

HEAVY ALCOHOL USE COMPARED TO ALCOHOL AND MARIJUANA USE: DO COLLEGE STUDENTS EXPERIENCE A DIFFERENCE IN SUBSTANCE USE PROBLEMS?*

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ABSTRACT

This study examines the risk for alcohol and other drug (AOD) problems resulting from alcohol plus marijuana use compared to alcohol-only use. Data are from telephone interviews with 1113 randomly selected college students attending two large urban universities in the southwestern United States. Alcohol and marijuana users (dual users) were more likely to be younger and report a higher mean number of drinks per occasion and experiencing all AOD problems studied compared to alcohol-only users. Multivariate logistic regression analysis findings reveal the relationship between dual-substance use and increased risk for AOD problems remained after controlling for demographics and alcohol use behaviors. Such problems include greater odds of legal problems and riding with or being an intoxicated driver. College students using alcohol and marijuana are at much higher risk for AOD problems than are students who use alcohol only, even when heavy drinking is taken into account.

Alcohol and other drug use are among the top threats to college student health in the United States. Alcohol consumption is highly prevalent among college

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students, as documented through a number of national level studies. The 2003 data from the Monitoring the Future study found that 86.2% of college students report lifetime alcohol use with 66.2% reporting use in the prior 30 days. Of those with recent use, 38.5% reported heavy episodic drinking during the two weeks prior to being surveyed. It was further found that 30% of 19-22 year olds reported that most or all of their friends get drunk once a week (Johnston, O'Malley, Bachman, & Schulenberg, 2004).

Similar findings have been reported by studies designed specifically to examine college students' alcohol use. Presley and associates reported that 83.5% of college students reported they had consumed alcohol at least once during past 12 months (Presley, Meilman, & Lyster, 1995). Wechsler and colleagues found that about 42% of all college students were heavy episodic drinkers in that they reported having five or more drinks at a single setting (Wechsler, Dowdall, Davenport, Maenner, Gledhill-Hoyt, & Lee, 1998). This heavy drinking is often associated with alcohol-related problems, and Presley et al. (1995) reported that nearly 60% of respondents reported experiencing at least one substance use problem.

The epidemiology of drug use among college students is also reported in the on-going *Monitoring the Future Study*. Johnston and associates (2004) found that the lifetime prevalence rate for marijuana was 50.7% among full-time college students. When gender is considered, males and females reported a similar lifetime prevalence rate for marijuana (51.8% and 50.1% respectively). The lifetime reports of marijuana use have increased during the past decade. The trend data for college students indicate that, in 1995, 41.7% of college students reported lifetime use of marijuana while 50.7% reported such use in 2003. In fact, lifetime prevalence of marijuana use among college students increased 1.2% from 2002 to 2003 (Johnston et al., 2004).

Gledhill-Hoyt, Lee, Strote, and Wechsler (2000) found the trend of increased use of marijuana from their research with 140 universities. Interestingly, they found that nearly one third of college students reporting the age at onset for marijuana use to be at age 18 or older. This finding was supported by a multi-wave follow-up study reported by Windle and Wiesner (2004) in which it was found that there were relatively high rates of lifetime cannabis abuse/dependence disorders among adults who, when in high school, were only experimenters or abstainers. This indicates that a meaningful percentage of college students do not begin their use of marijuana until they are out of high school.

A few predictors have been found for marijuana use. In a study of U.S. college students, it was found that cigarette smoking, low religiosity, and heavy episodic drinking were strong predictors of marijuana use (Bell, Wechsler, & Johnston, 1997) and living away from parents (Gfroerer, Greenblatt, & Wright, 1997).

A small number of studies have examined the long-term association of marijuana use or marijuana plus alcohol use with long term consequences. Schuster, O'Malley, Bachman, Johnston, and Schulenberg (2001) found a clear

linear relationship for males, but less so for females. Men who used marijuana three or more times over a 12 month period during their senior year in high school had significantly lower occupational attainment at the 10-year follow-up. Women were also impacted, but the association was less unequivocal. Stenbacka (2003) found that the reports of using both alcohol and marijuana in adolescence resulted in higher risk for escalation to adult alcohol and drug abuse than youth using only alcohol or cannabis alone. A longitudinal study that followed adolescents after 10-12 years found that youth who used marijuana had higher rates of antisocial symptoms and arrests regardless of age at onset (Flory, Lynam, Milich, Leukefeld, & Clayton, 2004).

Little research has examined combined effects of using alcohol and marijuana as they relate to substance use problems reported by college students. Given the association of heavy episodic drinking and marijuana use as noted by Wechsler, Dowdall, Davenport, and Castillo (1995) and the longitudinal implications for problems in later adulthood, this study is important.

A prior study found higher rates of reported AOD problems among college students (Shillington & Clapp, 2001). However, the previous study reported on a relatively small sample of college students. Further, the national data indicate that the use of marijuana has increased during the interim five years between the prior study and the current one. Thus, in a time of increasing marijuana use among college students, relatively little is known about alcohol and marijuana use as it relates to AOD problems for single and poly-substance users. This study provides data directly related to this important issue.

METHODS

Design

The present study is a secondary analysis of data collected as part of an ongoing evaluation of an environmental prevention program targeting alcohol-related problems such as drunk driving. This relational study used cross-sectional survey data collected at two large urban public universities located in the southwestern United States.

Sample

Between fall semester 2002 and spring semester 2003, a university-based social science research laboratory administered 1607 telephone interviews with randomly selected undergraduate students at the two universities. The sampling frame for this study included all undergraduate students registered at the study universities during the above semesters. Approximately 400 student phone numbers were randomly selected each semester at each school from registration records for interview. Each selected number was called up to four times. If no

student was contacted in those attempts, the number was randomly replaced. Students contacted but refusing to participate in the study were randomly replaced. Refusal rates averaged about 25% across survey waves.

Given the size of the population at the study universities, this sample size allows for a 95% level of confidence (± 5.0) when estimating population parameters.

Given that our purpose is to examine the relationships among marijuana use, alcohol use, and related problems, estimating population parameters at each institution is not of primary concern. That is, we are interested in the conceptual relations among the variables of interest. Bivariate analyses of the data, including chi-square and ANOVAs, comparing the two universities indicate that the schools do not differ on most of the demographic variables and many of the substance use and problem variables assessed here. As such, and to increase our statistical power, the data from the two schools were pooled for analysis. However, the two schools were identified as being different on ethnicity in that one had a higher percentage of Hispanic/Latino students while the other had more Caucasian students. Because of this ethnic difference, we later control for ethnicity and for school of attendance in our multivariate logistic regression analyses.

Telephone Interview Procedure

Data were collected by the Social Science Research Laboratory located at San Diego State University. Trained interviewers made all the calls and a senior research manager monitored calls for quality assurance. Each interviewer followed the script exactly. No irregularities were reported during data collection.

The interview schedule was programmed into a computer-assisted data-entry system (CADE). Data were entered directly into an electronic database during each interview. All skip patterns were preprogrammed into the CADE system.

Instrument

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 AOD use and related problems. Presley and associates (1995) reported the psychometric properties of the Core were acceptable. In addition to the standard questions taken from the Core Survey, we included a series of questions measuring contexts of student drinking (see Clapp, Shillington, & Segars, 2000). Those original items were validated in an earlier study (Clapp et al., 2003). The CAGE, a brief (four items) and psychometrically established alcohol problem screening scale (Ewing, 1984), was also included in the study. The four CAGE items are yes/no and coded yes = 1. A score of two or higher indicates a potential alcohol problem.

Measures

A drink was defined as one beer, one glass of wine, one mixed drink, or one shot of spirits. Alcohol consumption was measured using a series of questions about their alcohol consumption during the past 28 days. These questions included the following: a) Thinking specifically now about the *past 4 weeks, or 28 days*, on how many days, if any, did you have at least one drink of beer, wine, or liquor? b) On how many of those ___ days (when you had a drink) did you have *more than one* drink? c) On how many of those ___ days (when you had more than one drink) did you have *three or more drinks*? d) On how many of those ___ days (when you had three or more drinks) did you have *six or more drinks*? These items were scored using the Consumption Models Analysis Program developed by Gruenewald and Nephew (1994). Based on the analysis of this set of questions covering the past 28 days, drinking frequency (f), mean drinks per occasion (dpo), and a drinking variance estimate (s^2) in drinks per occasion can be computed. Gruenewald et al. (1994) argued that each individual's drinking pattern can be described as a point in three-dimensional space defined by these three variables. The total consumption level can be estimated from the product of $(f) \times (dpo)$. In order to obtain the average drinks per occasion we computed a 12 month estimate of DPO [12×28 day dpo].

Alcohol use during the past 12 months was based upon a question that asked if they had at least one drink during that time period. The response categories were 0 = no, 1 = yes. A single item asked the number of times respondents used marijuana in the past year. This variable was recoded into a bivariate variable with 0 = no and 1 = yes. For those reporting alcohol only and no marijuana use, they were coded as an "alcohol only (AO) user" and any respondent reporting alcohol use and marijuana use as "alcohol plus marijuana (AM) user." Both AO use and AM use variables were queried for the past year prior to being surveyed. We excluded abstainers from all bivariate and multivariate analyses. The procedure resulted in 1,113 valid cases for analysis.

In addition to the substance use questions, the interview schedule asked respondents the number of days in the last year they experienced or engaged in any of the following problems as a result of their AOD use: a) hangover, b) poor academic performance, c) had legal problems, d) damaged property, e) physical fights, f) verbal fights, g) got nauseous or vomited, h) drove under the influence, i) rode with an intoxicated driver, j) got criticized for their drinking behavior, k) felt guilty for drinking, l) drank in the mornings, m) were criticized for drinking, or n) felt they should cut down. These items were coded 0 = no, 1 = yes.

A summary variable was created that summed the total number of AOD problems reported. In addition, we included the four CAGE items as potential problem indicators. The CAGE consists of four questions asking the respondent if they: a) have tried to cut down on their drinking; b) if they have been criticized for

their drinking; c) if they feel bad and need to cut down; and d) if they are drinking in the morning.

Analyses

All analyses were conducted using the Statistical Package for the Social Sciences v. 13.0 (SPSS, 2004). To test the association between substance use (alcohol only vs. alcohol and marijuana) and the substance use problem, we conducted bivariate analyses and computed the appropriate Chi-Squared tests and one-way ANOVA models. For multivariate analyses, we computed forced entry multiple logistic regression models. For all analyses, diagnostic values were examined (e.g., percentage of empty cells in chi-square tables, two-log odds in logistic regressions, etc.). All statistical tests employed met the assumptions of the respective test.

FINDINGS

It was found that among an original sample of 1607 students, 83% reported having used alcohol during the year prior to the survey. After excluding students who did not report alcohol use and others with missing data on important variables, we had a final sample size for this study of 1113. Our sample was 44.8% male, with 57.1% reporting their ethnicity as Caucasian, 26.4% Hispanic, and 6.7% Asian/Pacific Islander, with a mean age of 24.8 years. About 82% of the sample were undergraduate students and 85.3 % were full time students.

Table 1 presents frequencies for past year marijuana and alcohol use behaviors, and AOD problems reported by respondents. For past-year use it was found that 71.2% of the students in our sample reported using alcohol only and 28.8% reported using both alcohol and marijuana. Thus, 793 of the cases could be classified as alcohol only users and 320 cases were classified as poly-substance users. The mean number of drinks per occasion was found to be 3.51 per day.

Table 1 also presents the AOD problems reported being experienced during the prior 12 months. Overall, four-fifths of cases reported at least one AOD-related problem. The two most frequently reported physical problems resulting from substance use were hangovers reported by 59.7% and getting sick/nauseous reported by 40.1%. Disturbingly, almost 40% of those included in the analyses reported riding with an AOD impaired driver and 29.6% reported driving while under the influence of alcohol. There were a number of other problems reported by this sample of students. It was found that 19% reported missing class and 7% reported doing badly in school due to substance use. Although the reports of physical fights was rather low, it was found that 23.5% of students reported being in verbal fights while using.

As for the CAGE items, it was found that 34.6% reported feeling they should cut down on their use. A high percentage of students reported feeling guilty about their alcohol use (21.2%), while 11.2% reported being criticized by someone

Table 1. Twelve Month Substance Use Behaviors and Reported Problems ($N = 1113$)

	<i>N</i>	Percent
Past 12 month substance use behaviors		
Alcohol use only	793	71.2
Alcohol and marijuana use	320	28.8
Drinks per occasion	Mean = 3.51/day, Range 1-17	
Problems during past 12 months		
Hangover	665	59.7
Did poorly on school test or project	79	7.1
Legal problems	47	4.2
Damaged property	34	3.1
Got into physical fight	51	4.6
Got into verbal argument	262	23.5
Got nauseous or vomited	446	40.1
Drove under influence	329	29.6
Was passenger in car with drunk driver	429	38.5
Missed class	214	19.2
CAGE—Criticized for drinking behavior	125	11.2
CAGE—Should cut down	385	34.6
CAGE—Feel guilty about drinking	236	21.2
CAGE—Drinking in the mornings	68	6.1
Experienced any problems	903	81.1
	Mean Number of Problems = 3.03 (2.59) Range 0-14	

for their drinking. When examining the summary variable for reporting any of the problems, it was found that the students had a mean of 3.0 alcohol and drug problems for the past year.

Bivariate Results

In order to understand the differences between students who report only using alcohol compared to those who reported alcohol and marijuana use, bivariate statistics of Chi-square and ANOVA were utilized. Although not reported in a table, it was found that white students (65.4%) were significantly more likely to report being alcohol and marijuana (AM) users compared to the non-white students (23.9%) (Chi-square = 10.31, $p < .001$). So for further analyses, whites were coded as the referent group. No differences were found between males and

females. When the age of poly substance users (mean = 22.3, $SD = 4.6$) was compared to the age of AO users (25.8, $SD = 8.8$) using Analysis of Variance (ANOVA), it was found that the AM users were significantly younger ($F = 48.89$, $p < .001$). An analysis was also conducted to examine the mean number of drinks per occasion reported by the two groups. It was found that the AM users reported significantly more drinks consumed per occasion. The AO users reported a mean of 3.0 drinks per occasion and the AM users reported 4.76 drinks per occasion ($F = 99.49$, $p < .0001$).

Table 2 presents the bivariate associations between the drug use variable (alcohol only vs. alcohol plus marijuana use) and the 14 specific AOD problem indicators. The dual substance users were found to be more likely to report each of the 14 AOD problems compared to AO users. As can be seen, there were over three-fourths (80.0%) of AM users who reported a hangover compared to about half of AO users (51.6%). Significantly more AM users reported doing poorly

Table 2. Chi-Square Results for Alcohol User and Alcohol Plus Marijuana Users and Reported Problems ($N = 1110$)

Variables	Alcohol use only ($N = 793$)	Alcohol and marijuana use ($N = 320$)	Chi-square
Hangover	409 (51.6%)	256 (80.0%)	76.59***
Did poorly on school test/project	34 (4.3%)	45 (14.1%)	33.04***
Trouble with the police	12 (1.5%)	35 (10.9%)	50.07***
Damaged property	13 (1.6%)	21 (6.6%)	18.66***
Got into physical fight	28 (3.5%)	23 (7.2%)	6.97***
Got into verbal argument	133 (16.8%)	129 (40.3%)	70.20***
Got nauseous or vomited	252 (31.8%)	194 (60.6%)	79.01***
Missed class	113 (14.2%)	101 (31.6%)	44.00***
Drove while drunk	195 (24.6%)	134 (41.9%)	32.71***
Was passenger in car with drunk driver	254 (32.0%)	175 (54.7%)	49.41***
CAGE—Tried to cut down	234 (29.5%)	151 (47.2%)	31.50***
CAGE—Criticized for drinking behavior	77 (9.7%)	48 (15.0%)	6.40**
CAGE—Feel should cut down	156 (19.7%)	80 (25.0%)	3.87*
CAGE—Drink in the morning	30 (3.8%)	38 (11.9%)	26.02***
Experienced any problem	596 (75.2%)	307 (95.9%)	64.31***

* $p < .05$. ** $p < .01$. *** $p < .001$.

on a test/project for school, being in trouble with the police, damaging property, being in a physical or verbal fight, being physically ill, driving drunk or being a passenger in a car with a drunk driver, and missing class. The AM users were also more likely to report problems from the CAGE as well. They were more likely to report being criticized for their drinking, thought they should cut down their use, tried to cut down, and drank in the morning than did the AO users. It was found that nearly every AM user endorsed at least one problem at 95.9% compared to 75.2% of the AO group. Those who used alcohol only reported a mean number of problems of 2.45 ($SD = 2.3$) and the AM users had a mean number of problems of 4.47 ($SD = 2.65$).

Multivariate Results

Multiple logistic regression analyses were conducted to identify the increased risk for AOD problems among alcohol and marijuana users compared to alcohol only users while controlling for drinks per occasion and demographics. We conducted a multiple logistic regression model in which age, ethnicity, gender, school, drinks per occasion, and poly-substance use are regressed on each AOD problem found significant in the bivariate analyses. Table 3 reports the odds ratio and 95% confidence intervals for alcohol use compared to alcohol plus marijuana use for each AOD problem. The strongest odds ratio was for having problems with the police. AM users were nearly six times more likely to report this problem compared to AO users.

Among this sample, students who were AM users were over twice as likely to report doing poorly on a school test/project, damaging property, getting into a verbal fight, drinking in the mornings, and having been physically ill. The students reporting using alcohol and cannabis were nearly twice as likely to report riding in a vehicle with a drunk driver and to drive under the influence themselves compared to the alcohol only users. The poly-users were also more likely to report hangovers, missing class, driving while intoxicated, trying to cut down, and been criticized for their drinking behavior, compared to alcohol only users when controlling for demographics and heavy episodic drinking. The AM users were 3.71 times more likely to report a AOD related problem compared to the alcohol only users after controlling for demographics and drinks per occasion.

DISCUSSION

National data collection efforts have identified a continued increase in the reports of marijuana use among college students with the Harvard School of Public Health College Alcohol Study identifying an increase of 22% from 1996-1999 (Gledhill-Hoyt et al., 2000). The national Monitoring the Future study found that over half of college students reported lifetime use of marijuana and 33.7%

Table 3. Odds Ratio and 95% Confidence Intervals for Reported Problems and Alcohol Plus Marijuana Use after Controlling for Age, Gender, Ethnicity, and Drinks per Occasion Using Multiple Logistic Regression

Problem variable	Odds ratio	(95% Confidence Intervals)
Hangover	1.92	1.36–2.72
Did poorly on school test/project	2.83	1.70–4.69
Trouble with the police	5.96	2.88–12.33
Damaged property	2.20	1.03–4.69
Got into physical fight		ns
Got into verbal argument	2.33	1.69–3.21
Got nauseous or vomited	2.11	1.54–2.87
Missed class	1.90	1.34–1.27
Drove while drunk	1.90	1.40–2.58
Was passenger in car with drunk driver	2.06	1.14–1.28
CAGE—Tried to cut down	1.80	1.34–2.43
CAGE—Criticized for drinking behavior	1.76	1.15–2.68
CAGE—Feel should cut down	ns	ns
CAGE—Drink in the morning	2.44	1.41–4.23
Experienced any problem	3.71	2.09–6.84

reported using it during the past year. Alcohol use is found to be over 80% for both lifetime use and past 12-month use (Johnston et al., 2004). Prior research has found that dual substance users tend to report more AOD related problems relative to alcohol only users (Shillington & Clapp, 2001).

The present study supports earlier findings by Shillington and Clapp (2001); college students who use alcohol and marijuana report significantly higher percentages of various substance use problems within the past year. This study did find more poly-substance users at 28.8% compared to 17.1 % in the earlier study (Shillington & Clapp, 2001). The students with both alcohol and marijuana use did result in higher odds of problems reported compared to the alcohol only users in this study compared to the 2001 study. The AM users had higher odds for hangovers, police problems, damaging property, being in verbal arguments, and being a passenger with an intoxicated driver in this study compared to the earlier research. The only problem where the odds ratio was lower in this study was missing class.

Although only generalizable to similar large universities in the southwestern United States, the present study utilized two waves of carefully collected cross-sectional data, affording the opportunity to examine a large number of respondents who used both marijuana and alcohol. However, due to the cross-sectional nature of the study, only associations between substance use and reported problems are reported. We cannot discuss the causative relationship between the substance use patterns and problems experienced by college students. Also, these data are self-reported and thus need to be interpreted with the caution usually prescribed with self-report data. The validity of self-reports has been reviewed and discussed in the alcohol use literature (Midanik, 1988).

Of particular note, dual substance users are more likely to experience any problem and over five times more likely to experience trouble with police. Dual use students also were more likely to report affirmative responses to three of the four CAGE indicators. As such, such dual users represent an important segment of the population for prevention planners and researchers alike.

Although we controlled for drinks per occasion in our analyses, it is worth noting that there was a substantial and significant difference between the two groups, with marijuana and alcohol using respondents reporting 1.76 more drinks per occasion ($M = 4.76$). Thus, the multi-substance using students also tend to be heavier drinkers than their non-marijuana using counterparts.

As a group, dual marijuana and alcohol users are seldom specifically targeted for intervention. Many college campuses have secondary prevention programs for heavy drinkers that are identified through legal or administrative sanctions. Although many of the strategies embraced in such programs have evidence of efficacy (Larimer & Cronce, 2002), the focus of these programs tends to be on alcohol problems. Further research is needed to examine 1) whether the underlying mechanisms that lead to substance-related problems are different for dual marijuana and alcohol users than for alcohol only users, and 2) whether alcohol-based interventions are adequate to address the problems experienced by dual users.

Implications

The etiology of dual marijuana and alcohol use is also unclear. Although there is no single etiological theory of college alcohol use and problems, there is abundant evidence suggesting physiological (Spear, 2002), psychological (Baer, 2002), social (Baer, 2002; Lange & Voas, 2000), and environmental (Clapp et al., 2003) factors contribute to such behavior. Likewise, we have etiological models to predict marijuana use (Brook, Balka, & Whiteman, 1999). Dual alcohol and marijuana use, however, might not be adequately explained by such factors. As marijuana use increases among college students and alcohol use remains heavy, such research takes on great importance.

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