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Sobriety checkpoint and open container laws in U.S.: Associations with reported drinking-driving

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Abstract

Objective—To assess how two types of drinking-driving laws—permitting sobriety checkpoints and prohibiting open containers of alcohol in motor vehicles—are associated with drinking-driving, and how enforcement efforts may affect these associations.

Methods—We obtained 2010 data on state-level drinking-driving laws and individual-level self-reported drinking-driving from archival sources (Alcohol Policy Information System, National Highway Traffic Safety Administration, and Behavioral Risk Factor Surveillance System). We measured enforcement of the laws via a 2009 survey of state patrol agencies. We computed multi-level regression models (separate models for each type of law) that first examined how having the state law predicted drinking-driving, controlling for various state- and individual-level covariates; we then added the corresponding enforcement measure as another potential predictor.

Results—We found that states with a sobriety checkpoint law, compared to those without a law, had 18.2% lower drinking-driving; states that conducted sobriety checks at least monthly (vs. not conducting checks) had 40.6% lower drinking-driving (the state law variable was not significant when enforcement was added). We found no significant association between having an open container law and drinking-driving, but states that conducted open container enforcement, regardless of having a law, had 17.6% less drinking-driving.

Conclusion—Our results suggest that having a sobriety checkpoint law and conducting checkpoints as well as enforcement of open containers laws, may be effective strategies for addressing drinking-driving.

Keywords

alcohol; impaired driving; sobriety checkpoints; open container; enforcement

INTRODUCTION

Rates of alcohol-related traffic fatal crashes in the U.S. have decreased over the past several decades, yet have only declined slightly in recent years with over one-third of fatal crashes being alcohol-related (NHTSA 2014). Various state laws in the U.S. are aimed at reducing drinking-driving rates such as those that impose limits on the blood alcohol content (BAC)

among drivers, those that permit law enforcement to conduct sobriety checkpoints on roadways, or those prohibiting open containers of alcohol in passenger compartments of cars. Although state-level laws can be effective in reducing drinking-driving, research is limited on laws that prohibit open containers of alcohol in motor vehicles and laws permitting the use of sobriety checkpoints.

The effectiveness of various laws in reducing drinking-driving and traffic crashes has been examined (e.g., Whetten-Goldstein et al., 2000; Ying et al., 2013). The most well-studied drinking-driving laws are those that set BAC limits for drivers, with many studies showing that lower BAC limits are associated with reduced impaired driving and crashes (Fell and Voas 2014). These studies have been instrumental in influencing federal legislation that requires states to set BAC limits at 0.08 g/dL for adult drivers in order to receive federal highway funding (NHTSA 1998). By 2005 all states set a 0.08 BAC limit for adults, and since 1998 all have set a BAC limit of 0.02 or less for youth drivers (<https://alcoholpolicy.niaaa.nih.gov>).

Several of the studies that assess associations between various alcohol control policies and driving-related outcomes have included laws prohibiting open containers of alcohol in motor vehicles as one of the policies studied (e.g., Chang et al., 2012; Eisenberg, 2003; Stout et al. 2000; Whetten-Goldstein et al. 2000; Ying et al., 2013). Only one study we identified examined the relationship between open container laws and self-reported drinking-driving—Stout and colleagues (2000) found that states with open container laws had lower rates of drinking-driving among drinkers and heavy drinkers. The others examined the association between open container laws and motor vehicle fatalities, and these had mixed results. Some concluded that traffic fatalities were not associated with open container laws (Chang et al., 2012; Whetten-Goldstein et al., 2000) while others found that states with open container laws tended to have fewer alcohol-related traffic fatalities (Eisenberg, 2003; Ying et al., 2013). Open container laws have not been enacted in all states—42 states have such laws as of 2015.

Sobriety checkpoint laws permit law enforcement agencies to conduct campaigns on public roadways where officials stop all vehicles or systematically select and stop vehicles that pass to evaluate drivers for signs of impairment. In the U.S., testing a driver's blood alcohol level (via breath tests) can only be done when there is a suspicion of impairment; in Australia and several European countries, breath tests can be conducted of all drivers (Bergen et al. 2014). Although studies show that specific sobriety checkpoint campaigns conducted in various U.S. cities and states have been associated with reduced alcohol-related crashes and impaired driving (Bergen et al. 2014; Elder et al., 2002; Erke et al. 2009), we identified only one assessing the laws effect on whether having state-level sobriety checkpoint laws affect traffic crash rates (Villaveces et al., 2003) which showed no association. None of the studies we identified assessed associations with drinking-driving rates. As of 2015, not all states permit law enforcement to conduct sobriety checkpoints—38 states explicitly permit sobriety checkpoints by law.

A state must have a law permitting sobriety checkpoints in order for law enforcement officials to conduct checkpoints; however, having such a law in place does not mean that law

enforcement agencies within the state conduct sobriety checkpoints, nor do the laws indicate the frequency or intensity of the enforcement. A survey of state highway offices in 2000 regarding use of sobriety checkpoints demonstrated that 74% of agencies conducted checkpoints at least once a year and 22% conducted them on a weekly basis (Fell et al. 2003). Similarly, having a state law prohibiting open containers of alcohol in vehicles does not ensure that law enforcement agents are conducting active enforcement of the law. Although some laws can be effective with little or no enforcement (e.g., minimum legal drinking age; Wagenaar and Wolfson 1994), enforcement can certainly improve a law's effectiveness (Elder et al. 2002; Fell et al. 2014; Ross 1984).

We conducted an assessment of sobriety checkpoint and open container laws in the 50 U.S. states and examined how these laws are associated with self-reported drinking-driving. We also examined how enforcement efforts by state patrol agencies—sobriety checkpoint campaigns and open container enforcement—may affect these associations.

METHODS

We obtained data at the state level (sobriety checkpoint and open container laws) as well as at the individual level (drinking-driving) for the 50 U.S. states. We also measured state-level enforcement practices via a survey of state-level law enforcement agencies. The study was approved by the University of Minnesota's Institutional Review Board.

State Laws

We obtained data on sobriety checkpoint laws for 2010 from the National Highway Traffic Safety Administration (NHTSA 2011). We obtained data on open container laws for 2010 from the Alcohol Policy Information System, an online database funded by the National Institute of Alcohol Abuse and Alcoholism that tracks U.S. state alcohol policies (<https://alcoholpolicy.niaaa.nih.gov>). For both types of laws, we used dichotomous measures indicating whether the state had a law or not.

Drinking-driving

We obtained drinking-driving data from the 2010 Behavioral Risk Factor Surveillance System (BRFSS; CDC, 2010). The BRFSS is a nationally representative household random-digit dial telephone survey of adults aged 18 and older in all US states. It is conducted annually by the U.S. Centers for Disease Control and Prevention (CDC). A total of 451,075 participated in the 2010 survey. 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 across states from 39.1% to 68.8% (median: 54.6%; CDC, 2011). We used data from the survey item, "During the past 30 days, how many times have you driven when you've perhaps had too much to drink?" We dichotomized the responses to 0 vs. 1 or more.

Enforcement Practices

We conducted a telephone survey of state highway patrol agencies regarding their drinking-driving enforcement efforts. We contacted agencies in the 49 states that have a statewide highway patrol agency (Hawaii does not have a statewide agency). Forty-eight of the 49

participated (Mississippi did not participate). At each agency, we spoke with the director or a representative who could best report on drinking-driving enforcement strategies used by the agency. The survey consisted of items pertaining to numerous types of drinking-driving enforcement efforts; we used three items for this study. For sobriety checkpoints, we used two items “Has your agency conducted sobriety checkpoints in the past year?” (yes/no) and “How often in the past years has your agency conducted sobriety checkpoints?” (daily, weekly, monthly, few times per year). The responses from these two questions were combined to a three-level variable: no; yes, less than monthly; yes at least monthly. Three states that reported conducting sobriety checkpoints did not report on the frequency of those checks (Arkansas, Florida, and Indiana)—we assigned the frequency to “less than monthly” as a conservative estimate. For open containers, we used one item: “Has your agency conducted enforcement efforts regarding open containers of alcohol in vehicles?” (yes, no, or “we don’t have an open container law”; dichotomized to yes vs. no, with those reporting that state had no law set to no). We did not measure frequency of open container enforcement.

Covariates

We included several covariates likely to affect drinking-driving rates. From the BRFSS we included six covariates at the individual level—sex, age (a continuous variable trichotomized to 18–20, 21–28, and 29+ based on frequency distribution), race (a five-level variable collapsed to four categories: white non-Hispanic, black non-Hispanic, Hispanic, and other race/ multi-race), education (at least a four-year college degree vs. less education), marital status (married vs. non-married) and binge drinking (yes vs. no; defined as five or more drinks for males and four or more drinks for females on one occasion in past 30 days). We included two state-level covariates: the percent of adults who report attending a religious services at least once a week from a national survey of adults in 2007–2008 (Pew Research Center, 2009), and total vehicle miles traveled (VMT) per population in 2009 from the Department of Transportation (U.S. DOT, 2012; population data obtained from 2010 U.S. Census). The VMT per population measure was originally a continuous variable that we recoded to a three-level categorical variable, based on frequency distribution, for analyses: <9,000; 9,000–10,000; >10,000).

Analyses

Our predictor variables were the state laws and our outcome variable was individual-level self-reported drinking-driving. We also tested how state-level enforcement variables may affect these associations. Following calculation of descriptive statistics for all variables, we computed a series of multilevel logistic regression models separately for sobriety checkpoint and open container laws controlling for all state- and individual-level covariates. The first model examined the relationship between the state law variable (predictor) and individual drinking-driving (outcome). Next we examined the relationship between state-level enforcement and individual drinking-driving. Third, we computed a model with the state law variable (predictor), the drinking-driving outcome, and enforcement as an additional predictor. Finally, we computed a model combining the sobriety checkpoint and open container measures. Descriptive statistics were computed in SAS 9.3 (SAS Institute, 2011). Multi-level regression models were computed in MPlus (Muthen and Muthen, 1998–2012).

We used a significance level of $\alpha = 0.05$. BRFSS data were weighted to be representative of state populations. We limited all multilevel models to the 48 states that participated in the enforcement survey (models that included sobriety checkpoint enforcement data are limited to 47 states because one agency did not answer this survey question; we chose “none” as the referent group for sobriety checkpoint enforcement in models 2, 3, and 7 for ease of interpretation). For both types of laws, we included data from states that conducted enforcement even if they did not have the corresponding law ($n=3$; see Table 1). For individual-level data from BRFSS we only included individuals who had data on all covariates for the 48 (or 47) states included in the models—for models with 48 states 23,437 individuals were missing (total $n=402,873$); for models with 47 states 18,752 individuals were missing (total $n=398,120$). For

RESULTS

Descriptive Statistics

Laws permitting sobriety checkpoints were in place in 36 states (Table 1). Of these 36 states, 34 conducted sobriety checkpoints—11 conducted checks less than monthly and 23 conducted checks at least monthly. In one state that does not have a law permitting sobriety checkpoint (South Carolina) the state patrol reported doing checks. Laws prohibiting open containers of alcohol beverages in motor vehicles were present in 43 states, and state patrol agencies in 19 of these states reported conducting enforcement of the open container law (Table 1). Two states that do not have an open container law reported doing open container enforcement (Connecticut, Virginia).

Among the weighted BRFSS sample, 51% were female, most were age 29 or older, 70% were white, about one third had a college degree, and 62% were married (Table 2). Approximately 15% of sample reported binge drinking and nearly 2% reported drinking-driving. On average 39% of residents in a state regularly attended religious services and the average vehicle miles travelled per population was just over 10,000.

Regression Models

For the sobriety checkpoints, we found that states with a law permitting sobriety checkpoints tended to have lower levels of drinking-driving (21.2% less than states without a law; model 1; Table 3). Similarly, states where the state patrol agencies conducted sobriety checkpoints (compared to those that do not) had lower levels of drinking-driving (24.2% lower when checks are done less than monthly; 29.2% lower when checks are done at least monthly; model 2). In the full model (model 3), we found that the state law variable was not significant, while the enforcement variable was significant. States that conducted checks at least monthly (vs. not conducting checks), regardless of having a law, tended to have 40.1% less self-reported drinking-driving; states that conducted checks less than monthly (vs. not conducting checks), regardless of having a law, tended to have 36.2% less self-reported drinking-driving. There was no significant difference in drinking-driving between conducting checkpoints less than monthly versus at least monthly.

For the open container models, we found no significant association between states having a law prohibiting alcohol beverages in vehicles and drinking-driving rates (model 4). We did find that states where state patrols conducted open container enforcement had lower levels of drinking-driving (17.5% lower than in states that did not conduct enforcement; model 5). In the full model, we found that the state law variable was not significant, while the enforcement variable was significant—states that conducted open container enforcement regardless of having a law had 17.6% less self-reported drinking-driving (model 6).

In models with both laws and their enforcement together (model 7), we found very similar results as in the separate models. The state law variables were not significant, while the enforcement variables were. States that conducted open container enforcement, compared to those that did not, had 18.2% less self-reported drinking-driving. States that conducted sobriety checkpoints at least monthly (vs. not conducting checks) had 40.7% less self-reported drinking-driving while states that conducted checks less than monthly had 37.9% less self-reported drinking-driving.

Of the individual covariates sex (OR=2.1), Hispanic (OR=0.8), marital status (OR=0.7), college (OR=1.3), and binge drinking (OR=27.4) were significant in all models; the other individual-level covariates (age, black, and other race) were not significant in any models. Of the state-level covariates, vehicle miles travelled (VMT) per population was significant for models that had sobriety checkpoint variables—states with higher VMT per population had 14–18% percentage less drinking-driving (VMT was not significant for open container models). The percentage of residents who regularly attend religious services was not significant in any of the models.

DISCUSSION

As one of the few nationwide assessments of the potential effectiveness of sobriety checkpoint and open container laws, we found that sobriety checkpoint laws were associated with lower rates of self-reported drinking-driving while open container laws were not. In both cases, we controlled for a number of covariates known to be associated with drinking-driving. Our results for sobriety checkpoint laws are generally consistent with other studies (Bergen et al., 2014); however, most studies assessed effects of sobriety checkpoint campaigns rather than sobriety checkpoint laws. Our results for open container laws are in contrast to those found in the one other study (Stout et al., 2000) that examined associations between open container laws and self-reported drinking driving. Due to the limited research and the mixed results, it is premature to make any clear conclusions about open container laws.

Enforcement is often important to improving a law's effectiveness (Elder et al. 2002; Fell et al. 2014; Ross, 1984). In our comparison of states with agencies that conducted enforcement with those that did not, we found that states where the state patrol agencies conducted the associated enforcement strategy tended to have lower levels of drinking-driving. For sobriety checkpoint enforcement, conducting checks (regardless of the frequency) appears to be needed to have effects on drinking-driving. Although conducting checkpoints at least monthly versus less than monthly was associated with lower levels of drinking-driving, this

difference in frequency of checkpoints was not statically significant. These results point to the important role that law enforcement plays in increasing the effectiveness of drinking-driving laws, and are also consistent with other studies (Fell et al. 2014; Sanem et al. 2015).

We expanded on previous studies by also assessing how enforcement practices may affect the associations between drinking-driving laws and self-reported drinking-driving rates. The results were different for the two types of laws. For sobriety checkpoints, we found that when considering both having a law in place and enforcement of that law, the enforcement variable was associated with lower rates of drinking-driving, and this relationship was greater than when enforcement was considered alone. For open containers, we found that in the combined model which included the law variable and the enforcement variable, the enforcement variable remained statistically significant, the law variable remained non-significant and the drinking-driving outcome was of the same magnitude as when the enforcement variable was considered alone. For both types of laws, it appears that enforcement of the laws may be particularly important for addressing drinking-driving. Legislation that provides incentives for states to conduct sobriety checkpoints and open container enforcement may be useful for decreasing drinking-driving. This type of legislation has proved effective for other state-level alcohol-related issues such as adoption of lower BAC limits for motor vehicle drivers and a higher minimum legal drinking age. More research is needed to determine the optimal enforcement methods for each type of law; some guidance is available for sobriety checkpoints (e.g., NHTSA, 2002), but less is known about the optimal ways to conduct open container enforcement.

Our results should be considered in light of several limitations. Because of the cross-sectional nature of the study, no causal inferences can be made. We do plan future analyses with longitudinal data. In addition, although we controlled for numerous individual- and state-level covariates, we did not consider effects of all possible factors that may affect drinking-driving rates such as other drinking-driving laws (e.g., drinking-driving penalties). We expanded the current literature by measuring enforcement practices; however, we were able to survey only one representative from each state highway patrol agency. Social desirability may have affected these responses, and information from additional officers, other agencies (e.g., local police) or other sources (e.g., Insurance Institute for Highway Safety) may have provided more valid data on state-level enforcement practices. Our outcome measure is also self-reported and the prevalence of drinking-driving is quite low, suggesting under-reporting. We do not expect, however, that the under-reporting varies systematically by state. Future studies with other data sources such as Fatality Accident Reporting System (FARS) is recommended. Finally, the variable measuring sobriety checkpoint laws and the variable measuring sobriety checkpoint enforcement were highly correlated ($r = 0.79$) which may limit the validity of the model that included both of these variables; however, the model converged and provided interpretable results.

Our study is the only one that has examined state-level sobriety checkpoint and open container laws and the associations between these laws and drinking-driving rates, as well as the role of enforcement among these associations. Our results suggest that having state-level sobriety checkpoint laws and state patrol agencies that conduct the checkpoints may be effective strategies for addressing drinking-driving. In addition, active enforcement of laws

prohibiting open containers of alcohol may help reduce drinking-driving. The important next steps are to examine the longitudinal nature of these relationships in order to determine potential causal mechanisms.

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Table 1

Sobriety checkpoint and open container laws and enforcement practices by 50 U.S. states

	Number of states	States	Percent of residents reporting drinking-driving ³
Sobriety Checkpoints			
Have Law ¹	36		1.69
Conduct enforcement at least monthly	23	AL, AZ, CA, GA, IL, KS, KY, ME, MD, MO, NV, NM, NY, NC, ND, OH, OK, PA, SD, TN, VT, VA, WV	1.63
Conduct enforcement less than monthly	11	AR, CO, CT, DE, FL, IN, LA, NE, NH, NJ, UT	1.74
Do not conduct enforcement	1	MA	2.88
No data on enforcement	1	HI	1.92
No Law ¹	14		2.07
Conduct enforcement at least monthly	1	SC	1.71
Conduct enforcement less than monthly	0	--	--
Do not conduct enforcement	11	AK, ID, IA, MI, MN, MT, RI, TX, WA, WI, WY	2.18
No data on enforcement	2	MS, OR	2.38
Open Containers			
Have Law ²	43		1.79
Conduct enforcement	19	AK, AZ, GA, ID, IL, IN, IA, KS, ME, MI, MT, NJ, NM, NC, ND, OK, OR, RI, UT	1.67
Do not conduct enforcement	23	AL, CA, CO, FL, KY, LA, MA, MD, MN, NE, NV, NH, NY, OH, PA, SC, SD, TN, TX, VT, WA, WI, WY	1.85
No data on enforcement	1	HI	1.92
No Law ²	7		1.64
Conduct enforcement	2	CT, VA	1.74
Do not conduct enforcement	4	AR, DE, MO, WV	1.70
No data on enforcement	1	MS	1.03

¹2010 data on sobriety checkpoint laws from the National Highway Traffic Safety Administration. Digest of Impaired Driving and Selected Beverage Control Laws Twenty-Fifth Edition

²2010 data on open container laws from APIS online database (www.alcoholpolicy.niaaa.nih.gov)

³Weighted frequency for all individuals in the state/states listed; from the Behavioral Risk Factor Surveillance System 2010

NOTE: All enforcement data are from in-house survey conducted in 2009

Table 2Descriptive statistics for all individual- and state-level covariates for 48 U.S.states¹

	Percent of BRFSS participants (n=426310) ¹	Mean (SD) per state (n=48 states) ¹
Sex		
Male	48.7	48.8 (0.1)
Female	51.3	51.2 (9.4)
Age		
18–20 years	4.8	5.2 (1.6)
21–28 years	10.5	11.0 (1.9)
29 years and older	84.7	83.8 (3.1)
Race/ethnicity		
White	70.1	78.2 (12.5)
Black	9.7	7.7 (8.0)
Hispanic	13.3	7.8 (8.8)
Other	6.9	6.3 (3.7)
Education		
College degree	36.0	34.8 (5.7)
No college degree	64.0	65.2 (5.7)
Marital status		
Married	61.7	62.6 (3.1)
Not married	38.3	37.4 (3.1)
Binge drinking	14.8	14.9 (3.1)
Drinking-driving	1.8	1.9 (0.7)
Percent of residents who regularly attend religious services ²	n/a	38.6 (9.0)
Vehicle miles traveled per population ³	n/a	10167.4 (1759.3)

¹Data are from the Behavioral Risk Factor Surveillance System (BRFSS) 2010 except as indicated (data is weighted using weights provided by BRFSS) and are limited to the 48 states in U.S. used in analytic models (2 states did not complete enforcement survey)

²From Pew Research Center, 2009

³From National Highway Traffic Safety Administration, 2009

Table 3

Multilevel Model Results: Associations between sobriety checkpoint and open container laws/enforcement and drinking-driving for 48 U.S. states/

	Percent difference in drinking-driving						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Sobriety Checkpoint Law	-21.2 *	--	20.1	--	--	--	20.8
Sobriety Checkpoint Enforcement							
At least monthly	--	-29.2 *	-40.1 *	--	--	--	-40.7 *
Less than monthly	--	-24.2 *	-36.2 *	--	--	--	-37.9 *
None	--	referent	referent	--	--	--	referent
Open Container Law	--	--	--	2.9	--	5.2	-2.1
Open Container Enforcement	--	--	--	--	-17.5 *	-17.6 *	-18.2 *
AIC	21098	20800	20800	21111	21101	21103	20792
Adjusted BIC	21200	20908	20915	21214	21202	21211	20921

* significant at p<0.05

Two states did not participate in the enforcement survey so models limited to 48 states (with the exception of models with sobriety checkpoint enforcement data being limited to 47 states because one state did not complete this survey item)

Note: All models adjusted with covariates (individual level: age, sex, race/ethnicity, education, marital status, binge drinking; state-level: church attendance, vehicles miles travelled per population); see manuscript text for summary estimates for covariates

-- = variable not include in model

Referent=referent group