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Association Between Alcohol-Impaired Driving Enforcement-Related Strategies and Alcohol-Impaired Driving

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Abstract

All states in the U.S. prohibit alcohol-impaired driving but active law enforcement is necessary for effectively reducing this behavior. Sobriety checkpoints, saturation patrols, open container laws, and media campaigns related to enforcement efforts are all enforcement-related strategies for reducing alcohol-impaired driving. We conducted surveys of all state patrol agencies and a representative sample of local law enforcement agencies to assess their use of alcohol-impaired driving enforcement-related strategies and to determine the relationship between these enforcement-related strategies and self-reported alcohol-impaired driving behavior obtained from the Behavioral Risk Factor Surveillance System. We found that sobriety checkpoints, saturation patrols, and enforcement of open container laws were associated with a lower prevalence of alcohol-impaired driving but, more importantly, a combination of enforcement-related strategies was associated with a greater decrease in alcohol-impaired driving than any individual enforcement-related activity. In addition, alcohol-impaired driving enforcement-related strategies were associated with decreased alcohol-impaired driving above and beyond their association with decreased binge drinking. Results suggest law enforcement agencies should give greater priority to using a combination of strategies rather than relying on any one individual enforcement activity.

Keywords

alcohol-impaired driving; enforcement; sobriety checkpoints; saturation patrols; open container laws; latent class analysis

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1. Introduction

Despite more than 100 years of concerted efforts to decrease alcohol-impaired driving since the first impaired driving law was enacted in 1910, alcohol-impaired driving persists as a public health problem and contributes to many preventable deaths (Fell & Voas, 2006). In a nationwide 2010 telephone survey, 1.8% of respondents, or four million adults, reported engaging in alcohol-impaired driving at least once in the past 30 days (CDC, 2011-b). Alcohol-related motor vehicle crashes resulted in 10,322 deaths in the United States in 2012, accounting for 31% of the total motor vehicle traffic deaths (NHTSA, 2013). On average, approximately one fatality occurred in an alcohol-related crash every 51 minutes in 2012 (NHTSA, 2013).

Blood alcohol concentration (BAC) limits and open container restrictions are two laws that aim to reduce alcohol-impaired driving. As of August 1, 2005, all 50 states in the U.S. have a legal BAC limit of 0.08% for drivers age 21 or older (NIAAA, 2013a). Based on strong evidence of their effectiveness in reducing alcohol-related motor vehicle crash fatalities, the Community Preventive Services Task Force recommends 0.08% BAC laws (Shults et al, 2001). Many states have adopted laws that prohibit open containers of alcohol, including beer, wine, and distilled spirits, in the passenger compartments of non-commercial motor vehicles (NIAAA, 2013b). These open container laws are designed to reduce impaired driving by limiting access to alcoholic beverages inside a motor vehicle (NIAAA, 2013b). State laws vary in terms of restrictions for passengers, the alcoholic beverages to which the law applies, and whether or not the law applies only if the vehicle is in motion (NIAAA, 2013b). Effects of open container laws have not been well studied.

Laws need to be actively enforced to be maximally effective (Babor et al, 2010, NRC & IOM, 2003; Ross, 1984). Deterrence theory proposes that the perceived certainty, severity, and celerity (or swiftness) of punishment for law violations determine the efficacy of the threat of the punishment (Ross, 1981, 1992). Penalties that are severe, certain, and administered swiftly will generally deter risky behavior the most effectively (Babor et al, 2010). In terms of alcohol-impaired driving, the greater the perceived likelihood of being caught engaging in alcohol-impaired driving, prosecuted, convicted, and punished, the more severe the perceived eventual punishment, and the quicker the punishment is delivered, the greater will be the effect of the threat of punishment for engaging in alcohol-impaired driving (Ross, 1981).

Two primary types of enforcement strategies have been used to enforce alcohol-impaired driving laws: sobriety checkpoints and saturation patrols. The first of these strategies, sobriety checkpoints, involve law enforcement officials systematically evaluating all or randomly selected drivers for alcohol impairment at selected points on the roadway (NHTSA, 2002). Law enforcement agents using checkpoints may remove some alcohol-impaired drivers from the road but the primary goal is to reduce driving after drinking by increasing the perceived risk of arrest. Publicizing the use of checkpoints, visibility of the checkpoints, likelihood of arrest, and drivers' beliefs about their ability to avoid arrest may all influence perceived risk of arrest (Homel et al, 1988). The second enforcement strategy, saturation patrols, involves an increased enforcement effort in a specific geographic area

with the goal of identifying and arresting drivers who are showing signs of impaired driving (NHTSA, 2002). Multiple agencies often combine and concentrate their resources to conduct saturation patrols. Consistent with deterrence theory, both of these enforcement strategies work by increasing the perceived likelihood of being detected while driving after consuming alcohol (Homel et al, 1988). In addition, media campaigns that are carefully planned, well executed, and attain adequate audience exposure can increase the perceived certainty of punishment and thus can complement and enhance the effectiveness of enforcement strategies in reducing alcohol-impaired driving and alcohol-related crashes (Elder et al, 2004).

Sobriety checkpoints effectively prevent alcohol-impaired driving, alcohol-related crashes, and associated fatal and nonfatal injuries (Shults et al, 2001). This conclusion is based on 23 studies conducted on interventions implemented at the city, county, state, and national level (Shults et al, 2001). Despite being an effective enforcement tool, sobriety checkpoints are underused in the United States for a number of reasons, including lack of police resources and lack of funding (Fell et al, 2003). The effectiveness of saturation patrols is less clear. A Cochrane review of 32 studies that tested the effects of increased police patrols on traffic deaths, injuries, and crashes demonstrated that increased police patrols generally reduced traffic crashes and fatalities but evidence for their effect on traffic injuries was less consistent (Goss et al, 2008). The quality and methodological rigor of these studies were often poor and, therefore, the existing evidence, although supportive, does not firmly establish whether increased police patrols decrease the negative consequences of alcohol-impaired driving (Goss et al, 2008).

Research strongly suggests that multicomponent approaches are associated with lower rates of alcohol-impaired driving and negative consequences associated with alcohol-impaired driving (Babor et al, 2010). On the basis of strong support of their effectiveness in reducing alcohol-impaired driving, the Community Preventive Services Task Force recommends using multicomponent interventions (Shults et al, 2009). Additionally, studies that assessed state-level countermeasures and community-level programs found multi-strategy programs (that included combinations of DUI laws, political leadership, resources, regulatory control and availability, media campaigns, awareness days, education and prevention programs, alcohol-free events, and pedestrian safety and seat belt use initiatives) to be associated with lower likelihood to drive while impaired and fewer fatal crashes involving alcohol (Hingson et al, 1996, Shults et al, 2002). These studies all assessed multicomponent programs that included a wide range of strategies not just enforcement-related strategies.

One recent study investigated the effects of combining multiple enforcement strategies on the rate of crashes involving a drinking driver in a sample of communities (Fell et al, 2014). The number of DUI arrests and the number of sworn officers per 10,000 driving-aged population were both negatively associated with the ratio of alcohol-impaired driving to non-alcohol impaired driving crashes while no significant associations were found between alcohol-impaired-driving crash rates and citations for seat belt, speeding, other moving violations and warnings, or with the use of sobriety checkpoints (Fell et al, 2014).

Based upon a recent national survey of state and local law enforcement agencies, Erickson and colleagues concluded that recommended enforcement strategies to detect and prevent alcohol-impaired driving are employed in many jurisdictions but underutilized in others (Erickson et al, in press-b). Among 48 state patrol agencies, 72.9% conducted sobriety checkpoints, 95.8% conducted saturation patrols, and 43.8% conducted enforcement of open container laws, with 27.1% of agencies using all three strategies. Among 1,082 local law enforcement agencies, 44.0% conducted sobriety checkpoints, 65.9% conducted saturation patrols, and 43.0% conducted open container enforcement, with 18.3% of agencies conducting all three enforcement efforts (Erickson et al, in press-b). Descriptive statistics of enforcement-related strategies are presented in Table 1.

Further analyzing these data, Erickson and colleagues concluded that alcohol enforcement activities cluster in meaningful ways and that enforcement agencies can be classified within enforcement domains based on the pattern or types of alcohol enforcement activities they conduct (Erickson et al, in press-a). They assessed the presence of 29 alcohol policy enforcement activities within five enforcement domains (underage alcohol possession/consumption, underage alcohol provision, underage alcohol sales, impaired driving, and overservice of alcohol) and conducted a series of latent class analyses through which they identified unique enforcement activity classes for each of the enforcement domains. The latent class analysis of the alcohol-impaired driving enforcement domain, based on four enforcement activities (sobriety checkpoints, saturation patrols, open-container enforcement, and media contact related to enforcement efforts), led to the identification of three enforcement classes: (1) a uniformly low enforcement class characterized by very low levels of all four strategies (the latent class analysis indicated that 29.7% of agencies were in this class), (2) a uniformly high enforcement class characterized by high levels of saturation patrols, high levels of media campaigns, and fairly high levels of sobriety checkpoints (19.4% of agencies), and (3) an enforcement class characterized by high levels of saturation patrols, high levels of media campaigns, and fairly low levels of sobriety checkpoints (50.9% of agencies; Erickson et al, in press-a).

The present study adds to the extant knowledge related to the enforcement of alcohol-impaired driving laws by assessing the enforcement-related strategies of state and local law enforcement agencies across the U.S. and determining if: (1) individual enforcement strategies aimed at alcohol-impaired driving are associated with less alcohol-impaired driving behavior, (2) a combination of strategies is associated with a greater decrease in alcohol-impaired driving than any individual enforcement-related activity, and (3) the associations observed between enforcement strategies aimed at alcohol-impaired driving and alcohol-impaired driving behavior remain after controlling for binge drinking.

2. Models and Methodology

We conducted two surveys to assess enforcement strategies related to alcohol-impaired driving during 2010-2011: (1) a survey of all state patrol agencies in the United States and (2) a survey of a stratified random sample of local law enforcement agencies in the United States. We also used data from the 2010 Behavioral Risk Factor Surveillance System (BRFSS) to assess state-level rates of self-reported alcohol-impaired driving and binge

drinking, as well as demographic variables. The present study was reviewed and approved by the Institutional Review Board at the University of Minnesota.

2.1 Enforcement Agency Surveys and Measures

We contacted 49 state patrol agencies using the Official Directory of State Patrol and State Police (available online at www.statetroopersdirectory.com) (Hawaii has no state patrol agency) to participate in a telephone survey. If requested by the respondent, we provided the option of completing the survey online (19% of state patrol agencies completed the survey online). All but one state patrol agency responded to our survey (response rate=48/49, 98%).

We selected local law enforcement agencies using a list of 15,833 municipal and county law enforcement agencies from the U.S. Department of Justice Bureau of Justice Statistics (available from <http://bjs.ojp.usdoj.gov/content/pub/pdf/cs1lea04.pdf>) for 2004 (the most recent list available at the time of the survey). We used a multi-stage sampling strategy to select agencies from each state to be representative at the state level, based on both size and type of agency. Our final sample comprised 1,631 law enforcement agencies.

Approximately two-thirds (66.3%) of local law enforcement agencies responded (1082/1631). Response rates varied across states (50%-86%). Non-responding agencies did not significantly differ (chi-square tests; $\alpha=0.05$) from responding agencies in terms of agency type, number of agencies per 1 million residents and several jurisdiction characteristics (proportion of black residents, proportion of residents aged 15-20, or proportion of residents living in poverty); however, agencies in smaller jurisdictions (<10,000) and agencies in jurisdictions with a lower proportion of Hispanic residents (<3%) were *less* likely to respond. A detailed description of the sampling method and survey administration is described elsewhere (Erickson et al, in press-b)

We surveyed a representative from each agency via telephone or online. The surveys contained a series of questions pertaining to agencies' alcohol-impaired driving enforcement-related strategies used during the previous year (sobriety checkpoints, saturation patrols, open containers in vehicles, and contact with local media), which served as our key exposure variables. To assess the use of sobriety checkpoints and saturation patrols, we asked participants to indicate if their agency used each type of enforcement strategy to target alcohol-impaired driving violations. Response options for each were: "yes, once in the last year," "yes, 2-3 times in the last year," "yes, 4-5 times in the last year," "yes, 6 or more times in the last year," and "no." To assess open container enforcement, we asked participants, "Has your agency conducted enforcement efforts regarding open containers in vehicles?" Response options were "yes," "no," and "we don't have an open container law." To assess media contact for local law enforcement agencies, we asked participants, "How often in the past year has your agency collaborated or communicated with local media outlets to promote your enforcement efforts regarding drinking and driving?" Response options were "never," "once or twice," and "three or more times." We recoded these variables as dichotomous: "no/never" and "at least once". To assess media contact for state patrol agencies, we asked participants, "How frequently are media campaigns used to publicize your agency's enforcement efforts specific to drinking and driving (for example, TV ads, freeway signs)?" Response options were "daily," "weekly," "monthly," "a few

times a year,” “once a year,” “less than once a year,” and “never”. We recoded these variables as dichotomous: “monthly or more” and “a few times a year or less”. For analysis, we used the dichotomous enforcement variable for each of the four state patrol alcohol-impaired driving enforcement-related strategies and used the proportion of local law enforcement agencies per state that reported conducting each type of enforcement-related strategy at least once.

We also used the three-class alcohol-impaired driving enforcement measure developed by Erickson and colleagues: (1) uniformly low enforcement class, (2) uniformly high enforcement class, and (3) enforcement class with high levels of saturation patrols, high levels of media contact, and fairly low levels of sobriety checkpoints (Erickson et al., in press-a). A detailed description of the latent class analysis methodology, model fit, and model selection is described elsewhere (Erickson et al, in press-a). For the present analysis, we used the proportion of local law enforcement agencies per state in the uniformly low enforcement class and the proportion of local law enforcement agencies per state in the uniformly high enforcement class.

2.2 Behavioral Risk Factor Surveillance System Survey and Measures

We used individual-level reports of alcohol-impaired driving, alcohol consumption, and demographics drawn from the 2010 BRFSS (CDC, 2010). The BRFSS is a nationally representative household random-digit dial telephone survey of adults aged 18 years and older in all US states. It is conducted annually by the state department of health or a contracted research organization in each state and is coordinated nationally by the U.S. Centers for Disease Control and Prevention (CDC). We used datasets publicly available for researchers through the CDC and the National Center for Health Statistics (CDC, 2010). A total of 451,075 respondents completed or partially completed 2010 BRFSS interviews. The 2010 BRFSS cooperation rate (defined as the proportion of respondents interviewed of all eligible units in which a respondent was contacted and selected) ranged from 56.8% to 86.1% (median: 76.9%). The 2010 BRFSS response rate (defined as the number of complete and partial interviews divided by an estimate of the number of eligible units) ranged from 39.1% to 68.8% (median: 54.6%) (CDC, 2011).

Alcohol-impaired driving, our key outcome measure, was defined as responding “one or more times” to the following BRFSS question: “During the past 30 days, how many times have you driven when you’ve had perhaps too much to drink?” The specific survey question about driving after drinking alcohol is administered every other year; we, therefore, used the 2010 BRFSS data for our analyses. Binge drinking was defined as responding “one or more times” to the following BRFSS question: “Considering all types of alcoholic beverages, how many times during the past 30 days did you have X [X=5 for men; X=4 for women] or more drinks on an occasion?”

We also used the BRFSS data to control for five demographic variables known to be associated with alcohol consumption. Sex is a dichotomous variable: male, female. Age was measured based on the question “What is your age” (a continuous variable collapsed into five categories: 18-24 years, 25-34 years, 35-44 years, 45-54 years, 55+ years). Race/ethnicity was measured using a variable calculated by BRFSS based on responses to two

questions “Which one of these groups would you say best represents your race? (seven response choices)” and “Are you Hispanic or Latino? (yes/no)”. The calculated variable had five categories, which we reduced to four: White, non-Hispanic; Black, non-Hispanic; Hispanic; Other (multi-racial or other race, non-Hispanic). Education was measured based on the question “What is the highest grade or year of school you completed” (a five-category variable that we collapsed to two: high school graduate or less and attended or graduated from college or technical school). Marital status was measured based on the question “What is your marital status” (a six-level variable that we collapsed to two: married, not married).

We weighted the data to be representative of state populations. Further details about the BRFSS and the survey methodology are available at www.cdc.gov/brfss.

3. Calculation

After examining all study variables descriptively, we estimated a number of multilevel logistic regression models to examine the association between alcohol-impaired driving law enforcement-related strategies (by both local law enforcement agencies and state patrol agencies) and self-reported alcohol-impaired driving. We regressed alcohol-impaired driving separately on each of 10 enforcement measures: four state patrol individual enforcement measures (conducting sobriety checkpoints, saturation patrols, open container enforcement, and media campaigns related to enforcement); four local law enforcement agency individual enforcement measures (percent agencies in state conducting sobriety checkpoints, saturation patrols, open container enforcement, and media contact); and two local law enforcement agency aggregate enforcement measures (percent agencies in state in high enforcement class, percent agencies in state in low enforcement class). We adjusted all models for the effects of age, sex, race, education, and marital status. We re-estimated each model including a dichotomous indicator for binge drinking as an additional covariate to determine whether enforcement-related strategies had effects on alcohol-impaired driving controlling for binge drinking. All regression models were conducted in MPlus v7 (Muthen & Muthen, 1998-2012) and accounted for clustering of individuals within states and included appropriately-scaled individual BRFSS weights (Carle, 2009). Statistical significance was measured at the 0.05 level.

4. Results

Descriptive statistics from the BRFSS are presented in Table 1. The majority of individuals who participated in the 2010 BRFSS are female (51.3%), 25–54 years of age (54.8%), white, non-Hispanic (80.7%), married (62.4%), and attended or graduated from college or technical school (60.9%). Among 2010 BRFSS participants, 15.1% reported engaging in binge drinking and 1.8% reported engaging in alcohol-impaired driving.

Results of the multilevel logistic regression analyses for the association between alcohol-impaired driving enforcement-related strategies and alcohol-impaired driving are presented in Table 2.

The prevalence of self-reported alcohol-impaired driving was lower in states where state patrol agencies conducted sobriety checkpoints, conducted saturation patrols, and enforced

open container laws. Saturation patrols had the strongest inverse association with self-reported alcohol-impaired driving. The prevalence of self-reported alcohol-impaired driving was higher in states where state patrol agencies reported media campaigns related to enforcement efforts. To facilitate interpretation, model estimates and intercepts were exponentiated and state-level alcohol-impaired driving prevalences were calculated. Alcohol-impaired driving prevalences were .09 to .36% lower in states engaging in these enforcement activities, which translate to 21% to 47% reductions in alcohol-impaired driving in these states.

The prevalence of self-reported alcohol-impaired driving was lower in states where a large proportion of local law enforcement agencies conducted sobriety checkpoints, conducted saturation patrols, and enforced open container laws. Sobriety checkpoints and open containers laws had the strongest inverse associations with self-reported alcohol-impaired driving rates. These estimates translate to 29% to 48% reductions in alcohol-impaired driving in states where all agencies reported enforcement versus states where none of the agencies reported engaging in the enforcement.

We next examined whether the relationship between conducting alcohol-impaired driving enforcement-related strategies and self-reported alcohol-impaired driving would remain after controlling for high-risk alcohol consumption. After controlling for binge drinking, although attenuated, a statistically significant relationship remained between all four state patrol agency enforcement-related strategies and alcohol-impaired driving. For local law enforcement agencies, a statistically significant relationship remained only between sobriety checkpoints and alcohol-impaired driving after controlling for binge drinking.

For our combined enforcement measure representing patterns of alcohol-impaired driving enforcement-related strategies by local law enforcement agencies, we found that the effects were larger than those associated with any of the individual enforcement activities. Compared to a state with no local agencies in the high enforcement class, a state with all local agencies in the high enforcement class had a model-estimated 84% lower prevalence of alcohol-impaired driving. Conversely, compared to a state with no local agencies in the low enforcement class, a state with all local agencies in the low enforcement class had a model-estimated 71% higher prevalence of alcohol-impaired driving. After controlling for binge drinking, the effects of the enforcement classes were attenuated but still significantly associated with alcohol-impaired driving.

5. Discussion

Previous studies have demonstrated that sobriety checkpoints effectively reduce alcohol-impaired driving, alcohol-related crashes, and associated injuries (Shults et al, 2001). Our study also demonstrates that sobriety checkpoints conducted by local law enforcement agencies and state patrols are associated with lower prevalence of self-reported alcohol-impaired driving. Unfortunately, law enforcement agencies underutilize sobriety checkpoints because they lack the resources and funding to conduct them (Fell et al, 2003). However, sobriety checkpoints can be effectively conducted with as few as two to five

officers, and, moreover, grant money may be available to conduct sobriety checkpoints (Fell et al, 2003).

Existing evidence has not firmly established if increased police patrols (i.e., saturation patrols) reduce alcohol-impaired driving, alcohol-related crashes, and associated injuries (Goss et al, 2008). Additionally, the effects of open container laws have not been well studied. Our study suggests that saturation patrols and enforcement of open container laws conducted by local law enforcement agencies and state patrols are associated with lower prevalence of self-reported alcohol-impaired driving. Additional research on these enforcement-related strategies is warranted but our study suggests that these strategies might be important tools for reducing alcohol-impaired driving.

Alcohol-impaired driving appears to be positively associated with media campaigns and contact related to enforcement efforts but in the present data, the association is statistically significant only at the state patrol level. Although there are many potential explanations for this finding, one obvious possibility is that enforcement agencies initiated media campaigns in response to prevalent alcohol-impaired driving behavior.

The present findings demonstrate an association between alcohol-impaired driving enforcement-related strategies and alcohol-impaired driving. The mechanism underlying this association might be a decrease in high-risk alcohol use and/or a decrease in driving following high-risk alcohol use. This study demonstrates that, although attenuated, the effects of sobriety checkpoints, saturation patrols, and enforcement of open containers laws at the state patrol level remain statistically significant after controlling for binge drinking. For local law enforcement agencies, a statistically significant relationship remained only between sobriety checkpoints and alcohol-impaired driving. This finding suggests that the association between alcohol-impaired driving enforcement-related strategies and decreased alcohol-impaired driving does not occur simply through a reduction in binge drinking. Rather, individuals engaging in binge drinking might be making decisions to prevent alcohol-impaired driving, such as drinking at home or using a designated driver.

While determining which individual enforcement-related strategies effectively reduce alcohol-impaired driving is important, latent class analysis allows us to determine whether a combination of enforcement-related strategies has a greater association with alcohol-impaired driving. The uniformly high enforcement class (which includes extremely high levels of saturation patrols and media contact and fairly high levels of sobriety checkpoints) in fact is associated with a greater decrease in alcohol-impaired driving than any individual enforcement-related activity. Previous research has demonstrated that multicomponent approaches are associated with lower rates of alcohol-impaired driving and negative consequences associated with alcohol-impaired driving (Babor et al, 2010, Hingson et al, 1996; Shults et al, 2002; 2009). Our finding supports these previous findings and shows the potential value of law enforcement agencies implementing multiple enforcement-related strategies to more effectively reduce alcohol-impaired driving in communities.

Despite being positively associated with alcohol-impaired driving, media campaigns and contact related to enforcement activities is a strategy included in the combination of

enforcement-related strategies that is associated with the largest decrease in alcohol-impaired driving. This finding supports The Community Guide's conclusion that mass media campaigns can effectively reduce alcohol-impaired driving and alcohol-related crashes if they are implemented in conjunction with other ongoing prevention activities, such as high visibility enforcement (Elder et al, 2004).

The current study has a number of limitations. First, both enforcement agencies and individuals who participated in the BRFSS submitted self-report data. Enforcement agencies may have inflated their enforcement efforts to look more favorable. However, because many agencies reported not conducting many of the enforcement activities, this potential response bias may be minimal. Because of social desirability, the prevalence of alcohol-impaired driving collected through the BRFSS may represent underreporting of this behavior. Second, we surveyed only one representative from each enforcement agency; this respondent may not have accurate information about all aspects of the agency's alcohol enforcement activities. To minimize this potential problem, we attempted to survey the individual within each agency most knowledgeable about alcohol enforcement. Third, we attempted to obtain a sample of local law enforcement agencies from each state that was representative at the state level, but it is possible that agencies that did not respond to our survey may have been less likely than agencies that did respond to engage in enforcement-related strategies. However, few differences exist between responders and nonresponders. Fourth, we utilized certain analytic simplifications. The data are hierarchical with agencies nested within states, and, although this was included in regression models, clustering was not accounted for in latent class models due to model complexity. Also, each agency was assigned to their most likely class and that was used for the regression models. This does not account for differences in the probability of class membership and may bias estimates; however, examination of the posterior probabilities (which were all quite high) suggests little concern. Fifth, this study uses cross-sectional data. We asked agencies about their enforcement activities in 2009 and analyzed BRFSS data from 2010 but because of this study's cross-sectional design, our ability to make causal inferences is limited. Sixth, the analysis did not include many potential state-level confounders related to alcohol-impaired driving, including alcohol price, and alcohol availability, because of data availability, data quality, and a limited number of degrees of freedom. Finally, this study is a first step towards determining the association between alcohol-impaired driving enforcement-related strategies and alcohol-impaired driving. Further research should determine how combinations of state patrol law enforcement-related strategies are associated with alcohol-impaired driving and how local law enforcement-related strategies and state patrol enforcement-related strategies might interact to decrease alcohol-impaired driving.

6. Conclusions

This study provides a meaningful contribution to the alcohol-impaired driving law enforcement research literature. It demonstrates that sobriety checkpoints, saturation patrols, and enforcement of open container laws are associated with a lower prevalence of alcohol-impaired driving and that a combination of individual enforcement-related strategies is associated with a greater decrease in alcohol-impaired driving than any individual enforcement-related activity. Further, alcohol-impaired driving enforcement-related

strategies are associated with decreased alcohol-impaired driving above and beyond their association with decreased binge drinking. Results suggest law enforcement agencies should give greater priority to using a combination of strategies rather than relying on any one individual enforcement activity.

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Highlights

- Individual enforcement strategies were associated with less alcohol-impaired driving.
- A combination of strategies was associated with a larger impact on this behavior.
- This association remained after controlling for high-risk alcohol consumption.
- Enforcement agencies should prioritize using a combination of strategies.

Table 1

Descriptive Statistics

Individual-Level BRFSS Variables (n=451,075)^a	%
Sex	
Male	48.7
Female	51.3
Age	
18-24 years	11.2
25-34 years	17.5
35-44 years	18.1
45-54 years	19.2
55+ years	33.4
Race	
White, Non-Hispanic	80.7
Black, Non-Hispanic	4.9
Hispanic	5.5
Other (multi-racial or other race, non-Hispanic)	5.3
Education	
High school graduate or less	37.3
Attended or graduated from college or technical school	60.9
Marital status	
Married	62.4
Not married	38.0
Binge drinking	15.1
Alcohol-impaired driving	1.8
State Patrol Enforcement-Related Strategies	
% of Agencies	
Individual Strategies	
Conduct sobriety checkpoints	72.9
Conduct saturation patrols	95.8
Enforce open container laws	43.8
Use media campaigns to publicize agency's enforcement efforts	75.0
Local Law Enforcement Agency Enforcement-Related Strategies	
% of Agencies	
Individual Strategies	
Conduct sobriety checkpoints	44.0
Conduct saturation patrols	65.9
Enforce open container laws	43.0
Use media contact to publicize agency's enforcement efforts	65.9
LCA Classes	
Agencies in uniformly high enforcement class	19.4
Agencies in uniformly low enforcement class	29.7

^aBRFSS data is weighted to provide representative population-based estimates.

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Table 2

Multilevel Logistic Regression

Enforcement-Related Strategies	Alcohol-Impaired Driving (Crude) ^a				Alcohol-Impaired Driving (Adjusted for Binge Drinking) ^a			
	Estimate	<i>p</i>	Prevalence Difference	Difference (%)	Estimate	<i>p</i>	Prevalence Difference	Difference (%)
State Patrol								
Sobriety checkpoints	-.311	.000	-0.0014	-26.6	-.280	.000	-0.0006	-24.4
Saturation patrols	-.637	.000	-0.0036	-46.9	-.515	.000	-0.0013	-40.2
Open container laws	-.235	.000	-0.0009	-20.9	-.164	.007	-0.0003	-15.1
Media campaigns related to enforcement efforts	.251	.000	0.0010	28.4	.176	.009	0.0003	19.2
Local Law Enforcement								
Sobriety checkpoints	-.647	.000	-0.0027	-47.5	-.471	.000	-0.0009	-37.5
Saturation patrols	-.346	.027	-0.0015	-29.1	-.196	.193	-0.0004	-17.8
Open container laws	-.641	.003	-0.0025	-47.2	-.326	.102	-0.0006	-27.8
Media contact related to enforcement efforts	.066	.727	0.0003	6.8	-.036	.839	-0.0001	-3.5
Uniformly High Enforcement Class	-1.848	.000	-0.0052	-84.2	-1.297	.000	-0.0019	-72.6
Uniformly Low Enforcement Class	.539	.006	0.0025	71.0	.369	.068	0.0008	44.5

^a All models adjusted for the effects of age, sex, race, education, and marital status.