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Alcohol and Drug Use Among Young Adults Driving to a Drinking Location

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Abstract

Background—Clubs that feature electronic music dance events (EMDEs) draw young adults aged 18 to 34 who are at high-risk for alcohol-related crashes to locations where alcohol sales are the principal source of revenue. Up to 30% of these attendees may also use drugs. This provides an important context in which to study driving arrangements that reflect concern with impaired driving. We explored whether drivers were using less alcohol and fewer drugs at exit than their passengers were and whether a driver for the group ever changed after consuming too much during the evening.

Methods—Using biological measures of alcohol consumption (breath tests) and drug use (oral fluid tests), 175 drivers and 272 passengers were surveyed among young adults arriving at and departing from EMDEs in San Francisco.

Results—Upon exit from the drinking locations, only 20% of the drivers, compared to 47% of the passengers, had a high breath alcohol concentration (defined as a BrAC of .05 g/dL or greater). Further, there was evidence that drivers with high BrACs switched to passenger status on exit and former passengers with lower BrACs replaced those drivers. However, there were no differences in the prevalence of drug use among drivers and passengers.

Conclusions—These findings suggest that the effort by young adult drivers to avoid alcohol-impaired driving appears to be reducing the number of drivers with high BrACs returning from drinking locations, such as EMDEs, by about one third. However, there is no similar pattern for drugged driving.

Keywords

Drinking and driving; impaired driving; drugged driving; designated drivers; public education

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1. INTRODUCTION

Electronic music dance events (EMDEs) where disc jockeys play recorded music are a popular feature of local nightlife in a number of metropolitan areas. Event promoters collect entrance fees, and club owners profit from alcohol sales. Young adults who are the fans of the featured disk jockeys are drawn to the events for a night of dancing and, for some, heavy drinking. Although drug use is discouraged by club management, studies indicate that about one in five attendees had been using drugs upon arrival at the EMDE, and a small amount of use occurs on the site (Miller et al., 2009a). These club events attract young adults aged 18 to 34, the age group that has the highest percentage (31% in 2010, National Center for Statistics and Analysis, 2012) of drivers with illegal breath alcohol concentration (BrAC ≥ .08) in fatal crashes. That age group is also the primary target of the National Highway Traffic Administration (NHTSA) in its national impaired-driving enforcement and public information programs (e.g., see Linkenbach and Perkins, 2005). Young adults arriving by car at EMDEs are generally small close-knit groups of friends who have traveled together to drinking events in the past and share many common characteristics related to alcohol and drug use (Miller et al., in press, 2009a, 2009b.)

The EMDE environment where alcohol and drugs are consumed by attendees at high risk for involvement in alcohol-related crashes provides a fertile ground for studying the driving practices of young adults. We hypothesize that, although driving decisions are influenced by multiple factors, identification of the person driving and the driver's substance use status upon arrival at and departure from the club reflects a group's driving practices and the level of effort made to avoid impaired driving. In this study, based on driver status and alcohol and drug measurements, we indirectly tested four driving-related actions designed to reduce impaired driving: (a) individuals reduce alcohol and drug consumption when planning to drive; (b) drivers, if acting as designated drivers, further reduce alcohol consumption; (c) drivers switch to passenger status if drinking heavily; and (d) light-drinking passengers are selected to drive when drivers switch to passenger status. Specifically, we tested five general hypotheses related to young adult impaired-driving risk status: (a) Compared to passengers, drivers exhibit lower impaired-driving risk; (b) Compared to nondesignated drivers, designated drivers exhibit lower impaired-driving risk; (c)Drivers who switch to passenger status on exit exhibit a higher impaired-driving risk than other drivers do; (d)Passengers who replace drivers have lower driving-risk indicators than other passengers; (e) Passengers who replace drivers have lower driving-risk indicators than the drivers they replace.

2. METHOD

2.1 Recruitment

Over a 30-week period from June through November 2010, we interviewed 1,148 attendees at 38 nighttime EMDEs at 8 clubs in San Francisco (Miller et al., 2012, in press; Johnson et al., 2012). These two reports describe the recruitment and data-collection procedures in detail. At entrance and at exit, we collected four types of data: (a) verbal interviews conducted by research assistants, (b) paper-and-pencil self-administered surveys of drug and alcohol use and club experiences, (c) oral assays for drug tests, and (d) breathalyzer tests for blood alcohol levels. This study is limited to an analysis of the drug and alcohol biological measures and questions covering the driving role (driver, designated driver, or passenger) and the drinking intentions of groups of EMDE patrons arriving by car.

Research sites were set up next to club entrances and staffed with a team of 8 to 10 researchers. Using portal methodology (Voas et al., 2006), a random procedure for recruiting groups was implemented by selecting the first person who crossed an imaginary line on the sidewalk as they approached the club entrance. Participants were recruited as groups because 95% of the patrons of EMDEs arrive in groups, and individual members are generally unwilling to remain behind when their group enters or leaves the club. The informed consent process was approved by the Pacific Institute for Research and Evaluation's Institutional Review Board. Our interviewers assured the potential participants that the survey was anonymous, that it would require 10 to 15 minutes at entry and at exit, and that they would be paid $10 at entrance and $20 at exit for their participation. A wristband with a unique identifier allowed the linking of entrance and exit data without personal identifiers, and 93% of those contacted at entry was reinterviewed at exit. Outdoor recruitment was difficult. Our records indicate that approximately 40% of the people we approached did not stop to listen to our recruitment efforts. Of the EMDE patron groups, approximately two thirds (63%) participated.

2.2 Sample Description

Of the 1,148 patrons we interviewed at the EMDEs, 447 (in 175 vehicle groups) traveled to the sites by automobile. They constitute the sample for this study. The median age was 31, and 50.1% were male. A third (33.7%) of the participants was White (non-Hispanic); a quarter (24.6%), Hispanic; a fifth (21.2%), Asian; and a fifth were Black, multiracial, or other. Half (55.2%) were college graduates, 57.7% had full-time employment, 19.6% were full-time college students, and 19.7% described themselves as gay, lesbian, or bisexual.

2.3 Data Collection

We collected five types of data for this study: (a) *The driver versus passenger status* was ascertained for each individual in the group at entry and exit. In addition, group members were asked at entry whether their group had a designated driver (DD), and if they did, the group's driver was classified as a "DD" for this study; (b) *Drinking intentions* were determined at entry. Participants were asked their drinking intentions for the evening (not drinking, drinking but not get buzzed, get buzzed but not drunk, get drunk or very drunk); (c) *Breath samples for BrAC levels* were collected at entry and at exit using the Intoxilyzer 400 (CMI, Inc., Owensboro, Kentucky); (d) *Oral fluid samples for illegal drug analysis* were collected using the Quantisal™ collection device (Immunalysis Corporation, Pomona, California) and forwarded to the Immunalysis Inc. laboratory for analysis. Participants were coded as using an illicit drug if positive for cannabis (THC), cocaine (+ metabolites), amphetamines, methamphetamines, ecstasy and other club stimulants (e.g., MDA, MDMA, MDEA), hydromorphone, hydrocodone, oxycodone, oxymorphone, morphine, ketamine, PCP, or heroin; (e) *Demographic predictors* (age, sex, race/ethnicity, educational level, and employment status) were collected from all participants at entry.

2.3.1 Driving risk—The breath measure of alcohol (BrAC) and the illegal drug use derived from the oral fluid sample were used to define the risk of impaired driving. Although laboratory studies (Moskowitz and Fiorentino, 2000) have found evidence for impairment at BrACs as low as .02 g/dL, case control, relative risk studies (Blomberg et al., 2009) have generally identified a BrAC .05 g/dL as the level at which crash risk is clearly elevated, and most industrialized nations have established that BrAC as the illegal level for driving. We therefore selected a BrAC of .05 g/dL or higher as our indicator of risk for alcohol-impaired driving. Establishing a drug concentration level that reflects impairment is substantially more difficult. Some progress has been made in identifying specific concentration levels of certain illegal drugs that impair driving (Elvik, 2012; Li et al., 2012). However, the many substances involved and the more complex relationship of blood concentration to driving impairment has tended to support the establishment of legal limits that make any detectible level in a driver an offense (DuPont et al., 2012; Li et al., 2012; Reisfield et al., 2012). The U.S. Office of National Drug Control Policy (2010) recommends that states enact per se laws specifying that any measurable amount of an illicit drug constitutes impaired driving, and 12 states have done so (Lacey et al., 2010). We therefore accepted any measurable amount of an illegal drug as our drugged-driving risk indicator for this study.

2.3.2 Drinking intentions—We collected drinking-intention information (not drinking, drinking but not get buzzed, get buzzed but not drunk, get drunk or very drunk) from each individual upon arrival at the EMDE. This was an important moderating measure because of its logical relationship to the quantity of drinking at the site, which was reflected in an increase of BrACs at the EMDE and the ultimate BrAC and the percentage of drivers with high BrACs at exit. Because of its importance in moderating the impaired-driving risk variable, we included it in the analyses of the five hypotheses evaluated in this study.

2.4 Data Analysis

Upon exit from the clubs, 175 of the 447 participants who traveled to the club by vehicle indicated they were going to drive, and 272 indicated they would be passengers. Dependent measures included (a) self-reported drinking intentions measured at entry (5-point scale with responses ranging from "not drink" to "get very drunk"), (b) entry BrAC and exit BrAC and the increase in BrAC from entrance to exit (all three as continuous scores), (c) a dichotomous indicator of whether the participant's BrAC was .05 g/dL or higher at exit, and (d) a dichotomous indicator of whether the participant was using an illegal drug at entrance and exit. Analyses were conducted using generalized linear modeling in SAS (ver. 9.2; SAS Institute Inc., Cary, North Carolina), which provided flexibility in analyzing continuous versus binomial outcomes. We divided the sample into four orthogonal groups: those who were drivers to and from the club ($n = 147$), those who were passengers to and from the club ($n = 245$), those who arrived as passengers but left as drivers ($n = 28$), and those who arrived as drivers but left as passengers ($n = 27$). Additionally, survey responses were used to identify who from the "consistent" driver group were *designated* ($n = 116$) versus *nondesignated* drivers ($n = 23$) (8 cases had missing data). These latter two groups were compared to test Hypothesis 2.

Initial analysis tested whether any demographic predictors (age, sex, race/ethnicity, educational level, and employment status) were significantly related to the alcohol and drug use variables. Only race/ethnicity significantly predicted a BrAC ≥ .05 g/dL at exit ($p < .05$). More Hispanic participants (50.9%) had high BrACs relative to White (non-Hispanic), Asian, and Other participants (ranging from 32.2 to 33.3%). (The relationship between race/ethnicity and drug use at exit was marginally significant, $p < .07$.) Therefore, race was included as a categorical covariate in all subsequent analyses. Further, preliminary analysis found no evidence that vehicle group significantly accounted for variability in high BrACs in our sample; thus, peer group was not included as a random variable in the models.

We analyzed the whole dataset using planned comparisons, with each of the five risk hypotheses involving a separate contrast. Controlling for race/ethnicity, we applied each contrast to each of seven outcomes: drinking intentions, entry BrAC, exit BrAC, increase in BrAC, percentage with BrACs ≥ .05, and percentage positive for an illegal drug at entrance or exit. Specifically, for Hypothesis 1, we contrasted the "consistent" driver and the "consistent" passenger groups. For Hypothesis 2, we contrasted the DD versus non-DD groups (from among the "consistent" drivers). For Hypothesis 3, we contrasted "consistent" drivers with "switched" drivers (i.e., drivers who switched to passenger status at exit). For Hypothesis 4, we contrasted "consistent" passengers with "switched" passengers (i.e., passengers who switched to driver status at exit). Finally, for Hypothesis 5, we contrasted "switched" drivers with "switched" passengers (i.e., those who switched roles at exit).

3. RESULTS

Mean BrACs and prevalence rates for each of the seven dependent measures for the two groups contrasted for each of the five hypotheses are listed in Table 1. The groups are organized into pairs in five rows: (1) passenger versus drivers; (2) DDs versus non-DDs, (3) "consistent" drivers versus "switched" drivers; (4) "consistent" passengers versus "switched" passengers; and (5) "switched" passengers versus "switched" drivers. In Table 1, statistically significant comparisons (within each row-pair) are indicated by bold ($p \geq .01$) and italic ($p \geq .05$) fonts.

3.1 Comparing drivers to passengers (Hypothesis 1)

We predicted that drivers, relative to passengers, would display fewer impaired-driving risk indicators. As shown in row 1a versus 1b of Table 1, drivers did have significantly lower drinking intentions ($F(1, 423) = 52.6$, $p < .01$), lower BrACs at entry ($F(1, 432) = 8.2$, $p < .01$) and exit ($F(1, 432) = 36.5$, $p < .01$), lessor increases in BrAC while at the club ($F(1, 432) = 23.2$, $p < .01$), and fewer BrACs ≥ .05 at exit ($F(1, 432) = 25.3$, $p < .01$). However, there were no differences between groups in drug use at entrance or exit. A formal contrast affirmed that the difference in the proportion of high BACs (at exit) between drivers and passengers was significantly different from the proportion of drug-positives (at exit) between drivers and passengers ($F(1, 855) = 12.1$, $p < .01$).

3.2 Comparing DDs and non-DDs (Hypothesis 2)

We predicted that among "consistent" drivers, those assuming the DD responsibility would demonstrate lower alcohol and drug risk levels than non-DDs. Rows 2a and 2b in Table 1 indicates that, although the differences between the DDs and the non-DDs where in the expected direction (DDs lower), only the comparison in the percentage of drivers with BrACs ≥ .05 at exit was significantly different ($F(1,436) = 5.1$, $p < .05$).

3.3 Comparing "consistent" drivers with "switched" drivers (Hypothesis 3)

We predicted that relative to "consistent" drivers, "switched" drivers would consume more alcohol and have higher-risk indicators. Table 1 (line 3a and 3b) shows that the drivers who switched had greater drinking intentions ($F(1, 423) = 9.5$, $p < .01$), did not have higher BrACs at entry but did have higher exit BrACs ($F(1, 432) = 14.2$, $p < .01$). Further, they had a greater increase in BrACs while at the club ($F(1, 432) = 10.7$, $p < .01$) and a greater percentage of high-BrAC drivers on exit ($F(1, 432) = 17.5$, $p < .01$). However, they did not exhibit a significant difference in BrACs at entry or in drug use at either entry or exit.

3.4 Comparing "consistent" passengers with "switched" passengers (Hypothesis 4)

We predicted that if groups seek low-BrAC drivers, passengers who convert to drivers would have significantly lower risk indicators than "consistent" passengers. Rows 4a and 4b of Table 1 show that, although "switched" passengers did not differ from "consistent" passengers in their arrival BrACs, they had significantly lower drinking intentions ($F(1, 423) = 7.0$, $p < .01$), lessor increases in BrACs while at the club ($F(1, 432) = 16.3$, $p < .01$), lower exit BrACs ($F(1, 432) = 8.9$, $p < .01$), and a lower percentage of individuals with high BrACs at exit ($F(1, 432) = 7.0$, $p < .01$). There were no significant differences in drug use between "switched" passengers and "consistent" passengers.

3.5 Comparing "switched" drivers with "switched" passengers (Hypothesis 5)

We suggested that passengers who replaced drivers would have lower risk indicators than the drivers they replaced. Lines 5a and 5b in Table 1 show that these two groups did not differ significantly on initial drinking intentions or on arrival BrACs. However, "switched" passengers did have significantly lower exit BrACs ($F(1, 432) = 8.0$, $p < .01$), drank less while at the EMDE ($F(1, 432) = 13.4$, $p < .01$), and a lower percentage of high-BrAC drivers when leaving the site than those they replaced ($F(1, 432) = 10.2$, $p < .01$). Differences in the prevalence of drug use at entry and exit between the two groups were not statistically significant.

3.6 Additional drug analysis

Although none of the comparisons regarding drug prevalence at entry or exit was statistically significant, the sample estimates are in the predicted directions (i.e., lower for drivers relative to passengers, lower for DDs versus non-DDs, and lower for "switched" passengers relative to "switched" drivers). We combined the groups displayed in Table 1 to create (post hoc) a high- and a low-risk group. The high-risk group consisted of "consistent" passengers and "switched" drivers, whereas the low-risk group consisted of designated drivers and "switched" passengers. Non-DDs were excluded. Comparison of these two groups on drug use at exit failed to find significant differences ($p = .34$). Additionally, we conducted an interaction to formally test whether alcohol rates (prevalence with exit BrACs ≥ .05 g/dL) differed significantly from drug prevalence exit rates as a function of belonging to the low- versus high-risk (post hoc) groups. The interaction was statistically significant ($F(1, 803) = 11.6$, $p < .01$). The low-risk group was significantly less likely to have BrACs ≥ .05 g/dL than the high-risk group. Further, this difference was significantly greater than the difference between the low- and high-risk groups in drug use measured at exit.

4. DISCUSSION

The general picture presented by these results is that young adult travel arrangements to drinking locations are influenced by an effort to avoid alcohol-impaired driving. If we accept the drinking level of the passengers as the norm for the young adults in the EMDE environment, then being a driver reduced their mean exit BAC by half, from .053 to .025, and the percentage at a high-risk for impaired driving (BrAC ≥ .05) from 1 in 2 to 1 in 5 (46.7% versus 20.2%). Of particular interest is the evidence that drivers arrived at the site with lower BrACs than their passengers did. This could result from two possibilities: lighter drinkers are more likely to choose or to be chosen to drive to drinking locations or drivers are more likely to limit drinking (avoid "preloading") before arriving at the club. Both possibilities appear to match their lower intent to drink at the club, which was validated by the statistically significant smaller increase in BrACs while at the EMDEs. Thus, the differences in impaired-driving risk levels between drivers and passengers attending weekend night events appears to be principally a function of the selection of the driver.

The extent of the group influence on the selection of the driver is suggested by the finding that 116 of the 139 groups indicated that they had a DD. However, the response to the DD question does not necessarily indicate a formal decision-making process or when the decision was made. Lange and colleagues (2006) demonstrated that it was possible to moderate the drinking of drivers headed for bars by raising the DD issue. Their results and ours suggest that the DD question serves as an alerting function that influences the passengers' perception of risk and creates social pressure on the driver that results in reduced consumption at the site.

A key opportunity for achieving a public health benefit is to replace drivers who have been drinking heavily with substitute drivers who have lower BrACs. In this study, drivers who decided to switch had three times the percentage of high-risk drivers (65% compared to 20%), as did the drivers who drove to and from the club, suggesting that their heavy drinking played a role in the decision to switch. The passengers who took over the driving had substantially lower BrACs than the drivers they replaced. Only 20% of the 27 switching passengers had high BrACs, compared to 47% of the 245 “consistent” passengers in this study. Thus, the substitution process appeared to be influenced by the drinking status of both the drivers and the passengers who replaced them. The replacement of 17 high-BrAC drivers among the 27 drivers who switched to passengers, with only 5 high-BrAC drivers among the passengers who replaced those drivers, resulted in reducing the overall percentage of high-BrAC drivers among the 174 drivers (147+27) leaving the club from 27.0% to 20.0%, a one-fourth reduction in impaired-driving risk.

In contrast to this clear indication of actions to avoid alcohol-impaired driving, this study indicates that little or no substantial action is being taken to avoid drugged driving. None of the five hypotheses regarding alcohol use and driving was found to be valid for drug use. We confirmed the difference between drug use and alcohol use in driving with an additional study contrasting high- and low-risk driver groups. The significance of this result may be limited by the low number of drug users (≈ 20%) in our sample and by the fact that most of the drug use occurred before arrival at the EMDEs. Clearly, however, this suggests that the perceived risk of driving with an illegal drug is not a significant factor in determining driver versus passenger status among the EMDE attendees in our sample. This is perhaps not surprising given the relatively limited publicity given to the risk of drugged driving compared to drunk driving.

4.1 Limitations

Among the limitations of this study is that we have no direct observations or reports on the driving decision process. Our study is on driving status and changes in status as related to alcohol and drug use. We established a random participant selection system; however, we found it somewhat difficult to contact club patrons when the area outside the EMDEs was very crowded. We were therefore unable to get the attention of about 40% of the club attendees in order to approach them to participate in the study. Nevertheless, of those we contacted and explained the study, 63% agreed to participate. We inquired if any of the attendees we tested had participated in our survey previously, and if they had, we did not include them a second time. As the survey was anonymous, however, a few participants may have been interviewed more than once. Possibly, the question regarding the DD status asked on arrival at the club provoked a positive response in some groups where no overt decision had been formally made before driving; if so, the responses may have primarily reflected a greater concern with driving safety. Additionally, the relatively small numbers in the DD versus non-DD comparison may have limited the statistical power of that analysis. Although both the DD designation and the report on drinking intentions could be influenced by a motivation to provide socially acceptable responses, a strength of this study is that both alcohol- and drug-use statuses are based on biological measures rather than self-report.

4.2 Summary

The driving of young adults aged 18 to 34 apparently is strongly influenced by behaviors that limit the risk of impaired driving. Drivers are drinking less than their passengers, both before arriving at the site and while at the club. Drivers who specifically assume the DD responsibility for others in the group are less likely to have high-risk BrACs. A third of the heavy drinking drivers avoid driving after drinking and are replaced by passengers with lower BrACs, reducing by a quarter the number of high-risk drivers departing from the drinking locations. The impaired-driving avoidance actions identified in this study appear to occur at two points: before leaving for the site when the group's driver is determined, and after drinking has begun at the site when driver's status may change. This suggests that there are two opportunities to implement interventions: those directed at transportation planning and those at entry to drinking locations designed to alert groups to the risks of impaired driving. The lack of driving actions to reduce the risk of drugged driving suggests the need for a well-designed public media campaign to educate drivers on the risks of combining drugs and driving. However, the multiplicity of substances that can affect driving is likely to make progress in reducing drug-impaired driving more difficult than for alcohol-impaired driving, which involves a single, comparatively simple substance whose impact on driving is relatively well understood and accepted.

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Table 1

Results of the tests of five hypotheses regarding alcohol and drug use by drivers and their passengers traveling to EMDEs

			Alcohol risk indicators					Drug risk indicators	
Type of comparison	**Hypothesized risk**	***N***	**Drinking intentions[a] at entry**	**Mean BrAC at entry**	**Mean BrAC at exit**	**Increase in BrAC entry to exit**	**% with BrAC≥.05 at exit**	**% using at entry**	**% using at exit**
1a. Drivers to and from	Low	147	**0.86**	**.011**	**.025**	**.014**	**20.2**	16.4	18.7
1b. Passengers to and from	High	245	**1.56**	**.021**	**.053**	**.032**	**46.7**	17.7	20.6
2a. Designated drivers	Low	116	0.77	.010	.022	.012	*16.5*	15.2	17.2
2b. Nondesignated drivers	High	23	1.14	.016	.040	.024	*38.7*	20.3	24.3
3a. Drivers switched to passengers	High	27	**1.48**	.021	**.061**	**.039**	**64.6**	20.1	23.9
3b. Drivers to and from	Low	147	**0.86**	.011	**.025**	**.014**	**20.2**	16.4	18.7
4a. Passengers switched to drivers	Low	28	**1.08**	.023	**.027**	**.004**	**19.5**	11.5	11.3
4b. Passengers to and from	High	245	**1.56**	.021	**.053**	**.032**	**46.7**	17.7	20.6
5a. Drivers switched to passengers	High	27	**1.48**	.021	**.061**	**.039**	**64.6**	20.1	23.9
5b. Passengers switched to drivers	Low	28	**1.08**	.023	**.027**	**.004**	**19.5**	11.5	11.3

Statistically significant differences are in bold, $p \geq .01$, and italics, $p \geq .05$.

[a]Not drinking (0), drinking but not get buzzed (1), get buzzed but not drunk (2), get drunk or very drunk (3).