

# Reducing DUI among US college students: results of an environmental prevention trial

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## ABSTRACT

**Aims** Driving under the influence (DUI) of alcohol is among the most common and serious alcohol-related problems experienced by US college students. Community-based prevention trials using environmental approaches to DUI prevention have been effective in reducing DUI. Such interventions remain untested in college settings. This study is the first to test the efficacy of an environmental prevention campaign to reduce DUI among college students.

**Design** We used a quasi-experimental non-equivalent comparison group design to test the efficacy of the DUI prevention intervention. Students at the experimental university were exposed to a DUI prevention intervention that included a social marketing campaign, a media advocacy campaign and increased law enforcement (DUI checkpoints and roving DUI patrols).

**Setting** Students from two large public universities located along the US/Mexico border participated in the seven-semester study.

**Participants** In total, 4832 college students took part.

**Measures** Using telephone interviews of randomly selected students, we took pre- and postintervention measures of self-reported DUI.

**Findings** Self-reported DUI (past year) decreased significantly from pre-test to post-test (odds ratio = 0.55) at the intervention school, whereas rates at the comparison campus remained stable. The campus-intervention interaction was statistically significant ( $P < 0.05$ ), suggesting that the campaign led to the observed change in DUI.

**Conclusions** Environmental DUI campaigns similar to those validated in community prevention trials can be effective in college settings. Further research, however, is needed to determine the robustness of the changes associated with such campaigns.

**KEYWORDS** College drinking, drinking and driving, DUI enforcement, perceived risk of DUI.

## INTRODUCTION

Driving under the influence (DUI) of alcohol remains one of the most serious public health problems in the United States (National Center for Health Statistics 1994). For college students, DUI is both common (Wechsler *et al.* 2002) and deadly (Hingson *et al.* 2002). Despite this, the prevention and research communities have done little to

address DUI in college settings (Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism 2002). Indeed, the recent National Institute on Alcohol Abuse and Alcoholism (NIAAA) task force on college drinking listed DUI interventions as a tier 2 intervention—one that has been shown to be effective in community settings but is untested in college settings. This study is the first to test such an intervention in a college setting.

### DUI and college students

In national studies using random-sampling designs, the prevalence of DUI (past year) reported by college students ranged from 26.5 to 27.8% (Hingson *et al.* 2002). In a non-random survey of 43 360 college students, Presley, Meilman & Lyerla (1995) reported 31.9% of students aged 20 years and younger and 33.6% of students aged 21 years and older admitted to driving while intoxicated (DWI) in the year prior to being surveyed. Hingson *et al.* (2002) noted that, in the 2000 National Household Survey of Drug Abuse, 18–24-year-olds not in college reported lower rates of DUI (19.8%) than their collegiate counterparts. Using data from the national surveys, Hingson *et al.* (2002) estimated that, nationally, more than 1100 college students died in alcohol-related motor vehicle accidents in 1998.

In their national study of college drinking, Wechsler *et al.* (1998) reported that the overall prevalence rate of driving after drinking alcohol within the college student population increased between 1993 and 1997 from 31.6% to 35.8%. By 1999, Wechsler *et al.* (1998) noted that 18.6% of non-heavy episodic drinkers, 39.7% of occasional heavy episodic drinkers, and 48.0% of frequent heavy episodic drinkers had driven after consuming alcohol. These analyses, however, do not specify whether the respondent was intoxicated while driving.

In another national study, Presley *et al.* (1998) reported that 17.0% of all students reported driving while intoxicated at least once in the past year, with 6.6% reporting the behavior three to five times and 9.0% reporting the behavior six or more times during that same period. Presley *et al.* (1998) also noted that these rates were fairly stable between 1995 and 1997. Despite the relatively high prevalence rate of DWI, only 1.5% of all students in the Presley *et al.* study reported being arrested for DWI/DUI.

The etiology of DUI among college students has not been studied carefully. Indeed, there have been few theoretical or comprehensive empirical studies examining DUI in this population. Several studies, however, have examined the correlates of DUI using both bivariate and multivariate analytical approaches. These studies provide a better understanding of the factors predicting DUI-related behaviors.

In a national study of college students ( $n = 17\ 592$ ), Wechsler *et al.* (1994) reported that driving after drinking alcohol was associated with the frequency of heavy episodic consumption (five or more drinks at a single setting for men, four or more for women). More than 60% of males reported frequent heavy drinking (three or more episodes in the past 2 weeks) in the 30 days prior to being surveyed. Almost half (49%) of frequent

female heavy drinkers engaged in this behavior. In addition to driving after drinking, more than 20% of infrequent heavy drinkers and about 50% of frequent heavy drinkers reported riding with an intoxicated driver in the 30-day period before being surveyed (Wechsler *et al.* 1994). Wechsler and associates found little difference between males and females for these behaviors in this study.

In a recent study, Clapp *et al.* (2003b) examined predictors of DUI using survey data collected at two large universities located in the south-western United States. Similar to the studies noted above, this study found positive relationships between drinking behaviors and DUI. In this study, heavy episodic drinking, frequency of drinking, variance of drinking and drinks per occasion all predicted DUI. Interestingly, the study found that marijuana use was a stronger predictor of DUI than the other variables tested in the study (Clapp *et al.* 2003b).

### Preventing DUI

Despite the lack of DUI prevention efforts targeting college students, environmental DUI prevention campaigns have worked in community settings (Voas *et al.* 1997). Of particular note, for instance, was the Community Trials Project (Voas 1997) that used a model of increased enforcement of DUI laws supported by media advocacy to reduce alcohol-related accidents. Conceptually, the combination of media coverage/campaigns and DUI checkpoints result in increased perceptions of the risk of arrest for DUI in the general population which, in turn, leads to reduced DUI and accident rates. Underlying this approach is the deterrence model. As noted by Ross (1982), general deterrence can be conceptualized as:

'the effect of threatened punishment upon the population in general, influencing potential violators to refrain from a prohibited act through a desire to avoid the legal consequences' (p. 8).

Ross noted that the practice of general deterrence targets both those who have engaged in the illicit behavior and those who have not but have potential to do so. General deterrence has short-term effects and long-term effects. Short-term effects are behavioral changes or restraints based on fear of consequences. Long-term effects are a function of aggregate short-term effects and include development of social and moral norms and habits that prohibit the illicit behavior (Ross 1982).

In this study, we evaluated the extent to which a college DUI prevention intervention that included a social marketing and law enforcement campaign increased students' perceived risk of getting a ticket or being arrested

**Table 1** Timeline of intervention activities at the experimental university.

Semester	<i>Roving DUI</i>	<i>DUI checkpoints</i>	<i>Social marketing</i>	<i>Media coverage</i>
<i>Spring 2000</i>	NA	NA	NA	NA
<i>Fall 2000</i>	NA	NA	NA	NA
<i>Spring 2001</i>	NA	NA	NA	NA
<i>Fall 2001</i>	NA	1	NA	Local TV
Spring 2002	2	1	Ads in campus paper: posters; cards; magnets	Local TV; campus paper
Fall 2002	2	NA	Ads in campus paper; posters; cards; magnets	NA
Spring 2003	1	2	Ads in campus paper; posters; cards; magnets	Local TV; campus paper
Total	5	4	Ads in campus paper ( <i>n</i> = 32); posters ( <i>n</i> = 500); cards ( <i>n</i> = 1500); magnets ( <i>n</i> = 100)	TV coverage ( <i>n</i> = 3); stories in paper ( <i>n</i> = 2)

Baseline semesters are indicated by italics.

for DUI and reduced their occurrences of self-reported DUI.

## METHOD

### Design

To test the efficacy of our campaign, we used a non-equivalent control group pre-test/post-test design (Campbell & Stanley 1964). Two large public universities located in the south-western United States participated in the study. The baseline (pre-test) period began in the spring semester of 2000 and ended in December 2001. The intervention period (post-test) began in the spring semester of 2002 and ran through the spring semester of 2003. The beginning of the intervention period coincided with the start of our social marketing campaign.

### Intervention

During the baseline period, campus police officers at each university conducted standard DUI enforcement (i.e. pulling over suspected drunk drivers) as part of their regular duties and no special DUI enforcement was present at either school. During this period, there was one DUI checkpoint conducted near the experimental campus. This checkpoint was operated by the local city police and was not part of the present project. There were no DUI-related media campaigns during the baseline period at either university.

During the intervention period, standard DUI enforcement continued at the comparison university. At the experimental university there was a marked increase in enforcement coupled with a media campaign. The

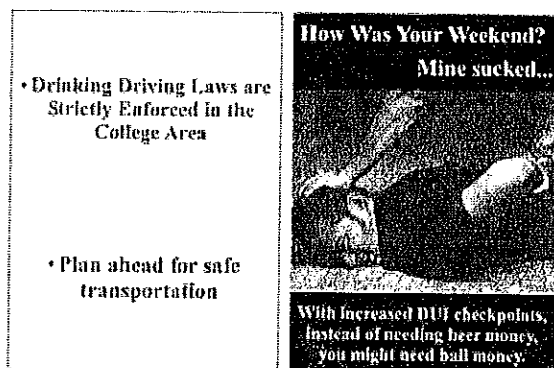
prevention campaign featured DUI checkpoints, media coverage, and a student-designed social marketing campaign aimed at increasing students' perceptions of risk of arrest for DUI. The specific activities are presented by semester in Table 1.

### *DUI checkpoints*

DUI checkpoints were operated by the campus police with assistance from the local city police and the highway patrol. Checkpoints were conducted on three main streets surrounding the campus. These streets were selected because they had a significant amount of student foot traffic and motor vehicle traffic. On average, 730 cars were stopped at each checkpoint. Consistent with Ross (1982), the primary goal of the checkpoints was to increase the perception of risk of arrest for DUI. Arrests were a secondary goal. As such, the checkpoints included 10–15 officers, several police cars with their lights turned on, cones, flares and large spotlights. On average, each DUI checkpoint cost \$3000 (US) to operate.

### *Media coverage*

For each checkpoint, the local media (including the campus paper) were contacted. The checkpoints all received coverage on local television news broadcasts. During the intervention period, the campus newspaper ran six stories related to DUI. One of these stories (early spring 2003) focused directly on increased enforcement. During the baseline period, the school paper ran 11 DUI-related stories. Like any community-based prevention effort using media advocacy, the success of placing issue-related stories is predicated on several factors. In this case



**Figure 1** Campaign advertisement promoting increased enforcement

the campus newspaper, an independent student-managed paper, changed editorial staff each year. This made it difficult to place stories consistently during the intervention period.

#### *Social marketing campaign*

Over the course of the entire prevention effort, we disseminated the following social marketing materials: advertisements in the school newspaper ( $n = 32$ ), posting of advertisements in public areas on campus ( $n = 500$ ), posting of ( $n = 100$ )  $12' \times 12'$  magnets embossed with the advertisement around campus, and distribution of advertisements ( $n = 1500$ ) on  $4' \times 5'$  promotion cards (these cards are similar to those used by bars and clubs to advertise on campus). Marketing materials were distributed each week. The advertisement used in all the social marketing materials during the campaign is presented in Fig. 1. Media materials cost approximately \$5000 (US) to produce.

#### *Site characteristics*

Table 2 provides comparison data for the experimental and control universities. The control campus is somewhat smaller than the experimental campus, but the gender distributions at the two universities are similar. Freshmen and sophomores made up a larger portion of the control campus's undergraduates than they did at the experimental campus. Alternatively, the graduate departments were roughly proportional to the size of the university. Asian Americans comprised a larger portion of the experimental campus's population, and Latinos comprised a larger portion of control campus's population. Each university was slightly less than 60% white. The universities were similar in that they both had small fraternity/sorority communities. This means that this group, which has been found to be at high risk for alcohol problems (Presley *et al.* 1995; Wechsler *et al.* 1997),

played a negligible role in the current study. A larger portion of the student body lived on campus at the control site than at the experimental site. Both sites had campus newspapers that accepted alcohol advertisements.

#### *Telephone interviews*

Data were collected at each university, each semester during the study. A university-based social science research laboratory conducted telephone interviews with respondents. Trained interviewers conducted the interviews, which were monitored randomly by professional research staff to ensure data quality.

Each semester of the study, 400 students were sampled randomly from registration records at each of the two universities. Students refusing to participate were replaced randomly. Our response rates ranged from 31% to 44% across campuses and semesters, and our cooperation rate (interviews completed) among responding students ranged from 66% to 92%. The actual percentages are provided in Table 3. A sample of 400 students per semester at a given university allows for 95.0% confidence with a  $\pm 5\%$  margin of error when estimating population parameters for that semester. Overall sample size is sufficient for analysis of subpopulations.

#### *Interview*

An original interview schedule was developed for this study. The instrument included several items from the core survey (Presley *et al.* 1995), including measures of alcohol and other drug (AOD) use and related problems. In addition to the standard questions taken from the core survey, quantity–frequency–variability items developed by Gruenewald & Nephew (1994) were included along with several demographic items.

The primary outcome measure for the study was based on the following survey item: within the past year, have you driven a vehicle while being under the influence of alcohol? In addition, during the last two semesters of data collection, we asked participants to indicate their perceived risk of being ticketed or arrested for DUI within a 1-mile radius of campus. This was measured using a five-point scale ranging from 'very unlikely' to 'very likely'.

#### *Analysis plan*

Analysis was conducted on participants who were between ages 18 and 23; our working data set consisted therefore of 1681 participants from the experimental campus and 1798 from the control campus. Our first analysis used logistic regression to predict the outcome measures (driving under the influence in the past

Table 2 Comparison of the experimental and comparison sites.

Variable	Control campus population	Control campus sample	Experimental campus population	Experimental campus sample
Gender				
Men	7274 (47.2%)	46.8% ± 0.01	10 715 (45.0%)	42.1% ± 0.01
Women	8135 (52.8%)	53.2% ± 0.01	13 057 (55%)	57.9% ± 0.01
Class standing				
Freshmen	3276 (21.3%)	19.6% ± 0.01	3825 (16.1%)	19.2% ± 0.01
Sophomores	2581 (16.7%)	20.0% ± 0.01	3263 (13.7%)	11.0% ± 0.01
Juniors	2185 (14.2%)	18.0% ± 0.01	7075 (29.8%)	22.3% ± 0.01
Seniors	3285 (21.3%)	24.0% ± 0.01	9609 (40.42%)	29.2% ± 0.01
Unclassified undergrads	646 (4.2%)		NA	
Graduate	2378 (15.4%)	18.4% ± 0.01	5299	18.3% ± 0.01
Race/ethnicity				
Asian American	238 (2%)	2.9% ± 0.003	3606 (15.2%)	12.8% ± 0.01
American Indian	389 (3%)	2.5% ± 0.003	251 (1.1%)	0.4% ± 0.001
African American	359 (2%)	3.0% ± 0.003	1293 (5.4%)	4.9% ± 0.005
Hispanic/Latino	5735 (37%)	37.5% ± 0.01	4755 (20.0%)	16.0% ± 0.01
White/other	8679 (56%)	54.0% ± 0.01	13 866 (58.3%)	65.7% ± 0.01
Age				
Mean (SD)	NA		24 (6.3)	
Median	26	22	22.3	22
Greek system members				
N (% of students)	730 (4.7%)	7.0% ± 0.005	600 (2.5%)	5.6% ± 0.005
Housing status				
Off campus	11 932 (77.4%)	75.5% ± 0.01	20 557 (89%)	88.5% ± 0.01
On campus	3477 (22.6%)	24.5% ± 0.01	2615 (11.0%)	11.3% ± 0.01
AOD incidents				
1996–97	195		254	
1997–98	116		209	
Campus paper				
Yes/no	Yes		Yes	
Alcohol ads (yes/no)	Yes		Yes	
Campus bar				
Yes/no	No		Yes	
Distance to Mexican border in minutes	50		30	
Current AOD programs				
Target/type	Athletes/peers		Population/CAPP	Population/norms
State laws				
Same for both locations	Administrative license suspension, 0.08 per se, implied consent, age 21, zero tolerance		Administrative license suspension, 0.08 per se, implied consent, age 21, zero tolerance	

12 months) from campus variable (experimental versus comparison), intervention period variable (pre-test versus post-test), and the interaction between those two factors. The baseline period (pre-test) ranged from spring 2000 to fall 2001, whereas the intervention period (post-test) spanned spring 2002 to spring 2003. The social marketing and media campaign began in spring 2002.

In addition to these variables, the analyses included participant sex, age, fraternity/sorority status and two measures of alcohol consumption: (1) the number of days in the last 28 days that they had at least one alcoholic drink, and (2) the maximum number of drinks consumed on any 1 day during the last 28 days. Both measures were adapted from work by Gruenewald & Nephew (1994). The logistic regression was conducted in a stepwise fashion,

Wave	Experimental campus		Comparison campus	
	Response rate (%)	Cooperation rate (%)	Response rate (%)	Cooperation rate (%)
Spring 2000 (1)	31	68	38	74
Fall 2000 (2)	32	66	36	74
Spring 2001 (3)	38	76	39	83
Fall 2001 (4)	35	82	35	87
Spring 2002 (5)	35	85	44	92
Fall 2002 (6)	31	86	36	91
Spring 2003 (7)	30	72	36	77

Response rate:  $\text{completes}/(\text{eligible}) + e$  (unknown eligibility)  $e = \text{eligible}/(\text{eligible} + \text{ineligible})$ ; cooperation rate:  $\text{completes}/(\text{qualified refusals} + \text{terminates} + \text{completes})$ .

**Table 4** Odds ratios for driving after drinking by campus and intervention.

	Experimental	Comparison
Pre-intervention	1.00	0.67
Post-intervention	0.55	0.64

with covariates entered in the first step, and the school and intervention variables entered in the second step.

Secondly, analysis of covariance (ANCOVA) was used to examine change in perceived risk of DUI arrest from the fall 2002 semester to the spring 2003 semester at the experimental university relative to the comparison university. Although both semesters fall within the post-test period, DUI checkpoints and significant media coverage occurred in early spring 2003. This analysis examined change in perception of DUI risk attributable to those intervention activities. Unfortunately, data on the perceived risk of DUI arrest were not collected throughout the study, so cannot be used as a mediator of the change in the self-reported drinking-and-driving rate. The analysis included age, gender, fraternity/sorority status and drinking quantity and frequency as covariates.

#### Limitations of analysis

Although statistical methods have been developed to produce unbiased standard errors from mixed and nested models, the application of these models is not always feasible. In this research, logistical demands prohibited us from using multiple control campuses and multiple intervention campuses. Further, we were unable to assign campuses randomly to conditions. Our influence over enforcement policies and procedures was greater at the experimental campus than at the control campus; this constraint necessitated the assignment of particular campuses to particular conditions.

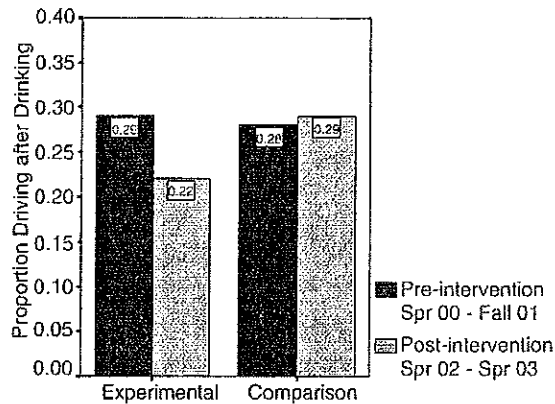
**Table 3** Summary of San Diego campus alcohol prevention partnership study response rates and cooperation rates.

Although our design limits our ability to attribute change in outcomes to DUI intervention *per se* (as opposed to some feature of the particular campus), the validity of our findings are strengthened: (1) by controlling statistically for differences in demography and recent drinking history of participants, and (2) by including a baseline (pre-intervention) period as well as an experimental versus control comparison.

## RESULTS

Analysis of driving after drinking within the past year revealed a statistically significant interaction between campus and intervention, Wald (1) = 9.23,  $P < 0.01$ . Table 4 displays the odds ratios (after controlling for gender, age, fraternity/sorority status and quantity/frequency of alcohol consumption) for driving after drinking using the experimental university's pre-intervention period as the reference. The results reveal a considerable drop in self-reported driving after drinking following the DUI prevention campaign tested at the intervention campus. However, no similar drop was found at the comparison university. Figure 2 reveals the actual proportion of students (not controlling for the covariates) who reported driving after drinking during the past year as a function of campus and intervention period.

Except for gender, each of the covariates (age, fraternity status, drinking frequency and maximum consumption quantity) independently and significantly predicted self-reported driving after drinking. The likelihood of driving after drinking increased with age (ranges 18–23), Wald (1) = 11.88,  $P < 0.01$ , odds ratio = 1.10, and individuals belonging to a fraternity or sorority were more likely to have driven after drinking, Wald (1) = 3.92,  $P < 0.01$ , odds ratio = 1.33. Finally, both greater drinking frequency [Wald (1) = 86.99,  $P < 0.01$ , odds ratio = 1.10]



**Figure 2** Proportion of students who drove after drinking in the past 12 months

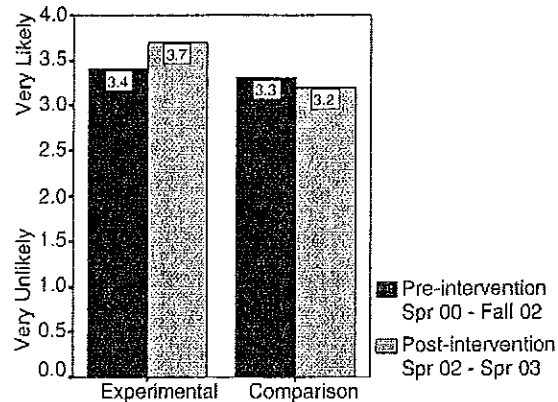
and greater consumption [Wald (1) = 18.93,  $P < 0.01$ , odds ratio = 1.05] increased the likelihood of reporting driving after drinking.

Analysis of perceived risk for DUI arrest revealed a statistically significant interaction between campus and semester (fall 2002 versus spring 2003),  $F_{1, 1570} = 5.01$ ,  $P < 0.05$ . This analysis included the same covariates (gender, age, fraternity/sorority status, drinking frequency and quantity). As shown in Fig. 3, perceptions of DUI risk increased for students at the experimental university following fall 2002, whereas no change was observed at the comparison university.

## DISCUSSION

This study is the first to test the efficacy of an environmental DUI prevention intervention in a college community. As noted earlier, such interventions have been effective in community settings (Voas *et al.* 1997). Given the seriousness of DUI as a public health risk (Hingson *et al.* 2002) and the prevalence of this behavior within the college student population, the results of this study are encouraging. Several issues, however, should be considered when interpreting our findings. Moreover, there are several practical considerations related to developing and implementing such campaigns.

Regarding our research design, a few limitations must be considered. First, we could use only one self-report measure of DUI. Ideally, we would have validated this measure with roadside BAC surveys. Unfortunately, such surveys were beyond the resources of the project. Secondly, because the data used to evaluate the campaign were drawn from an ongoing study, we could not conduct a true pre-test of our mediator variable, perceptions of risk of arrest. The findings related to perceptions of risk of arrest for DUI, however, are consistent with the conceptual model presented earlier.



**Figure 3** Perceived risk of DUI ticket or arrest

A third limitation was that it was logistically not feasible to assign more than one university to each condition. The lack of multiple schools per treatment prevented us from estimating variance independently due to school clusters. Although school and treatment effects are intertwined, steps were taken (i.e. statistically control from demographic differences and using baseline measures) to attenuate differences that might be due to school-specific characteristics. Although this may limit the generalizability of the design, the results still suggest the effectiveness of the DUI intervention program administered at the experimental campus.

The two universities were located in somewhat different geographic areas. One university is in a larger urban setting, whereas the other is in a smaller urban area surrounded by a rural community. Despite the geographic differences, the schools are comparable in terms of drinking rates. Further, both universities are within a 40-minute drive to the US/Mexico border, a risk factor for heavy drinking and DUI (Clapp *et al.* 2001). Although this unique socio-geographic setting is considerably different than most US universities, it is arguably a more difficult setting in which to intervene. As such, the results of this study are even more encouraging.

The intervention tested in this study was fairly comprehensive and may be beyond the financial means of many colleges and universities. Although there are costs associated with developing campaign materials, many universities regularly produce such materials for 'norms' social marketing campaigns that have unproven efficacy (Clapp *et al.* 2003a). The primary cost associated with environmental DUI prevention campaigns such as the one detailed here is police officer overtime. DUI checkpoints are labor-intensive and require typically up to 10 police officers to conduct.

Beyond cost, several other issues related to law enforcement must be considered. In the project described here, the experimental university had a public safety

department with sworn law enforcement officers who had the authority to conduct the DUI checkpoints. Many colleges and universities do not have this feature and would have to rely on community law enforcement to undertake a campaign such as the one described here.

Regardless of who is conducting the DUI enforcement, the relationship between college prevention professionals and law enforcement officials is crucial to the success of such efforts. In our project, we had a long history of working with both the campus and the municipal police departments on a variety of alcohol prevention issues. Even with this level of mutual trust, the effort described here required considerable coordination on the part of the research team.

Future studies are needed to test environmental DUI prevention campaigns across different college settings. Ideally, future studies would measure perception of risk of DUI arrest using a true pre-design/post-design. Roadside blood alcohol concentration surveys would also greatly enhance future studies.

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