

Voas et al. (1997) found that the perception of risk was directly related to the level of enforcement as represented by the number of breath-test devices provided to the police departments, the number of officers trained at the experimental sites, and the amount of local newspaper coverage of enforcement activities. Thus, key elements of effective local prevention strategy include (a) media advocacy training and technical assistance and (b) DUI enforcement equipment, training, and additional officer hours.

Local News About DUI Enforcement

The details of this strategy (used in conjunction with actual DUI enforcement) are described in “Public Awareness of Drinking/Driving Enforcement.”

Sobriety Checkpoints and Random Breath

A strategy for increasing perceived certainty of apprehension is to increase the frequency and visibility of drinking-and-driving enforcement. Ross (1992) estimated that the objective probability

Testing

of apprehension for an impaired driver in the United States is one in a thousand. Increasing this probability could translate into a higher *perceived* probability of detection and fewer accidents. The traditional way of doing this is simply to intensify police enforcement in the form of short-term intensive checkpoints such as during holidays. Such campaigns do generally reduce accidents, but once again, their effects are generally short lived (Ross, 1982).

At sobriety checkpoints, only motorists who are judged by police to have been drinking are asked to take a breath test. This approach greatly weakens the deterrent potential because experienced offenders believe (with some justification) that they can avoid detection. An estimate is that police miss as many as 50% of drivers with BACs higher than .10 (McKnight & Voas, 2001).

An alternative to such selective testing of drivers is random breath testing (RBT) or compulsive breath testing (CBT), as it is practiced in Australia, New Zealand, and some European countries. Motorists are stopped at random by police and required to take a preliminary breath test, even if they are not suspected of having committed an offense or having been involved in an accident. The defining feature of RBT is that any motorist at any time may be required to take a test, and he or she cannot influence the chances of being tested. Testing varies from day to day and from week to week. Although the testing schedule is not announced publicly in advance, testing nonetheless is always highly visible and publicized in the news media. Refusal to submit to a breath test is equivalent to failing a breath test. By the mid-1990s, millions of motorists in Australia were being tested each year, at a rate of about .6 tests per license holder per year (Henstridge, Homel, & Mackay, 1997). In 1999, most (82%) Australian motorists reported having been stopped at some time, whereas few motorists in the United Kingdom (only 16%) and in the United States (29%) reported having been stopped (Williams, Ferguson, & Cammisa, 2000).

Shults et al. (2001) reviewed 23 studies of RBT and selective testing. They found a decline of 22% (range 13 to 36%) in fatal crashes, with slightly lower decreases for noninjury and other accidents for such enforcement strategies. Henstridge et al. (1997) conducted a time-series analysis for four Australian states and found that RBT was twice as effective as selective checkpoints. Sherman (1990) found that, in Queensland, Australia, RBT resulted in a 35% reduction in fatal accidents, compared with 15% for checkpoints. He estimated that every increase of 1,000 in the daily testing rate corresponded to a decline of 6% in all serious accidents and 19% in single-vehicle nighttime accidents. Moreover, analyses revealed a measurable deterrent effect of RBT on the whole population of motorists 10 years later. Homel (1988) showed that the deterrent effect of RBT also provided heavy drinkers with a legitimate excuse to drink less when drinking with friends.

Fell, Lacey, and Voas (2004) reported that substantial and consistent evidence from research shows that highly publicized, highly visible, and frequent sobriety checkpoints in the United States reduce impaired driving fatal crashes by 18 to 24%. A recent survey of checkpoint use, however, demonstrated that, despite the U.S. Department of Transportation's efforts to encourage checkpoint use through publications and the provision of funds for equipment and officers' overtime, only about a dozen of the 37 states that conduct checkpoints do so weekly. The survey found that lack of local police resources and funding, lack of support by task forces and citizen activists, and the perception that checkpoints are not productive or cost-effective are the main reasons for their infrequent use. However, low-staffing sobriety checkpoints conducted by as few as three to five officers have been shown to be just as effective as checkpoints conducted by 15 or more officers. Moreover, a modified sobriety checkpoint program using passive alcohol sensors (*PASpoints*) can be implemented by small- to moderate-sized communities in the United States to deter impaired driving. If implemented in a majority of communities, this strategy can potentially reach the high level achieved by several Australian states in their RBT programs. The *PASpoint* system calls for a small group of three to five officers on traffic patrol duty to converge on a preset site and conduct a mini-checkpoint, returning to their standard patrol duties within 2 hours.

Severity of Punishment

Punishment for a drinking-and-driving conviction has typically been increased either by changing the maximum penalties or by introducing mandatory minimum penalties. Only limited evidence supports the positive effect of these laws (Ross & Voas, 1989). Indeed, their effects could be counterproductive if the judicial system is overburdened or if prosecutors fail to pursue these cases (Little, 1975; Ross & Voas, 1989). Severe penalties do not appear to produce fewer accidents than less severe penalties (Homel, 1988; Ross, 1992). McKnight and Voas (2001) observed, however, that tough penalties such as imprisonment can have beneficial indirect effects by providing a sanction of last resort to motivate repeat offenders to participate in more constructive programs such as probation or residential treatment.

The NHTSA/NIAAA (September, 1999) report discussed a review of the literature on the effectiveness of a number of individual sanctions imposed for driving while under the influence of alcohol. The sanctions included incarceration, out-of-home placement, residential weekend intervention (for screening and assessment), probation, home detention, electronic home monitoring, driver's license suspension/revocation, license plate removal/registration revocation, community service, restitution, victim-offender mediation, attendance at victim impact panels, fines, emergency department visitation, education, and treatment.

The report's conclusion stated that few of these sanctions have

been empirically tested, either for adults or minors. However, one sanction of relevance to this section has been tested with youth. The police in Tulsa, Oklahoma, developed an emergency department visitation program in which minors spent time in an emergency room, preferably late at night on the weekend, to view the effects of drunk driving. In addition, youth visited a rehabilitation center for patients with spinal cord injuries, attended a VIP presentation, participated in a small group alcohol counseling session, and wrote an essay about their experiences in the program. A study of this program found reduced recidivism (i.e., rearrest for DUI) among 16- to 25-year-olds over 2 years. Program participants had a recidivism rate of 1.2% compared to the national DUI rearrest rate of approximately 30% (Police Executive Research Forum).

One punishment that seems to be consistently effective is license disqualification. License loss can be effective for both alcohol-related and non-alcohol-related accidents. Offenders with no license suspension recidivate more (McKnight & Voas, 2001; Peck et al., 1985; Ross, 1992; Siskind, 1996), and offenders receiving longer suspensions tend to recidivate less, at least for non-alcohol-related offenses (Homel, 1981). One study found that as many as three-quarters of disqualified drivers continue to drive while unlicensed (Ross & Gonzales, 1988), but they tend to drive less and more cautiously, at least while suspended.

Swiftness of Punishment

Celerity or swiftness of punishment is the proximity of punishment to the drinking-and-driving event. One example is administrative license suspensions or revocations for drinking and driving where licensing authorities can suspend licenses without a court hearing, quickly and closer in time to the actual offense. Administrative suspension or revocation can occur in 40 of the 50 states in the United States; its effect on drinking-and-driving accidents is consistently positive, and its mechanism seems to be general deterrence (Ross, 1992; McKnight & Voas, 2001). Miller, Galbraith, and Lawrence (1998a) concluded that the benefit-to-cost ratio was \$11 per dollar invested when violators receive a 6-month license suspension.

Intermediate Variable

Public Awareness of Drinking-and-Driving Enforcement

Conceptual Definition

Public awareness of drinking-and-driving enforcement is the level of public attention given to DUI enforcement.

Measurement

This variable can be measured by frequency counts of news coverage of DUI enforcement in local news media, in newspapers, on the radio, and/or on television. DUI enforcement news coverage can be measured by a factor score for newspapers developed by Treno et al. (1996). The factor score reflects the total number of stories, the total area of the new stories, the number of stories longer than 18 column inches, and the total number of stories with pictures or graphics.

Relationship of the Intermediate Variable to the Problem

PUBLIC AWARENESS OF DRINKING-AND-DRIVING ENFORCEMENT does not influence alcohol-related motor vehicle crashes directly but, instead, works in conjunction with actual increases in DUI enforcement to increase perceived risk of DUI arrest. This has been demonstrated empirically by Voas et al. (1997). See Figure 2 under “Perceived Risk of DUI Arrest.”

In our model, the relationships are as follows:

PUBLIC AWARENESS OF DRINKING-AND-DRIVING ENFORCEMENT → PERCEIVED RISK OF DUI ARREST,

which mediates the relationship between

DRINKING AND DRIVING AFTER DRINKING → ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

In turn, there are three variables that influence public awareness of drinking-and-driving enforcement, including

DUI ENFORCEMENT,
COMMUNITY NORMS ABOUT DRINKING AND DRIVING,

and

ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

Relationship of Intermediate Variable to Other Variables

Public Awareness of Drinking-and-Driving Enforcement to Perceived Risk of DUI Arrest

As shown in Voas et al. (1997), public news attention to actual changes in DUI enforcement can actually increase perceived risk. The significance of public awareness to the success of any DUI enforcement program was first demonstrated by Ross’ (1973) classic review of the British Road Safety Act, where the effect of the new breath-test law on crashes was much greater than would have been expected from the number of tests actually conducted.

As described by Voas (1997), public awareness was the responsibility of each community's enforcement task force and project staff. Task force members and the project coordinator received training in media advocacy. The Community Trials Project provided a media advocacy consultant who worked closely with the coordinator and the police department leadership in planning enforcement operations. As a result, many media events were planned around enforcement operations. Because the attention of the public can wander and the effect of even a highly publicized campaign can decay over time, a policy of changing the news coverage foci every few months was adopted. News might focus on the novelty of the passive sensor flashlights at one time, on checkpoints at a later time, and on multijurisdictional "sweeps" at a still later time, even though the same basic enforcement techniques were being used throughout (Voas, 1997).

Holder et al. (1997) and Voas (1997) described media advocacy within the Community Trials Project as referring to the strategic use of news media to advance a social or public policy initiative. They found increased perceived risk of arrest after drinking and driving was linked to increased DUI news coverage. Other results indicated that (a) training in media advocacy can increase coverage of news events generated by local community members including volunteers; (b) increased news coverage can be generated for both electronic (television) and print media; (c) increased news coverage drew the public's attention to specific issues in support of prevention components; (d) although there are differential audiences/readers for the print (newspaper) and electronic (television) media, both audiences are affected; and (e) media advocacy can be more effective than a paid public information campaign in increasing public awareness of alcohol issues.

*Alcohol-Related
Motor Vehicle
Crashes to Public
Awareness of
Drinking-and-
Driving
Enforcement*

There are several ways to depict the relationship between the frequency of problem occurrence (in this case, motor vehicle crashes) and community norms about drinking and driving. Problem frequency may be directly correlated, so that increased frequency leads to increased concern. An alternate interpretation is that significance to the community helps moderate the relationship between problem frequency and community concern, such that concern will be high only when problem frequency is high and the problem is perceived as significant.

Holder et al. (1997) and Voas et al. (1997) found that the effect of publicity wore off as the public became aware that police were not using their new authority as extensively as had been expected. Voas and Hause (1987) reported that a strong decline in nighttime crashes in the first year of an intensified DUI patrol program was halved in the second year when there was no publicity given to the program. Further evidence for the importance of publicizing enforcement programs has been provided by Mercer (1985) who found that reductions in crashes occurred only when sobriety

checkpoints were well publicized.

Strategies

Local News Coverage of DUI Enforcement

Local news stimulated by media advocacy, as described in Treno et al. (1996), can affect drinking-and-driving behavior. The effectiveness of media advocacy training and technical assistance in producing increased media coverage of the Community Trials Project was demonstrated by Treno et al. (1996) and Holder and Treno (1997). The initial media advocacy training was not specific to enforcement; however, it prepared the local prevention staff and community members to work effectively with local news media. The public's perception of the risk of being arrested for drinking and driving was a major intermediate variable. Thus, news attention to DUI enforcement was defined as a significant component output (see Figure 2 under "Perceived Risk of DUI Arrest").

Random Breath Testing

Consistent and highly visible DUI enforcement, such as random breath testing, is an essential strategy to complement local news coverage of enforcement. See detailed discussions of enforcement strategies in the section on "DUI Enforcement."

Intermediate Variable**DUI Enforcement****Conceptual Definition**

DUI enforcement refers to the level of enforcement used to detect drivers who are legally intoxicated (i.e., driving under the influence of alcohol). The level of legal intoxication is defined by the law as a specific level of blood alcohol concentration. Any driver with a measured BAC equal to or higher than this defined level is considered intoxicated and can be arrested for DUI. Although the effects of the BAC level on driving performance depend on factors such as an individual's weight, rate of drinking, and amount of food in the stomach, deterioration in performance becomes quite marked between BACs of .05 and .08. Performance can even be affected whenever a driver's BAC is higher than .00.

The goal of DUI enforcement is to reduce the number of persons who drink and then drive, thereby reducing automotive crashes and fatalities. One way to do this is to remove impaired drivers from the roadways and punish them to deter similar occurrences in the future. To accomplish this goal, DUI enforcement can use one or more of the specific regulations and rules such as BAC limits, per se laws, zero-tolerance laws, administrative license revocation, and automobile interlock devices. In terms of specific enforcement policies, the two most salient include random breath testing (used only outside of the United States) and sobriety checkpoints (legal in the United States).

Measurement

The level of DUI enforcement can be measured as follows:

1. *The number of DUI arrests completed within a specific period in a location.* This indicator reflects the level of police actions in locating and apprehending legally impaired (drunk) drivers. Because enforcement is often selective (i.e., highly dependent upon the type of drinking-and-driving checking and surveillance used), a DUI arrest rate is largely a reflection of police activity and not the actual drinking-and-driving rates on the roadways.
2. *The number of sobriety checkpoints or roadblocks conducted by the police during a defined time.* This reflects the frequency of checkpoints by police but, due to scheduling (e.g., only during high-profile times such as a holiday), may not represent a systematic checking of drinking and driving nor even the actual number of breath checks conducted at these roadblocks.
3. *The number of BAC breath checks actually completed by the police during a specific time.* These breath checks, if conducted regularly or randomly, can be a valid indicator of frequency of driver checks for legal impairment.
4. *The cumulative number of breath-test devices in operation (both PBTs and passive sensor flashlights) in active*

enforcement. These instruments provided two benefits: (1) increased police capability to apprehend drunk drivers and (2) additional trained officers in the use of these sensors and DUI enforcement techniques generally. The units increased officer motivation to investigate potential DUI offenders. This is one of the better measures of enforcement.

5. *The actual date of each checkpoint or major special DUI enforcement sweep that was conducted about once a month.*

Relationship of the Intermediate Variable to the Problem

In our model,

DUI ENFORCEMENT → PERCEIVED RISK OF DUI ARREST,

which mediates the relationship between

DRINKING AND DRINKING AFTER DRIVING →

ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

DUI ENFORCEMENT also directly affects

PUBLIC AWARENESS OF DRINKING/DRIVING ENFORCEMENT,

which again affects

PERCEIVED RISK OF DUI ARREST.

DUI ENFORCEMENT is influenced by

COMMUNITY ACTIVISM ABOUT DRINKING AND DRIVING.

Relationship of Intermediate Variable to Other Variables

DUI Enforcement to Perceived Risk of DUI Arrest

Traditionally, law enforcement directed at drinking and driving has been designed to catch offenders, based on the assumption that such practices will prevent or deter people from driving after drinking. Deterrence, then, essentially increases the perceived probability or likelihood of apprehension for drinking and driving. Deterrence is also influenced by factors such as severity and swiftness of punishment (Ross, 1992). The relationship between enforcement and harm (alcohol-related motor vehicle crashes) is reciprocal in that frequent, severe, or publicly significant traffic crashes involving at least one drinking driver can stimulate increased DUI enforcement. It is also likely that DUI enforcement decays or becomes less significant to law enforcement when there is less attention to such crashes.

The importance of perceived risk in determining driver behavior has been recognized by researchers concerned with drinking and driving (Reed, 1981; Ross, McCleary, & Epperlein, 1981; Voas, 1982). The actual risk of arrest for DUI is quite small. Borkenstein (1974) estimated that, in the United States there is approximately one DUI arrest for every 2,000 driving events above the legal limit. Subsequently, public perception is of a low risk of detection and arrest is accurate. Modest changes in the actual risk of arrest are

likely to have little effect on driver behavior (Ross, 1982). Further, substantially bolstering DUI enforcement, though effective (Voas & Hause, 1987), may be politically and economically costly. However, when changes in traffic enforcement are implemented and publicity is widespread, the public may overestimate the risk, at least for a time, and the amount of drinking and driving declines. Voas and Hause (1987), in their Stockton study, demonstrated the dynamic relationship between public perception of arrest risk and drinking-and-driving behavior. When it becomes clear that the actual risk of arrest has not risen appreciably, however, the public returns to its former behavior, and drinking and driving once again increases (Ross et al., 1981).

DUI Enforcement to Public Awareness of Drinking-and-Driving Enforcement

This relationship shown in Figure 1 reflects the interaction of changes in enforcement and the public awareness of enforcement. The community learns about DUI enforcement in two ways: (1) observing actual enforcement as drivers (or passengers), and (2) reports from others and in the news. Thus, highly visible and frequent enforcement is observed by drivers while on the roadways, and any publicity (planned or natural local news attention) will increase public awareness (i.e., people will talk about their perceptions of enforcement). See results and discussion in Voas and Hause (1987).

Alcohol-Related Motor Vehicle Crashes to Community Activism About DUI Enforcement

One example where increased DUI enforcement substantially decreased alcohol-related motor vehicle crashes is provided by Voas and Hause (1987). Several studies have demonstrated that increasing the total number of police patrols dedicated to apprehending impaired drivers will reduce alcohol-related crashes (Levy, Voas, Johnson, & Klein, 1978; Vingilis & Salutin, 1980; NHTSA, 1995a; Hingson, Howland, Schiavone, & Damiata, 1990). The limitation with this method is that, once the extra manpower is withdrawn, the influence on crashes disappears over time (Voas & Hause, 1987).

Strategies

Sobriety Checkpoints and Random Breath Testing

The system of randomly stopping and breath testing motorists originated in Sweden and has been most comprehensively applied in Australia (Homel, 1988; Homel, McKay, & Henstridge, 1995), producing apparently permanent reductions in serious injury crashes of one-third or more where this technique was fully implemented (Homel, 1988). Because of the First Amendment requirement that enforcement stops be “reasonable,” this procedure has been used more sparingly in the United States. Where applied with reasonable frequency (Voas, Rhodenizer & Lynn, 1985; Levy, Shea & Asch, 1989; NHTSA, 1995a); however, it has produced significant reductions in alcohol-related crashes (Stuster & Blowers, 1995).

The principal limitation of this procedure has been the belief by most police department officials that relatively large numbers of

officers are required to meet the legal requirements for conducting a checkpoint. However, legal checkpoints staffed with as few as four officers are as effective as those with ten or more officers (NHTSA, 1995a). The British Road Safety Act of 1968 demonstrated the powerful effect that the threat of roadside breath testing could have on alcohol-related crashes (Ross, 1973; Ross, 1977). The Australian police have demonstrated the longer-term effectiveness of random testing by increasing the testing rate to equal a third or a half of the number of licensed drivers each year (Homel, 1988). The United States has been slow to adopt this “chemistry-based” enforcement system (Voas & Lacey, 1990) because the states have only recently adopted the *per se* illegal laws that establish a specific BAC as a drunk-driving offense. Once such laws were in place, defense attorneys frequently succeeded in challenging the officer to present behavioral evidence of impairment to demonstrate that they had “probable cause” to make the arrest and require the breath test.

In the United States, when the police have been provided with handheld preliminary breath-test (PBT) devices for testing motorists at the roadside, DUI arrests have increased (Cleary & Rogers, 1986; Saffer & Chaloupka, 1989). Passive sensors (built into flashlights and not requiring a mouthpiece to obtain a driver’s breath sample) are also sensitive detectors of breath alcohol (Lestina & Lund, 1989). At sobriety checkpoints, only motorists who are judged by police to have been drinking are asked to take a breath test. This approach greatly weakens the deterrent potential because experienced offenders believe (with some justification) that they can avoid detection. An estimate is that police miss as many as 50% of drivers with a BAC higher than .10 (McKnight & Voas, 2001).

As described above, an alternative to such selective testing of drivers is RBT or CBT, as it is practiced in Australia, New Zealand, and some European countries. (Henstridge et al., 1997). Shults et al. (2001) reviewed 23 studies of RBT and selective testing found a decline of 22% (range 13 to 36%) in fatal crashes, with slightly lower decreases for noninjury and other accidents for such enforcement strategies

Lowering BAC Limits for All Drivers

The relative crash risk of drivers at a BAC of .05 is double the crash risk for a zero-BAC driver; at .08, the risk is multiplied by 10; and at .15 or higher, the relative risk is in the hundreds (Borkenstein et al., 1974). The risk curve is even steeper for serious and fatal crashes, for single-vehicle crashes, and for young people (Jonah, 1986; Mayhew et al., 1986). Given the strong relationship between BAC and risk, countries have established *per se* laws—that is, a specific BAC level (usually .05 or .08) at which a driver can be arrested (Andenaes, 1988). The BAC can be measured by taking a blood sample from a driver; it can also be measured via an analysis of the exhaled breath. Thus, the invention of the breathalyzer and other portable devices for collecting samples of drivers’ breaths,

combined with *per se* legislation, revolutionized law enforcement of drinking and driving.

All U.S. states have longstanding laws prohibiting driving while impaired by alcohol. In 49 states, it is also illegal to operate a motor vehicle with a BAC higher than a specified limit, regardless of whether the operator is visibly impaired. Originally, a BAC of .10 or .15 was considered illegal, but all states have since lowered the limit. At a BAC of .08, all drivers are expected to experience impairment in driving-related skills. In support of .08 BAC laws, the U.S. Congress included a provision in the Fiscal Year 2001 Department of Transportation and Related Agencies Appropriations Act 213 requiring states and territories to implement .08 BAC laws by October 1, 2003, or risk losing federal highway construction funds. By that date, 45 states, the District of Columbia, and Puerto Rico had enacted laws lowering the illegal BAC to .08.

Certain policies depend upon laws that clearly define drinking and driving with a BAC at or higher than a prescribed level for the whole population (e.g., .08 or .05) or for young drivers (usually zero or .02). Evidence for the general deterrent influence of these *per se* laws is strong, although the effects tend to be temporary (Ross, 1982). This success has led many countries to set even more stringent BAC levels.

Bartl and Esberger (2000) reviewed the international evidence on the effect of lower-level BAC laws. They found that lower BAC limits produced positive results consistently. The effect for Sweden of its .02 law, introduced in 1990, was estimated at 6% (Norström, 1997). Henstridge et al. (1997) analyzed daily accident data for four Australian states between 1976 and 1992 to control for seasonal effects, daily weather patterns, economic and road use activity, alcohol consumption, the day of the week, and other legal interventions. They concluded that the effect of the .05 BAC limit on fatal accidents ranged from 8% in New South Wales to 18% in Queensland. Using roadside survey data in South Australia, Kloeden and McLean (1994) observed a 14% decline in drivers with a positive BAC.

The final major initiative involving BAC levels has been the establishment of very low BACs (usually .02) for young or inexperienced drivers. Shults et al. (2001) reviewed six well-designed studies of the effect of these laws in the United States and Australia. Estimated declines in fatal crashes ranged from 24 to 9%. Although further evaluation is required, the research to date suggests that the effects of BAC laws are mostly positive, long-term, and cost-effective (Mann et al., 2001). Ross (1982) hypothesized that the deterrent effect wears off because drivers initially grossly exaggerate the certainty of apprehension in response to the publicity. Gradually, however, this initial effect wears off, and drivers realize that their chances of detection are in fact not very high. Making motorists *uncertain* about the real risk

of detection may paradoxically be the key to cost-effective deterrence (Homel, 1988; Nagin, 1998).

Severity of Punishment

Punishment for drinking-and-driving conviction has typically been increased, either by changing the maximum penalties or by introducing mandatory minimum penalties. There is limited evidence to support the positive influence of these laws (Ross & Voas, 1989). Indeed, their effects could be counterproductive if the judicial system is overburdened or if prosecutors fail to pursue these cases (Little, 1975; Ross & Voas, 1989). Severe punishments do not appear to produce fewer accidents than less severe penalties (Homel, 1988, Ross, 1992). McKnight and Voas (2001) observed, however, that tough penalties such as imprisonment can have beneficial indirect effects by providing a sanction of last resort to motivate repeat offenders to participate in more constructive programs such as probation or residential treatment.

Swiftness of Punishment

Swiftness of punishment is the proximity of punishment to the drinking-and-driving event. One example is administrative license suspensions or revocations for drinking and driving, where licensing authorities can suspend licenses without a court hearing, quickly and closer in time to the actual offense. Administrative license suspension can occur in 40 of the 50 states in the United States, where the effect on drinking-and-driving accidents is consistently positive. The mechanism seems to be general deterrence, with an average reduction of 5% in alcohol-related crashes and a reduction in fatal crashes of 26% associated with administrative licensing revocation (Ross 1992; McKnight & Voas, 2001).

Frequency of Punishment

A strategy for increasing certainty of apprehension and punishment is to increase the frequency and visibility of drinking-and-driving enforcement. Ross (1992) estimated that the objective probability of apprehension for an impaired driver in the United States is one in a thousand. Increasing this probability may therefore translate into a higher *perceived* probability of detection and fewer accidents. The traditional way of doing this is simply to intensify police enforcement in the form of short-term intensive checkpoints, such as during holidays. Such campaigns generally reduce accidents, but once again, their effects are generally short lived (Ross, 1982).

Low BAC Limits for Young Drivers

Young drivers (aged 16 to 20) are at risk for traffic crashes, including alcohol-involved crashes, as a result of their limited driving experience and their tendency to experiment with heavy or binge drinking. Lower BAC limits for young drivers (sometimes called zero-tolerance laws) set BAC limits at the minimum that can be reliably detected by breath-testing equipment (i.e., .01-.02). Zero-tolerance laws also commonly invoke other penalties, such as automatic confiscation of the driver's license. An analysis of the effect of zero-tolerance laws in the first 12 U.S. states enacting them showed a 20% relative reduction in the proportion of SVN

fatal crashes among drivers aged 20 and younger, compared with nearby states that did not pass zero-tolerance laws (Hingson et al., 1994; Martin, Grube, Voas, Baker, & Hingson, 1996). Zwerling and Jones (1999), after a review of six studies on the effects of zero tolerance, found that all showed a reduction in injuries and crashes (but three were not statistically significant due to lack of statistical power). Voas, Tippetts, and Fell (1999), in a national study of U.S. states, found a net decrease of 24% in the number of young drivers with positive BACs after implementation of zero-tolerance laws. Similarly, a 19% reduction in self-reported driving after any drinking and a 24% reduction in driving after five or more drinks was found using survey data from 30 states (Wagenaar, O'Malley, and LaFond, 2001). Although all of the studies occurred in the United States, the evidence of effectiveness for low BAC limits for young drivers is quite strong, a conclusion reinforced by Shults et al. (2001) who found reductions of between 24 and 9% in fatal crashes after reviewing both U.S. and Australian studies.

Strategies (Summary)

Effective measures to prevent injuries and deaths from impaired driving include the following:

- Promptly suspending the driver's licenses of people who drive while intoxicated (DeJong & Hingson, 1998).
- Lowering the permissible BAC levels for adults to .08 in all states (Shults et al., 2001).
- Zero-tolerance laws for drivers younger than 21 in all states (Shults et al., 2001).
- Sobriety checkpoints (Shults et al., 2001).
- Multifaceted community-based approaches to alcohol control and DUI prevention (Holder et al., 2000; DeJong & Hingson, 1998).
- Mandatory substance abuse assessment and treatment for driving-under-the-influence offenders (Wells-Parker, Bangert-Drowns, McMillan, & Williams, 1995).
- Reducing the legal BAC limit to .05 (Howat, Sleet, & Smith, 1991; National Committee on Injury Prevention and Control, 1989).
- Raising state and federal alcohol excise taxes (National Committee on Injury Prevention and Control, 1989).

Implementing compulsory blood alcohol testing when traffic crashes result in injury (National Committee on Injury Prevention and Control, 1989).

Strength of the Evidence

The CDC Task Force recommended the use of sobriety checkpoints based on strong evidence of their effectiveness in reducing fatal and nonfatal crash injuries and in reducing alcohol-impaired

driving and alcohol-related crashes. These findings should be applicable to all drivers in areas where sobriety checkpoints can be conducted.

In addition, evidence supports a conclusion that setting a reasonably low-level BAC, undertaking frequent and visible enforcement of existing BAC limits, threatening and actually suspending driving privileges, and establishing certainty of punishment, especially through randomized enforcement, form a combined strategy with the strongest potential for prevention success.

Another compelling finding is that comprehensive treatment including counselling or therapy plus license suspension can be effective in reducing recidivism. Restorative approaches, although promising if they incorporate license loss, require further evaluation. The application of ignition interlock devices has shown positive results but has not been widely tested in countries other than the United States.

Regarding young drivers, the scientific evidence shows that low BAC limits, delayed access to a full license, and curfews for young drivers can be effective strategies for reducing drinking-and-driving among the young. Graduated licensing schemes can incorporate all these strategies within one system by controlling the rate and manner in which young drivers gain access to full driving privileges. These schemes have been well accepted where implemented, and the small number of evaluations all show safety benefits (Begg et al., 2000; Mayhew, 2000; Ulmer, Ferguson, Williams, & Preusser, 2000).

Intermediate Variable**DUI Enforcement****Conceptual Definition**

Community activism about DUI enforcement refers to organized action by community members and/or organizations to produce changes in drinking-and-driving policy and activity within the community and to support desired policies.

Measures

Alternative ways to measure levels of community activism against DUI enforcement include (a) formation of MADD or other volunteer groups against drinking and driving and the number of members in the community, (b) public news coverage of drinking and driving and alcohol-related motor vehicle crashes, (c) number and frequency of letters to the editor and editorials against drinking and driving. Other process indicators could include documented meetings with elected officials requesting high priority to drinking-and-driving enforcement and documented changes in enforcement priority following the meetings.

Relationship of the Intermediate Variable to the Problem

As with most intermediate variables, COMMUNITY ACTIVISM ABOUT DUI ENFORCEMENT does not affect ALCOHOL-RELATED MOTOR VEHICLE CRASHES directly, but rather works through other variables. In our model,

COMMUNITY ACTIVISM ABOUT DUI ENFORCEMENT →
DUI ENFORCEMENT → PERCEIVED RISK OF DUI ARREST,

which mediates the relationship between

DRINKING AND DRIVING AFTER DRINKING →
ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

In turn,

ALCOHOL-RELATED MOTOR VEHICLE CRASHES

has a feedback loop to

COMMUNITY ACTIVISM ABOUT DUI ENFORCEMENT.

Relationship of Intermediate Variable to Other Variables**Community Activism About DUI Enforcement to DUI Enforcement**

MADD is an example of activism which appears to have stimulated changes associated with reductions in alcohol-related motor vehicle crashes. MADD in 1991 released its report, "Rating the States," showing all 50 U.S. states and their involvement in anti-drunk-driving measures including DUI enforcement. MADD's support was instrumental in passage of zero-tolerance legislation, which lowered the BAC limit for young drivers, in 2000. The 600th chapter was also established in the year 2000. As of July 2004, all 50 states have passed the .08 BAC law, thanks to the efforts of MADD. Other enforcement measures that have received MADD

support include frequent, visible DUI enforcement sobriety checkpoints, which potentially can reduce fatalities by 20%, and stricter enforcement of safety belt usage laws to prevent additional injuries on the public roads.

Community activism is an important factor in generating support and resources for DUI enforcement. Voas (1997) described how increases in community activism and mobilization helped increase support for DUI enforcement as part of a large-scale community trial to reduce alcohol consumption and associated problems in California. Voas et al. (1997) examined the influence of community activism as part of a larger set of community interventions targeting alcohol use and associated problems in a community. They reported that media advocacy training and technical assistance resulted in increased DUI news coverage, additional police officer hours for DUI enforcement, greater use of breathalyzers, increased officer training, and more checkpoints. In turn, increased DUI news coverage and DUI enforcement resulted in greater perceived risk of DUI arrest and consequent reduced drinking and driving.

*Alcohol-Related
Motor Vehicle
Crashes to
Community
Activism about
DUI Enforcement*

Since MADD has been in existence, there has been a 43% decline in alcohol-related traffic fatalities (MADD stats and resources homepage). NHTSA recently reported that alcohol-related traffic fatalities decreased 2.1% between 2003 and 2004. This figure translates into 16,654 deaths from preventable drunk driving, down from a high of 26,173 alcohol-related deaths in 1982. This evidence represents at least a potential link between alcohol-related motor vehicle crashes and community activism. An example is the direct effect of MADD's activism on motor vehicle crashes. We therefore postulate the feedback loop from alcohol-related crashes to community activism.

Strategies

*Community
Coalitions to
Prevent Drunk
Driving*

One strategy for increasing community activism concerning drinking and driving is to form a coalition of persons with interest and concern about alcohol-related motor vehicle crashes. Active and mobilized communities have shown clear decreases in alcohol, tobacco, and other drug use and changes in perceived norms about substance use. In addition, these communities have improved perceptions of neighborhood quality by environmental changes, such as closing crack houses and removing billboards for alcohol and tobacco. Coalition membership must be appropriate to the shared purpose and plan for action, in this case, efforts to increase DUI enforcement in the community. If comprehensive service coordination is the task, organization leaders need to be involved, especially if an organization is expected to be a key contributor to a particular intervention. If community mobilization is the task, grassroots activists and community citizens must be involved. Community linkage coalition models require a mix of both types of community members. This mix results in diverse expectations and

operating assumptions for the coalition that must be resolved to avoid conflict and role confusion.

Leadership is essential and can take different forms. Effective leadership may reside with a dynamic or visionary individual. But one problem associated with this type of leadership is that it is not transferable. Well-functioning coalitions often create opportunities for satisfying and effective participation of members resulting in a “leadership of ideas” demonstrated in a well-articulated plan of action.

Facilitating community-based collective action requires appropriate roles for paid staff. Paid coalition staff members operate more effectively as resource providers and facilitators rather than as direct community organizers. Paid staff can fill essential clerical, coordination, and communications functions that provide the glue to hold diverse coalitions together. Paid staff can also provide leadership through expertise in strategies and programmatic activities that will further the coalition goals.

Staff members who handle the coalition-based community processes must approach their strategies and programmatic actions from an outcome-based perspective and must be ready to make adjustments to the plan of action to meet these outcome-based goals. The effectiveness of community-based processes is not a reflection of the coalition’s organizational structure or design. It is a function of strategies and activity. If the intervention appears to be ineffective, changes and adjustments in the coalition’s action plan, not its organizational structure, are required.

*Community
Activism and
Mobilization*

Voas (1997) described how increases in community activism and mobilization helped increase support for DUI enforcement as part of a large-scale community trial to reduce alcohol consumption and associated problems in California. Local coalition members in the experimental communities worked with the City Council of elected officials, as well as stimulated media advocacy. The purpose of these activities was to increase support for DUI enforcement by establishing a drinking-and-driving task force. Each task force consisted of community leaders and officials who could be most effective in providing law enforcement with support for high visibility DUI activities. This included MASS, elected city or county officials, the police chief or his designee, representatives of the business community, and the licensed beverage industry. Task force objectives included providing support for DUI enforcement activities, assisting the police department in obtaining local government support for the use of state highway funds for these activities, and raising funds for the production of public information materials to publicize the enforcement efforts.

Intermediate Variable**Drinking****Conceptual Definition**

Drinking refers to the consumption of alcohol prior to or concurrent with driving a motor vehicles or walking in traffic as a pedestrian. Since driving involves multiple tasks, the demands of which can change continually. To drive safely, one must maintain alertness, make decisions based on ever-changing information present in the environment, and execute maneuvers based on these decisions. Drinking alcohol impairs a wide range of skills necessary for carrying out these tasks.

Measures*Blood Alcohol Concentration*

The preferred measurement of drinking would be the BAC level of an individual. The proportion of alcohol to blood in the body is expressed as the *blood alcohol concentration (BAC)*. In the field of traffic safety, BAC is expressed as the percentage of alcohol in deciliters of blood: for example, .10% is equal to .10 grams per deciliter).

Alternative

Except for regular measurement via breath or blood, the BAC level of drinkers is not available. Therefore, self-reports of alcohol consumption can be used as an alternative. The Timeline FollowBack (TLFB) interview (Sobell, Sobell, Klajner, Pavan, & Basian, 1986) is one of the more widely used of the self-report measures. It is a calendar-based method in which individuals are presented with a calendar and report the quantity and frequency of alcohol consumed daily over a given period (typically 1 to 6 months). Although this instrument is lengthy to administer, it yields reliable drinking-event estimates, as days of use are tied to other life events visually.

In addition, SAMHSA's SPF SIG has provided numerous other measures of consumption and where data on these measures can be located, as indicated below.

Alternative Indicator Recommended***Current Use of Alcohol by Persons Aged 12 and Older****Justification*

Approximately 100,000 deaths each year in the United States are attributed to alcohol misuse. Studies have shown that youth who begin drinking at an early age are at increased risk of problem drinking later in life. Purchase and consumption of alcohol by persons younger than age 20 is illegal.

Definition

Percentage of persons aged 12 and older reporting any use of alcohol within the past 30 days.

<i>Data Source</i>	National Survey on Drug Use and Health (NSDUH), Substance Abuse and Mental Health Services Administration (SAMHSA), U.S. Department of Health and Human Services (DHHS)
<i>Frequency</i>	Annual
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Age
<i>Strengths</i>	NSDUH is the only national source that currently provides prevalence of use estimates for both adolescents and adults for every state.
<i>Limitations</i>	State-level estimates for most states are based on relatively small samples. Although augmented by model-based estimation procedures, estimates for specific age groups have relatively low precision (i.e., large confidence intervals). The estimates are provided directly by SAMHSA, and raw data that could be used for alternative calculations (e.g., demographic subgroups) are not available. The estimates are subject to bias due to self-report and nonresponse (refusal/no answer).

Alternative Indicator Recommended

Current Use of Alcohol by High School Students

<i>Justification</i>	Approximately 100,000 deaths each year in the United States are attributed to alcohol misuse. Alcohol misuse results in injuries, violence, fetal alcohol spectrum disorder, and other negative health and safety consequences. Purchase of alcohol by persons aged 20 and younger is illegal. Young people who consume alcohol are more likely than adults to drink heavily.
<i>Definition</i>	Percentage of students in grades 9 through 12 reporting any use of alcohol within the past 30 days
<i>Data Source</i>	YRBSS, CDC
<i>Frequency</i>	Biennial
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Grade level, gender, race/ethnicity
<i>Strengths</i>	YRBSS estimates are typically based on larger samples than the NSDUH and can be further broken down by grade level, gender, and race/ethnicity. Some states also collect YRBSS data for individual communities or school districts, which can be compared

with their state-level data.

Limitations

As of 2003, weighted representative samples were available for only 32 states. Not all states participate, and some participating states do not provide representative samples. YRBSS is a school-based survey, so students who have dropped out of school are not represented. It is also subject to bias due to self-report, noncoverage (refusal by selected schools to participate), and nonresponse (refusal/no answer). Estimates for some subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Current Use of Alcohol by Persons Aged 18 and Older

Justification

Approximately 100,000 deaths each year in the United States are attributed to alcohol misuse.

Definition

Percentage of persons aged 18 and older reporting any use of alcohol within the past 30 days

Data Source

BRFSS, CDC

Frequency

Annual

Geographic Levels

National and State

Demographic Categories

Age, gender, and race/ethnicity

Strengths

BRFSS provides prevalence estimates of adult use for every state. State-level estimates are typically based on larger samples than the NSDUH and may be further broken down by age, gender, and race/ethnicity.

Limitations

BRFSS is a telephone survey subject to potential bias due to self-report, noncoverage (households without telephones), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Current Binge Drinking by Persons Aged 12 and Older

Justification

Binge drinking, as indicated by consumption of five or more drinks within a short time span, is strongly associated with injuries, motor vehicle crashes, violence, fetal alcohol spectrum disorder, chronic liver disease, and several other chronic and acute conditions. Approximately 100,000 deaths per year are attributed to alcohol use.

<i>Definition</i>	Percentage of persons aged 12 and older reporting having five or more drinks on at least one occasion within the past 30 days
<i>Data Source #1</i>	NSDUH, SAMHSA, DHHS
<i>Frequency</i>	Annual
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Age
<i>Strengths</i>	This measure, used consistently for many years and by many different surveillance systems, is an easily obtainable indicator of alcohol use behavior that is almost certain to cause impairment. The NSDUH is the only national source that currently provides prevalence estimates for both adolescents and adults for every state.
<i>Limitations</i>	This measure does not capture the frequency of binge drinking or the amount of alcohol consumed on any one occasion. State-level estimates for most states are based on relatively small samples. Although augmented by model-based estimation procedures, estimates for specific age groups have relatively low precision (i.e., large confidence intervals). The estimates are provided directly by SAMHSA, and the raw data that could be used for alternative calculations (e.g., demographic subgroups) are not available. The estimates are subject to bias due to self-report and nonresponse (refusal/no answer). A limitation is that the results are only reported as percentage of students in grades 9 through 12 who report having five or more drinks on at least one occasion in the past 30 days, as measured by the YRBSS.

Alternative Indicator Recommended

Current Binge Drinking by High School Students

<i>Justification</i>	Binge drinking, as indicated by consumption of five or more drinks within a short time span, is strongly associated with injuries, motor vehicle crashes, violence, fetal alcohol spectrum disorder, chronic liver disease, and several other chronic and acute conditions. Approximately 100,000 deaths per year are attributed to alcohol misuse. Purchase of alcohol by persons aged 20 and younger is illegal. Young people who consume alcohol are more likely than adults to binge drink.
<i>Definition</i>	Percentage of students in grades 9 through 12 who report having five or more drinks in a row (i.e., within a couple hours) on at least one occasion within the past 30 days.

<i>Data Source #1</i>	YRBSS, CDC
<i>Frequency</i>	Biennial
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Grade level, gender, and race/ethnicity
<i>Strengths</i>	This measure, used consistently for many years and by many different surveillance systems, is an easily obtainable indicator of an alcohol-use behavior that is almost certain to cause impairment. YRBSS estimates are typically based on larger samples than the NSDUH and can be further broken down by grade level, gender, and race/ethnicity. Some states also collect YRBSS data for individual communities or school districts, which can be compared with their state-level data.
<i>Limitations</i>	This measure does not capture the frequency of binge drinking or the amount consumed on any one occasion. As of 2003, weighted representative samples were only available for 32 states. Not all states participate, and some participating states do not provide representative samples. YRBSS is a school-based survey, so students who have dropped out of school are not represented. It is also subject to bias due to self-report, noncoverage (refusal by selected schools to participate), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Current Binge Drinking by Adults Aged 18 and Older

<i>Justification</i>	Binge drinking, as indicated by consumption of five or more drinks within a short time span, is strongly associated with injuries, motor vehicle crashes, violence, fetal alcohol spectrum disorder, chronic liver disease, and several other chronic and acute conditions. Approximately 100,000 deaths per year are attributed to alcohol misuse.
<i>Definition</i>	Percentage of persons aged 18 and older reporting having five or more drinks on at least one occasion within the past 30 days.
<i>Data Source</i>	BRFSS, CDC
<i>Frequency</i>	Annual
<i>Geographic Levels</i>	National and state
<i>Demographic</i>	Age, gender, and race/ethnicity

Categories

Strengths This measure, used consistently for many years and by many different surveillance systems, is an easily obtainable indicator of an alcohol use behavior that is almost certain to cause impairment. The BRFSS provides prevalence estimates of adult use for every state. State-level estimates may be further broken down by age, gender, and race/ethnicity.

Limitations This measure does not capture the frequency of binge drinking or the amount of alcohol consumed on any one occasion. The BRFSS is a telephone survey subject to potential bias due to self-report, noncoverage (households without telephones), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended

Current Heavy Use of Alcohol by Adults Aged 18 and Older

Justification Heavy use of alcohol pertains to a pattern of regular use at levels that exceed U.S. Dietary Guidelines and are associated with heightened levels for all causes of mortality. Heavy drinkers are at increased risk for a variety of adverse health outcomes, including alcohol abuse and dependence.

Definition Percentage of women aged 18 and older reporting average daily alcohol consumption greater than one drink per day. Percentage of men aged 18 and older reporting average daily alcohol consumption greater than two drinks per day.

Data Source BRFSS, CDC

Frequency Annual

Geographic Levels National and state

Demographic Categories Age, gender, and race/ethnicity

Strengths BRFSS provides prevalence estimates of adult use for every state. State-level estimates are typically based on larger samples than the NSDUH and may be further broken down by age, gender, and race/ethnicity.

Limitations Average daily consumption does not capture variations in how the amounts of alcohol consumed are distributed over multiple days. BRFSS is a telephone survey subject to potential bias due to self-report, noncoverage (households without phones), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Alternative Indicator Recommended***Early Initiation of Alcohol Use***

<i>Justification</i>	Initiation of alcohol use at young ages, especially in pre-adolescence, has been linked to more intense and problematic levels of use in adolescence and adulthood. Young people who consume alcohol are more likely than adults to binge drink. Purchase of alcohol by persons under the age of 21 is illegal.
<i>Definition</i>	Percentage of students in grades 9 through 12 who report first use of alcohol before age 13 (more than just a few sips)
<i>Data Source</i>	YRBSS, CDC
<i>Frequency</i>	Biennial
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Grade level, gender, and race/ethnicity
<i>Strengths</i>	This measure may be defined for all respondents, unlike average age of first use that can only be defined for users. YRBSS estimates are typically based on larger samples than the NSDUH and can be further broken down by grade level, gender, and race/ethnicity. Some states also collect YRBSS data for individual communities or school districts, which can be compared with their state-level data.
<i>Limitations</i>	Cut-point of 13 years may not be sensitive to changes in average age of first use across the age continuum. As of 2003, weighted representative samples were only available for 32 states. Not all states participate, and some participating states do not provide representative samples. YRBSS is a school-based survey, so students who have dropped out of school are not represented. It is also subject to bias due to self-report, noncoverage (refusal by selected schools to participate), and nonresponse (refusal/no answer). Estimates for subgroups may have relatively low precision (i.e., large confidence intervals).

Indicator Recommended With Reservations***Total Sales of Ethanol per Year per Capita***

<i>Justification</i>	Per capita consumption of absolute alcohol has been used historically as an indicator of overall drinking within a state and has been shown to be correlated with many types of alcohol
----------------------	---

	problems.
<i>Definition</i>	Total sales of ethanol in beer, wine, and spirits per year, estimated in gallons of ethanol per 10,000 population aged 14 and older
<i>Data Source</i>	Alcohol Epidemiologic Data System (AEDS)
<i>Frequency</i>	Annual
<i>Geographic Levels</i>	National and state
<i>Demographic Categories</i>	Not applicable
<i>Strengths</i>	The indicator is consistently defined and readily available from archival data for all states and for many years.
<i>Limitations</i>	Findings regarding the association between per capita alcohol consumption and negative consequences have been inconsistent. Average consumption levels may not be sensitive in identifying areas with a high prevalence of heavy use where there are also high rates of abstinence. Estimates may be inflated due to consumption by nonresidents (e.g., tourists and other visitors). Untaxed alcohol (e.g., products that are smuggled or homemade) are not captured in this indicator.
<i>Relationship of the Intermediate Variables to the Problem</i>	In our model, DRINKING is associated with ALCOHOL-RELATED MOTOR VEHICLE CRASHES through the intermediate variable DRINKING AFTER DRIVING (i.e., as drinking increases, the risk of drinking and driving can increase). DRINKING AFTER DRIVING is mediated by the PERCEIVED RISK OF DUI ARREST. Intermediate variables that directly influence DRINKING include PRICE, RETAIL AVAILABILITY, ALCOHOL SERVING AND SALES PRACTICES, ALCOHOL PROMOTION, COMMUNITY NORMS ABOUT DRINKING, SOCIAL AVAILABILITY, DRINKING CONTEXT, and INDIVIDUAL FACTORS.
<i>Relationship of Intermediate Variables to Other Variables</i>	
<i>Drinking to Driving After Drinking</i>	There is clear evidence that motor vehicle crash risk increases with alcohol consumption. BACs between .01 and .09 are associated with increased crash risk, and even BACs as low as .02 affect response times to dangerous road situations (West et al., 1993; Zador, 1991). The risk curve relating alcohol consumption to traffic crashes is best represented with an accelerating slope—that is, any drinking is associated with increased crash risk, and risk increases sharply as consumption increases (Hurst et al., 1994). Consistent with this finding, Levy and Miller (1995), using data from a large scale study by Borkenstein et al. (1974), estimated that 91% of crashes involved drivers with a BAC level of .10, 43.5% with BACs

between .08 and .099, and 24% with BACs between .01 and .0799.

Research has demonstrated that the relative crash risk of drivers at a BAC of .05 is double the crash risk for a zero-BAC driver; at .08, the risk is multiplied by ten; and at .15 or higher, the relative risk is in the hundreds (Borkenstein et al., 1974). The risk curve is even steeper for serious and fatal crashes, for single-vehicle crashes, and for young people (Jonah, 1986; Mayhew et al., 1986). The many skills involved in driving are not all impaired at the same BAC (Starmer, 1989). For example, a driver's ability to divide attention between two or more sources of visual information can be impaired by a BAC of .02 or lower (Howat, 1991; Moskowitz, Burns, & Williams, 1985). However, it is not until BACs of .05 or higher are reached that impairment occurs consistently in eye movements, glare resistance, visual perception, reaction time, certain types of steering tasks, information processing, and other aspects of psychomotor performance (Hindmarch, Bhatti, Starmer, Mascord, & et al., 1992; Finnigan & Hammersley, 1992).

In turn, alcohol consumption, even at low levels, is also associated with increased likelihood of being in a fatal crash. Blincoe and Faigin (1992) estimated that 19.2% of all traffic accidents, and 39.7% of fatal crashes, involved alcohol use. Ostrom and Eriksson (1993) found that alcohol was one of the biggest contributing factors in SVN fatal crashes. Fell and Nash (1989) found that alcohol was involved in 80% of fatal crashes that occurred between 8 p.m. and 4 a.m., especially on weekends.

The likelihood of being involved in a fatal accident increases with higher BAC levels. Zador (1991) found that individuals with BACs of .02 to .04 were 1.4 times more likely to be in a single-vehicle fatal crash. This risk increased to 11.1 times higher for BACs between .05 and .09, 48 times higher for BACs between .10 and .14, and a staggering 380 times higher for BACs of .15 or higher. Correcting for police underreporting of alcohol involvement, Miller et al. (1998b) reported that 34% of all fatalities in traffic crashes were attributable to alcohol, and 80% of victims in fatal crashes involved a driver with a BAC of at least .10. For young drivers, the association between alcohol use and likelihood of fatal crashes showed a steeper slope for each .02 BAC increase.

Studies have alcohol impairment of driving skills substantially increases the risk of a crash even allowing for driving skill, fatigue, speed, and weather conditions. The BAC is a measure of the relative level of alcohol in the driver's blood and has been shown as a good indicator of motor vehicle crash risk. A 160-pound man will have a BAC of approximately .04 one hour after consuming two 12-ounce beers or two other standard drinks on an empty stomach (1). Although the effects of BAC on driving performance depend on factors such as an individual's weight, rate of drinking, and stomach content (i.e., food in stomach), deterioration in performance becomes quite marked between BACs of .05 and .08, even though there can be lower performance even when a driver

has a BAC higher than zero. See discussion of BAC and risk of traffic crash in section on “Drinking and Driving.”

Strategies

Effective strategies for reducing drinking-and-driving events are described in conjunction with other intermediate variables that are associated with this variable: for example, ALCOHOL SERVING AND SALES PRACTICES, RETAIL AVAILABILITY, and PRICE. For persons who are alcohol-dependent, there are specific strategies for reducing their overall drinking that can affect (if successful) the future risk of DRIVING AFTER DRINKING.

Alcoholism Treatment

Some convicted drinking-and-driving offenders continue their pre-conviction behavior and are thus re-arrested and/or involved in further traffic crashes. The effect of routine punishments for these repeat offenders can be enhanced if combined with alcohol treatment (DeYoung, 1997). From a policy perspective, well-designed treatment programs are probably worth the investment if a reduction in alcohol-related crashes is the goal (Wells-Parker, 2000). Wells-Parker et al. (1995) conducted a meta-evaluation of 215 evaluative studies on drinking-and-driving remediation (treatment) programs and concluded that treatment without license suspension is generally ineffective (see Tashima & Marelich, 1989). The overall conclusions of this meta-analysis was that license suspension plus education, psychotherapy-counselling or follow-up contact-probation (preferably in combination) can produce an additional 7 to 9% reduction in drinking-and-driving recidivism and alcohol-related accidents when compared with control groups that largely received license restrictions only (sometimes more severe than for the treatment groups).

Intermediate Variable**Alcohol Serving and Sales Practices****Definition**

Alcohol serving and sales practices is the ways in which alcohol is served to customers in licensed on-premise establishments and sales practices in off-premise establishments.

Measures***BAC Distribution of Customers***

One preferred measurement of alcohol service is the level of intoxication (high BAC level) among customers in an on-premise alcohol outlet. Because a substantial percentage of drinking drivers come from bars, restaurants, and pubs, this is a preferred indicator of overserving to customers—that is, the BAC distribution of customers leaving an establishment, which could be obtained with regular BAC checks of customers. However, these data are difficult to obtain on a regular basis.

Alternative 1—Self-Reported Drinking

An alternative is self-reports of level of drinking at on-premise establishments. Several commonly used, psychometrically sound instruments can be used to assess self-reported alcohol consumption (see the “Drinking” section).

Alternative 2—Pseudopatron Surveys

Pseudopatron surveys are efforts to measure changes in the alcohol serving behavior of wait persons in a licensed on-premise establishment. The typical protocol for this type of survey is to employ actors who enter an establishment acting as though they are drunk or very impaired. The test of this evaluation is whether the wait person will actually serve the *drunk* individual, especially if he/she requests multiple drinks in a short time span.

Relationship of Intermediate Variable to Problem

Alcohol sales and serving practices do not have a direct effect on alcohol-related motor vehicle crashes, but they have been documented as having an effect on high-volume drinking for customers obtaining alcohol from licensed establishments. Specifically,

ALCOHOL SALES AND SERVICE PRACTICES → DRINKING →
DRIVING AFTER DRINKING,

which is mediated by

PERCEIVED RISK OF ARREST →
ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

Relationship of Intermediate Variable to Other Variables***Alcohol Serving and Sales Practices***

In the United States, an estimated 50% of impaired drivers had their last drink at a licensed establishment (O’Donnell, 1985).

to Drinking

Toomey et al. (2004) reported that, across studies assessing propensity for alcohol sales to obviously intoxicated patrons, sales rate estimates ranged from 58 to 85% for on-premise establishments (e.g., bars).

Wait persons in licensed alcohol establishments often encounter intoxicated patrons and frequently continue to serve alcohol to these individuals. The LEVEL OF DRINKING, especially high volume or high BAC levels, and high-risk drinking are influenced by to the serving and sales practices of licensed retail outlets. Using two waves of actors demonstrating obvious signs of intoxication, Toomey et al. (1999) found that the actors were served alcohol more than 60% of the time. Published research describes the outcome when establishment managers of licensed establishments take purposeful action to reduce alcohol service to customers who appear to be intoxicated. Two effective actions are training of servers and changing the establishment's serving policies to reduce service to obviously intoxicated customers. Server training, for example, has reduced the service to obviously drunk customers, which reduces in number of intoxicated patrons leaving a bar and the number of violent incidents surrounding on-premise outlets (e.g., Wallin, Norstrom, & Andreasson, 2003).

One of the early evaluations of server intervention—the Navy Server Study (Saltz, 1985, 1987a; Hennessy & Saltz, 1989; Saltz & Hennessy, under review)—sought to simply answer the question of whether the concept of server intervention had potential merit as a prevention strategy. Two similar Navy clubs for enlisted personnel were selected, with one serving as a program site and the other as a comparison. The program involved extensive consultation with the club manager, producing several changes in club policies and practices, and an 18-hour training course for all staff. The outcome measure was the proportion of patrons whose drinking (either by self-report or direct observation) was estimated to be higher than the legal limit of intoxication (at the time, .10 BAC). The program resulted in a fairly dramatic reduction in that proportion (from 33 to 15%), at least over the short run (i.e., 2 months after implementation).

The policy changes included promoting nonalcoholic beverages and food, overtly delaying service of an alcoholic beverage if it would put the patron at or higher than the legal limit for intoxication, and the discontinuance of beer sold in pitchers. Where food service had been previously segregated from the bar area, a food service station was installed in the barroom, and money incentives were provided for servers and cooks to promote food sales. In addition, where servers had been free to roam anywhere in the building to serve customers, the new program required their being assigned to specific sections of optimal size so that customers' consumption could be monitored. The food and beverage menus were expanded, and drink prices raised marginally to cover the program costs.

In this case study, care was taken to find a program site in which there was (a) heavy drinking and (b) a high level of interest and cooperation from the manager. As with other efficacy studies, it sought optimum conditions, delivered a comprehensive program with high intensity, and limited the scope of application to one or two establishments to maintain that level of intensity. In the early evaluations of any program, issues of generalizability are postponed while investigating the inherent merit of the prevention strategy. Thus, optimum conditions are more appropriate to the task than seeking out, say, a “typical” setting.

Strategies

Responsible Beverage Service Programs

Toomey et al. (2004) demonstrated that the probability of alcohol sales to obviously intoxicated patrons is very high. Because of such findings, responsible beverage service or sales (RBS) has been promoted to decrease service to intoxicated patrons. In general, RBS involves the creation of clear policies (e.g., requiring clerks or servers to check identification for all customers appearing to be younger than 30) and training in their implementation (e.g., teaching clerks and servers to recognize altered or false identification) (see Rydon & Stockwell, 1997, for a summary of RBS strategies for licensed establishments). RBS can be implemented at both on-license (Saltz & Stanghetta, 1997) and off-license establishments (Grube, 1997).

Server intervention training programs can include teaching servers about alcohol beverage control (ABC) laws, identifying intoxicated patrons, offering patrons food with drinks, delaying service to rapid drinkers, refusing service to intoxicated or underage patrons, and discouraging intoxicated patrons from driving. These programs vary widely in terms of the content covered, instructional time, and the training method (e.g., face-to-face vs. videotaped). Some programs are offered in classroom settings by professional trainers, whereas others consist only of a video or written material that employees are encouraged to use on their own. Some programs also evaluate the alcohol serving policies of a drinking establishment and recommend changes to reduce intoxication, such as eliminating drink promotions, serving a variety of nonalcoholic beverages, or increasing the availability of food.

Saltz and Hennessy (under review, 1990b), Saltz (1988), and Saltz et al. (1987b) demonstrated that server training is most effective when coupled with a change in actual serving policy and practices of a bar or restaurant. RBS has been found to reduce the number of intoxicated patrons leaving a bar (e.g., Dresser & Gliksman, 1998; Gliksman et al., 1993; Saltz, 1987b, 1989) and decrease the number of vehicle crashes (e.g., Holder & Wagenaar, 1994). Responsible beverage service training may decrease the likelihood that customers will become intoxicated, thus decreasing the chance that customers will drive while intoxicated. (Lapham,

Skipper, Chang, Barton, & Kennedy, 1998).

Whether RBS interventions can reduce minors' use of alcohol is less clear. Establishments with firm and clearly stated policies (e.g., that all patrons who appear younger than 30 must have their IDs checked), coupled with a system for monitoring staff compliance, are less likely to sell alcohol to minors (Wolfson et al., 1996a; Wolfson et al., 1996b). Some studies, however, showed interventions had little influence (Grube, 1997; Lange, Stockwell, Rydon, & Beel, 1996, 1998). In at least one study, however, RBS training was associated with an increase in self-reported checking of identification by servers (Buka & Birdthistle, 1999). The apparent changes in behavior persisted among trained servers for as long as 4 years.

As of January 1, 2000, 11 states had established mandatory server training programs for all licensed establishments, and 10 states provided liability protection to establishments that voluntarily implemented server training. Factors other than server training can also influence serving practices in licensed establishments. These factors include enforcement of existing ABC laws (Lange et al., 1998), server liability (or dram shop) laws (Buka & Birdthistle, 1999), high-profile server liability cases (Buka & Birdthistle, 1999), and community coalitions to encourage responsible serving practices. These factors can influence the degree of management support for server training and improvements in serving practices, essential for changing server behavior (Wolfson et al., 1996b). Mosher, Toomey, Good, Harwood, and Wagenaar (2002) conducted a qualitative analysis of 23 state RBS laws to determine how effective the laws were in mandating or encouraging high-quality RBS programs. Findings showed that RBS legislation was weak across all states overall. Although some states were strong in one or two of the RBS components, almost all states were weak in at least one component.

Dram Shop Liability

Dram shop liability laws allow individuals injured by a minor who is under the influence of alcohol or by an intoxicated adult to recover damages from the alcohol retailer who served or sold alcohol to the person causing the injury (Holder, et al., 1993; Mosher, 1979; Mosher et al. 2002; Sloan, Stout, Whetten-Goldstein, & Liang, 2000). In some jurisdictions, the retailer can be liable for the damages the minor or drinker causes to himself or herself. Owners and licensees can be held liable for their employees' actions under most or all dram shop liability laws (Mosher et al., 2002).

Many dram shop liability statutes include a Responsible Business Practices Defense. This provision allows retailers to avoid liability if they can establish that they took reasonable steps to avoid serving minors and obviously intoxicated adults. Key to the defense is evidence that the retailer trained his or her staff, including both servers and managers; established management policies designed to deter irresponsible sales and service; and had

fully implemented the training procedures and policies at the time of the sale or service.

Server Liability

Research suggests that implementation of dram shop liability may lead to significant increases in checking age identification and greater care in service practices (e.g., Sloan et al., 2000). The available studies also indicate that dram shop liability laws can significantly reduce SVN crash deaths, alcohol-related traffic crash deaths, and total traffic crash deaths among minors (Chaloupka, Saffer, & Grossman, 1993; Sloan, Reilly, & Schenzler, 1994; Sloan et al., 2000). Further, the research indicates that such laws also reduce alcohol-related traffic crashes, total traffic crashes, homicides, and other unintentional injuries in the general population (Chaloupka et al., 1993; Sloan et al., 1994, 2000). Overall, dram shop liability has been estimated to reduce alcohol-related traffic fatalities among underage drivers by 3 to 4% (Chaloupka et al., 1993). The perceived likelihood of being successfully sued under dram shop liability statutes may be important. 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 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. They 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 and found 6.5 and 5.3% declines in injurious traffic crashes following the filing of two major liability suits in 1983 and 1984.

Hours of Sale

Chikritzhs and Stockwell (2002) examined the effect of longer hours of sales for licensed hotels in Perth, Western Australia, associated with impaired-driver road crashes and driver's breath-alcohol levels (BALs). They applied time-series analyses using multiple linear regressions to determine whether an association existed between the introduction of extended trading at ETP hotels and (a) monthly levels of impaired-driver road crashes and (b) drivers' BALs. Trends associated with non-ETP hotels were included as controls and possible confounders were considered. After controlling for the trend in crash rates associated with non-ETP hotels and the placement of mobile police breath-testing stations on Perth freeways, a significant increase in monthly crash rates for ETP hotels was found. This relationship was largely accounted for by the high-alcohol-content beer, wine and spirits purchased in greater quantities by ETP hotels. No relation was found between drivers' BALs and the introduction of ETP hotels. Late trading was associated with increased levels of impaired driver road crashes and alcohol consumption, particularly high-risk alcoholic beverages.

Minimum Drinking The U.S. General Accounting Office (GAO, 1987) reviewed 32

Age

published research studies both before and after the law changed. The GAO concluded that there was solid scientific evidence that increasing the minimum age for purchasing alcohol reduced the number of alcohol-involved traffic crashes for those younger than 21. These and more recent studies uniformly show that increasing the minimum drinking age significantly decreases self-reported drinking by young people, the number of fatal traffic crashes, and the number of arrests for DUI.

Yu, Varone, and Shacket (1997) found a 70% decrease in self-reported alcohol purchases by 19- and 20-year-olds after implementation of a minimum drinking age of 21 years in New York state. O'Malley and Wagenaar (1991) found that the minimum age affected self-reported alcohol use among young people and reduced traffic crashes. Indeed, the effect on vehicle crashes continued well after young people reached the legal drinking age. Klepp, Schmid, & Mirray (1996) found that implementation of the uniform minimum legal drinking age of 21 in the United States reduced the overall prevalence of drinking and driving. Saffer and Grossman (1987a,b), Wagenaar (1981, 1986b), and Wagenaar and Maybee (1986a) indicated that raising the minimum legal drinking age from 18 to 21 decreased SVN crashes involving young drivers from 11 to 16% at all levels of crash severity. Voas et al. (1999), using data from all 50 states and the District of Columbia for the years 1982 through 1997, concluded that enactment of age 21 as the minimum drinking age law was responsible for a 19% net decrease in fatal crashes involving young drinking drivers after controlling for driving exposure, beer consumption, enactment of zero-tolerance laws, and other relevant changes in the laws during that period.

In the most comprehensive review to date, Wagenaar and Toomey (2002) analyzed all identified published studies (a total of 132) on the drinking age from 1960 to 1999. They coded eight key variables for each study. The variables included the jurisdiction (i.e., state or province) studied, specific outcome measures analyzed (e.g., self-reported drinking, vehicle crash fatalities), and whether the study was specific to college student populations. In addition, each study was rated on three indicators of methodological quality. In 48 of the studies they reviewed, the effects of changes in the drinking age on alcohol consumption was examined, using a total of 78 alcohol consumption measures (e.g., sales figures, self-reported drinking). Of the 78 measures, 45% showed that a higher legal drinking age was associated with reduced alcohol consumption among youth, whereas five studies found that a higher drinking age was associated with greater adolescent consumption.

Wagenaar and Toomey (2002) found 57 published studies that assessed the effects of changes in the legal minimum drinking age on indicators of drunk-driving and traffic crashes. A total of 102 crash outcome measures were analyzed (e.g., fatal crashes, drink-driving crashes, self-reported driving after drinking). Of the 102 analyses, more than 50% indicated that raising the drinking age

reduced crashes and lowering it raised the crash rate. Only two found a positive relationship between the legal drinking age and traffic crashes. Of the 95 analyses including comparison groups, 50 (53%) found a statistically significant effect of changing the drinking age on vehicle crashes.

Intermediate Variable**Alcohol Sales and Service—Regulations, Enforcement, and Sanctions****Conceptual Definition**

Regulations are the formal laws, rules, and standards that govern alcohol distribution, as well as sales and service, in establishments that are licensed to sale alcohol. Enforcement refers to enforcing policies to decrease the use of alcohol. Official policies might include arrest, prosecution, and punishment to help reduce alcohol availability and alcohol-related violations. Punishment might include fines to stores that sell alcohol to minors or stiff penalties for drinking and driving. The distinguishing characteristic of the enforcement domain is the reliance on the formal criminal justice system to implement penalties. *Informal enforcement* is also an important complement to formal mechanisms. An example of *informal enforcement* is community members being unwilling to patronize stores that sell alcohol to minors.

Some alcohol policies, such as increases in excise taxes, can be implemented without significant enforcement effort. For many strategies, however, enforcement appears to be a key determinant of effectiveness. The deterrent effect of alcohol policies is affected by their severity, the probability of their imposition, and the swiftness with which they are imposed (e.g., Ross, 1982). Although severe, penalties for many alcohol offenses are seldom enforced and thus can be expected to generate only a modest deterrent effect (Hafemeister & Jackson, 2004). Arrests of minors for possession of alcohol, for example, are rare, in part, because of the burden of prosecuting them as a criminal violation and reluctance on the part of law enforcement and courts to enforce criminal penalties in such cases. Moreover, because criminal proceedings are often lengthy and removed in time from the infraction, the punishment is seldom swift or certain.

Measures

Grunewald and Janes (1991) developed a classification system to measure physical and economic availability. Formal laws and regulations governing activities of state alcohol beverage control agencies in the United States were classified into 10 categories of physical availability and 4 categories of economic availability. These categories were subjected to similarity analysis to determine variation among states. Kruskal's stress-one measure revealed three major dimensions of alcohol control laws: forms of retail sales, administrative penalties for violations of alcohol control laws, and price restrictions. This finding suggests that the license/monopoly distinction frequently used to categorize state alcohol control systems is inadequate to characterize the variations in control systems.

Relationship of the Intermediate

ALCOHOL SERVING AND SALES—REGULATIONS, ENFORCEMENT, AND SANCTIONS is not directly associated with ALCOHOL-RELATED MOTOR VEHICLE

Variable to the Problem

CRASHES. Instead, the logic chain is as follows:

ALCOHOL SERVING AND SALES—REGULATIONS, ENFORCEMENT AND SANCTIONS → ALCOHOL SERVING AND SALES PRACTICES → DRINKING → DRIVING AFTER DRINKING,

which is mediated by

PERCEIVED RISK OF DUI ARREST → ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

In addition,

ALCOHOL SALES AND SERVICE—REGULATIONS, ENFORCEMENT, AND SANCTIONS → RETAIL AVAILABILITY → DRINKING → DRIVING AFTER DRINKING,

which is mediated by

PERCEIVED RISK OF DUI ARREST → ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

This intermediate variable is also linked to PRICE through a logical relationship that has not been empirically established.

Relationship of the Intermediate Variable to Other Variables

The intermediate variable is expressed as actual enforcement of sales and service laws and regulations and sanctions for violations of these laws and regulations. It has largely been studied in terms of specific enforcement, as described in the “Strategies” section below.

Alcohol Sales and Service—Regulations, Enforcement, and Sanctions to Alcohol Serving and Sales Practices

McKnight and Streff (1993) evaluated the influence of increased enforcement of laws prohibiting service to obviously intoxicated patrons. Notices were sent to licensed establishments in Washtenaw County, Michigan, and plainclothes police officers visited bars and restaurants monitoring beverage service for one year. Service to pseudopatrons feigning intoxication declined from 84 to 47% (later rising to 58%), while service in a comparison site showed declines of a much smaller magnitude. The proportion of DUI arrestees coming from licensed establishments declined from 32 to 23% (with no changes in DUI enforcement practices) where the proportion increased slightly at the comparison site.

Alcohol Sales and Service—Regulations, Enforcement, and Sanctions to Retail Availability

The formal powers and resources of state alcohol beverage control agencies place them in a position to regulate access to alcoholic beverages through restrictions on retail distribution and sales. For example, monopoly states restrict access to spirits, and sometimes wine, by allowing retail sales only through state stores. On the other hand, license and monopoly states share in restricting sales through the use of price posting and fixing provisions. The degree to which these powers are realized in restrictions on alcohol outlets (e.g., licenses) and subsequent alcohol consumption (e.g., sales) was investigated by Janes and Gruenewald (1991). They found in a cross-sectional analysis of data available from 44 ABC jurisdictions in the United States, it was shown that states with greater restrictions on retail sales had greater resources for the

conduct of ABC activities and lower densities of spirit outlets. These states, however, had greater densities of wine and beer outlets. States with greater marketplace restrictions had more resources for ABC enforcement activities and lower outlet densities across all beverage types. Further, supporting the suggestion that availability and demand may be simultaneously related, greater outlet densities were related to greater alcohol consumption (for beer) and greater levels of consumption were related to greater outlet densities (for wine).

Alcohol Sales and Service—Regulations, Enforcement, and Sanctions to Price

Some communities have established regulations to restrict “happy hours” and other price promotions of alcohol, especially in on-premise outlets (i.e., bars and restaurants). The relationship of such regulations to price and thus to consumption has little research, but given the price elasticity of alcohol consumption, it is reasonable to postulate that any action that effects eventual retail price to the consumer can influence the demand for alcohol.

Strategies

Minimum Purchase Age Law Enforcement

One strategy used to reduce drinking by underage individuals is restrictions on retail access to alcohol through the establishment of MPA laws, which should reduce the number of alcohol-related motor vehicle crashes. The minimum drinking age in all 50 states is 21 years. Raising the MPA has resulted in decreased alcohol consumption (O’Malley & Wagenaar, 1991; Wagenaar, 1982; Williams & Lillis, 1986; Wagenaar & Toomey, 2002). Strategies to limit youth access to alcohol have generally involved some combination of merchant education, community participation and mobilization, and enforcement through compliance checks and penalties for violators (OJJDP, 1999). Multiple component policies that include community participation and enforcement, as well as media publicity, may reduce access by as much as 35 to 40% (Grube, 1997; Wagenaar, Murray, & Gehan, 2000).

Similar to laws regarding youth tobacco access, restrictions on youth alcohol access were shown to be effective only with an enforcement component. For example, an undercover buying operation conducted by the Michigan State Police found that underage purchases were reduced by 73%, from 75% at baseline to 20% by the program’s conclusion (Michigan State Police, 1989). Underage police cadets in Denver were able to purchase 59% of the time at baseline, which dropped to 32% and 26% with increased enforcement (Preusser, Williams, & Weinstein, 1994).

Community participation and mobilization are important complements to formal enforcement efforts because inadequate community support for such interventions may serve to reduce resources dedicated to enforcement (Wagenaar & Wolfson, 1994, 1995). Lewis et al. (1996) found that enforcement implemented through a community coalition could be just as effective in reducing youth access to alcohol as more traditional enforcement mechanisms. In their study, liquor stores under citizens’

surveillance showed a reduction in underage sales, from 83 to 33%, compared to a decrease from 45 to 36% in control sites.

Nationally, however, weak enforcement appears to be more the norm, resulting in youth apparently having readily available access to alcohol (Jones-Webb et al., 1997; Radecki & Strohl, 1991; Wagenaar et al., 1993). Forster, Murray, Wolfson, & Wagenaar (1995) reported the results of an enforcement program conducted in 24 communities in Minnesota and Wisconsin. They found that buyers who were age 21 but looked younger were successful in buying alcohol about 50% of the time. Off-premise sale purchases were more successful if the clerks were male and the store was located in a residential area or mall. On-premise sale buys were more successful if the server looked younger than 30, if the firm was a restaurant/bar combination as opposed to bar alone, and if warning signs were posted (likely because signs may have substituted for more substantive merchant educational programs). Wagenaar and Wolfson (1994) found that, without adequate penalties, attempts to reduce underage retail sales were likely to be ineffective. Wagenaar and Wolfson (1994) reported that only two of every 1,000 occurrences of underage drinking resulted in arrest.

The enforcement of laws against sales of alcohol to youth varies considerably across states. States that take youth drinking less seriously have much lower arrest rates for violations of sales to youth, whereas other states that apparently take sales of alcohol to youth seriously have much higher arrest rates for law violations (Wagenaar & Wolfson, 1994). Wagenaar and Wolfson (1994) found that states that had more arrests for minor crimes tended to have fewer arrests for underage drinking. They concluded that where penalties were lenient, there was inadequate threat to deter providers of alcohol from selling alcohol or providing alcohol to underage persons. Consequently, Wagenaar and Wolfson (1994) concluded that the enforcement and penalties against providing alcohol to youth were inadequate to serve as an effective deterrent. Because few commercial establishments were cited for serving/selling alcohol to youth, there was no real practical level of deterrence for retail establishments (Wagenaar & Wolfson, 1994).

*Alcohol Possession
Laws*

Another strategy used to reduce drinking among minors involves issuing penalties to youth themselves for possessing alcohol. Consistent enforcement of MPA laws, combined with penalties for possession, has been found to reduce alcohol-related crashes (Preusser & Williams, 1992).

*Legal (Tort)
Liability
Concerning Alcohol
Sales and Service
to Youth and Dram
Shop Liability*

Liability and administrative regulations are strategies that have the power of court or legal regulation to hold persons or establishments responsible for sale or service of alcohol to youth and the social provision of alcohol (social hosts) to youth. Tort liability concerning drinking and alcohol sales and service establishes civil penalties, usually some form of a fine or liability for civil suit, for those who are found responsible for specific types

of alcohol-involved harm, including providing alcohol to minors (see discussion by Sloan et al., 2000). Most tort liability provisions and court actions have been directed at licensed establishments for providing alcohol to an underage person. The rationale for establishing third-party liability, rather than first-party offenders (e.g., drunks or minors), includes a recognition that such parties may lack the ability to make appropriate compliance decisions (Kraakman, 1998). Further, there are fewer third parties to regulate, third parties can be efficient monitors of alcohol service practices, and commercial sellers are in a better financial position to render compensation. Most states require that the individual who is held liable must be old enough to consume alcohol. Thus a legal age third party, not the minor, is held liable for underage legal action. Therefore, even if a licensed establishment's sales and service of alcohol to a minor may be an illegal sale, the minor cannot establish the statutory cause of action (Matthew Bender & Co., *Liquor law Liability*, Ref. 14-401, Pub. 498).

Dram Shop Liability

Dram shop liability is a special form of Tort Liability that allows individuals who have been harmed by a person who is impaired by alcohol to sue that person. Retail alcohol outlets have long contended that drinkers who purchase alcohol from legal licensed establishments are responsible for the consequences of their own drinking. State legislatures and the courts under dram shop liability have established that providing alcohol to an obviously intoxicated person or in amounts that obviously lead to impairment can be grounds for a civil suit and possible damages. The use of dram shop liability has been advanced as a potential tool to deter sellers and social hosts from irresponsible selling or provision of alcohol. This is discussed in Mosher (1984) and Holder et al. (1993). Much of the research concerning the effects of tort liability, in general, and dram shop liability, in particular, has focused on intoxicated persons who subsequently are involved in some type of traffic crash. Because selling or serving alcohol to persons under the legal drinking age can also be grounds for liability in many states, this also becomes a part of the possible prevention strategies to reduce alcohol service and sales to youth, especially when an intoxicated minor is involved in a traffic crash. In addition, youth are more likely than older people to be driving while impaired by alcohol (Gruenewald et al., 1996).

Tort liability has several supportive features as an alternative for prevention. The argument for tort liability concerning youth drinking is the threat of possible monetary damage for inflicting harm on another while the youth is impaired by alcohol. If those who provide alcohol to a youth who subsequently injures others are liable for damages, this can deter, so the argument goes, those who would provide alcohol to a youth.

Evidence of the relationship between alcohol regulations and alcohol-related motor vehicle crashes is provided by Sloan et al. (2000), who analyzed traffic fatalities across all states and

examined the potential effect of a number of factors on fatalities over time and across states. In particular, they examined the effect of tort liability on commercial servers for selling alcohol to underage drinkers, while controlling for other dependent variables. They found that imposing such tort liability on commercial services resulted in reduced fatality rates for drivers aged 15 to 20. This single, cross-sectional, time-series study demonstrated the potential of tort liability regarding the selling of alcohol to persons younger than 21. Even though a single study, the use of data from all 50 states across time increased the import of their findings. The only issue for replication concerns the selection of other intervening and explanatory variables not included by these authors. This study did not include a variable for the existence of social host liability.

*Zero-Tolerance
Laws*

Zero-tolerance laws set lower BAC limits for underage drivers and/or create a risk of loss of license when an underage youth has been found to be drinking, even if the youth was not driving. Usually this limit is set at the minimum that can be reliably detected by breath-testing equipment (i.e., .01-.02 BACs). Zero-tolerance laws also commonly invoke other penalties such as automatic license revocation. An analysis of the effect of zero-tolerance laws in the first 12 states enacting them showed a 20% relative reduction in the proportion of SVN fatal crashes among drivers younger than 21, compared with nearby states that did not pass zero-tolerance laws (Hingson et al., 1994; Martin & Andreasson, 1996). Zwerling and Jones (1999) reviewed six studies on the effect of zero-tolerance laws. All six studies showed that the policy reduced injuries and crashes attributed to youthful drivers. In three of the studies, however, the reductions were not statistically significant, possibly because of a lack of statistical power. More recent empirical studies have provided additional evidence for the effectiveness of zero-tolerance laws. Thus, a study of all 50 states and the District of Columbia in the United States demonstrated a net decrease of 24% in the number of young drivers with positive BACs that resulted from implementation of zero-tolerance laws (Voas et al., 1999). Similarly, a 19% reduction in self-reported driving after any drinking and a 24% reduction in driving after five or more drinks was found using *Monitoring the Future (MTF)* survey data from 30 states (Wagenaar, O'Malley, & LaFond, in press). Differences in enforcement of zero-tolerance laws have been identified as a key issue in understanding why some programs are less successful than others (Ferguson, Fields, & Voas, 2000), as has lack of awareness on the part of young people (Balmforth, 1999; Hingson et al., 1995). The use of media campaigns to increase young peoples' awareness of reduced BAC limits and of enforcement efforts can significantly increase the effectiveness of zero-tolerance laws (Blomberg, 1992).

*Laws/Enforcement
of Serving to*

Currently, 47 states and the District of Columbia prohibit sales to obviously intoxicated persons (Florida, Nevada, and Wyoming are

*Obviously
Intoxicated
Patrons and
Overserving to
Drinking*

the only exceptions). Despite these laws, alcohol sales to obviously intoxicated patrons in on-premise establishments, such as bars, continue to occur 58 to 85% of the time. These laws are often not enforced by the police and are ignored by bar and liquor store owners. In one study, Toomey et al. (2004) used trained actors who tried to buy alcohol while appearing intoxicated. For 10 months, actors visited 372 bars and liquor stores in 11 communities. The research team found 79% of the establishments sold alcohol to these pretend drunks.

*Restrictions on
Price Promotions
and Alcohol
Discounts*

One of the strategies undertaken by some communities is to regulate or restrict “happy hours” and other price promotions of alcohol, especially in on-premise outlets (i.e., bars and restaurants). Although this is a reasonable strategy, there is no research on its effectiveness.

*Alcohol Policies at
Schools and
Universities*

School and university policies are formal regulations that provide for sanctions against youth for the possession of alcohol on school or university property. The penalties are usually a part of school policies that ban or provide restrictions for possession or provision of alcohol on school property. Such policies are popular among schools, colleges, and universities. Nearly half of the elementary, middle/junior high, and senior high schools in the United States have explicit policies prohibiting alcohol use on campus and at school functions and, in some cases, prohibiting the possession of alcohol by students (Modzeleski, Small, & Kann, 1999). Universities have similar policies prohibiting alcohol in school facilities, prohibiting use by underage students, or restricting alcohol advertising on campus (Wechsler, Kuo, Lee, & Dowdall, 2000). Grimes and Swisher (1989) found that students report such policies are barriers to drinking, but there are few controlled evaluations of such policies. Odo, McQuiller, and Stretsky (1999) studied newly enacted policy that prohibited alcohol in all university-affiliated living residences (i.e., dorms, fraternities, sororities). They found that such policies were associated with reduced prevalence of drinking in the affected residences but were not associated with the frequency of heavy drinking. A case study of a campus prohibition on underage drinking or possession of alcohol, public consumption, and use of kegs was reported (Cohen & Rogers, 1997) with positive findings. It lacked a control or comparison condition, however, so it is not possible to accept these findings unconditionally. These studies provide promising but incomplete evidence of the potential for such administrative policies to reduce underage drinking.

Intermediate Variable**Retail Availability****Conceptual Definition**

Retail availability is the level of access or convenience for individuals to obtain alcohol (independent of the cost of alcohol). In general, when convenient and easily accessible in a given community, people drink more and the rates of alcohol problems are higher. Conversely, when alcohol is less convenient (e.g., fewer retail outlets with limited hours of sale) and less accessible (e.g., restrictions on drinking age), people generally drink less and problem rates are lower. Retail availability of alcohol can be affected by license restrictions, hours of sale, minimum age of purchaser, and alcohol outlet density (distance to a retail outlet).

Measures

Retail availability can be measured as sales through retail channels. These typically include various commercial outlets, such as liquor stores. Alcohol may also be available through grocery, convenience, and drug stores, depending upon the state. Other venues for alcohol retail availability include food establishments and bars. Typically, sales to underage youth are of most interest from a policy perspective and may be monitored through compliance checks. Because increased retail availability has been associated with increased consumption across all ages (see below), adult consumption may be of interest as well. This can be measured via sales receipts.

Relationship of Intermediate Variable to Problem

In our model,

RETAIL AVAILABILITY

is not directly related to

ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

Instead,

RETAIL AVAILABILITY → DRINKING → DRIVING AFTER DRINKING,

which is mediated by

PERCEIVED RISK OF DUI ARREST →

ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

In turn,

RETAIL AVAILABILITY

is assumed to be influenced by

ALCOHOL SERVINGS AND SALES—REGULATIONS, ENFORCEMENT, AND SANCTIONS.

Relationship of the Intermediate Variable to Other Variables

Retail Availability to Drinking

The retail markets for alcohol can be formal or informal. *Formal alcohol markets* can be defined as those that are regulated by government, whether at the community, the regional, or the national level. In developed countries, formal retail markets for alcohol (like most commodities) are regulated to ensure purity, safety, and accurate description of the product and the collection of taxes. Some countries also have special sales regulations for alcoholic beverages, reflecting their status as a commodity that raises special concerns about health, safety, and public order. Thus, retail outlets for the sale of alcoholic products may have general limits on hours of operation or days allowed for retail services and the placement and location of the retail market. Further, restrictions may be placed on advertising and marketing of the alcoholic products and on who may purchase the products. Special taxes on alcoholic beverages may also be part of the regulatory regime. Restricting alcohol availability through law has been a key policy in Canada, the United States, and Scandinavian countries.

Restrictions on retail availability are intended to limit consumer access to products or to regulate the context in which products are used. Most availability policies, however, do not restrict access altogether; rather, they serve to increase the effort required to obtain substances or change the context in which consumption occurs, thus changing consumption practices. In general, research concerning restrictions or limits on retail availability of alcohol has demonstrated overall effects on the general population's level of consumption and alcohol-related problems.

Gruenewald et al. (1996) completed an analysis of geographically based data from four communities conducted to evaluate relationships between measures of the physical availability of alcohol and rates of driving after drinking. From a review of the literature, it was expected that rates of driving after drinking would be directly related to the availability of alcohol at on-premise establishments. Based on theoretical arguments regarding the life activities that underlie drinking and driving, it was expected that the effects of availability upon these outcomes would extend significantly beyond local area outlets. Taking into account the geographic variations in environmental characteristics (road network density, traffic flow, population density), and socioeconomic (age, gender, race, marital status, income, employment) and drinking characteristics (rates of abstention, frequency and quantity of use) of resident populations, a spatial analysis of drinking-and-driving and alcohol-related crashes was conducted. The results of the analysis showed that physical availability was unrelated to self-reports of driving after drinking and driving while intoxicated and significantly related to rates of SVN crashes. In the latter case, physical availability affected both local and adjacent area rates of crashes.

Several longitudinal studies have demonstrated that changes in

the number of outlets are related to changes in alcohol use. When overall availability is low, the addition of a few outlets can have noticeable effects on drinking. Gruenewald, Ponicki, and Holder (1993b) conducted a time-series cross-sectional analysis of alcohol consumption and density of alcohol outlets across 50 U.S. states. The results suggested that a 10% reduction in the density of alcohol outlets would reduce consumption of spirits from 1 to 3% and consumption of wine by 4%.

The evidence is quite strong that these systems hold down rates of alcohol consumption and alcohol-related problems. For example, alcohol retail monopolies are associated with lower levels of alcohol-related motor vehicles. The evidence suggests that elimination of government off-premise monopolies typically increase total alcohol consumption. Thus, large-scale changes in alcohol distribution systems among states in the United States have led to great increases in the number of alcohol outlets (e.g., through the privatization of alcohol monopolies resulting in increased alcohol sales; Holder & Wagenaar, 1990; Wagenaar & Holder, 1995). A summary of seven time-series analyses of six U.S. states and of New Zealand showed a consistent increase in total consumption when government-owned off-premise outlets were replaced with privately owned outlets (Wagenaar & Holder, 1996). Several studies show substantial long-term increases in alcohol sales following privatization (Holder & Wagenaar, 1990; Wagenaar & Holder, 1991, 1995), although others only found short-term increases (Mulford, Ledolter, & Fitzgerald, 1992). Until effects of such privatization are fully evaluated, states should consider preventing privatization because reversal of the privatization process is not politically feasible. Typically, the network of stores in such a government-operated system is sparse rather than dense, and the opening hours are limited.

A variety of alcohol-related problems are more likely to occur where drinking places are clustered. These include motor vehicle crashes (Watts & Rabow, 1983; Rush, Gliksman, & Brook, 1986; Scribner, MacKinnon, & Dwyer, 1995; Jewell & Brown, 1995; Gruenewald et al., 1996) and pedestrian injury collisions (LaScala, Gerber, & Gruenewald, 2000; LaScala, Johnson, & Gruenewald, 2001). Findings have shown that alcohol-related problems respond to alterations in the availability of alcohol (e.g., measures of abuse [Chiu, Perez, & Parker, 1997] and motor vehicle crashes [Blose & Holder, 1987]).

Strategies

Studies of alcohol regulations suggests that restrictions on the physical availability of alcohol, including retail availability, can contribute to the reduction of alcohol-related problems. Specific effective policies include reductions in the hours and days of sale and the number of alcohol outlets, as well as restrictions on access to alcohol (Babor, et al, 2003)

Types of Retail

Whether in a formal or an informal market, alcoholic beverages

Outlets

are sold to retail customers in two forms. One form is for consumption elsewhere (off-premise); this form influences drinking, the drinking occasion, and the potential consequences through the conditions of sale. This effect generally stops at the point when the sale is made. The opportunities to affect these off-premise retail outlets are thus limited to regulations on the time, costs, and place of alcohol sales.

The other form in which alcoholic beverages are sold is as drinks served in glasses or other drinking vessels, with the actual consumption usually occurring on or about the premises where the drink is served. These are typically called “on-premise” retail outlets. Here, the opportunities to influence drinking—its context and its potential consequences—are broader, as there is an opportunity to directly influence what happens during and after the actual purchase. Regulations may specify drink sizes, disallow discounted drinks such as during “happy hours,” and include requirements for responsible beverage service training, programs to provide “safe rides” for drinking drivers, and so on. Regulations may also apply to the design and furnishing of the tavern or restaurant, food service, availability of entertainment, and other non-alcohol-specific matters.

For off-premise outlets, a major policy decision has been whether (and which kinds of) alcoholic beverages can be sold in conjunction with other goods, and which other goods. When Finland changed in 1968 from selling beer only in government monopoly stores to selling it also in grocery stores, alcohol consumption rose by 50% in the next year, and alcohol problem rates also shot up (Bruun, Edwards, & Lumio, 1975). As Abbey, Scott, and Smith (1993) have shown, this practical impediment can be easily overcome if purchases of alcohol are combined with other routine life activities (e.g., shopping for other goods).

Regulation of on-premise alcohol outlets has a rich and detailed history in many societies. Within the on-premise category, restaurants are often differentiated from taverns, according to whether food or drinking is the primary activity. Cross-sectional studies have found that drinking and driving is associated with bars and restaurants and particularly (in Australia) with bars serving beverages with high alcohol content (Gruenewald, Stockwell, Beel, & Dyskin, 1999; Gruenewald, Millar, Ponicki, & Brinkley, 2000; Stockwell, Lang, & Rydon, 1993).

There is an interaction between restrictions, such as hours and days of sale (discussed previously), and the type of outlets. For example, the effects of changes in hours or days of sale are likely to be dependent on the context and may primarily affect specific subpopulations of drinkers. Often, much cheaper alcohol is available through off-premise sales, rather than through on-premise sales, so that hours of operation for off-premise sales are likely to have the greatest effect on the most marginal drinkers. This effect, however, will be limited if the restrictions apply only to

particular forms of alcohol. Those drinking late in taverns, particularly on weekdays, are usually an especially heavy-drinking segment of the population. Restrictions on closing hours for on-premise drinking need to take account of the collective nature of much on-premise drinking and the predictable violence and police problems that commonly occur in and around drinking places in many societies. Using local land-use powers, communities in California often enforce early closing times to keep the closing-time disturbance in the neighborhood to a reasonable hour (Wittman, 1997). Setting closing hours at a time later than local public transport systems run invites unsafe journeys home.

Retail availability of alcohol is shaped by state and local regulations that determine the number, location, types, and serving-and-selling practices of alcohol retailers. How states and localities regulate retail availability varies considerably. Some are very restrictive, whereas others have only limited controls.

*Publicly Owned
Alcohol Retail
Outlets*

One form of retail alcohol regulation retail outlets is for the government to monopolize ownership of one or more types. The idea of government ownership of alcohol sales outlets in the interest of public order or public health first arose around 1850. A government monopoly typically greatly reduced the number of outlets, limited the hours of operation for sales, and removed the private profit motive for increasing sales.

*Densities or
Concentration of
Retail Outlets*

The number of outlets grows in response to population, and outlets are usually established along roadway systems. Outlet counts are either in terms of population densities (numbers of outlets per person) or geographic densities (numbers of outlets per kilometre of roadway). In developed societies, people may easily drive or use public transport to obtain alcohol. To limit the number of outlets for alcoholic beverages increases opportunity costs for obtaining alcohol, and may thus deter use and problems (Grossman, Coate, & Arluck, 1987; Gruenewald et al., 1993a). Outlet density is also higher in many U.S. cities today. Densities of bars, restaurants, and off-premise establishments have reached the level of one outlet for every 75 feet of roadway in many California cities (Gruenewald & Treno, 2000). The number of outlets may be restricted directly or indirectly through policies that make licenses more difficult to obtain (e.g., by increasing the cost of a license). Several states limit the number of alcohol outlets and control the price of alcohol by maintaining state-run (rather than privately owned) outlets. A trend in the last few decades has been to privatize such state monopolies.

*Hours and Days of
Sale*

A number of studies have indicated that changing either the hours or the days of alcohol sales can redistribute the times at which many alcohol-related crashes and other alcohol-related violent events occur (e.g., Smith, 1988; Ligon & Thyer, 1993; Nordlund, 1984, 1985; Hauge & Nordlie, 1984; Österberg & Säilä, 1991). Smith (1988), for example, found that the introduction of Sunday

alcohol sales in the city of Brisbane, Australia, was related to casualty and reported property damage traffic crashes. Another study in Australia found increases in traffic crashes and assaults following extensions of trading hours (Chikritzhs & Stockwell, 2002).

Based on this evidence, it appears that changes in licensing provisions that substantially modify hours of service can have a significant effect on drinking and drinking-related problems overall. These studies suggest that reduced hours and days of sale can have net effects in reducing overall alcohol consumption and problems levels, with the effects concentrated during the times of closure but not matched by counterbalancing changes at other times of the week.

Outlet Location

The location of alcohol sales outlets may be limited by a number of provisions at the local, state, or national level. For instance, typically the outlet cannot be located in violation of local zoning laws, which limit the outlets to particular kinds of commercial sites. Other common provisions, for instance in many U.S. states, forbid location near a school or place of worship. The density of outlets may be limited by requiring a minimum distance between them. Alcohol sales may also be forbidden at locations such as highway rest stops. These laws and regulations serve various purposes outside the direct regulation of outlet behaviors (e.g., restricting the exposure of youth to alcohol sales and use), but all serve to restrict, directly or indirectly, the availability of alcohol within specific neighborhoods. Little evidence is available on the extent to which these provisions influence overall rates of alcohol-related problems, although one study suggested that locating an outlet near a highway system may affect alcohol-related crashes more than locating the same outlet in a dense downtown area (Gruenewald & Treno, 2000).

State Retail Monopolies

Miller, Snowden, Birckmayer, and Hendrie (2006) determined that state retail alcohol monopolies are associated with reduced underage drinking and deaths of impaired drivers aged 20 and younger. Using regression analyses, they estimated the effects of monopolies on drinking, binge drinking, the impaired-driving death rate of drivers aged 20 and younger, and the odds that a driver aged 20 and younger who died was alcohol-positive. The regressions controlled for states with midnight driving curfews. In states with a retail monopoly over spirits or wine and spirits, an average of 14.5% fewer high school students reported drinking alcohol in the past 30 days and 16.7% fewer reported binge drinking in the past 30 days than did high school students in non-monopoly states. Monopolies over both wine and spirits were associated with larger consumption reductions than monopolies over spirits only. Lower consumption rates in the monopoly states, in turn, were associated with a 9.3% reduction in the impaired-driving death rate of drivers aged 20 and younger in monopoly states versus nonmonopoly states. The analysis suggests that

alcohol monopolies prevent 45 impaired-driving deaths each year.

Liquor by the Drink

Allowing distilled spirits to be sold over the counter in licensed establishments (which has been called “Liquor by the Drink” or “LBD”) occurred in 20 plus states over several years after the end of American Prohibition. Holder and Blose (1987) conducted an interrupted time-series analysis of North Carolina’s change in distilled spirits availability, which occurred when the state allowed individual counties to implement LBD in 1978. Analyzing counties within the state compared with a comparison set of counties (those which continued the LBD ban from January 1973 through December 1982), they found that spirits sales rose from between 6 and 7.4%. In counties implementing the change, LBD was also associated with statistically significant increases of 16 to 24% in both the number of police-reported alcohol-related accidents and in SVN accidents among male drivers aged 21 and older. No change in alcohol-related accidents was found for non-LBD counties. SVN accidents involving male drivers aged 20 and younger did not change for either the experimental or comparison groups (see Blose & Holder, 1987).

**Strategies
(Summary)**

A summary of strategies that serve to limit retail availability follow (See Table 2):

- *Restrictions on who may purchase alcohol (MPA laws)* – States restrict any person younger than the established legal age from purchasing alcohol. Currently, the MPA in all 50 states is 21.
- *Retail compliance checks* – Retail compliance checks are a form of undercover law enforcement that involves attempts by minors to purchase alcohol.
- *Protecting government control of alcohol sales* – 21 states and 1 local jurisdiction control the sale of some or all alcoholic beverages at the wholesale and retail levels.
- *Outlet density restrictions* – Regulation of outlet density is usually applied at the local level and sets the number of alcohol licenses as ratio of outlets per capita or per square mile.
- *Restrictions on location of outlets* – Regulations on outlet locations may prohibit alcohol outlets near sensitive areas such as schools or in establishments where alcohol has not been sold previously, such as laundromats.
- *Prohibition of minors from bars* – Many states allow persons younger than age 21 to enter bars.
- *Controls on manner of sale* – Controls on manner of sale are often aimed at preventing underage drinking. Some examples include—
 - Requiring that sellers of alcohol be at least 21 years old;

- Restricting the issuance of temporary licenses at youth-oriented and family-oriented events;
 - Prohibiting alcohol sales at specific venues popular with youth;
 - Designating alcohol-free days or periods within longer events, such as community fairs; and
 - Establishing restricted drinking sections where young people are not permitted to enter during the event.
- *Restrictions on hours and days of sale* – Some states and communities prohibit on-premise or off-premise purchase of alcoholic beverages on Sundays or after a certain evening (not early morning) hour.

Table 2. Strategies Aimed at Retail Availability

Strategy	Effect	Scope	Longevity	Maintenance Cost
MPA laws	Effective in reducing alcohol consumption and related problems	Affects all individuals under the MPA	Ongoing until repeal of law	Associated with enforcement of law
Retail compliance checks	Effective in reducing sales to minors	Affects all individuals under the MPA	Dependent on intervals of enforcement	<ul style="list-style-type: none"> • Associated with personnel • Higher when compliance rate is low • Lower when compliance rate is high
Government control of sales	Effective in reducing consumption and related problems	Affects all individuals within the jurisdiction	Ongoing unless alcohol sales are privatized	<ul style="list-style-type: none"> • Absorbed by revenue generated by sales • Low compared to costs incurred by states after privatization
Outlet density restrictions	Effective in reducing consumption and related problems	Affects all individuals within the jurisdiction	Ongoing unless restrictions are weakened	Negligible due to low cost of enforcement
Restrictions on location of outlets	No research documenting nature of effects	Affects all individuals within the jurisdiction	Ongoing unless restrictions lifted	Negligible due to low cost of enforcement
Prohibition of minors from bars	No research documenting nature of effects	Affects all minors within the jurisdiction	Dependent on enforcement	Associated with enforcement
Controls on manner of sales	No research documenting nature of effects	Affects all individuals but primarily minors within the jurisdiction	Either ongoing unless restrictions lifted or limited to the duration period of specialized sales	Associated with enforcement
Restrictions on hours and days of sale	Effective in reducing consumption and related problems	Affects all individuals within the jurisdiction	Ongoing unless restrictions lifted	Negligible due to low cost of enforcement

Intermediate Variable**Price****Conceptual Definition**

Price is the cost of alcohol sold by retail outlets. The demand for alcohol, as for many other products, responds both to price and to available income. As alcohol becomes more expensive, consumption decreases. When it becomes less expensive, consumption increases. Similarly, when other factors remain unchanged, an increase in disposable income among consumers leads to an *increase* in consumption, whereas a decrease in income leads to a *decrease* in consumption. Responses to price changes may differ from one group to another. For example, young people (who tend to have less disposable income) are more responsive to price than older people are (Pacula 1998). In general, increasing the price of alcohol decreases consumption and problems.

Measures

The construct *price elasticity* provides a metric of responsiveness to price that can be compared across studies. It is measured as the percentage of change in per capita quantity divided by the percentage of change in price, and it provides an index of the estimated percentage of change in alcohol use associated with a certain percentage of change in price. Price elasticities are generally expressed as two distinct components: (1) the decision to begin, continue, or quit drinking (i.e., participation or prevalence); and (2) how much an individual smoker drinks (i.e., consumption). Thus, the total elasticity is equal to the combination of prevalence elasticity and consumption per drinker elasticity.

Alternative Measures**Alcohol Price**

<i>Definition</i>	State Alcoholic Beverage Excise Taxes (Beer, Wine or Spirits)
<i>Data Source</i>	Department of Revenue for each state or www.taxpolicycenter.org/TaxFacts/TFDB/Content/PDF/alcohol_rates.pdf
<i>Frequency</i>	Annually
<i>Geographic Levels</i>	Every state
<i>Strengths</i>	State alcohol taxes are regularly collected in every state, and there are consistent data for such taxes (and their collections) annually over many years. Excise taxes have been extensively used by econometric studies of the relationship of alcohol prices to drinking and alcohol-related harms.
<i>Limitations</i>	Although state excise taxes are available for many years, state excise taxes are only from 10 to 15% of the total retail price and do not reflect wholesale prices, retail markups, price promotions, or

profits.

References

Cook, P. J. (1981). The effect of liquor taxes on drinking, cirrhosis, and auto accidents. In M. Moore & D. Gerstein (Eds.), *Alcohol and public policy: Beyond the shadow of prohibition* pp. 255-285). Washington, DC: National Academy Press.

Cook, P. J., & Moore, M. J. (2001). Environment and persistence in youthful drinking patterns. In J. Gruber (Ed.), *Risky behavior among youths* pp. 375–437). Chicago, IL: University of Chicago Press.

Grossman, M., Chaloupka, F. J., Saffer, H., & Laixuthai, A. (1994). Effects of alcohol price policy on youth: A summary of economic research. *Journal of Research on Adolescence*, 4(2), 347-364.

Alternative Measures

Alcohol Price

Definition

American Chamber of Commerce Researchers' Association (ACCRA) sets a representative retail price based on a type of popular alcohol products representing beer, wine, and spirits. The specific brands used changes from year to year but can include (a) a six pack of Schlitz, Miller Light, or Budweiser beer; (b) a 750 ml bottle of Seagram's Seven or J&B Scotch whisky; and (c) a 1.5 liter bottle of Gallo or Livingston Cellars or Paul Maisson Chablis.

ACCRA produces the Cost of Living Index to provide a useful and reasonably accurate measure of living cost differences among urban areas. Items on which the Index is based have been carefully chosen to reflect the different categories of consumer expenditures. Weights assigned to relative costs are based on government survey data on expenditure patterns for midmanagement households. All items are priced in each place at a specified time and according to standardized specifications.

ACCRA, founded in 1961 as the American Chamber of Commerce Researchers Association, is a nonprofit professional organization comprising research staff of chambers of commerce, economic development organizations, and related entities throughout the United States and Canada. Originally titled Inter-City Cost of Living Indicators Project, the ACCRA Cost of Living Index has been published quarterly since 1968.

Data Source

The complete quarterly ACCRA Cost of Living Index is available by subscription. For more information, visit ACCRA's website at www.costofliving.org or call (703) 522-4980.

Although at least one city or town in every state is included, not all are represented. Cities or towns typically included in the alcohol price listings are:

1. A place within a federally designated metropolitan area in the United States and Canada.

2. A city in a nonmetropolitan county in which the county population exceeds 50,000 or the city population exceeds 35,000.
3. A city outside a metropolitan area that has historically participated before these criteria were adopted in 1991 and modified in 1999 (and the city has continued to provide data without an interruption of more than one quarter).

<i>Frequency</i>	Quarterly or annually since 1968.
<i>Geographic Levels</i>	Every state and selected cities and towns.
<i>Strengths</i>	The price information reflects a typical retail price and, in principle, is based upon information provided by the specific city or town participating in the price survey. These data have been used by a number of econometric studies.
<i>Limitations</i>	These data are judged by some researchers to be subject to significant measurement error, and such taxes are not always highly correlated with either the detailed Consumer Price Index or with state excise tax levels. See Young and Bielinska-Kwapisz (2003).
<i>References</i>	<p>Young, D. J., & Bielinska-Kwapisz, A. (2002). Alcohol taxes and beverage prices. <i>National Tax Journal</i>, <i>LV</i>, 57–73.</p> <p>Young, D. J., & Bielinska-Kwapisz, A. (2003). Alcohol consumption, beverage prices, and measurement error. <i>Journal of Studies on Alcohol</i>, <i>64</i>, 235–238.</p>

Alternative Measures

Alcohol Price

<i>Definition</i>	The standard price for alcoholic beverages sold by a State Retail Monopoly (only for states with retail monopolies).
<i>Data Source</i>	The State Alcoholic Beverage Control Commission
<i>Frequency</i>	Monthly, quarterly, or annually
<i>Geographic Levels</i>	Entire state
<i>Strengths</i>	The price reflects the actual standard price for each and every beverage sold by the state retail monopoly and is therefore available over a number of years and is consistent for the entire state.
<i>Limitations</i>	Such price data are only available in states that operate retail monopolies and do not include beer that is sold under private license in every state and includes wine only in some cases. Also retail monopoly prices reflect state excise taxes, the wholesale cost

of the beverage, and the operating cost of the retail monopoly and any state “profits” that may be reflected only in excise taxes. Tax rates may well vary according to alcohol content and size of container.

Reference Young, D. J., & Bielinska-Kwapisz, A. (2003). Alcohol consumption, beverage prices, and measurement error. *Journal of Studies on Alcohol*, 64, 235–238.

Alternative Measures

Alcohol Price

Definition The alcoholic Beverage Price Index form the Consumer Price Index of the U.S. Department of Commerce.
 The Consumer Price Index (CPI) is a measure of the average change over time in the prices of consumer items—goods and services that people buy for day-to-day living. Although there is an annual price index for “alcoholic beverages” over the entire United States, there are city specific indexes for eight urban areas. If your state or city is represented, this alcohol beverage CPI can be used.

Data Source The CIP calculates an annual price index for alcohol beverages for the entire country, which is available for a large number of years. For specific cities that are surveyed, there are beverages specific alcoholic price indices available.

Frequency Annually when available.

Geographic Levels Entire country and selected urban centers

Strengths The price index is consistently collected by the CPI and can produce a long, reliable (inflation adjusted) time series.

Limitations The CPI for alcoholic beverages is produced each year only nationally and periodically for selected urban reporting centers.

Relationship of Intermediate Variable to Problem

In our model,
 PRICE → DRINKING → DRIVING AFTER DRINKING,
 which is mediated by
 PERCEIVED RISK OF DUI ARREST →
 ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

In turn,
 PRICE
 is assumed to be linked to
 ALCOHOL SALES AND SERVICE—REGULATIONS, ENFORCEMENT,

AND SANCTIONS.

***Relationship of
Intermediate
Variable to Other
Variables***

Price to Drinking

Most research seems to indicate that alcohol price and consumption or other alcohol-related outcomes are inversely related—that is, as the prices on beer, wine, and liquor increase, alcohol consumption and associated problems tend to decrease. Likewise, as prices drop, use and related problems tend to rise. Although the government can raise the price of alcohol through increasing excise taxes, tax hikes have not been widely used to influence drinking in the United States. Chaloupka, Grossman, and Saffer (2002) reported that alcohol prices remained stable during the last quarter of the 20th century, which, with inflation, amounts to price reductions over time. Thus, the real price of distilled spirits dropped by 32%, wine by 28%, and beer by 20% between 1975 and 1990 (Bureau of Labor Statistics [BLS]; Chaloupka et al., 2002).

Numerous econometric studies have helped to establish the association between price and alcohol use and problems. These investigations consisted of cross-sectional analyses of population data to determine price elasticities of alcohol demand. Price elasticity is defined as the percentage of change in demand from a 1% increase in price and can be represented as

$$\text{TOTAL PRICE ELASTICITY} = \frac{\% \text{ CHANGE IN PER CAPITA QUANTITY}}{\% \text{ CHANGE IN PRICE}}$$

This concept provides a measure of responsiveness to price that can be compared across studies.

Alcohol price has been linked to heavy drinking and increased risk of harm from heavy drinking. Researchers have confirmed that higher taxes on alcohol consumption can reduce public health problems associated with alcohol including traffic crashes (Chaloupka et al., 1993; Cook & Tauchen, 1982). Cook (1981) studied the effect of 39 changes in state taxes on distilled spirits between 1960 and 1975. In 30 of the 39 instances, sales of distilled spirits fell after the tax increase. This was accompanied by reduced traffic fatalities (given the significant percentage of fatal crashes that involve one or more drinking drivers). Cook (1981) also found an association between prices (expressed as state alcohol excise taxes) and such crashes. In general, using alcohol taxes as instrumental variables, traffic fatalities are found to be negatively related to prices, which follows the finding that alcohol consumption is strongly positively related to fatalities.

Many investigators have examined the association between alcohol beverage prices and alcohol-associated problems, including

drinking-and-driving and crime, and the clear consensus is that they are inversely related (see recent reviews by Birckmayer, Holder, Yacoubian, & Friend, 2004, and Chaloupka et al., 2002). Chaloupka et al. (1993) and Mast, Benson, & Rasmussen (1999) found that increased prices were associated with decreased drinking and driving among all ages, and Cook (1981) reported that increased taxes were related to fewer driving fatalities. Kenkel (1993) estimated that a 10% increase in alcohol price would result in 7% less drinking and driving among all men and more than 8% less drinking and driving among all women. Price effects were even greater, however, among young men and women (13 and 21%, respectively). Dee (1999) and Dee and Evans (2001) reported that price increases would reduce motor vehicle accident fatalities among those aged 18 to 20 years. Safer and Grossman (1987a), after adjusting for inflation, found that increased beer taxes, combined with raising the MLDA, would reduce fatal crashes among those aged 18 to 20 by 15%. In addition, many studies have shown that increased alcohol costs are associated with reductions in both violent and nonviolent crimes (Cook & Moore, 1993; Grossman & Markowitz, 2001; Markowitz, 2000; Markowitz & Grossman, 1998, 2000; Safer, 2001).

Much research on the effect of taxes has focused on the drinkers who cause the most social damage, including underage drinkers and heavy or abusive drinkers. Studies of the effect of price on youth typically also consider effective enforcement of minimum legal drinking age laws (MLDA), as the two are highly associated with youth access to alcohol. Based on the 1982 and 1989 *MTF* surveys, Laixuthia and Chaloupka (1993) reported that raising the MDLA to age 21 across all states, combined with higher beer taxes, decreased youth drinking, particularly among heavy users.

Many studies have consistently reported that young drinkers are more price sensitive than adults, particularly heavy young drinkers, and that price effects increase over time. Based on data from the 1976-1989 *MTF*, Grossman, Chaloupka, and Sirtalan (1998) reported long-run price demand elasticities of -0.65, which was more than double the figure in which degree of addiction was ignored (-0.29). Moreover, they found that long-run elasticities were 60% greater than short-run elasticities. Studies of youth have also reported gender effects. Chaloupka and Wechsler (1996) estimated that a tax increase would reduce the number of women college students who drank by 15% and who binge drank by 20%, but found no effect for men. They suggested that these results may be attributable to the fact that the cost of alcohol on college campuses includes both the retail price and the ready availability of alcohol at parties and other social situations.

There is considerable debate in the literature regarding whether abusive drinkers are less price sensitive than nonabusive ones. Becker and Murphy (1988) and Becker, Grossman, and Murphy (1994), in their Rational Model of Addiction, hypothesized that addicts consider the future consequences of the decision to

consume their chosen substance of abuse, so price increases will decrease use likelihood among addicts, just as it might for nondependent individuals.

Empirical studies support Becker’s model. Grossman (1993) found that a 10% increase in alcohol price would reduce cirrhosis mortality, which is typically seen in heavy drinkers, by an estimated 8.3 to 12.8%. Cook and Tauchen (1982) reported that a \$1 increase in alcohol price would reduce cirrhosis mortality by 5.4 to 10.8%. Using data from the 1971-1975 and 1976-1980 National Health and Nutrition Examination Surveys, Coate and Grossman (1988) and Grossman et al. (1987) indicated that raising beer prices and the MLDA appeared to decrease consumption among both light and heavy young drinkers. Discrepant results, however, have occasionally been found. Manning, Blumberg, and Moulton (1995), for example, showed that moderate drinkers were most price-responsive, with a price elasticity of -1.19, whereas both light and heavy drinkers had elasticities nearly equal to zero.

Strategies

There are two basic strategies for controlling price: increased alcohol taxes and retail price controls (see Table 3).

Increased Alcohol Taxes

Alcohol taxes are imposed either as *gallonage taxes* that are based on the quantity of beverage sold or as a *percentage taxes* that are based on the selling price.

Retail Price Controls

Retail price controls limit or prohibit the sale of alcohol using discounted prices.

Table 3. Strategies Aimed at Economic Availability

Strategy	Effect	Scope	Longevity	Maintenance Cost
Increase alcohol taxes	Effective in reducing consumption, motor vehicle fatalities, violence, and property crime	Affects all individuals in jurisdiction	Ongoing if taxes imposed as a percentage of total price.	Minimal
Retail price controls	No research documenting nature of effects	Affects all individuals in jurisdiction	Ongoing unless controls lifted	Minimal

Intermediate Variable**Community Norms About Drinking****Conceptual Definition**

Community norms about drinking refer to the level of acceptability (or unacceptability) of drinking in general, as well as the level of drinking (such as heavy drinking or drinking to drunkenness). The norms, expectations, and values of a society are powerful determinants of behavior in a variety of ways. To some extent, all of the laws and policies and other strategies discussed herein are the formal codification of these norms. Norms and values, however, exert a strong influence on behavior even when legal or formal detection and punishment are unlikely. Powerful and complex values have developed around alcohol with related norms regarding when, where, and how alcohol use is appropriate and desirable. Some of these values and norms are part of the broader culture; others can exist on a smaller scale—within a given community, social group, or subculture.

Communities that adopt laws and policies that restrict behavior or punish violations are more likely to shape norms and values that are less tolerant of alcohol excesses. Thus, many of the most well-known strategies for preventing alcohol problems can be seen as expressions of community values. A well-publicized enforcement campaign to reduce sales of alcohol to minors not only reduces underage access to alcohol, but also affirms the value the community places on protecting its young people. Similarly, prohibition of alcohol sponsorship of a community celebration is a control on alcohol advertising (and possibly of availability). It also asserts the community's commitment to an environment in which alcohol is less prominently featured.

Measures

Social norms and values may vary among genders, ages, and races/ethnicities within a population, and these may change independently over time. One possible way of defining the overall community value for a population may be conceptualized as the mean or unweighted average of norms for all salient groups. Each group's contribution to the total may be a function of its relative importance or social influence within the whole. Obviously, use of an average may yield spurious results in defining the social norm for a given community and may become problematic if subgroups within a population have radically different use rates. Thus, classifying any group's values may become further refined by examining smaller subgroups within a population (e.g., states, cities, age, gender) in addition to the larger whole.

Community acceptability about drinking could be measured via survey questions/items in which respondents are asked to give a score on a range to indicate their level of agreement with a statement or provide their level of acceptability or unacceptability of drinking or specific forms of drinking, heavy drinking, binge

Relationship of the Intermediate Variable to the Problem

drinking, youth drinking, public drinking, etc.

COMMUNITY NORMS ABOUT DRINKING **does not affect**

ALCOHOL-RELATED MOTOR VEHICLE CRASHES

directly but instead works through other intermediate variables.

That is,

COMMUNITY NORMS ABOUT DRINKING → DRINKING → DRINKING AFTER DRIVING,

which is mediated by

PERCEIVED RISK OF DUI ARREST → ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

COMMUNITY NORMS ABOUT DRINKING **is hypothetically linked to**

SOCIAL AVAILABILITY

and to

DRINKING CONTEXT.

In turn,

COMMUNITY NORMS ABOUT DRINKING

is assumed to be influenced by

ALCOHOL PROMOTION.

Relationship of the Intermediate Variable to Other Variables

Community Norms About Drinking to Drinking

This relationship expresses the potential influence or effect of the level of community acceptability or social acceptability (within subgroups) about drinking. The relationship can be conceptualized as a positive portion of the feedback loop, in which increased social acceptability of consumption in turn results in increased use, and this in turn may result in increased social acceptability. It is possible that the influence of social acceptability on drinking demonstrates a threshold effect, such that only consumption beyond a certain magnitude yields a notable increase in acceptability. A given community may become concerned about problems associated with alcohol consumption. This concern is part of a negative feedback loop in which social norms result in decreased consumption that eventually results in a decline in the community forces that discourage use.

Salience is an important concept in terms of helping define community norms. It refers to the importance that individuals in a given group attribute to social norms regarding alcohol consumption. It can be considered to function as a dynamic elasticity in the strength of the positive or negative influence of the norm. Salience is thought to exist within a set range over a given

time span. An example of this construct in terms of alcohol is seen in the increased news coverage of drinking and driving in the United States in the 1980s and more recently (Clark & Hlton, 1991; Mouden & Russell, 1994). Social reinforcement may then serve to maintain salience. In contrast, without additional input, salience may decay.

Countries differ in alcohol consumption not only because of difference in the price and physical availability of alcohol, but also because of differences in social values and norms about drinking (Makela, Room, Single, Sulkunen, & Walsh, 1981; Osterberg, 1991; Yang, 2002). Skog (1980, 1986) observed that individuals living in “dry” environments (i.e., in which the environment did not sanction drinking and/or excess drinking) might tend towards its members becoming light, rather than heavy, alcohol consumers. Likewise, individuals inhabiting “wet” environments might show a propensity toward heavier use. Thus, the more prominent drinking is in a community, the lower the abstinence rates are likely to be. The percentage of population that abstains is dependent in part on the relative importance of drinking in the community.

National surveys provide evidence that subgroup alcohol consumption levels and patterns may differ from national averages (Clark & Midanik, 1982; Hilton, 1988). Akabaliev and Dimitrov (1997) found Turk-Bulgarians were more likely to endorse policies restricting alcohol use than Christian Bulgarians, which they attributed to the salience of abstinence within the Islamic culture. Razvodovsky (2001) further discussed the protective influence of the Muslim religion’s attitude towards alcohol use. Yang (2002) stated that low-consumption rates of the Chinese were likely associated with their propensity to flush when consuming alcohol and their strong social sanctions against heavy drinking.

Cabrera Strait (2001) and Huriwai (2002) reported that increased substance use might be associated with the stress of acculturation and associated cultural change, which are functions of cultural interactions. Medina-Mora, Borges, and Villatoro (2000) discussed how globalization had helped to homogenize consumption levels and patterns across groups. In addition, Jung (2000) discussed how alcohol use among U.S. minorities was likely influenced by the stress associated with marginality, poverty, and prejudice.

Among current drinkers, Whites were more likely to be light consumers of all ethnical and racial groups. The LAES indicated that all groups showed nearly similar rates of heavy consumption (about 7 to 8% each), whereas the NHSDA showed that Whites had higher rates of binge drinking. Herd (1991) found that aggregate drinking levels for U.S. African Americans were lower than male or female national averages. Caetano (1987a, 1991) found that Mexican-American women drank less than the average across U.S. women, whereas Mexican-American men showed use levels similar to those of other U.S. men, although their patterns

differed. Given similar levels of consumption, however, African-Americans are more likely to suffer from alcohol-related problems than their White counterparts (Herd, 1995, Jones-Webb, 1995).

Based on the 1998 National Household Survey, Medina-Mora et al. (2000) reported that drinking among U.S. Mexicans was proscribed as a male activity. Moreover, they found that, although daily drinking was uncommon among Mexicans, drinking at “fiestas” to the point of being drunk was common. Further, cirrhosis was one of the top ten leading causes of death in Mexico. Warner, Canino, and Colon (2001) reported that U.S. youth showed higher lifetime rates of alcohol and drug use than Puerto Rican youth. American Indians and Alaskan Natives are more likely than other racial/ethnic groups to experience problems from alcohol use (May & Smith, 1988). Based on a survey of 174 Navajo Indians in a health care facility in the southwestern United States, May and Smith (1988) reported that respondents saw drinking as a negative behavior and opposed alcohol legalization. In fact, a majority of the respondents endorsed the “drunken Indian” stereotype. Such attitudes might have been partly born of the problems experienced among Indians associated with alcohol consumption.

Community norms about alcohol use may also be expressed by a society’s knowledge about and attitudes towards real or perceived outcomes associated with heavy use. For example, Paglia and Room (1996) reported that, from a sample of 994 adults in Ontario, more than 75% of participants associated alcohol with aggression and held individuals who had become drunk responsible for their behaviors when intoxicated. Girasek, Gielen, and Smith (2002) conducted a telephone survey of 943 U.S. adults. They found that the sample accurately estimated the proportion of fatal fall, drowning, and poisoning victims who were legally drunk when they died. Although there were some issues about which participants were less accurate (e.g., they overestimated the number of intoxicated drivers involved in fatal crashes), results generally indicated that public awareness of alcohol’s contribution to social problems was high.

Based on a survey conducted in Australia of 149 offenders and 149 participants in the community, Baum (2000) reported that both groups showed a high level of knowledge generally, but were less knowledgeable regarding the number of drinks that would likely put the driver over the legal limit. Both groups were also in agreement about the importance of measures to reduce drunk driving. The two groups differed, however, on attitudes towards drunk drivers, with the community members holding more negative attitudes.

Perceptions regarding alcoholism may be shaped by several competing factors. Based on a review of 266 articles on alcohol use, Crawford (1984) found that the term “alcoholism” had negative connotations and that these perceptions varied according

to respondent sociodemographic and drinker characteristics, as well as time and location.

Crawford, Thomson, Gullion, and Garthwaite (1989) reported that attitudes towards deviancy, rather than perceptions of alcoholism as a disease, were important in determining humanitarian attitudes toward alcoholics. Greenfield and Room (1997) reported that U.S. national surveys conducted between 1979 and 1990 showed that drinking level, Protestant affiliation, and/or age were significant predictors of accepting drinking or drunkenness.

Caetano (1987b) surveyed 482 California residents regarding their attitudes towards alcoholism and its treatment. Most stated that alcoholism was an illness, but 40% asserted that alcoholics chose to drink. Participants were generally supportive of abstinence, rather than controlled drinking, as a desirable treatment goal. Responses did not differ according to whether the participant had been affected by alcoholism or whether they had their own drinking problem.

*Community Norms
to Drinking
Context*

Community values regarding acceptable or unacceptable consumption levels may vary, not only by subgroup but also within a subgroup by drinking location. Greenfield and Room (1997) examined the results of eight comparable questions from national surveys and found that norms regarding the social acceptability of heavy drinking varied by situation, showing greater acceptability at home than in a bar, particularly among men. Trends indicated that there was increasing acceptance of both men and women drinking in bars. Parker and Rebhun (1995) showed that as drinking becomes a part of routine activities away from home, the risk of victimizations can increase. Moreover, he reported that fights and arguments are more likely to occur in bars and pubs than elsewhere.

Community norms can be expressed in public policies designed to restrict alcohol use and the drinking context. Public policies might serve as proxies that help indicate a given group's social norms regarding heavy use in particular. Such attitudes might, in combination with other types of research, represent another means of understanding a group's alcohol-related community norms. Generally, results of surveys in both the United States and abroad showed increasing support over time for restrictions on alcohol access and use (e.g., Giesbrecht & Greenfield, 1999; Pendleton, Smith, & Roberts, 1990).

Based on a newly developed instrument to assess attitudes toward alcohol policies, Latimer et al. (2003) found that policies limiting underage use were among the most widely supported of the five assessed (marketing, consumption in public places, distribution, tax increases, and youth access). They speculated that support for such policies might partially be a function of the fact that they do not directly affect adults. Least supported were policies that limited distribution, in part because such policies reduce access by

both heavy consumers and average drinkers.

Torrönen (2003) examined commentaries on alcohol policies from six daily newspapers published between 1993 and 2000. Results showed that editorials were slanted towards discussions of liberalization of alcohol policies from the state. This perspective peaked in 1996-1997 and then declined during the latter portion of the decade, when concerns increased regarding disruption from heavy drinking and use among youth became more prominent issues. These findings are consistent with those of Lemmens, Vaeth, and Greenfield (1999), who conducted a content analysis of five major U.S. newspapers between 1985 and 1991 and found that most articles depicted alcohol either neutrally or negatively. These results were consistent with an increased public health focus on alcohol use.

*Community Norms
About Drinking to
Social Availability*

We hypothesize that community norms about acceptability of drinking in general, as well as providing alcohol in informal or social settings, can influence the level of high-risk drinking before driving.

Strategies

Potential strategies to influence community norms might be called “carrot or reward” strategies and “stick or punish” strategies. See Table 4. Awareness and education are directed at changing community values and norms through campaigns and media efforts. Punishment or threat strategies establish a civil liability for the social serving of alcohol (i.e., parties and other informal venues).

*Media and
Awareness
Programs*

These strategies are designed to work directly on community norms and values.

- *Awareness campaigns*—These campaigns seek to educate large numbers of individuals with informational messages delivered through various forms of media, through contests, and through the distribution of materials (e.g., key chains, pamphlets).
- *Coordinated media efforts*—Coordinated media efforts center around a particular policy-based prevention approach. For example, coordinated media may be used to highlight attention to a specific alcohol problem and its causes and to generate community support for a policy or policies that will address those causes.

Table 4. Strategies Aimed at Changing Community Values

Strategy	Effect	Scope	Longevity	Maintenance Cost
Information campaigns	Limited research reporting minimal effects on consumption or related problems	Affects all individuals exposed to the campaign	Dependent on longevity of the campaign and appeal of the messages	Related to materials development, production, and dissemination
Coordinated media efforts	Effects on alcohol-related problems	Affects all individuals exposed to the campaign	Dependent on the longevity of the campaign	Minimal and primarily associated with time and energy expenditures

Legal (Tort) Liability Concerning Social Availability of Alcohol to Adults and to Underage Persons

Liability and administrative regulations are strategies that have the power of court or legal regulation to hold persons responsible for the social provision of alcohol (social hosts) to adults (who become drunk or impaired) and underage youth. Tort liability concerning drinking and alcohol sales and services establishes civil penalties, which has already been discussed under “Alcohol Serving and Sales Practices” (see discussion by Sloan et al., 2000). In a few jurisdictions, tort liability has been extended to social hosts with the rationale that social hosts can monitor their guests’ drinking before driving and the serving of alcohol to minors. In some states, such as California, there are strict limits on social host liability, but courts are increasingly finding ways around these limits. In one example in 1995, New Hampshire recognized a common-law cause of action for social host liability; in another example in 1992, a North Carolina court recognized a cause of action for a social host who serviced a visibly intoxicated guest. In a 1999 case in Georgia, there was a lawsuit against a 16-year-old boy and his parents who served alcohol in their home to a 15-year-old girl. The parents were not held liable because they were not home at the time and there was no evidence that they had previously provided beer to their son or his friends. Even though he himself was a minor, the boy was held liable, and it was of no consequence that the girl willingly drank the alcohol, for under the Georgia legal code, the cause of action belonged to the plaintiffs.

Dram shop liability is a special form of tort liability that allows individuals who have been harmed by an alcohol-impaired person to sue that person. The use of dram shop liability has been advanced as a potential tool to deter sellers and social hosts from irresponsible selling or provision of alcohol. This is discussed in Mosher (1984) and Holder et al. (1993). Much of the research concerning the effects of tort liability, in general, and dram shop liability, in particular, has focused on intoxicated persons who subsequently are involved in a traffic crash. Because selling or serving alcohol to persons younger than the legal drinking age can also be grounds for liability in many states, this also becomes a part of the possible prevention strategies to reduce alcohol service

and sales to youth, especially when an intoxicated minor is involved in a traffic crash. In addition, youth are more likely than older people to be driving while impaired by alcohol (Gruenewald et al., 1996).

Sloan et al. (2000) analyzed traffic fatalities across all states and examined the potential effect of several factors on fatalities over time and across states. In particular, they examined the effect of tort liability on commercial servers for selling alcohol to underage drinkers. They found that imposing such tort liability on commercial services resulted in reduced fatality rates for drivers aged 15 to 20, controlling for other dependent variables. This study did not include a variable for the existence of social host liability.

Intermediate Variable**Promotion****Conceptual Definition**

Promotion refers to intentional efforts by alcohol producers, distributors, and retailers to stimulate increased demand for their products. Retailers attempt to increase demand by advertising and promoting their products, which increases the attractiveness of drinking by creating an image favorable to consumption of these substances. Advertisements and promotions are designed to recruit new users and to retain old users. Promotion also influences the community and social context of drinking, potentially altering the perceived legitimacy of social drinking, including normalizing drinking and the integration of alcohol use into everyday life.

Measures

Measures of promotions and advertisements for alcohol include—

- the number and location of billboards in a community which promote alcohol;
- the dollars actually expended for advertising alcoholic products in the nation, state, or locality; and
- the number and frequency of price promotions in bars and restaurants in a community.

Relationship of Intermediate Variable to the Problem

ALCOHOL PROMOTION is assumed to influence

COMMUNITY NORMS ABOUT DRINKING,

which in turn is linked to

DRINKING AND TO DRINKING CONTEXT.

ALCOHOL PROMOTION is also linked to DRINKING directly.

Relationship of Intermediate Variable to Other Variables*Alcohol Promotion to Community Norms About Drinking*

Alcohol advertising and other pro-drinking messages are ubiquitous in many Western countries, including the United States. Images of alcohol are transmitted via billboards; signs in stores; sponsor logos; magazine and print messages; routine television and radio programming; and drinking events depicted in movies, books, and comics. Entertainment and sports that are popular among youth are strongly associated with alcohol industry sponsorships (Hill & Casswell, 2001). Portrayals of alcohol use in advertising are typically positive (i.e., a problem-free activity without harmful consequences). Media characters in alcohol advertising tend to be wealthy, upper-class managers and professionals who are familiar to viewers, and content analysis has linked alcohol with a highly valued lifestyle that is successful,

relaxed, romantic, and adventurous (Grube, 1993).

Exposure to drinking in popular media, such as television and movies, also influences social norms regarding alcohol. Wallack, Grube, Madden, and Breed (1990) found that drinking occurs more often on television than in real life, thereby potentially creating the impression that drinking is normative, popular, and widespread. Skog (1985) reported that the extent to which a given group's consumption fell above or below a national average influenced the effects of media exposure on use.

*Alcohol Promotion
to Drinking*

Several investigators, focusing on intentions to drink and alcohol advertising effects, have explored the association between alcohol advertising experiences and drinking behavior, especially on youth. Atkin, Neuendorf, and McDermott's (1983) U.S. national survey of 1,227 respondents aged 12 to 22 showed a positive correlation between the amount of exposure to beer, wine, and liquor ads and excessive alcohol consumption and drinking in hazardous contexts. Respondents could identify excessive consumption themes and hazardous drinking depicted in some ads, and many inferred an endorsement of such behaviors on the part of the sponsoring company. A survey of 655 seventh to twelfth graders found that respondents who reported being exposed to more alcohol television and magazine advertising drank more or expected to begin drinking soon (Atkin, Hocking, & Block, 1984).

Kuo, Weschler, Greenberg, and Lee (2003) provided compelling evidence linking price and promotions to problem drinking among college students. They analyzed the 2001 College Alcohol Study, which was a survey of more than 10,000 college students at 118 colleges, as well as 830 on-premise and 1,684 off-premise venues surrounding those colleges. Results showed that low price and heavy advertisement and promotional activities were associated with increased heavy drinking among college students and with total number of drinks consumed.

The intensity, omnipresence, and provocative content of advertising and other promotional practices raise questions about the contribution that alcohol promotion makes to problem drinking. Links have been established by researchers between exposure of children to advertising and their later attitudes toward alcohol, intentions to consume, and actual consumption.

Atkin (1990) noted that alcohol commercials can have a slight effect on alcohol misuse and on drinking and driving. He also reported that it can contribute to a modest increase in overall consumption by teenagers and that advertising and programming with positive images of drinkers leads the viewer to develop favorable attitudes toward alcohol. In a review of content analysis studies of television programs, it was concluded that the messages conveyed were that alcohol consumption is widely practiced and normative in many situations (Atkin & Block, 1981; Atkin et al., 1983).

To date, a definitive answer has not emerged as to whether alcohol advertising is a consistent contributing cause of aggregate rates of consumption and drinking-related problems. Whatever the unique effects of alcohol advertising might be at the aggregate level, they are likely overshadowed by other environmental factors, such as the real price of beverage alcohol, taxes, retail availability, or outlet density. Although empirical evidence of the direct effect of alcohol advertising on aggregate drinking levels remains ambiguous, research from the 1990s suggests that young persons are influenced by media portrayals of alcoholic beverages (see Casswell, 1995a, and Grube, 1995). Future panel studies with longer timeframes should offer further insights into the direction and nature of influences.

Despite the lack of definitive evidence regarding the effects of alcohol advertising at the aggregate level, the rationale for its restriction is based more on its indirect effects on the social climate surrounding alcohol (Casswell, 1995b; Hill & Casswell, 2001; Partenen & Montonen, 1988). Alcohol advertising may communicate a meta-message of society's approval (Postman, Nystrom, Strate, and Weingartner, 1988) and may reduce the likelihood of other public policies being implemented (Farrell, 1985; Van Iwaarden, 1985; Casswell, 1995a).

Strategies

Advertising Restrictions and Bans

At the aggregate level, a central focus has been trends in alcohol advertising, per capita consumption, and drinking problems. See Table 5. Studies have been conducted in this area to examine the effects of advertising restrictions, but methodological and practical issues (e.g., substitution of alternative sources of advertising from those banned, permeability of advertising from outside jurisdictions) suggest that the findings are inconclusive (Montanen, 1996).

Some natural experiments on partial advertising bans have not provided a sound basis for determining the unique potency of advertising (Montonen, 1996). Studies of partial advertising bans in Canadian provinces (Ogborne & Smart, 1980; Smart & Cutler, 1976) failed to show clear effects, perhaps because advertising from outside the province was not restricted. Simpson, Beirness, Mayhew, and Donelson (1985) concluded that bans produced no drop in consumption and that stricter rules did not produce lower rates of drinking. In contrast, a major cross-national time-series study of advertising bans implemented in European Community countries during the 1970s showed significant effects, including lower levels of consumption and alcohol-related problems, as indicated by motor vehicle fatality rates (Edwards et al., 1994; Saffer & Grossman, 1987a; Saffer, 1991; 1993a, 1993b, 1995, 1998).

Restrictions on alcohol promotion have been promulgated as a means to reduce the attractiveness of alcohol as a socially acceptable and available item, particularly among youth for whom

promotion appears to be designed primarily to recruit new users. The alcohol industry argues, however, that marketing serves only to set brand preference, not to attract new consumers.

Warning Labels

The warning label legislation is among the few U.S. federal alcohol policies motivated by public health concerns to be successfully enacted after 20 years of legislative attempts (Kaskutas, 1995). It was enacted in 1988 (P.L. 100-690) and implemented in November 1989. The warning label mandated on all alcohol containers carried a *Government Warning* tagline and alluded to the Surgeon General as the source of the determinations covered. The warnings included (a) birth defects risks during pregnancy; (b) impairment when driving; (c) impairment when operating machinery; and (d) health problems. Some states also require posted warnings of alcohol risks in establishments that serve or sell alcohol.

The effect of warning label exposure on conversations about risks of drinking during pregnancy also was seen among women of childbearing age (Kaskutas, Greenfield, Lee, & Cote, 1998) and was not limited to those with high levels of health consciousness (Kaskutas & Greenfield, 1997). Conversely, studies in prenatal clinics yielded little indication that the warning label had little effect on drinking by inner city ethnic minority women (Hankin, Sloan, & Sokol, 1998), so certain groups at particularly high risk may not be expected to be effectively reached.

Mass Media Campaigns and Counteradvertising

This intervention involves disseminating information about a product, its effects, or the industry that promotes it in order to decrease its appeal directly (Stewart, 1997). Counteradvertising can take the form of health warning labels on product packaging, media literacy efforts to raise public awareness of industry tactics, and a module in community or school prevention programs (e.g., Giesbrecht & Douglas, 1990; Greenfield & Zimmerman, 1993).

Research on mass media campaigns thus far has been limited primarily to evaluations of the federally mandated warnings on alcoholic beverage containers. A nationally sponsored evaluation effort indicated that a significant proportion of the population reported having seen the warning labels (Graves, 1993; Kaskutas & Greenfield, 1992). Self-reported precautionary behaviors have been found, including increased caution regarding drinking-and-driving and drinking during pregnancy (Kaskutas & Greenfield, 1992; Greenfield, 1997; Greenfield & Kaskutas, 1998; Greenfield, Graves, & Kaskutas, 1999). No direct effects of warning labels on alcohol-related problems have been reported. Much of the influence is consistent with the intent of Congress to remind the public of certain risks associated with drinking (Greenfield et al., 1999), although measures on the effect on youth (MacKinnon et al., 1993) and college students has not been significant. An experimental study of college students by Snyder and Blood (1992) involved participants looking at different advertisements for

alcoholic products, some with and some without the U.S. Surgeon General’s warning. Results showed that the warnings did not increase perceptions of alcohol risk and even made products more attractive to both drinkers and nondrinkers. Conversely, the U.S. Warning Labels Study showed that awareness—as indicated by conversations about risks—was greater among the more frequent drinkers, including young adults (Kaskutas & Greenfield, 1997; Greenfield & Kaskutas, 1998).

There is evidence that synergies are achieved by implementing multi-faceted strategies, such as health messages at the point of purchase signs and public service announcements (PSAs) (Kaskutas & Graves, 1994; Kaskutas et al., 1998). Greenfield and Kaskutas (1998) noted that, after 4 or more years, the warning label exposure rates may have leveled off, yet penetration of the warning label has been sufficient to reach numerous heavy drinkers (Greenfield, 1997). The more drinkers handle (open) containers and, especially for men, the more alcohol they purchase, the more likely they are to have seen and to have recalled the label’s messages. Thus, warning labels ensure that those most involved in drinking will have exposure to health messages.

Table 5. Strategies Aimed at Alcohol Advertising and Promotion

Strategy	Effect	Scope	Longevity	Maintenance Cost
Advertising bans	Conflicting results related to effects on consumption. Effects found on motor vehicle fatalities.	Affects all individuals within the jurisdiction imposing bans	Ongoing for comprehensive bans unless ban are lifted	Minimal
Restrictions on promotions	No research documenting nature of effects.	Affects all individuals within the jurisdiction	Ongoing unless restriction lifted	Minimal
Counter-advertising	Limited research concludes effects on impaired driving for PSAs only.	Affects all individuals within the message range.	Dependent on periodic inclusion of new ads to ensure “freshness” or appeal of message	Significant and associated with development of new advertisements and purchase of airtime and/or space
Warning labels	Effective in reducing consumption	Affects all individuals exposed to labels.	Dependent on continued resonance of the message	Associated with development and rotation of messages

Intermediate Variable**Drinking Context****Conceptual Definition**

Context refers to the environment in which alcohol is consumed, which in turn will lead to the consumption of high- or low-risk drinking behaviors and can be conceptualized as where one drinks, with whom one drinks, and when one drinks (Cahalan, Cisin, & Crossley, 1969). Others (Wilsnack, Wilsnack, & Klassen, 1984) have suggested adding, “why one drinks” to this definition. Ashley and Rankin (1988) note: “Under certain circumstances, relatively low levels of consumption on isolated occasions may result in damage to the individual drinker” (p. 232). When consumption is high, contextual risk or protective factors might be even more important. The identification of such characteristics has potential utility for developing prevention policies and programs. An underlying assumption of research into drinking contexts was postulated by Harford (1979): “The antecedents of alcohol consumption are to be found in the interactions between the individual and his/her environment. Thus consumption of alcoholic beverages is situationally specific, rather than a trans-situational property of specific individuals” (p. 289).

Measurement

As Jessor (1982) suggested, the five major ways of exploring drinking contexts include location of the drinking event, demographic/descriptive characteristics of the event and its participants, the meanings associated with drinking contexts, abstract dimensions of events such as social controls and norms, and personal perceptions associated with the context.

Relationship of the Intermediate Variable to the Problem

DRINKING CONTEXT is not linked directly with
ALCOHOL-RELATED MOTOR VEHICLE CRASHES.

Instead,

DRINKING CONTEXT

is linked directly to

DRINKING

and is influenced by

COMMUNITY NORMS ABOUT DRINKING

and by

INDIVIDUAL FACTORS.

Relationship of the Intermediate Variable to Other Variables

Drinking Context In a national study of drinking contexts, Hilton (1988) reported

to Drinking

that, across all alcohol consumption patterns (i.e., abstainer, light, moderate, heavy), contexts that included the presence of coworkers, close friends, and neighbors tended to be “wetter.” Demographically, men, more educated respondents, Catholics, and respondents residing in heavy drinking areas were more likely to report drinking heavily across drinking contexts. Similarly, Hilton (1988) reported that men drank more than women did in both public (bars, restaurants, etc.) and private (parties and homes) contexts. In addition, Hilton reported that drinking in public and the interaction between drinking in public and education each correlated with alcohol problems.

Researchers have paid little attention to drinking contexts frequented by college students. In an early study, Kraft (1982) examined alcohol-consumption patterns, related problems, and contexts of drinking at one East Coast university in the late 1970s. He reported that respondents most frequently drank with friends, on weekends, and at parties. The heaviest drinkers often patronized bars as well. With the increase in frequency of attendance at parties or bars, there was also an increase in the frequency of self-reported problem behaviors, such as driving drunk, academic problems, belligerence, job-related problems, vandalism, and trouble with authorities. In a study of drinking contexts frequented by college females, Hunter (1990) reported that female college students drank more often at parties and in bars than in any other context. During the past decade, alcohol research has focused largely on expectancies and perceptions related to alcohol use (Thombs, Beck, & Pleace, 1993; O’Hare, 1998).

Strategies

Many drinking drivers consume alcohol in locations other than their homes, such as licensed establishments and social events. Two strategies have been designed to provide safe transport following a drinking event: designated drivers and ride service programs.

Drinking Location Interventions

In addition to responsible beverage service programs, described elsewhere, interventions to alter the serving context in bars and restaurants have shown success in reducing the BAC levels of young people coming from such establishments. One successful program (called the “Border Project”) involved using media attention, law enforcement participation, and technical assistance/discussions with managers of bars and restaurants in border areas of Mexico to reduce the levels of high-volume drinking by young people in these establishments. The interventions resulted in partial bans on drinking in local on-premise establishments. A comparison the BAC levels of American youth as they entered Mexico and returned from Mexico showed that these interventions also achieved a statistically significant reduction in the levels of alcohol impairment of these border-crossing young adults (Voas, Tippetts, Johnson, Lange, & Baker,

2002; Voas, Lange, & Johnson, 2002; Lange & Voas, 2000).

*Ride
Transportation*

Two strategies have been designed to provide safe transport following a drinking event: designated drivers and ride service programs. *Designated driver programs* encourage one person in a group of drinkers to abstain in order to provide safe transport for the group. Simons-Morton and Cummings (1997) evaluated the effect of a retraining program for bar staff in six bars and restaurants. Despite changes in staff activities, promotion of the designated driver program was low and use of the program by patrons did not increase. Several other researchers (Brigham, Meier, & Goodner, 1995; Meier, Brigham, & Gilbert, 1998) have evaluated the effect of increased advertising on the use of designated driver programs in selected bars. They observed a small but consistent increase in use of the program. One study showed an increase from 3 users at baseline to an average of 7.5 users during the intervention. Results from a general population survey and barroom surveys indicated that heavier drinkers (i.e., those who reached higher BACs when drinking outside the home) and younger respondents were the most likely to use designated drivers (Caudill & Harding, 1997). In sum, there is no evidence that designated driver programs have negative effects; conversely, the effect of on-premise designated driver programs appears to be very small and even intensive promotions produce only modest increases.

A recent U.S. roadside survey (Fell, Voas, & Lange, 1997) found that a greater proportion of designated drivers had a BAC of .02 or higher compared with all other drivers sampled. But compared to drivers coming from bars, the designated drivers had BAC levels of .05 to .08. These data suggest designated drivers limit their consumption rather than abstain completely. Currently, there are no data on the overall effect (positive or negative) of designated drivers on traffic safety.

Ride service programs provide transportation to intoxicated persons who would otherwise drive. Unlike designated driver programs, they apply to all intoxicated persons who are potential drivers, not just to groups, and they do not require planning before the social event. Molof, Dresser, Ungerleider, Kimball, and Schaefer (1995) evaluated two longstanding, well-functioning ride service programs—one provides 2,500 free rides per year and serves primarily bar patrons and persons attending corporate or social host parties; the other program operates over the Christmas and New Year's season and provides 700 free taxi rides during that time. Although the programs in both communities were well-established and popular, there was no identifiable effect of either program on annual crash rates.

The "Operation Nez Rouge" program in Switzerland uses volunteers. A survey of past users found that about half planned on using the service before they were drinking, and the other half decided after or while drinking. Almost 75% thought it was a good

prevention program, whereas 7.5% thought it encouraged people to drink. About two-thirds of the respondents reported that the program made them more aware of possible impairment due to alcohol (Ayer, Francois, & Rehm, 1994).

Another evaluation of a ride service program in Colorado, which had been in operation since 1983, was described by Lacey, Jones, and Anderson (October, 2000). It was funded through the community and available anytime, on any day. Results showed a significant reduction associated with the program. Researchers argued that this program should be part of a comprehensive set of interventions, such as public information, enforcement, and sanctioning, to counter drinking and driving.

In summary, designated drivers and ride services appear to be popular among people who would presumably otherwise drive while intoxicated. They reach groups at high risk for drinking and driving (i.e., young, male heavier drinkers), and they generally increase awareness of the risks of drinking and driving (Ayer et al., 1994; Molof et al., 1995). These services, however, account for a relatively small percentage of drivers, so no overall effect on alcohol-involved accidents has been demonstrated to date.

SOCIAL AVAILABILITY

is influenced by

COMMUNITY NORMS ABOUT DRINKING.

***Relationship of the
Intermediate
Variable to Other
Variables***

*Social Availability
and Drinking*

Research on the use of social sources of alcohol by adults is limited. It is reasonable to assume, however, that the primary social sources of alcohol are parties and small gatherings involving family, friends, and/or work colleagues. One of the most common means by which adolescents obtain alcohol is through third-party transactions (i.e., underage individuals asking an adult aged 21 or older to purchase alcohol for them) (Jones-Webb et al., 1997; Smart, Adlaf, & Walsh, 1996; Wagenaar et al., 1993). Youth also cite their parents as a common source of alcohol, using the alcohol that is present in the home or obtaining and drinking alcohol with the permission of their parents (Smart et al., 1996; Wagenaar et al., 1993).

Several studies indicate that younger youth rely on social sources for alcohol much more than older youth (Harrison, Faulkerson, Park, 2000; Schwartz, Farrow, Banks, & Giesel, 1998; Wagenaar et al., 1996). A substantial portion of alcohol obtained by underage persons is from social sources (e.g., through friends, at parties, at home). Other persons purchasing alcohol and providing it to underage persons represents another social source. Such persons may or may not be of legal age to purchase alcohol.

Youth appear to have ready access to alcohol. Most 12th graders report that it is “fairly” or “very” easy to obtain access to alcohol (Johnson, O’Malley, & Bachman, 2003). In a national study of adolescents in grades 7-12, Swahn, Hamming, and Ikeda (2002) found that youth report relatively easy access to alcohol in their homes.

Purchase surveys reveal that from 30 to 70% of outlets sell to underage buyers, depending upon their geographical location (e.g., Forster et al., 1994, 1995; Grube, 1997; Preusser & Williams, 1992). Even at the lowest end of this range (30%), seven tries at different outlets will yield a 92% successful purchase rate. Given the likelihood that social networks of youth will share information about outlets at which alcohol has been successfully purchased, the estimated maximum of six unsuccessful tries before almost certain purchase is very conservative.

Focus group outcomes have also shown that underage youth typically procure alcohol from social sources through adults or at parties where parents and other adults are not present (Jones-Webb et al., 1997; Wagenaar et al., 1993). Wagenaar et al. (1996) found that 46% of 9th graders, 60% of 12th graders, and 68% of

youth aged 18 to 20 years obtained alcohol from an adult on their last drinking occasion. Students in 9th grade rely on home sources of alcohol much more than the older students. The reliance on home supply declines significantly by end of high school, but social sources continue to remain an important means of access across all ages.

Wagenaar et al. (1996) reported that commercial alcohol outlets were the source of alcohol for underage persons for about 3% of 9th grade students, 9% of 12th grade students, and 14% of youth aged 18 to 20 (see Table 6).

Although not a direct demonstration of a relationship between SOCIAL AVAILABILITY and ALCOHOL-RELATED MOTOR VEHICLE CRASHES, there is evidence of a relationship between SOCIAL AVAILABILITY AND DRIVING AFTER DRINKING. This suggests that any increase in drinking associated with increased social availability can increase crashes. Worldwide, it is estimated that 36 to 67% of drunk-driving offenders had their last drink in some type of unlicensed premise, such as in a home or at a party (Lang & Stockwell, 1991).

Table 6. Sources of Alcohol Supply by Age*

Source of Alcohol	9 th Grade	12 th Grade	Ages 18-20
Commercial alcohol outlet	3	9	14
Home	27	6	11
Another person aged 20 or younger	29	29	10
Another person aged 21 or older	46	60	68

Source: Wagenaar et al. (1996)

*All numbers in percentages for current drinkers over the past 30 days.

Strategies

Policies Targeting Social Availability to Underage Persons

Policies designed to control social availability of alcohol attempt to regulate the extent to which alcohol is available in nonretail settings, such as parties. Strategies include the following:

Keg Registration

Keg registration laws require the purchaser of a keg of beer to complete a form that links his/her name to a number on the keg. Keg registration is seen primarily as a tool for prosecuting adults who supply alcohol to young people at parties. Keg registration laws have become increasingly popular in local communities in the United States. There is apparently only one published study on the effectiveness of these laws. In that study of 97 U.S. communities, it was found that requiring keg registration was significantly and negatively correlated ($r = -.29$) with traffic fatality rates (Cohen, Mason, & Scribner, 2002). The evidence for the effectiveness of

keg registration, however, is best considered inconclusive.

Party Patrols

Another major way that underage drinkers gain access to alcohol is at parties (e.g., Wagenaar et al., 1993). Underage drinking parties frequently involve large groups and are commonly held in a home, an outdoor area, or other public location such as a hotel room. Party patrols are a recommended strategy to address underage drinking parties (Little & Bishop, 1998; Stewart, 1999). Parties are frequently cited as one of the settings at highest risk for youth alcohol consumption and related problems and have been linked to impaired driving, sexual assaults, violence, property damage, and initiation of alcohol use of younger adolescents by older adolescents (Mayer et al., 1998; Schwartz & Little, 1997; Wagenaar et al., 1993). Decreased sales to older minors, in turn, are expected to reduce availability of alcohol to younger adolescents. Party patrols involve police entering locations where parties are in progress. The police can use noise or nuisance ordinances as a basis for entering a party to observe if underage drinking is occurring. In party patrol strategies, police are enlisted, as a part of their regular patrol duties, to routinely (a) enter premises where parties that may involve underage drinking are underway; (b) respond to complaints from the public about noisy teenage parties where alcohol use is suspected; and (c) check, as part of regular weekend patrols, open areas and other venues where teen parties are known to occur. When underage drinking is discovered, the drinkers, as well as the person who supplied the alcohol, can be cited. Even when it is not possible to cite the person who supplied the alcohol, awareness of increased police activity can act as a deterrent and can express community norms regarding the unacceptability of providing alcohol to minors. As with other environmental interventions, public awareness and media attention is important to increase the deterrence effect of this strategy. There is some evidence that this technique is effective. Oregon implemented a weekend drunk driving and party patrol program that has law enforcement officers working with schools to identify in advance the anticipated location of teen parties, which the officers then patrol. An unpublished evaluation of this program revealed that arrests of youth for possession of alcohol increased from 60 to 1,000 individuals in one year (with a corresponding decrease of 35% in underage drunk-driving accidents) (Little & Bishop, 1998).

Social Host Liability

Under social host liability laws, adults who provide alcohol to a minor or serve an intoxicated adult in a noncommercial setting can be sued through civil action for damages or injury caused by that minor or intoxicated adult. Social host liability laws may deter adults from hosting underage parties, purchasing alcohol for or providing alcohol to minors, and overserving. There is very little research on the effectiveness of social host liability laws, and what evidence exists is conflicting. In one study across all 50 states for the years 1984-1995, social host liability laws were associated with

decreases in alcohol-related traffic fatalities among adults but were unrelated to such deaths among minors (Whetten-Goldstein, Sloan, Stout, & Liang, 2000). These laws were not related to SVN crashes for either group. Surprisingly, social host liability laws were related to increases in total motor vehicle fatalities among minors. In a second study, however, using self-reported drinking data spanning the 1980s and the 1990s (up to 1995), implementation of social host liability laws were associated with decreases in reported heavy drinking and in decreases in drinking and driving by lighter drinkers (Stout, Sloan, Liang, & Davies, 2000). They had no effect on drinking and driving by heavier drinkers. These conflicting findings may reflect the lack of a comprehensive program to make social hosts aware of their potential liability exposure. Social host liability may send a powerful message; however, that message must be effectively disseminated before it can have a deterrent effect (Holder & Treno, 1997).

Intermediate Variable**Individual Factors****Conceptual Definition**

Individual factors refer to those attributes of individuals that appear to increase or decrease risk of driving after drinking. In addition to a variety of environmental factors that influence the extent to which individuals engage in drinking and driving, researchers have recognized that there are certain individual-level influences shaping these behaviors. These factors do interact with the potential influences of family and peers, as well as environmental factors, to increase or limit the import of these influences.

Measures

Self-report measures that capture individual factors associated with heavy drinking and with drinking and driving can be relevant, as can personal attributes of drivers and passengers injured or killed in alcohol-involved motor vehicle crashes.

Relationship of the Intermediate Variable to the Problem

INDIVIDUAL FACTORS are associated with DRINKING AND DRINKING CONTEXT and with DRIVING AFTER DRINKING. A NHTSA report on fatal crashes in 2004 indicated that the highest percentage of drivers with BAC levels of .08 or higher was for drivers ages 21 to 24 (32%), followed by ages 25 to 34 (27%) and ages 35 to 44 (23%). The percentages of motor vehicle operators with BAC levels of .08 or higher in fatal crashes in 2004 were 27% for motorcycles, 22% for passenger cars, and 21% for light trucks. The percentage of drivers with BAC levels .08 or higher in fatal crashes was the lowest for large trucks (1%). Safety belts were used by only 28% of the fatally injured drivers with BAC levels of .08 or higher, compared to 41% of fatally injured drivers with BAC levels between .01 and .07 and 57% of fatally injured drivers with no alcohol (BAC = .00).

Drivers with BAC levels of .08 or higher involved in fatal crashes were eight times more likely to have a prior conviction for DWI than were drivers with no alcohol (BAC = .00) (8 and 1%, respectively). In 2004, 85% (11,791) of the 13,952 drivers with BACs of .01 or higher who were involved in fatal crashes had BAC levels of .08 or higher, and 51% (7,084) had BAC levels of .16 or higher. The most frequently recorded BAC level among drinking drivers involved in fatal crashes was .18.

In 2004, a total of 442 (21%) of the fatalities were children aged 14 and younger occurred in crashes involving alcohol. Approximately half (220) were passengers in vehicles with drivers who had BAC levels of .01 or higher. An additional 115 children were killed as passengers in vehicles with drivers who had not been drinking. Another 64 children aged 14 and younger who were killed in traffic crashes in 2004 were pedestrians or pedalcyclists who were struck by drivers with BACs of .01 or higher.

Relationship of the Intermediate Variable to Other Variables

Individual Factors to Drinking

There are several individual factors that increase a person's likelihood of heavy drinking and/or developing alcohol use disorders. One such factor is genetics, although its relative contribution compared to environmental factors has not been empirically established. Evidence of genetic influences include studies of animals (McKinzie et al., 1996), twins and adoptees (Cadoret, Yates, Troughton, Woodworth, & Stewart, 1996; Merikangas, 1990), and children of alcoholics (Bierut et al., 1998; Merikangas et al., 1998).

Age and gender also appear to be linked with problem use. In 2001, there were approximately 1.5 billion episodes of binge drinking in the United States. Binge drinking rates were highest among those aged 18 to 25 years; however, 70% of the binge-drinking episodes occurred among those aged 26 years and older (Naimi, 2003). Binge drinkers were 14 times more likely to report alcohol-impaired driving than nonbinge drinkers (Naimi, 2003). *Heavy drinking* is defined as consuming alcohol in excess of one drink per day on average for women and in excess of two drinks per day on average for men (NIAAA, 2004). In 2002, 5.9% of U.S. adults reported heavy drinking in the past 30 days; the prevalence of heavy drinking was greater for men (7.1%) than for women (4.5%) (CDC, BRFSS, various).

Strategies

Although strategies have not been developed to change genetic factors and biological markers, other individual-level interventions have been developed. See Table 7. For example, many prevention programs have been developed to convey information about alcohol (and other drugs) to children and youth. These programs seek to change attitudes and cultivate values that are inconsistent with substance use or (in the case of adults) are inconsistent with responsible use of substances. Strategies designed to shape knowledge, attitudes, and values overlap and are interrelated with strategies designed to change community values. For example, awareness campaigns educate communities and are intended to change community norms. They also can change an individual's knowledge and attitudes.

The major categories of strategies focused on individual knowledge, attitudes, and values follow.

- *Prevention programs* – Prevention programs are usually implemented in schools, though they may also be delivered in other settings, such as community centers. They often consist of packaged curricula that include information about

substances, resistance skills, and expressions of personal commitment.

- *Normative education* – This strategy is based on youth’s tendency to overestimate the amount of heavy drinking among their peers. The program uses prominently displayed informational materials to provide accurate information about drinking norms.
- *Family-oriented programs* – These programs are often operated in schools and community hubs and involve intensive participation in classes and meetings by both parents and children.
- *Rehabilitative programs for impaired drivers* – Rehabilitative programs are designed in part to change the knowledge and attitudes of individual drivers such that understanding of risks and responsible attitudes and behavior are reestablished.

Table 7. Strategies Addressing Individual Knowledge, Attitudes, and Values

Strategy	Effect	Scope	Longevity	Maintenance Cost
Prevention programs	Short-term effects on consumption	Affects all individuals exposed to the program	Dependent on on-going participation in the program	Significant and related to purchase of program materials and staff time to conduct program
Normative education	Limited research shows no effects on consumption or alcohol-related problems	Affects all individuals exposed to the campaign	Dependent on the longevity of the campaign	Related to materials development, production, and dissemination
Family-oriented programs	Limited research shows effects on consumption and related problems	Affects all individuals exposed to the program	Dependent on on-going participation in the program	Significant and related to purchase of program materials and staff time to conduct program
Rehabilitative programs for impaired drivers	Effects on consumption and impaired driving	Affects all individuals exposed to the program	Dependent on outside monitoring	Related primarily to monitoring
Rehabilitative programs for impaired drivers	Effects on consumption and impaired driving	Affects all individuals exposed to the program	Dependent on outside monitoring	Related primarily to monitoring

IV. References

- Abbey, A., Scott, R. O., & Smith, M. J. (1993). Physical, subjective, and social availability: Their relationship to alcohol consumption in rural and urban areas. *Addiction, 88*, 489-499.
- Akabaliev, V., & Dimitrov, I. (1997). Attitudes towards alcohol use among Bulgarians-Christians and Turks- Muslims. *Folia Med, 39*(1), 7-12.
- Andenaes, J. (1988). The Scandinavian experience. In M. D. Laurence, J. R. Snortum, & F. E. Zimring (Eds.), *Social control of the drinking driver* (pp. 43-63). Chicago: University of Chicago Press.
- Ashley, M., & Rankin, J. (1988). A public health approach to the prevention of alcohol-related health problems. *Annual Review of Public Health, 9*, 233-271.
- Atkin, C. K. (1990). Effects of televised alcohol messages on teenage drinking patterns. *Journal of Adolescent Health Care, 11*(1), 10-24.
- Atkin, C. K., & Block, M. (1981). *Content and effects of alcohol advertising*. East Lansing, MI: Michigan State University.
- Atkin, C. K., Hocking, J., & Block, M. (1984). Teenage drinking: Does advertising make a difference? *Journal of Communication, 34*(2), 157-167.
- Atkin, C. K., Neuendorf, K., & McDermott, S. (1983). The role of alcohol advertising in excessive and hazardous drinking. *Journal of Drug Education, 13*(4), 313-324.
- Ayer, S., François, Y., & Rehm, J. (1994). *Opération Nez rouge. Hiver 1993-1994. Evaluation auprès des usagers*. Lausanne: Institut suisse de prévention de l'alcoolisme et autres toxicomanies.
- Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., Grube, J., Gruenewald, P., Hill, L., Holder, H., Homel, R., Osterberg, E., Rehm, J., Room, R., & Rossow, I. (2003). *Alcohol: No ordinary commodity - research and public policy*. Oxford: Oxford University Press.
- Balmforth, D. (1999). *National survey of drinking and driving attitudes and behaviors* (DOT HS 808 644). Washington, DC: The Gallup Organization, National Highway Safety Traffic Safety Administration.
- Bartl, G., & Esberger, R. (2000). Effects of lowering the legal BAC limit in Austria. In H. Laurell & F. Schlyter (Eds.), *Proceedings of the 15th International Conference on Alcohol, Drugs and Traffic Safety - T'2000; May 22-26, 2000*. Stockholm, Sweden: International Council on Alcohol, Drugs and Traffic Safety (ICADTS).
- Baum, S. (2000). Drink driving as a social problem: Comparing the attitudes and knowledge of drink driving offenders and the general community. *Accident Analysis and Prevention, 32*, 689-694.
- Bauman, K. E., LaPrelle, J., Brown, J. D., Koch, G. G., & Padgett, C. A. (1991). The influence of three mass media campaigns on variables related to adolescent cigarette smoking: Results of a field experiment. *American Journal of Public Health, 81*, 597-604.
- Becker, G., Grossman, M., & Murphy, K. (1994). An empirical analysis of cigarette addiction. *American Economic Review, 84*, 396-418.
- Becker, G., & Murphy, K. (1988). A theory of rational addiction. *Journal of Political Economy, 96*(4), 675-700.
- Begg, D. J., Alsop, J., & Langley, J. D. (2000). The impact of graduated driver licensing restrictions on young driver crashes in New Zealand, *Proceedings of the 15th International Conference on Alcohol, Drugs, and Traffic Safety*. Stockholm, Sweden.
- Berger, D. E., & Snortum, J. R. (1986). A structural model of drinking and driving: Alcohol consumption, social norms, and moral commitments. *24*, 139-153.

- Berger, D. E., Snortum, J. R., Homel, R. J., Hauge, R., & Loxley, W. (1990). Deterrence and prevention of alcohol-impaired driving in Australia, the United States and Norway. *Justice Quarterly*, 7, 453-465.
- Birckmayer, J. D., Holder, H. D., Yacoubian, G. S., & Friend, K. B. (2004). A general causal model to guide alcohol, tobacco, and illicit drug prevention: Assessing the research evidence. *Journal of Drug Education*, 34(2), 121-153.
- Blincoe, L. J., & Faigin, B. M. (1992). *The economic cost of motor vehicle crashes 1990* (DOT HS 807 876). Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration.
- Blomberg, R. (1992). *Lower BAC limits for youth: Evaluation of the Maryland .02 law* (DOT HS 806 807). Washington, DC: U.S. Department of Transportation.
- Blose, J. O., & Holder, H. D. (1987, January). 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.
- Borkenstein, R. F., Crowther, R. F., Shumate, R. P., Ziel, W. B., & Zylman, R. (1974). The role of the drinking driver in traffic accidents. *Blutalkohol*, 11(Supplement 1), 1-132.
- Brigham, T. A., Meier, S. E., & Goodner, V. (1995). Increasing designated driving in a bar with prompts and incentives. *Journal of Applied Behavior Analysis*, 28(1), 83-84.
- Brown, I. D., & Groeger, J. A. (1988). Risk perception and decision taking during the transition between novice and experienced driver status. *Ergonomics*, 31(4), 585-597.
- Bruun, K., Edwards, G., & Lumio, M. (1975). *Alcohol control policies in public health perspective*. (F. F. f. A. Studies (Ed.) Vol. 25). Piscataway, NJ: Rutgers Center of Alcohol Studies Publications.
- Buka, S. L., & Birdthistle, I. J. (1999). Long-term effects of a community-wide alcohol server training intervention. *Journal of Studies on Alcohol*, 60, 27-36.
- Bureau of Labor Statistics. (1975-1990). *WWW Documents*. Accessed July 1, 2003, from the World Wide Web: www.bls.gov
- Burns, M. M., & Fiorentino, D. (2001, 07/23-07/24). *The Effects of Low BACs on Driving Performance*. Paper presented at the Summer Workshop on Low BACs, Committee on Alcohol, other Drugs and Transportation, the Transportation Research Board, Center of the National Academies in Woods Hole.
- Cabrera Strait, S. (2001). Examination of the influence of acculturative stress on substance use and related maladaptive behavior among Latino youth. *Dissertation Abstracts International*, 62(5), 2532B.
- Caetano, R. (1987a). Acculturation and drinking patterns among U.S. Hispanics. *Drug and Alcohol Dependence*, 19, 215-226.
- Caetano, R. (1987b). Public opinions about alcoholism and its treatment. *Journal of Studies on Alcohol*, 48(2), 153-160.
- Caetano, R. (1991). Findings from the 1984 National Survey of Alcohol Use Among U.S. Hispanics. In W. B. Clark & M. Hilton (Eds.), *Alcohol in America* (pp. 293-308). Albany: State University of New York Press.
- Cahalan, D., Cisin, I. H., & Crossley, H. M. (1969). *American drinking practices: A national study of drinking behavior and attitudes* (Monograph No. 6). New Brunswick, NJ: Rutgers Center of Alcohol Studies.
- Casswell, S. (1995a). The nature and effectiveness of media advocacy, counteradvertising, and health promotion messages. In S. E. Martin & C. P. Mail (Eds.), *The effects of the mass media on the use and abuse of alcohol* (pp. 269-273). Washington, DC: GPO.
- Casswell, S. (1995b). Public discourse on alcohol: Implications for public policy. In H. D. Holder & G. Edwards (Eds.), *Alcohol and public policy: Evidence and issues* (pp. 190-214). Oxford: Oxford University Press.

- Caudill, B. D., & Harding, W. M. (1997). *Designated drivers: who are they and do at-risk drinkers use them?* Paper presented at the Research Society on Alcoholism., San Francisco.
- CDC. (various). *Behavioral Risk Factor Surveillance System Survey Data*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.
- Chaloupka, F. J., Grossman, M., & Saffer, H. (2002). The effects of price on alcohol consumption and alcohol-related problems. *Alcohol Research and Health*, 26(1), 22-34.
- Chaloupka, F. J., Saffer, H., & Grossman, M. (1993). Alcohol-control policies and motor-vehicle fatalities. *Journal of Legal Studies*, 22(1), 161-186.
- Chaloupka, F. J., & Wechsler, H. (1996). Binge drinking in college: The impact of price, availability, and alcohol control policies. *Contemporary Economic Policy*, 14(4), 112-124.
- Chikritzhs, T., & Stockwell, T. (2002). The impact of later trading hours for Australian public houses (hotels) on levels of violence. *Journal of Studies on Alcohol*, 63(5), 591-599.
- Chiu, A., Y., Perez, P. E., & Parker, R. N. (1997). Impact of banning alcohol on outpatient visits in Barrow, Alaska. *The Journal of the American Medical Association*, 278(21), 1775-1777.
- Clark, W. B., & Hilton, M. E. (1991). *Alcohol in America: Drinking practices and problems*. Albany, NY: State University of New York Press.
- Clark, W. B., & Midanik, L. (1982). *Alcohol use and alcohol problems among U.S. adults: Results of the 1979 national survey* (NCHRP, Report 111, 1971). Washington, DC: U.S. Government Printing Office.
- Cleary, J., & Rodgers, A. (1986). *Analysis of the effects of recent changes in Minnesota's DWI laws: Part III. Longitudinal analysis of policy impacts*. St. Paul, MN: Minnesota House of Representatives, Research Department.
- Coate, D., & Grossman, M. (1988). Effects of alcoholic beverages prices and legal drinking ages on youth alcohol use. *Journal of Law and Economics*, 31, 145-171.
- Cohen, D. A., Mason, K., & Scribner, R. (2002). The population consumption model, alcohol control policies, and alcohol-related traffic fatalities. *Preventative Medicine*, 34(2), 187-197.
- Cohen, F., & Rogers, D. (1997). Effects of alcohol policy change. *Journal of Alcohol and Drug Education*, 42, 69-82.
- Cook, P. J. (1981). The effect of liquor taxes on drinking, cirrhosis, and auto accidents. In M. Moore & D. Gerstein (Eds.), *Alcohol and public policy: Beyond the shadow of prohibition* (pp. 255-285). Washington, DC: National Academy Press.
- Cook, P. J., & Moore, M. J. (1993). Violence reduction through restrictions on alcohol availability. *Alcohol Health and Research World*, 17, 151-156.
- Cook, P. J., & Tauchen, G. (1982). The effect of liquor taxes on heavy drinking. *Bell Journal of Economics*, 13(2), 379-390.
- Crawford, A. (1984). Attitudes about alcohol: A general review. *Drug and Alcohol Dependence*, 19(4), 279-311.
- Crawford, J. R., Thomson, N. A., Gullion, F. E., & Garthwaite, P. (1989). Does endorsement of the disease concept of alcoholism predict humanitarian attitudes to alcoholics? *International Journal of the Addictions*, 24(1), 71-77.
- deBaca, J. C., Lapham, S. C., Liang, H. C., & Skipper, B. J. (2001). Victim impact panels: Do they impact drunk drivers? A follow-up of female and male first-time and repeat offenders. *Journal of Studies on Alcohol*, 615-620.
- Dee, T. S. (1999). State alcohol policies, teen drinking and traffic accidents. *Journal of Public Economics*, 72(2), 289-315.
- Dee, T. S., & Evans, W. N. (2001). *Risky behavior among youth: An economic perspective*. Teens and traffic safety. (J. Gruber (Ed.)). Chicago: University of Chicago Press.

- DeJong, W., & Hingson, R. (1998). Strategies to reduce driving under the influence of alcohol. *Annual Reviews Public Health, 19*, 359-378.
- Derzon, J. H., & Lipsey, M. W. (2002). A meta-analysis of the effectiveness of mass-communication for changing substance use knowledge, attitudes, and behavior. In W. D. Crano (Ed.), *Mass Media and Drug Prevention: Classic and Contemporary Theories and Research* (pp. 231-258). Mahwah, NJ: Lawrence Erlbaum Assoc.
- DeYoung, D. J. (1997). An evaluation of the effectiveness of alcohol treatment driver license actions and jail terms in reducing drunk driving recidivism in California. *Addiction, 92*(8), 989-997.
- DeYoung, D. J., Tashima, H. N., & Maston, S. V. (2005). An evaluation of the effectiveness of ignition interlock in California. In P. R. Marques (Ed.), *Alcohol Ignition Interlock Devices—Volume II: Research, Policy, and Program Status 2005* (pp. 42-52). Oosterhout, The Netherlands: International Council on Alcohol, Drugs and Traffic Safety.
- Dresser, J., & Gliksman, L. (1998). Comparing statewide alcohol server training systems. *Pharmacology, Biochemistry, and Behavior, 61*, 150.
- Edwards, G., Anderson, P., Babor, T. F., Casswell, S., Ferrence, R., Giesbrecht, N., Godfrey, C., Holder, H. D., Lemmens, P., Mäkelä, K., Midanik, L. T., Norström, T., Österberg, E., Romelsjö, A., Room, R., Simpura, J., & Skog, O.-J. (Eds.). (1994). *Alcohol policy and the public good*. New York: Oxford University Press.
- Epperlein, T. (1987). Initial deterrent effects of the crackdown on drunken drivers in the state of Arizona. *Accident Analysis and Prevention, 19*(4), 271-283.
- Farrell, S. (1985). *Review of national policy measures to prevent alcohol-related problems*. Geneva: World Health Organization.
- Fell, J., Voas, R. B., & Lange, J. E. (1997). Designated driver concept: Extent of use in the USA. *Journal of Traffic Medicine, 25*(3-4), 109-114.
- Fell, J. C., Lacey, J. H., & Voas, R. B. (2004). Sobriety checkpoints: Evidence of effectiveness is strong, but use is limited. *Traffic Injury Prevention, 5*(3), 220-227.
- Fell, J. C., & Nash, C. E. (1989). The nature of the alcohol problem in U.S. fatal crashes. *Health Education Quarterly, 16*(3), 335-344.
- Ferguson, S. A., Fields, M., & Voas, R. B. (2000). Enforcement of zero tolerance laws in the US – Prevention Section. In H. Laurell & F. Schlyter (Eds.), *Alcohol, Drugs and Traffic Safety – T 2000: Proceedings of the 15th International Conference on Alcohol, Drugs and Traffic Safety, May 22-26, 2000* (Vol. 2, pp. 713-718). Stockholm, Sweden: ICADTS.
- Finnigan, F., & Hammersley, R. (1992). *Handbook of Human Performance: Vol. 2. Health and Performance*. The effects of alcohol on performance. (A. P. Smith & D. M. Jones (Eds.)). London: Academic Press.
- Flay, B. R., Miller, T. Q., Hedeker, D., Siddiqui, O., Brannon, B. R., Johnson, C. A., Hansen, W. B., Sussman, S., & C., D. (1995). The television, school and family smoking prevention and cessation project: VIII. Student outcomes and mediating variables. *Preventive Medicine, 24*, 29-40.
- Flynn, B. S., Worden, J. K., Secker-Walker, R. H., & Pirie, P. L., et al. (1994). Mass Media and School Interventions for Cigarette Smoking Prevention: Effects Two Years after Completion. *American Journal of Public Health, 84*(7), 1148-1150.
- Fors, S., & Rojeck, D. (1999). The effect of victim impact panels on DUI/DWI re-arrest rates: A twelve month follow-up. *Journal of Studies on Alcohol, 60*(4), 514-520.
- Forster, J. L., McGovern, P. G., Wagenaar, A. C., Wolfson, M., Perry, C. L., & Anstine, P. S. (1994). The ability of young people to purchase alcohol without age identification in northeastern Minnesota, USA. *Addiction, 89*, 699-705.

- Forster, J. L., Murray, D. M., Wolfson, M., & Wagenaar, A. (1995). Commercial availability of alcohol to young people: Results of alcohol purchase attempts. *Preventative Medicine, 24*, 324-347.
- Friend, K., & Levy, D. T. (2002). Reductions in smoking prevalence and cigarette consumption associated with mass-media campaigns. *Health Education Research, 17*(1), 85-98.
- Gibbs, J. P. (1975). *Crime, punishment and deterrence*. New York: E. Isevich.
- Giesbrecht, N., & Douglas, R. R. (1990). *The demonstration project and comprehensive community programming: Dilemmas in preventing alcohol-related problems*. Paper presented at the International Conference on Evaluating Community Prevention Strategies: Alcohol and Other Drugs, San Diego, CA.
- Giesbrecht, N., & Greenfield, T. K. (1999). Public opinions on alcohol policy issues: A comparison of American and Canadian surveys. *Addiction, 94*(521-531).
- Giesbrecht, N., & Grube, J. W. (2003). Education and persuasion strategies. In T. Babor, R. Caetano, S. Casswell, G. Edwards, N. Giesbrecht, K. Graham, J. Grube, P. Gruenewald, L. Hill, H. Holder, R. Homel, E. Österberg, J. Rehm, R. Room, & I. Rossow (Eds.), *Alcohol: No Ordinary Commodity: Research and Public Policy* (pp. 189-207). New York: Oxford University Press.
- Girasek, D. C., Gielen, A. C., & Smith, G. S. (2002). Alcohol's contribution to fatal injuries: A report on public perceptions. *Annals of Emergency Medicine, 39*(6), 622-630.
- Gliksman, L., McKenzie, D., Single, E., Douglas, R., Brunet, S., & Moffatt, K. (1993). The role of alcohol providers in prevention: An evaluation of a server intervention programme. *Addiction, 88*(9), 1195-1203.
- Graves, K. (1993). Evaluation of the alcohol warning label: A comparison of the United States and Ontario, Canada in 1990 and 1991. *Journal of Public Policy and Marketing, 12*(1), 19-29.
- Greenfield, L. A. (1998, April 5-7). *Alcohol and crime: An analysis of national data on the prevalence of alcohol involvement in crime* (Final Report No. NCJ 168632). Washington, DC: U.S. Department of Justice, Office of Justice Programs.
- Greenfield, L. A., & Henneberg, M. A. (2001). Victim and offender self-reports of alcohol involvement in crime. *Alcohol Research & Health, 25*(1), 20-31.
- Greenfield, T. K. (1997). Warning labels: Evidence of harm-reduction from long-term American surveys. In M. Plant, E. Single, & T. Stockwell (Eds.), *Alcohol: Minimizing the harm* (pp. 105-125). London: Free Association Books.
- Greenfield, T. K., Graves, K. L., & Kaskutas, L. A. (1999). Long-term effects of alcohol warning labels: Findings from a comparison of the United States and Ontario, Canada. *Psychology and Marketing, 16*(3), 261-282.
- Greenfield, T. K., & Kaskutas, L. A. (1998). Five years' exposure to alcohol warning label messages and their impacts; Evidence from diffusion analysis. *Applied Behavioral Science Review, 6*, 39-68.
- Greenfield, T. K., & Room, R. (1997). Situational norms for drinking and drunkenness: Trends in the US adult population, 1979-1990. *Addiction, 92*(1), 33-47.
- Greenfield, T. K., & Zimmerman, R. S. (Eds.). (1993). *CSAP Prevention Monograph-14: Second international research symposium on experiences with community action projects for the prevention of alcohol and other drug problems*. Washington, DC: US Department of Health and Human Services.
- Grimes, J. D., & Swisher, J. D. (1989). Educational factors influencing adolescent decision making regarding use of alcohol and drugs. *Journal of Alcohol and Drug Education, 35*, 1-15.
- Grossman, M. (Ed.). (1993). *The economic analysis of addictive behavior* Economics and the prevention of alcohol-related problems. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.

- Grossman, M., Chaloupka, F. J., & Sirtalan, I. (1998). An empirical analysis of alcohol addiction: Results from the Monitoring the Future panels. *Economic Inquiry*, 36(1), 39-48.
- Grossman, M., Coate, D., & Arluck, G. M. (1987). Price sensitivity of alcoholic beverages in the United States. In M. H. Moore & D. R. Gerstein (Eds.), *Control issues in alcohol abuse prevention: Strategies for states and communities* (pp. 169-198). Greenwich, CT: JAI Press.
- Grossman, M., & Markowitz, S. (2001). Alcohol regulation and violence on college campuses. In M. Grossman & C. R. Hsieh (Eds.), *The economics of substance use and abuse: The experiences of developed countries and lessons for developing countries* (pp. 169-198). United Kingdom: Edward Elgar Publishing Limited.
- Grube, J. W. (1993). Alcohol portrayals and alcohol advertising on television: Effects on children and adolescents. *Alcohol Health and Research World*, 17, 61-66.
- Grube, J. W. (1997). Preventing sales of alcohol to minors: Results from a community trial. *Addiction*, 92(Supplement 2), S251-S260.
- Grube, J. W. (Ed.). (1995). *Television alcohol portrayals, alcohol advertising, and alcohol expectancies among children and adolescents* The effects of mass media on the use and abuse of alcohol. Rockville, MD: NIAAA.
- Grube, J. W., & Stewart, K. (2004). Preventing impaired driving using alcohol policy. *Traffic Injury Prevention*, 5, 199-207.
- Gruenewald, P. (1988). *Analytic models of alcohol consumption: Dynamic models*. (Briefing paper no. 2). Berkeley, CA: Prevention Research Center.
- Gruenewald, P. J., & Janes, K. (1991). The role of formal law in alcohol control systems: A comparison among states. *The American Journal of Drug and Alcohol Abuse*, 17(2).
- Gruenewald, P. J., Millar, A., Ponicki, W. R., & Brinkley, G. (2000). Physical and economic access to alcohol: The application of geostatistical methods to small area analysis in community settings. In R. A. Wilson & M. C. DuFour (Eds.), *The Epidemiology of Alcohol Problems in Small Geographic Areas* (pp. 163-212). Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.
- Gruenewald, P. J., Millar, A. B., & Treno, A. J. (1993a). Alcohol availability and the ecology of drinking behavior. *Alcohol Health and Research World*, 17(1), 39-45.
- Gruenewald, P. J., Millar, A. B., Treno, A. J., Ponicki, W. R., Yang, Z., & Roeper, P. (1996). The geography of availability and driving after drinking. *Addiction*, 91(7), 967-983.
- Gruenewald, P. J., Ponicki, W. R., & Holder, H. (1993b). The relationship of outlet densities to alcohol consumption: A time series cross-sectional analysis. *Alcoholism: Clinical and Experimental Research*, 17(1), 38-47.
- Gruenewald, P. J., Stockwell, T., Beel, A., & Dyskin, E. V. (1999). Beverage sales and drinking and driving: The role of on-premise drinking places. *Journal of Studies on Alcohol*, 60(1), 47-53.
- Gruenewald, P. J., & Treno, A. J. (2000). Local and global alcohol supply: Economic and geographic models of community systems. *Addiction*, 95(Suppl. 4), S537-S549.
- Hafemeister, T. L., & Jackson, S. L. (2004). Effectiveness of sanctions and law enforcement practices targeted at underage drinking not involving operation of a motor vehicle. In D. o. B. a. S. S. a. E. Committee on Developing a Strategy to Reduce and Prevent Underage Drinking (Ed.), *National Research Council and Institute of Medicine, Reducing underage drinking: A collective responsibility, background papers*. Washington, DC: The National Academies Press.
- Hankin, J. R., Sloan, J. J., & Sokol, R. J. (1998). The modest impact of the alcohol beverage warning label geography of availability and driving after drinking. *Addiction*, 91, 967-983.
- Harford, T. C. (1979). Contextual drinking patterns among men and women. In A. Frank (Ed.), *Currents in Alcoholism*. New York: Grune and Stratton.

- Harrison, P. A., Fulkerson, J. A., & Park, E. (2000). The relative importance of social versus commercial sources in youth access to tobacco, alcohol, and other drugs. *Preventive Medicine, 31*, 39-48.
- Hauge, R., & Nordlie, O. (1984). Pa jakt etter virkeligheten (Chasing the reality). *Nordisk Tidsskrift for Kriminalvidenskab, 71*, 70-75.
- Heeren, T., Smith, R. A., Morelock, S., & Hingson, R. W. (1985). Surrogate measures of alcohol involvement in fatal crashes: Are conventional indicators adequate? *Journal of Safety Research, 16*(3), 127-133.
- Helander, A. (2001). Biological markers of alcohol use and abuse in theory and practice. In D. P. Agarwal & H. K. Seitz (Eds.), *Alcohol in Health and Disease* (pp. 177-205). New York: Marcel Dekker, Inc.
- Hennessy, M., & Saltz, R. (1989). Adjusting for multimethod bias through selection modeling. *Evaluation Review, 13*(4), 380-399.
- Henstridge, J., Homel, R., & Mackay, P. (1997). *The long-term effects of random breath testing in four Australian states: a time series analysis* (No. CR 162). Canberra, Australia: Federal Office of Road Safety.
- Herd, D. (1991). Drinking patterns in the Black population. In W. B. Clark & M. E. Hilton (Eds.), *Alcohol in American: Drinking practices and problems* (pp. 308-328). Albany: State University of New York Press.
- Herd, D. (1995). The impact of region and urbanization on African American drinking patterns: Results from national study. *Contemporary Drug Problems, 22*(3), 453-482.
- Hill, L., & Casswell, S. (2001). *Alcohol advertising and sponsorship: Commercial freedom or control in the public interest?* International handbook of alcohol dependence and problems. (T. J. Peters & T. Stockwell (Eds.)). New York: John Wiley and Sons.
- Hilton, M. E. (1988). Trends in drinking problems and attitudes in the United States: 1979-1984. *British Journal of Addiction, 83*, 95-112.
- Hindmarch, I., Bhatti, J. Z., Starmer, G. A., Mascord, D. J., & et al. (1992). The effects of alcohol on the cognitive function of males and females and on skills relating to car driving. *Human Psychopharmacology Clinical and Experimental, 7*, 105-114.
- Hingson, R., Heeren, T., Kovenock, D., Mangione, T., Meyers, A., Morelock, S., Lederman, R., & Scotch, N. (1987). Effects of Maine's 1981 and Massachusetts' 1982 driving-under-the-influence legislation. *American Journal of Public Health, 77*(5), 593-597.
- Hingson, R., Heeren, T., & Winter, M. (1994). Lower legal blood alcohol limits for young drivers. *Public Health Reports, 109*(6), 739-744.
- Hingson, R., Heeren, T., & Winter, M. (1999). Preventing impaired driving. *Alcohol, Research & Health, 23*(1), 31-39.
- Hingson, R., Heeren, T., & Winter, M. (1995). Effects of lower blood alcohol limits for young and adult drivers. *Alcohol, Drugs and Driving, 10*, 243-252.
- Hingson, R., & Howland, J. (1990). Use of laws to deter drinking and driving. *Alcohol Health and Research World, 14*, 36-43.
- Hingson, R., McGovern, T., Howland, J., Heeren, T., Winter, M., & Zakocs, R. (1996). Reducing alcohol-impaired driving in Massachusetts: The Saving Lives Program. *American Journal of Public Health, 86*(6), 791-797.
- Hingson, R. H., Howland, J., Schiavone, T., & Damiata, M. (1990). The Massachusetts saving lives program: six cities widening the focus from drunk driving to speeding, reckless driving, and failure to wear safety belts. *Journal of Traffic Medicine, 18*, 123-132.
- Holder, H., & Treno, A. (1997). Media advocacy in community prevention: News as a means to advance policy change. *Addiction, 92*(2 Suppl), S189-S200.
- Holder, H. D. (1994). Mass communication as an essential aspect of community prevention to reduce alcohol-involved traffic crashes. *Alcohol, Drugs and Driving, 10*(3-4), 295-307.

- Holder, H. D., & Blose, J. O. (1987). 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.
- Holder, H. D., Gruenewald, P. J., Ponicki, W. R., Treno, A. J., Grube, J. W., Saltz, R. F., Voas, R. B., Reynolds, R., Davis, J., Sanchez, L., Gaumont, G., & Roeper, P. (2000). Effect of community-based interventions on high-risk drinking and alcohol-related injuries. *Journal of the American Medical Association*, 284(18), 2341-2347.
- Holder, H. D., Janes, K., Mosher, J., Saltz, R. F., Spurr, S., & Wagenaar, A. C. (1993). Alcoholic beverage server liability and the reduction of alcohol-involved problems. *Journal of Studies on Alcohol*, 54(1), 23-26.
- Holder, H. D., Saltz, R. F., Grube, J. W., Voas, R. B., Gruenewald, P. J., & Treno, A. J. (1997). A community prevention trial to reduce alcohol-involved accidental injury and death: Overview. *Addiction*, 92(Suppl 2), S155-S171.
- Holder, H. D., & Wagenaar, A. C. (1990, June 10–15). *Effects of the elimination of a state monopoly on distilled spirits retail sales in Iowa*. Paper presented at the 35th International Institute on the Prevention and Treatment of Alcoholism, Berlin, Germany.
- Holder, H. D., & Wagenaar, A. C. (1994). Mandated server training and reduced alcohol-involved traffic crashes: A time series analysis of the Oregon experience. *Accident Analysis and Prevention*, 26(1), 89-98.
- Homel, R. (1981). Penalties and the drink-driver: A study of one thousand offenders. *Australia and New Zealand Journal of Criminology*, 14, 225-241.
- Homel, R. (1988). *Policing and punishing the drinking driver. A study of general and specific deterrence*. Research in criminology. (A. Blumstein & D. P. Farrington (Eds.)). New York: Springer-Verlag.
- Homel, R., McKay, P., & Henstridge, J. (1995). The impact on accidents of random breath testing in New South Wales; 1982–1992. In C. N. Kloeden & A. J. Mclean (Eds.), *Proceedings of the 13th International Conference on Alcohol, Drugs and Traffic Safety, Adelaide, 13 August - 19 August 1995* (Vol. 2, pp. 849-855). Adelaide, Australia: NHMRC Road Accident Research Unit, The University of Adelaide 5005.
- Howat, P., Sleet, D., & Smith, I. (1991). Alcohol and driving: Is the 0.05% blood alcohol concentration limit justified? *Drug and Alcohol Review*, 10, 151-166.
- Hunter, G. T. (1990). A survey of the initial context of drinking among college women. *Journal of Alcohol & Drug Education*, 35(3), 73-80.
- Huriwai, T. (2002). Re-enculturation: Culturally congruent interventions for Maori with alcohol and drug-use associated problems in New Zealand. *Substance Use and Misuse*, 37(8-10), 1259-1268.
- Hurst, P. M. (1973). Epidemiological aspects of alcohol in driver crashes and citations. *Journal of Safety Research*, 5(3), 130-148.
- Hurst, P. M., Harte, D., & Frith, W. J. (1994). The Grand Rapids dip revisited. *Accident Analysis & Prevention*, 26(5), 647-654.
- Jessor, R. (1982). *Some problematic aspects of research on drinking contexts*. In *Social Drinking Contexts* (Research Monograph No. 7 DHEW Publication No. (ADM) 82–1097). Washington, DC: NIAAA.
- Jewell, R. T., & Brown, R. W. (1995). Alcohol availability and alcohol-related motor vehicle accidents. *Applied Economics*, 27, 759-765.
- Johnson, L. D., O'Malley, P. M., & Bachman, J. G. (2003). *Monitoring the Future national survey results on drug use, 1975-2002. Volume 1: Secondary school students* (NIH Publication No. 03-5375). Bethesda, MD: National Institute on Drug Abuse.
- Jonah, B. A. (1986). Accident risk and risk-taking behavior among young drivers. *Accident Analysis and Prevention*, 18, 255-271.

- Jones-Webb, R., Toomey, T., Miner, K., Wagenaar, A. C., Wolfson, M., & Poon, R. (1997). Why and in what context adolescents obtain alcohol from adults: A pilot study. *Substance Use & Misuse, 32*(2), 219-228.
- Jones-Webb, R. J. (1995). Relationships between socioeconomic status and drinking problems among Black and White men. *Alcoholism: Clinical and Experimental Research, 19*, 623-627.
- Jung, J. (2000). Racial/ethnic minorities and alcohol and other drug use. In J. Jung (Ed.), *Psychology of alcohol and other drugs: Research perspective*. Thousand Oaks, CA: Sage Publications.
- Kaskutas, L., & Greenfield, T. K. (1992). First effects of warning labels on alcoholic beverage containers. *Drug Alcohol Dependence, 31*(1), 1-14.
- Kaskutas, L. A. (1995). Interpretations of risk: The use of scientific information in the development of the alcohol warning label policy. *International Journal of the Addictions, 30*(12), 1519-1548.
- Kaskutas, L. A., & Graves, K. (1994). Relationship between cumulative exposure to health messages and awareness and behavior-related drinking during pregnancy. *American Journal of Health Promotion, 9*(2), 115-124.
- Kaskutas, L. A., & Greenfield, T. K. (1997). Behavior change: The role of health consciousness in predicting attention to health warning messages. *American Journal of Health Promotion, 11*, 186-193.
- Kaskutas, L. A., Greenfield, T. K., Lee, M., & Cote, J. (1998). Reach and effects of health messages on drinking during pregnancy. *Journal of Health Education, 29*, 11-17.
- Kenkel, D. S. (1993). Do drunk drivers pay their way? A note on optimal penalties for drunk driving. *Journal of Health Economics, 36*(2), 877-913.
- Klepp, K. I., Schmid, L. A., & Mirray, D. M. (1996). Effects of the increased minimum drinking age law on drinking and driving behavior among adolescents. *Addiction Research, 4*(3), 237-244.
- Kloeden, C. N., & McLean, A. J. (1994). *Late night drink driving in Adelaide two years after the Introduction of the .05 limit*. Adelaide, Australia: NHMRC Road Accident Research Unit.
- Kraakman, R. (1998). Third-party liability. In P. Newman (Ed.), *The New Palgrave Dictionary of Economics and the Law* (Vol. 3, pp. 583-587). London: Macmillan Reference.
- Kraft, D. P. (1982). *Public drinking practices of college youths: Implications for prevention programs* (Research Monograph No. 7 DHEW No. (ADM) 82-1097). Washington, DC: NIAAA.
- Kuo, M., Weschler, H., Greenberg, P., & Lee, H. (2003). The marketing of alcohol to college students. The role of low prices and special promotions. *American Journal of Preventive Medicine, 25*(3), 1-8.
- Lacey, J. H., Jones, R. K., & Anderson, E. W. (2000, October). *Evaluation of a full-time ride service program: Aspen, Colorado's tippy taxi service* (Final Report, DOT HS 809 155). Washington, DC: National Highway Traffic Safety Administration.
- Laixuthai, A., & Chaloupka, F. J. (1993). Youth alcohol use and public policy. *Contemporary Policy Issues, 11*(4), 70-81.
- Lang, E., & Stockwell, T. (1991). Drinking locations of drink-drivers: A comparative analysis of accident and nonaccident cases. *Accident Analysis & Prevention, 23*(6), 573-584.
- Lang, E., Stockwell, T., Rydon, P., & Beel, A. (1996). Use of pseudo-patrons to assess compliance with laws regarding under-age drinking. *Australian and New Zealand Journal of Public Health, 20*(3), 1-4.
- Lang, E., Stockwell, T., Rydon, P., & Beel, A. (1998). Can training bar staff in responsible serving practices reduce alcohol-related harm? *Drug and Alcohol Review, 17*(1), 39-50.
- Lange, J. E., & Voas, R. B. (2000). Youth escaping limits on drinking: Binging in Mexico. *Addiction, 95*(4), 521-528.

- Lapham, S. C., Skipper, B. J., Chang, I., Barton, K., & Kennedy, R. (1998). Factors related to miles driven between drinking and arrest locations among convicted drunk drivers. *Accident Analysis and Prevention, 30*(2), 201-206.
- LasScala, E. A., Gerber, D., & Gruenewald, P. J. (2000). Demographic and environmental correlates of pedestrian injury collisions: A spatial analysis. *Accident Analysis and Prevention, 32*(5), 651-658.
- LaScala, E. A., Johnson, F. W., & Gruenewald, P. J. (2001). Neighborhood characteristics of alcohol-related pedestrian injury collisions: a geostatistical analysis. *Prevention Science, Jun*(2), 123-134.
- Latimer, J., Dowden, C., & Muise, D. (2001). *The effectiveness of restorative justice practices: a meta-analysis*. Ottawa: Research and Statistics Division, Department of Justice.
- Latimer, W. W., Harwood, E. M., Newcomb, M. D., & Wagenaar, A. C. (2003). Measuring public opinion: A factor analytic study of a US probability sample. *Addictive Behaviors, 28*, 301-313.
- Leifman, H. (2001). Homogenisation in alcohol consumption in the European Union. *Nordic Studies on Alcohol and Drugs, 18*(1), 15-30.
- Lemmens, P. H., Vaeth, P. A., & Greenfield, T. K. (1999). Coverage of beverage alcohol issues in the print media in the United States, 1985-1991. *American Journal of Public Health, 89*(10), 1555-1560.
- Lestina, D., & Lund, A. K. (1989). *Laboratory evaluation of two passive alcohol sensors* (Technical Report). Arlington, VA: Insurance Institute for Highway Safety.
- Levy, D., Shea, D., & Asch, P. (1989). Traffic safety effects of sobriety checkpoints and other local DWI programs in New Jersey. *American Journal of Public Health, 79*(3), 291-293.
- Levy, D. T., & Miller, T. R. (1995). A cost-benefit analysis of enforcement efforts to reduce serving intoxicated patrons. *Journal of Studies on Alcohol, 56*(2), 240-247.
- Levy, P., Voas, R. B., Johnson, P., & Klein, T. M. (1978). An evaluation of the Department of Transportation's alcohol safety action projects. *Journal of Safety Research, 10*(4), 162-176.
- Lewis, R. K., Paine-Andrews, A., Fawcett, S. B., Francisco, V. T., Richter, K. P., Copple, B., & Copple, J. E. (1996). Evaluating the effects of a community coalition's efforts to reduce illegal sales of alcohol and tobacco products to minors. *Journal of Community Health, 21*(6), 429-436.
- Ligon, J., & Thyer, B. A. (1993). The effects of a Sunday liquor sales ban on DUI arrests. *Journal of Alcohol and Drug Education, 38*(2), 33-40.
- Little, B., & Bishop, M. (1998). Minor drinkers/major consequences: Enforcement Strategies for underage alcoholic beverage violators. *Impaired Driving Update, II*(6), 88.
- Little, J. W. (1975). *Administration of justice in drunk driving cases*. Gainesville, FL: The University Presses of Florida.
- Liu, C., & Chen, C.-L. (2004, March). *Time series analysis and forecast of annual crash fatalities* (DOT HS 809 717). Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration, National Center for Statistics and Analysis.
- MacKinnon, D. P., Pentz, M. A., & Stacy, A. W. (1993). The alcohol warning label and adolescents: The first year. *American Journal of Public Health, 83*, 585-587.
- Makela, K., Room, R., Single, E., Sulkunen, P., & Walsh, B. (1981). *Alcohol, Society and the State: A Comparative Study of Alcohol Control*. Toronto: Addiction Research Foundation.
- Mann, R. E., Macdonald, S., Stoduto, G., Bondy, S., Jonah, B., & Shaikh, A. (2001). The effects of introducing or lowering legal per se blood alcohol limits for driving: an international review. *Accident Analysis and Prevention, 33*, 569-583.

- Manning, W. G., Blumberg, L., & Moulton, L. H. (1995). The demand for alcohol: The differential response to price. *Journal of Health Economics*, *14*(2), 123-148.
- Markin, J. J. J. (1974). *Consumer Behavior: A Cognitive Orientation*. New York, NY: MacMillan.
- Markowitz, S. (2000). The price of alcohol, wife abuse and husband abuse. *Southern Economic Journal*, *67*(2), 279-303.
- Markowitz, S., & Grossman, M. (1998). Alcohol Regulation and Domestic Violence towards Children. *Contemporary Economic Policy*, *16*(3), 309-320.
- Markowitz, S., & Grossman, M. (2000). The effects of beer taxes on physical child abuse. *Journal of Health Economics*, *19*(2), 271-282.
- Marques, P. R., & Voas, R. B. (1995). Case-managed alcohol interlock programs: A bridge between the criminal and health systems. *Journal of Traffic Medicine*, *23*(2), 77-85.
- Marques, P. R., & Voas, R. B. (1998). Using the alcohol safety interlock data logger to track the drinking of convicted drunk drivers, *Supplement to Alcoholism. Clinical and Experimental Research. 1998 Scientific Meeting of the Research Society on Alcoholism. June 20–25, 1998—Hilton Head Island, SC* (Vol. 22, pp. 41A): Williams & Wilkins.
- Marques, P. R., & Voas, R. B. (2005). Interlock BAC tests, alcohol biomarkers, and motivational interviewing: Methods for detecting and changing high-risk offenders. In P. R. Marques (Ed.), *Alcohol Ignition Interlock Devices—Volume II: Research, Policy, and Program Status 2005* (pp. 25-41). Oosterhout, The Netherlands: International Council on Alcohol, Drugs and Traffic Safety.
- Martin, S., & Andreasson, S. (1996). Zero tolerance laws: Effective public policy? In J. D. Beard (Ed.), *Alcoholism: Clinical and experimental research. Reports of the Joint Scientific Meeting of the Research Society on Alcoholism and the International Society for Biomedical Research on Alcoholism* (Vol. 20, pp. 147A-150A). Baltimore, MD: Williams & Wilkins.
- Martin, S., Grube, J. W., Voas, R. B., Baker, J., & Hingson, R. (1996). Zero tolerance laws: Effective public policy? *Alcoholism: Clinical and Experimental Research*, *20*(Nov. Suppl.), 147A-150A.
- Mast, B. D., Benson, B. L., & Rasmussen, D. W. (1999). Beer taxation and alcohol-related traffic fatalities. *Southern Economic Journal*, *66*(2), 214-249.
- May, P. A., & Smith, M. B. (1988). Some Navajo Indian opinions about alcohol abuse and prohibition: A survey and recommendations for policy. *Journal of Studies on Alcohol*, *49*(4), 324-334.
- Mayer, R. R., Forster, J. L., Murray, D. M., & Wagenaar, A. C. (1998). Social settings and situations of underage drinking. *Journal of Studies on Alcohol*, *59*(2), 207-215.
- Mayhew, D. R. (2000, November 26-28 2000). *Effectiveness of graduated driver licensing*. Paper presented at the Road Safety: Research, Policing and Education, Brisbane, Australia.
- Mayhew, D. R., Donelson, A. C., Beirness, D. J., & Simpson, H. M. (1986). Youth, alcohol and relative risk of crash involvement. *Accident Analysis and Prevention*, *18*, 273-287.
- McCarthy, J. D., & Harvey, D. S. (1989). Independent citizen advocacy: The past and the prospects, *Surgeon General's workshop on drunk driving: Background papers, December 14–16, 1988* (pp. 247-260). Washington, DC: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.
- McKinzie, D. L., Eha, R., Murphy, J. M., McBride, W. J., Lumeng, L., & Li, T. K. (1996). Effects of taste aversion training on the acquisition of alcohol drinking in adolescent P and HAD rat lines. *Alcohol Clinical Experimental Research*, *20*(4), 682-687.
- McKnight, A. J., & Streff, F. M. (1993). The effect of enforcement upon service of alcohol to intoxicated patrons of bars and restaurants. In H.-D. Utzelmann, G. Berghaus, & G. Kroj (Eds.), *Alcohol, drugs and traffic safety - T-92: Proceedings of the 12th international*

- conference on alcohol, drugs and traffic safety, Cologne, 28 September - 2 October 1992 (Vol. 3, pp. 1296-1302). Köln, Germany: Verlage TÜV Rheinland GmbH.
- McKnight, A. J., & Voas, R. B. (2001). Prevention of alcohol-related road crashes. In N. Heather, T. J. Peters, & T. Stockwell (Eds.), *International handbook of alcohol dependence and problems* (pp. 741-769). Chichester, UK: John Wiley and Sons Ltd.
- Medina-Mora, M. E., Borges, G., & Villatoro, J. (2000). The measurement of drinking patterns and consequences in Mexico. *Journal of Substance Abuse, 12*, 183-196.
- Meier, S. E., Brigham, T. A., & Gilbert, J. B. (1998). Analyzing methods for increasing designated driving. *Journal of Prevention & Intervention in the Community, 17*(1), 1-14.
- Mercer, G. (1985). The relationship among driving while impaired charges, police drinking-driving checkpoint activity, media coverage, and alcohol-related casualty traffic accidents. *Accident Analysis and Prevention, 17*(6), 467-474.
- Michigan State Police. (1989). *Surveillance of alcohol vending establishments: Michigan SAVE Program*. Lansing, MI: Michigan State Police.
- Miller, T. R., & Blincoe, L. (1994). Incidence and cost of alcohol-involved crashes in the United States. *Accident Analysis and Prevention, 26*(5), 583-592.
- Miller, T. R., Galbraith, M., & Lawrence, B. A. (1998a). Costs and benefits of a community sobriety checkpoint program. *Journal of Studies on Alcohol, 59*(4), 465-468.
- Miller, T. R., Lestina, D. C., & Spicer, R. S. (1998b). Highway crash costs in the United States by driver age, blood alcohol level, victim age, and restraint use. *Accident Analysis and Prevention, 30*(2), 137-150.
- Miller, T. R., Snowden, C. B., Birckmayer, J., & Hendrie, D. (2006). Retail alcohol monopolies, underage drinking, and youth impaired driving deaths. *Accident Analysis and Prevention, 38*(6), 1162-1167.
- Minnesota Department of Public Safety. (2002). *Minnesota motor vehicle crash facts, 2002: Alcohol – related crashes*. Saint Paul, Minnesota: Department of Public Safety, Office of Traffic Safety.
- Modzeleski, W., Small, M. L., & Kann, L. (1999). Alcohol and other drug prevention policies and education in the United States. *Journal of Health Education, 30*(Suppl. 5), S42-S49.
- Molof, M. J., Dresser, J., Ungerleider, S., Kimball, C., & Schaefer, J. (1995). *Assessment of year-around and holiday ride service programs* (DOT HS 808 203). Washington, DC: National Highway Traffic Safety Administration.
- Montonen, M. (1996). *Alcohol and the Media*. WHO regional publications, European series, No. 62. Copenhagen: World Health Organization, Regional Office for Europe.
- Mosher, J. (1979). Dram Shop Law and the prevention of alcohol-related problems. *Journal of Studies on Alcohol, 40*(9), 773-798.
- Mosher, J. F. (1984). The impact of legal provisions on barroom behavior: Toward an alcohol-problems prevention policy. *Alcohol: An International Biomedical Journal, 1*(3), 205-211.
- Mosher, J. F., Toomey, T. L., Good, C., Harwood, E., & Wagenaar, A. C. (2002). State laws mandating or promoting training programs for alcohol servers and establishment managers: An assessment of statutory and administrative procedures. *Journal of Public Health Policy, 23*(1), 90-113.
- Moskowitz, H., Burns, M. M., & Williams, A. F. (1985). Skills performance at low blood alcohol levels. *Journal of Studies on Alcohol, 46*(2), 482-485.
- Moskowitz, H., & Fiorentino, D. (2000, April). *A review of the literature on the effects of low doses of alcohol on driving-related skills* (DOT HS 809 028). Washington, DC: Department of Transportation, National Highway Traffic Safety Administration.
- Moskowitz, H., & Robinson, C. (1988). *Effects of low doses of alcohol on driving-related skills: A review of the evidence* (DOT HS 807 280). Washington, DC: National Highway Traffic Safety Administration.

- Mouden, J. V., & Russell, A. (1994). Is it MADD trying to rate the states? A citizen activist approach to DWI prevention. *Alcohol, Drugs and Driving*, 10, 317-326.
- Mounce, N., Pendleton, O., & Gonzales, O. (1988). *Alcohol involvement in Texas driver fatalities*: Texas A&M University.
- Mulford, H. A., Ledolter, J., & Fitzgerald, J. L. (1992). Alcohol availability and consumption: Iowa sales data revisited. *J. Stud. Alcohol*, 53, 487-494.
- Nagin, D. S. (1998). Criminal deterrence research at the outset of the twenty-first century. In M. Tonry (Ed.), *Crime and justice: A review of research* (Vol. 23). Chicago: The University of Chicago Press.
- Naimi, T. S., Brewer, R., Mokdad, A., Denny, C., Serdula, M., & Marks, J. (2003). Binge drinking among US adults. *The Journal of the American Medical Association*, 289, 70-75.
- National Committee for Injury Protection and Control. (1989). *Injury prevention: Meeting the challenge*. New York, NY: Oxford University Press.
- National Highway Traffic Safety Administration. (1995a). *Experimental evaluation of sobriety checkpoint program* (Publ. No. DOT HS 808 287). Washington, DC: National Highway Traffic Safety Administration, 400 7th Street, SW.
- National Highway Traffic Safety Administration. (1995b, August). *Traffic safety facts 1994: A compilation of motor vehicle crash data from the Fatal Accident Reporting System and the General Estimates System* (DOT HS 808 292). Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration, National Center for Statistics and Analysis.
- National Highway Traffic Safety Administration. (1996). *Traffic safety facts 1995: Alcohol* (DOT HS 95F1). Washington, DC: U.S. Department of Transportation.
- National Highway Traffic Safety Administration. (2000). *Traffic safety facts 1999: A compilation of motor vehicle crash data from the Fatality Analysis Reporting System and the General Estimates System* (DOT HS 809 086). Washington, DC: National Highway Traffic Safety Administration.
- National Highway Traffic Safety Administration. (2003). *Traffic safety facts 2002: Alcohol* (DOT HS 809 606). Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration.
- National Institute on Alcohol Abuse and Alcoholism. (2004). *NIAAA Newsletter*. National Institute on Alcohol Abuse and Alcoholism. Accessed January 25, 2006, from the World Wide Web:
http://pubs.niaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.htm
- NHTSA. (1998). *Traffic safety facts 1997: Alcohol* (DOT HS 808 667). Washington: Department of Transportation, National Center for Statistics and Analysis.
- NHTSA/NIAAA. (September, 1999). *Sentencing and dispositions of youth DUI and other alcohol offenses: a guide for Judges and Prosecutors* (DOT HS 808 891). Washington DC: Institute National Highway Traffic Safety Administration (DOT)/National Institute on Alcohol Abuse Alcoholism.
- NIAAA (Ed.). (1995). *The effects of mass media on the use and abuse of alcohol*: U.S. Department of Health and Human Services.
- Nordlund, S. (1984). "Effekten av lørdagsstengningen ved Vinmonopolets butikker" (Effects of Saturday Closing of the Wine/Liquor Monopoly Outlets). *Alkoholpolitik-Tidsskrift for Nordisk Alkoholforskning*, 1, 221-229.
- Nordlund, S. (1985, June 2-7). *Effects of Saturday closing of wine and spirits shops in Norway*. Paper presented at the 31st International Institute on the Prevention and Treatment of Alcoholism, National Institute for Alcohol Research, SIFA Mimeograph No. 5/85, Oslo, Rome, Italy.

- Norström, T. (1997). Assessment of the impact of the 0.02% BAC-limit in Sweden. *Studies on Crime and Crime Prevention*, 6, 245-258.
- Odo, J., McQuiller, L., & Stretsky, P. (1999). An empirical assessment of the impact of RIT's student alcohol policy on drinking and binge drinking behavior. *Journal of Alcohol and Drug Education*, 44, 49-67.
- O'Donnell, M. A. (1985). Research on drinking locations of alcohol-impaired drivers: Implications for prevention policies. *Journal of Public Health Policy*, 510-525.
- Office of Applied Studies. (2000). *National Household Survey on Drug Abuse: Main findings 1999*. Rockville, MD: Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services.
- Office of Juvenile Justice and Delinquency Prevention (OJJDP). (1999, July 11-14, 1999). *Regulatory strategies for preventing youth access to alcohol: Best practices*. Paper presented at the OJJDP National Leadership Conference, Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice, Washington, DC.
- Ogborne, A. C., & Smart, R. G. (1980). Will restrictions on alcohol advertising reduce alcohol consumption? *British Journal of Addiction*, 75(3), 293-296.
- O'Hare, T. (1998). Alcohol expectancies and excessive drinking contexts in young adults. *Social Work Research*, 22(1), 44-50.
- O'Malley, P. M., & Wagenaar, A. C. (1991). Effects of minimum drinking age laws on alcohol use, related behaviors and traffic crash involvement among American youth: 1976–1987. *Journal of Studies on Alcohol*, 52(5), 478-491.
- Osterberg, E. (1991). Current approaches to limit alcohol abuse and the negative consequences of use: A comparative overview of available options and an assessment of proven effectiveness. In O. Aasland (Ed.), *The Negative Social Consequences of Alcohol Use* (pp. 266-269). Oslo: Norwegian Ministry of Health and Social Affairs.
- Österberg E., & Säilä S-L (Eds.). (1991). *Natural experiments with decreased availability of alcoholic beverages. Finnish alcohol strikes in 1972 and 1985*. (Vol. 40). Helsinki: The Finnish Foundation for Alcohol Studies.
- Ostrom, M., & Eriksson, A. (1993). Single-vehicle crashes and alcohol: A retrospective study of passenger car fatalities in northern Sweden. *Accident Analysis and Prevention*, 25, 171-176.
- Pacula, R. L. (1998). Does increasing the beer tax reduce marijuana consumption? *Journal of Health Economics*, 17, 557-585.
- Paglia, A., & Room, R. (1998). Alcohol and aggression: General population views about causation and responsibility. *Journal of Substance Abuse*, 10(2), 199-216.
- Parker, R. N., & Rebhun, L. (1995). *Alcohol and homicide: A deadly combination of two American traditions*. Albany, NY: State University of New York Press.
- Partanen, J., & Montonen, M. (1988). Alcohol and the mass media. *EURO Reports and Studies*, 108, 1-73.
- Peck, R. C., Sadler, D. D., & Perrine, M. W. (1985). The comparative effectiveness of alcohol rehabilitation and licensing control actions for drunk driving offenders: A review of the literature. *Alcohol, Drugs and Driving: Abstracts and Reviews*, 1(4), 15-40.
- Pendleton, L. L., Smith, C., & Roberts, J. L. (1990). Public opinion on alcohol policies. *British Journal of the Addictions*, 85(1), 125-130.
- Polacek, M., Rogers, E. M., Woodall, W. G., Delaney, H., Wheeler, D., & Nagesh, R. (2001). MADD victim impact panels and stages-of-change in drunk-driving prevention. *Journal of Studies on Alcohol*, 344-350.
- Police Executive Research Forum. *The Tulsa Police Department: A Case History*. Washington, DC: PERF.

- Postman, N., Nystrom, C., Strate, L., & Weingartner, C. (1988). *Myths, men, and beer: An analysis of beer commercials on broadcast television, 1987*. Washington, DC: AAA Foundation for Traffic Safety.
- Preusser, D. F., & Williams, A. F. (1992). Sales of alcohol to underage purchasers in three New York counties and Washington, DC. *Journal of Public Health Policy, 13*(3), 306-317.
- Preusser, D. F., Williams, A. F., & Weinstein, H. B. (1994). Policing underage alcohol sales. *Journal of Safety Research, 25*, 127-133.
- Preusser, D. F., Williams, A. F., Zador, P. L., & Blomberg, R. D. (1984). The effect of curfew laws on motor vehicle crashes. *Law and Policy, 6*, 115-128.
- Radecki, T. E., & Strohl, J. (1991). Survey of underage youth and alcohol purchase habits in 17 Midwest and Eastern states. *Drug Free Youth News, 1*-8
- Razvodovsky, Y. (2001). Cross-cultural aspects of drug use and misuse. *Journal of Addictive Diseases, 20*(2), 172.
- Richman, A. (1985). Human risk factors in alcohol-related crashes. *Journal of Studies on Alcohol, Supplement No. 10*, 21-31.
- Rider, R., Kelley-Baker, T., Voas, R., Murphy, B., McKnight, A. J., & Levings, C. (2006). The impact of a novel educational curriculum for first-time DUI offenders on intermediate outcomes relevant to DUI recidivism. *Accident Analysis and Prevention, 38*(3), 482-489.
- Ross, H., & Gonzales, P. (1988). The effect of license revocation on drunk-driving offenders. *Accident Analysis and Prevention, 20*(5), 379-391.
- Ross, H. L. (1973). Law, science and accidents: The British Road Safety Act of 1967. *The Journal of Legal Studies, 2*, 1-78.
- Ross, H. L. (1977). Deterrence regained: The Cheshire constabulary's breathalyzer blitz. *The Journal of Legal Studies, 6*, 241-249.
- Ross, H. L. (1982). *Deterring the drinking driver: Legal policy and social control*. Lexington, MA: Lexington Books.
- Ross, H. L. (1984). *Deterring the drinking driver: Legal policy and social control*. (2nd ed.). Lexington, MA: Lexington Books.
- Ross, H. L. (1992). *Confronting drunk driving: Social policy for saving lives*. New Haven, CT: Yale University Press.
- Ross, H. L., McCleary, R., & Epperlein, T. (1981). Deterrence of drinking and driving in France: an evaluation of the law of July 12, 1978. *Law Soc Rev, 16*, 345-374.
- Ross, H. L., & Voas, R. B. (1989). *The new Philadelphia story: The effects of severe penalties for drunk driving*. Washington, DC: AAA Foundation for Traffic Safety.
- Rush, B. R., Gliksman, L., & Brook, R. (1986). Alcohol availability, alcohol consumption and alcohol-related damage. The Distribution of Consumption model. *Journal of Studies on Alcohol, 47*, 1-10.
- Rydon, P., & Stockwell, T. (1997). *Alcohol: Minimising the Harm. What Works?* Local regulation and enforcement strategies for licensed premises. (M. Plant, E. Single, & T. Stockwell (Eds.)). New York: Free Association Books Ltd.
- Saffer, H. (1991). Alcohol advertising bans and alcohol abuse: An international perspective. *Journal of Legal Studies, 16*, 351-374.
- Saffer, H. (1993a). Advertising under the influence. In M. E. Hilton & G. Bloss (Eds.), *Economics and the prevention of alcohol-related problems*.
- Saffer, H. (1993b). Alcohol advertising bans and alcohol abuses: Reply. *Journal of Health Economics, 12*(2), 229-234.
- Saffer, H. (1995). Alcohol advertising and alcohol consumption: Econometric studies. In S. E. Martin & P. Mail (Eds.), *Effects of mass media on use and abuse of alcohol: NIAAA Monograph*.

- Saffer, H. (1998). Economic issues in cigarette and alcohol advertising. *Journal of Drug Issues*, 28(3), 781-793.
- Saffer, H. (2001). Substance abuse control and crime: Evidence from the National Survey of Drug Abuse. In M. Grossman & C. R. Hsieh (Eds.), *Economic analysis of substance use and abuse: The experience of developed countries and lessons for developing countries* (pp. 291-307). Cheltenham, United Kingdom: Edward Elgar.
- Saffer, H., & Chaloupka, F. (1989). Breath testing and highway fatality rates. *Applied Economics*, 21(7), 901-912.
- Saffer, H., & Grossman, M. (1987a). Beer taxes, the legal drinking age, and youth motor vehicle fatalities. *Journal of Legal Studies*, XVI, 351-374.
- Saffer, H., & Grossman, M. (1987b). Drinking age laws and highway mortality rates: Cause and effect. *Economic Inquiry*, 25, 403-417.
- Saltz, R. F. (1985). Server Intervention: Conceptual Overview and Current Developments. *Alcohol, Drugs, and Driving: Abstracts and Reviews*, 1(4), 1-14.
- Saltz, R. F. (1987a). The roles of bars and restaurants in preventing alcohol-impaired driving: An evaluation of server education. *Evaluation in Health Professions*, 10(1), 5-27.
- Saltz, R. F. (1987b). The roles of bars and restaurants in preventing alcohol-impaired driving: An evaluation of server intervention. *Evaluation and the Health Professions*, 10(1), 5-27.
- Saltz, R. F. (1988). Server intervention and responsible beverage service programs, *Surgeon General's workshop on drunk driving-Background papers* (pp. 169-179). Rockville, MD: U.S. Department of Health and Human Services, Office of the Surgeon General.
- Saltz, R. F. (1989). Research needs and opportunities in server intervention programs. *Health Education Quarterly*, 16(3), 429-438.
- Saltz, R. F., & Hennessy, M. (1990, August). *Reducing intoxication in commercial establishments: An evaluation of responsible beverage service practices*. Berkeley, CA: Prevention Research Center.
- Saltz, R. F., & Hennessy, M. (under review). *The efficacy of "responsible beverage service" programs in reducing intoxication*. Berkeley, CA: Prevention Research Center.
- Saltz, R. F., & Stanghetta, P. (1997). A community-wide responsible beverage service program in three communities: Early findings. *Addiction*, 92(Supplement 2), S237-S249.
- Schwartz, R. H., Farrow, J. A., Banks, B., & Giesel, A. E. (1998). Use of false ID cards and other deceptive methods to purchase alcoholic beverages during high school. *Journal of Addictive Diseases*, 17, 25-34.
- Schwartz, R. H., & Little, D. L. (1997). Let's party tonight: Drinking patterns and breath alcohol values at high school parties. *Family Medicine*, 29(5), 326-331.
- Scribner, R. A., MacKinnon, D. P., & Dwyer, J. H. (1995). The risk of assaultive violence and alcohol availability in Los Angeles County. *American Journal of Public Health*, 85(3), 335-340.
- Sherman, L. W. (1990). *Police crackdowns: Initial and residual deterrence*. *Crime and Justice: An Annual Review of Research*. Chicago: University of Chicago Press.
- Shinar, D., & Compton, R. (1995). Victim impact panels: Their impact on DWI recidivism. *Alcohol, Drugs and Driving*, 11(1), 73-87.
- Shults, R. A., Elder, R. W., Sleet, D. A., Nichols, J. L., Alao, M. O., Carande-Kulis, V. G., Zaza, S., Sosin, D. M., Thompson, R. S., & Task Force on Community Preventive Services. (2001). Reviews of evidence regarding interventions to reduce alcohol-impaired driving. *American Journal of Preventive Medicine*, 21(4 Suppl), 66-88.
- Simons-Morton, B. G., & Cummings, S. S. (1997). Evaluation of a local designated driver and responsible server program to prevent drinking and driving. *Journal of Drug Education*, 27(4), 321-333.

- Simpson, C. L., Beirness, D., Mayhew, D., & Donelson, A. (1985). *Alcohol specific controls: Implications for road safety*. Ottawa, ON: Traffic Injury Research Foundation of Canada.
- Siskind, V. (1996). Does licence disqualification reduce re-offence rates? *Accident Analysis and Prevention, 28*(4), 519-524.
- Skog, O. J. (1980). Social interaction and the distribution of alcohol consumption. *Journal of Drug Issues, 10*, 71-92.
- Skog, O. J. (1985). The collectivity of drinking cultures: A theory of the distribution of alcohol consumption. *British Journal of Addiction, 80*, 83-99.
- Skog, O. J. (1986). An analysis of divergent trends in alcohol consumption and economic development. *Journal of Studies on Alcohol, 47*, 19-25.
- Sloan, F. A., Reilly, B. A., & Schenzler, C. (1994). Effects of prices, civil, and criminal sanctions, and law enforcement on alcohol-related mortality. *Journal of Studies on Alcohol, 55*, 545-465.
- Sloan, F. A., Stout, E. M., Whetten-Goldstein, K., & Liang, L. (2000). *Drinkers, drivers, and bartenders: Balancing private choices and public accountability*. Chicago: University of Chicago Press.
- Smart, R. G., Adlaf, E. M., & Walsh, G. W. (1996). Procurement of alcohol and underage drinking among adolescents in Ontario. *Journal of Studies on Alcohol, 57*(4), 419-424.
- Smart, R. G., & Cutler, R. E. (1976). The alcohol advertising ban in British Columbia: Problems and effects of beverage consumption. *British Journal of Addiction, 71*(1), 13-21.
- Smith, D. I. (1988a). Effect on traffic accidents of introducing Sunday alcohol sales in Brisbane, Australia. *International Journal of the Addictions, 23*, 1091-1099.
- Smith, D. I. (1988b). Effect on traffic accidents of introducing Sunday alcohol sales in Brisbane, Australia. *International Journal of the Addictions, 23*(10), 1091-1099.
- Snyder, L. B., & Blood, D. J. (1992). The Surgeon General's alcohol warnings and alcohol advertising may have adverse effects on young adults. *Journal of Applied Communication Research, 20*(1), 37-53.
- Sobell, M. B., Sobell, L. C., Klajner, F., Pavan, D., & Basian, E. (1986). The reliability of a timeline method for assessing normal drinker college students' recent drinking history: Utility for alcohol research. *Addictive Behaviors, 11*, 149-162.
- Socie, E. M., Wagner, S. A., & Hopkins, R. S. (1997). The relative effectiveness of sanctions applied to first-time drunken driving offenders. *American Journal of Preventive Medicine, 10*(2), 85-90.
- Starmer, G. A. (1989). *Human Metabolism of Alcohol: Vol. I. Pharmacokinetics, Medicolegal Aspects, and General Interests*. Effects of low to moderate doses of ethanol on human driving-related performance. (K. E. Crow & R. D. Batt (Eds.)). Boca Raton: CRC Press.
- Stewart, K. (1999). *Strategies to Reduce Underage Alcohol Use: Typology and Brief Overview*. Washington, DC: Office of Juvenile Justice and Delinquency Prevention.
- Stewart, K., & Klitzner, M. (1990). Youth anti-drinking-driving programs. In R. J. Wilson & R. E. Mann (Eds.), *Drinking and driving: Advances in research and prevention* (pp. 226-249). New York: The Guilford Press.
- Stewart, K. G. (1997). Environmentally oriented alcohol prevention policies for young adults, *Secretary's Youth Substance Abuse Prevention Initiative: Resource papers. Pre-publication documents* (pp. 107-157). Rockville, MD: Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Prevention.
- Stockwell, T., Lang, E., & Rydon, P. (1993). High risk drinking settings: The association of serving and promotional practices with harmful drinking. *Addiction, 88*(11), 1519-1526.
- Stout, E. M., Sloan, F. A., Liang, L., & Davies, H. H. (2000). Reducing harmful alcohol-related behaviors: Effective regulatory methods. *Journal of Studies on Alcohol, 61*(3), 402-412.

- Stuster, J. W., & Blowers, M. A. (1995). *Experimental evaluation of sobriety checkpoint programs* (Final Report DOT HS 808 287). Washington, DC: National Highway Safety Administration.
- Swahn, M. H., Hamming, B. J., & Ikeda, R. M. (2002). Prevalence of youth access to alcohol or a gun in the home. *Injury Prevention, 8*(3), 227-230.
- Tashima, H. N., & Marlich, W. K. (1989). *A comparison of the relative effectiveness of alternative sanctions for DUI offenders, Vol. 1 of development of a DUI accident and recidivism tracking system*. Sacramento, CA: Department of Motor Vehicles.
- Thombs, D. L., Beck, K., & Pleace, K. (1993). The relationship of social context and expectancy factors to alcohol use intensity among 18-22 year olds. *Addiction Research, 1*(1), 59-68.
- Toomey, T., Wagenaar, A. C., Erickson, D. J., Fletcher, L. A., Patrek, W., & Lenk, K. M. (2004). Illegal alcohol sales to obviously intoxicated patrons at licensed establishments. *Alcohol Clinical Experimental Research, 28*(5), 769-774.
- Toomey, T. L., Wagenaar, A. C., Kilian, G., Fitch, O., Rothstein, C., & Fletcher, L. (1999). Alcohol sales to pseudo-intoxicated bar patrons. *Public Health Reports, 114*(4), 337-342.
- Torronen, J. (2003). The Finnish press's political position on alcohol between 1993 and 2000. *Addiction, 98*, 281-290.
- Treno, A. J., Breed, L., Holder, H. D., Roeper, P., Thomas, B. A., & Gruenewald, P. J. (1996). Evaluation of media advocacy efforts within a community trial to reduce alcohol-involved injury: Preliminary newspaper results. *Evaluation Review, 20*, 404-423.
- U.S. General Accounting Office (GAO). (1987, March). *Drinking-age-laws: An evaluation synthesis of their impact on highway safety* (GAO/PEMD-87-10). Washington, DC: USGAO/U.S. Superintendent of Documents.
- Ulmer, R. G., Ferguson, S. A., Williams, A. F., & Preusser, D. F. (2000). *Teenage crash reduction associated with delayed licensure in Connecticut*. Arlington, VA: Insurance Institute for Highway Safety.
- Van Iwaarden, M. J. (1985). Public health aspects of the marketing of alcoholic drinks. In M. Grant (Ed.), *Alcohol Policies* (pp. 45-55). Copenhagen: World Health Organization.
- Vingilis, E., & Salutin, L. (1980). A prevention programme for drinking driving. *Accident Analysis and Prevention, 12*, 267-274.
- Voas, R. B. (1997). Drinking and driving prevention in the community: Program planning and implementation. *Addiction, 92*(Supplement 2), S201-S219.
- Voas, R. B., & Hause, J. M. (1987). Detering the drinking driver: The Stockton experience. *Accident Analysis and Prevention, 19*(2), 81-90.
- Voas, R. B., Holder, H. D., & Gruenewald, P. J. (1997). The effect of drinking and driving interventions on alcohol-involved traffic crashes within a comprehensive community trial. *Addiction, 92*(Supplement 2), S221-S236.
- Voas, R. B., & Lacey, J. H. (1990). Drunk driving enforcement, adjudication, and sanctions in the United States. In R. J. Wilson & R. E. Mann (Eds.), *Drinking and driving: Advances in research and prevention* (pp. 116-158). New York: The Guilford Press.
- Voas, R. B., Lange, J. E., & Johnson, M. B. (2002). Reducing high-risk drinking south of the border by young Americans: The impact of a partial ban on sales of alcohol. *Journal of Studies on Alcohol, 63*(3), 286-292.
- Voas, R. B., Rhodenizer, A. E., & Lynn, C. (1985). *Evaluation of Charlottesville checkpoint operations* (Final Report DOT HS 806 989). Washington, DC (Available in hard copy format only from the National Technical Information Service, Springfield, VA): National Highway Traffic Safety Administration.
- Voas, R. B., Tippetts, A. S., & Fell, J. C. (1999). The United States limits drinking by youth under age 21: Does this reduce fatal crash involvements?, *43rd Annual Proceedings of the Association for the Advancement of Automotive Medicine, September 20-21, 1999*,

- Barcelona (Sitges), Spain* (pp. 265-278). Des Plaines, IL: Association for the Advancement of Automotive Medicine.
- Voas, R. B., Tippetts, A. S., Johnson, M. B., Lange, J. E., & Baker, J. (2002). Operation Safe Crossing: Using science within a community intervention. *Addiction*, *97*(9), 1205-1214.
- Vogel-Sprott, M. (1992). *Alcohol Tolerance and Social Drinking: Learning the Consequences*. New York: Guilford Press.
- Wagenaar, A., & Wolfson, M. (1994). Enforcement of the legal minimum drinking age. *Journal of Public Health Policy*, *15*, 37-53.
- Wagenaar, A. C. (1981). Effects of an increase in the legal minimum drinking age. *Journal of Health Policy*, *2*, 206-225.
- Wagenaar, A. C. (1982). Preventing highway crashes by raising the legal minimum age for drinking: An empirical confirmation. *Journal of Safety Research*, *13*, 57-71.
- Wagenaar, A. C. (1986a). The legal minimum drinking age in Texas: Effects of an increase from 18 to 19. *Journal of Safety Research*, *17*, 165-178.
- Wagenaar, A. C. (1986b). Preventing highway crashes by raising the legal minimum age for drinking: the Michigan experience 6 years later. *Journal of Safety Research*, *17*(3), 101-109.
- Wagenaar, A. C., Finnegan, J. R., Wolfson, M., Anstine, P. S., Williams, C. L., & Perry, C. L. (1993). Where and how adolescents obtain alcoholic beverages. *Public Health Reports*, *108*(4), 459-464.
- Wagenaar, A. C., & Holder, H. D. (1991). Effects of alcoholic beverage server liability on traffic crash injuries. *Alcoholism: Clinical and Experimental Research*, *15*(6), 942-947.
- Wagenaar, A. C., & Holder, H. D. (1995). Changes in alcohol consumption resulting from the elimination of retail wine monopolies: Results from five U.S. states. *Journal of Studies on Alcohol*, *56*(5), 566-572.
- Wagenaar, A. C., & Holder, H. D. (1996). The scientific process works: Seven replications now show significant wine sales increases after privatization. *Journal of Studies on Alcohol*, *57*, 575-576.
- Wagenaar, A. C., Murray, D. M., & Gehan, J. P. (2000). Communities mobilizing for change on alcohol (CMCA): Effects of a randomized trial on arrest and traffic crashes. *Addiction*, *95*, 209-217.
- Wagenaar, A. C., O'Malley, P. M., & LaFond, C. (2001). Lowered legal blood alcohol limits for young drivers: Effects on drinking, driving, and driving-after-drinking behaviors in 30 states. *American Journal of Public Health*, *91*(5), 801-804.
- Wagenaar, A. C., O'Malley, P.M., and LaFond, C. (in press). Very low legal BAC limits for young drivers: Effects on drinking, driving, and driving-after-drinking behaviors in 30 states. *American Journal of Public Health*.
- Wagenaar, A. C., & Toomey, T. L. (2002). Effects of minimum drinking age laws: Review and analyses of the literature from 1960 to 2000. *Journal of Studies on Alcohol Supplement*, *14*, 206-225.
- Wagenaar, A. C., Toomey, T. L., Murray, D. L., Short, B. J., Wolfson, M., & Jones-Webb, R. (1996). Sources of alcohol for underage drinkers. *Journal of Studies on Alcohol*, *57*(3), 325-333.
- Wagenaar, A. C., & Wolfson, M. (1995). Deterring sales and provision of alcohol to minors: A study of enforcement in 295 countries in four states. *Public Health Reports*, *110*(4), 419-427.
- Wallack, L. (1990). Two approaches to health promotion in the mass media. *World Health Forum*, *11*, 143.
- Wallack, L., & DeJong, W. (1995). Mass media and public health: Moving the focus from the individual to the environment. In S. E. Martin & C. P. Mail (Eds.), *The effects of the mass media on the use and abuse of alcohol* (pp. 253-268a). Bethesda, MD: U.S. Department

- of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Alcohol Abuse and Alcoholism.
- Wallack, L., Dorfman, L., Jernigan, D., & Themba, M. (1993). *Media advocacy and public health: Power for prevention*. Newbury Park, CA: Sage Publications.
- Wallack, L., Grube, J. W., Madden, P. A., & Breed, W. (1990). Portrayals of alcohol on prime-time television. *Journal of Studies on Alcohol*, *51*, 428-437.
- Wallin, Norstrom, & Andreasson. (2003). Alcohol prevention targeting licensed premises: a study of effects on violence. *J Stud Alcohol.*, *64*(2), 270-277.
- Warner, L. A., Canino, G., & Colon, H. M. (2001). Prevalence and correlates of substance use disorders among older adolescents in Puerto Rico and the United States: A cross-cultural comparison. *Drug and Alcohol Dependence*, *63*, 239-243.
- Watts, R. K., & Rabow, J. (1983). Alcohol availability and alcohol related problems in 213 California cities. *Alcoholism: Clinical and Experimental Research*, *7*(1), 47-58.
- Wechsler, H., Kuo, M., Lee, H., & Dowdall, G. W. (2000). Environmental correlates of underage alcohol use and related problems of college students. *American Journal of Preventive Medicine*, *19*(1), 24-29.
- Wells-Parker, E. (2000). *Assessment and screening of impaired driving offenders: An analysis of underlying hypotheses as a guide for development of validation strategies*. Paper presented at the Proceedings of the 15th International Conference on Alcohol, Drugs and Traffic Safety, Stockholm, Sweden.
- Wells-Parker, E., Bangert-Drowns, R., McMillen, R., & Williams, M. (1995). Final results from a meta-analysis of remedial interventions with drink/drive offenders. *Addiction*, *90*(7), 907-926.
- West, R., Wilding, J., French, D., Kemp, R., & Irving, A. (1993). Effect of low and moderate doses of alcohol on driving hazard perception latency and driving speed. *Addiction*, *88*, 527-532.
- Wheeler, D. R., Rogers, E. M., Tonigan, J. S., & Woodall, W. G. (2004). Effectiveness of customized Victim Impact Panels on first-time DWI offender inmates. *Accident Analysis and Prevention*, *36*(1), 29-35.
- Whetten-Goldstein, K., Sloan, F. A., Stout, E. M., & Liang, L. (2000). Civil liability, criminal law, and other policies and alcohol-related motor vehicle fatalities in the United States, 1984-1995. *Accident Analysis and Prevention*, *32*(6), 723-733.
- Williams, A. F., Karpf, R. S., & Zador, P. L. (1983). Variations in minimum licensing age and fatal motor vehicle crashes. *American Journal of Public Health*, *73*(12), 1401-1403.
- Williams, A. F. (1985). Young driver accidents: In search of solutions. In D. R. Mayhew, H. M. Simpson, & A. C. Donalson (Eds.), *Laws and regulations applicable to teenagers or new drivers: Their potential for reducing motor vehicle injuries*. (pp. 43-62). Ottawa: The Traffic Injury Research Foundation.
- Williams, A. F., Ferguson, S. A., & Cammisa, M. X. (2000). *Self-reported drinking and driving practices and attitudes in four countries and perceptions of enforcement*. Arlington, VA: Insurance Institute for Highway Safety.
- Williams, T. P., & Lillis, R. P. (1986). Changes in alcohol consumption by 18-year-olds following an increase in New York State's purchase age to 19. *Journal of Studies on Alcohol*, *47*, 290-296.
- Wilsnack, S. C., Wilsnack, R. W., & Klassen, A. D. (1984). *Epidemiological research on women's drinking, 1978-1984, in Women and Alcohol: Health-Related Issues, Research Monograph No. 16* (DHHS Publication No. (ADM) 86-1139). Washington, DC: National Institute on Alcohol Abuse and Alcoholism.
- Wittman, F. (1997). Local control to prevent problems of alcohol availability: Experience in California communities. In M. Plan, E. Single, & T. Stockwell (Eds.), *Alcohol: Minimising the harm: What works?* London and New York: Free Association Books.

- Wolfson, M., Toomey, T. L., Forster, J. L., Wagenaar, A. C., McGovern, P. G., & Perry, C. L. (1996a). Characteristics, policies and practices of alcohol outlets and sales to underage persons. *Journal of Studies on Alcohol*, 57(6), 670-674.
- Wolfson, M., Toomey, T. L., Murray, D. M., Forster, J. L., Short, B. J., & Wagenaar, A. C. (1996b). Alcohol outlet policies and practices concerning sales to underage people. *Addiction*, 91(4), 589-602.
- Worden, J. K., Waller, J. A., & Riley, T. J. (1975). *The Vermont public education campaign in alcohol and traffic safety*. Montpelier, VT: Department of Mental Health.
- Yang, M. J. (2002). The Chinese drinking problem: A review of the literature and its implication in a cross-cultural study. *Kaohsiung Journal of Medical Services*, 18(11), 543-550.
- Yu, J., Varone, R., & Shacket, R. W. (1997). *Fifteen-year review of drinking age laws: Preliminary findings of the 1996 New York State Youth Alcohol Survey*. New York: Office of Alcoholism and Substance Abuse.
- Zador, P. (1989). *Alcohol-related risk of fatal driver injuries in relation to driver age and sex*. Washington: Insurance Institute for Highway Safety.
- Zador, P. L. (1991). Alcohol-related relative risk of fatal driver injuries in relation to driver age and sex. *Journal of Studies on Alcohol*, 52(4), 302-310.
- Zobeck, T. S., & Williams, G. D. (1994). *Evaluation synthesis of the impacts of DWI laws and enforcement methods: Final Report* (Contract No. ADM-281-89-0002). Rockville, MD: Office of Policy Analysis, National Institute on Alcohol Abuse and Alcoholism (NIAAA).
- Zwerling, C., & Jones, M. P. (1999). Evaluation of the effectiveness of low blood alcohol concentration laws for younger drivers, *American Journal of Preventive Medicine* (Vol. 16, pp. 76-80).