

Impaired Driving Research Needs and Priorities

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INTRODUCTION

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

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

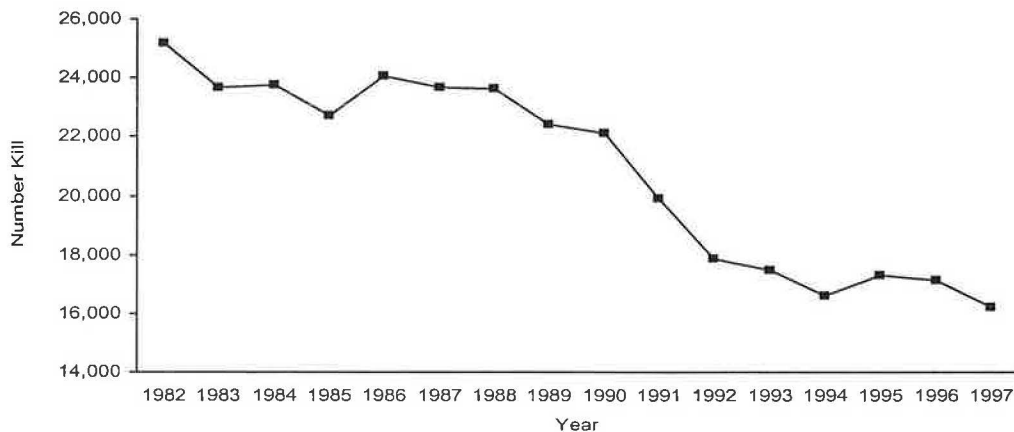


FIGURE 1 Alcohol-related fatalities, 1982-97.

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

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

Prevention Paradox

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

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

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

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

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

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

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

TABLE 1 Relative Risk of Crash Involvement by BAC

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

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

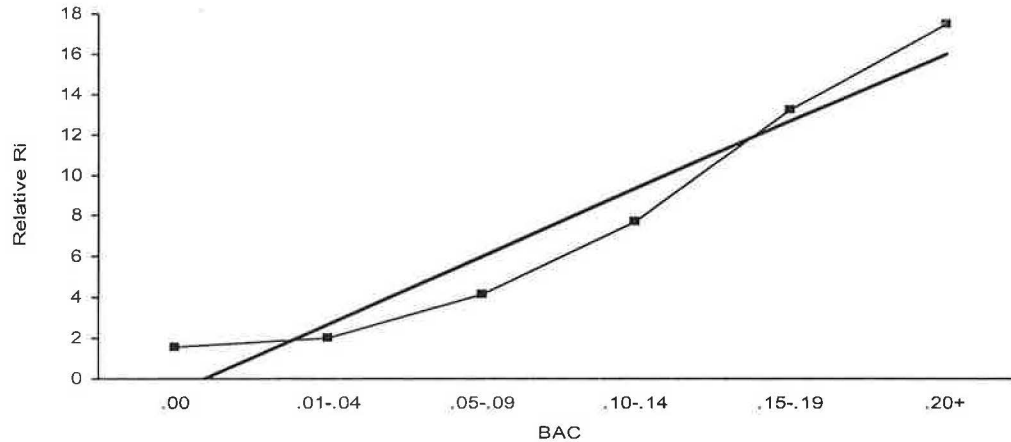


FIGURE 2 Risk by BAC with linear trend line.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

What Are the Trends in Impaired Driving by Females?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Alternative Approaches for the Prevention of Low BAC Driving

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

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

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

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

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

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

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

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

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

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

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

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

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

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