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Simultaneous vs. concurrent use of alcohol and cannabis in the National Alcohol Survey

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Abstract

Background—Cannabis is the most commonly used drug among those who drink, yet no study has directly compared those who use cannabis and alcohol simultaneously vs. concurrently (i.e., separately) in the adult general population. Here we assess differences in demographics, alcohol-related social consequences, harms to self, and drunk driving across simultaneous, concurrent, and alcohol-only using groups.

Methods—Secondary analyses of the 2005 and 2010 National Alcohol Survey (N=8,626; 4,522 female, 4,104 male), a Computer Assisted Telephone Interview survey of individuals aged 18 and older from all 50 states and DC. Blacks and Hispanics are over-sampled. Data were collected using list-assisted Random Digit Dialing (RDD). Multinomial and multivariable logistic regressions were used for analyses.

Results—The prevalence of simultaneous use was almost twice as high as concurrent use, implying that individuals who use both cannabis and alcohol tend to use them at the same time. Furthermore, simultaneous use was associated with increased frequency and quantity of alcohol use. Simultaneous use was also the most detrimental: compared to alcohol only, simultaneous use approximately doubled the odds of drunk driving, social consequences, and harms to self. The magnitudes of differences in problems remained when comparing drunk driving among simultaneous users to concurrent users.

Conclusion—The overall set of results is particularly important to bear in mind when studying and/or treating problems among alcohol/cannabis co-users because they demonstrate that in the general population, co-users are a heterogeneous group who experience different likelihoods of problems relative to co-use patterns.

Keywords

Cannabis; alcohol; co-use; concurrent use; simultaneous use

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INTRODUCTION

Cannabis is the most commonly used drug among those who drink, besides tobacco (Substance Abuse and Mental Health Services Administration, 2013). The recent legalization of cannabis in the states of Colorado and Washington highlights the need to better understand the relationship between cannabis and alcohol use, especially in terms of consequences and predictors: understanding consequences of co-use patterns will inform policy as the blossoming cannabis industry continues to grow, while identifying predictors will help public health practitioners and clinicians intervene with high-risk subgroups.

Predictors and consequences of co-use

Individual's cannabis and alcohol use trajectories are related (Martin et al., 1996; Pape et al., 2009), which can be explained by either common risk factors, or the nature of the substances causing use of one to lead to use of the other (Jackson et al., 2008). Individuals who use both cannabis and alcohol may be inherently more susceptible to poly-substance use because of common genetic vulnerabilities or behavioral under-control (McGue and Iacono, 2005; McGue et al., 2006; Zucker, 2006). Studies comparing alcohol only users to poly-substance users have found that those who use both alcohol and cannabis are more likely to be male and younger than those who use only alcohol (Harrington et al., 2012; Midanik et al., 2007). Alcohol abuse severity, treatment history and age of onset may predict cannabis use among risky drinkers (Booth et al., 2001); these factors predict worse drinking outcomes as well (Adamson et al., 2009), suggesting that they may moderate outcomes by worsening any negative effects of cannabis on alcohol.

The majority of studies on simultaneous use (i.e., co-ingestion of cannabis and alcohol) have relied on adolescent (Brière et al., 2011; Collins et al., 1998; Terry-McElrath et al., 2014) or college student samples (Martin et al., 1996). Within a prospective cohort of 6,589 Canadian high school students, simultaneous users consumed alcohol and cannabis more frequently than individuals who used alcohol only, cannabis only, or the two substances concurrently (i.e., in a given time period, such as 12 months, but not simultaneously). Simultaneous users also had more depressive symptoms, more problems at school, and were more likely to be male (Brière et al., 2011). Another study using 1976–2011 Monitoring the Future data examined the effects of simultaneous use on traffic tickets and accidents over time, and showed that high school seniors who mostly or always used cannabis and alcohol together had the highest rates of unsafe driving compared to individuals who combined the substances less frequently or tended to use the two concurrently (Terry-McElrath et al., 2014). Simultaneous users were more likely to be White, go out more often, and drink/use more than concurrent or single substance users (Terry-McElrath et al., 2013).

We found only three general population studies of simultaneous use among adults (Höhne et al., 2014; Midanik et al., 2007; Norton and Colliver, 1988). First, an older study using the 1982 National Household Survey on Drug Abuse data (N=5,624) showed that individuals who combined cannabis and alcohol were more likely to be male and in the 18–34 age group than not (Norton and Colliver, 1988). In the 2000 National Alcohol Survey (N=7,612), simultaneous use was related to increased social consequences, depression and alcohol dependence compared to alcohol-only users, and that simultaneous users were younger, less

educated, less likely to have a partner, and had heavier drinking patterns (Midanik et al., 2007); the authors did not make direct comparisons between simultaneous and concurrent users. Most recently, an epidemiologic study of German adults (N=7,912) showed that male gender, older age, less education, and having a substance use disorder all significantly predicted multiple intensive substance use (use of cannabis, alcohol and/or tobacco above a pre-defined threshold) compared to non- or single-intensive substance use (Höhne et al., 2014).

Rationale for current study

No study to date has examined differences in drunk driving and other alcohol-related harms and consequences between simultaneous and concurrent alcohol/cannabis users in the adult general population. We built on previous work by using a large (N=8,626) general population sample of adults to (1) assess differences in demographics across simultaneous, concurrent, and alcohol-only using groups; (2) assess differences in social consequences, harms to self, and drunk driving across simultaneous, concurrent, and alcohol-only using groups; and (3) directly compare social consequences, harms to self, and drunk driving between simultaneous and concurrent users.

MATERIALS AND METHODS

Sample

Data came from the 2005 (n = 6,919) and 2010 (n = 7,969) National Alcohol Survey (NAS) conducted by the Alcohol Research Group (ARG), Public Health Institute. Our analyses focus on current drinkers only because the outcomes of interest are alcohol-related (N = 8,626; 58% of the 2005 and 2010 samples). The NAS is a Computer Assisted Telephone Interview (CATI) survey of individuals aged 18 and older in households within all 50 states and DC. Blacks and Hispanics are over-sampled. For the 2005 and 2010 surveys, data were collected using list-assisted Random Digit Dialing (RDD). A Dual-Frame design, including both Landline and Cellular Phone cases, was implemented in 2010, providing coverage of 97.5% of the US households (Blumberg and Luke, 2009). The distribution of sample to cell phone and landline was based on optimal allocation taking account of relative cost of the two interview modes. The average interview time was 55 minutes for landline completed interviews and about 35 minutes on average for cell phone completed interviews. Cell phone respondents were asked a limited set of the landline questions, resulting in a shorter interview on average (while still including all measures utilized here). Those who completed the cell phone survey were compensated $10.00 for the cost of cell phone minutes. All respondents were given the option to be interviewed in either English or Spanish. AAPOR 3 cooperation rate was 52% (The American Association for Public Opinion Research, 2011). Three percent of the sample was removed due to missing data.

Measures

Current drinker status was classified according to overall alcohol frequency question and follow-up questions asking specifically if any alcohol was consumed in the past 12 months. *Cannabis use* was determined using the following question: “How often have you used marijuana, hash, pot, THC or ‘weed’ during the last twelve months? Was it every day or

nearly every day, about once a week, once every two or three weeks, once every month or two, less often than that, or never? ” For those who responded that they had used any cannabis in the past 12 months, a follow-up question was asked: “How often did you use alcohol and marijuana at the same time? Was it usually, sometimes, or never?” Based on this question and current drinker status, a trichotomous indicator variable was created to classify individuals as drinkers only, concurrent users (cannabis and alcohol used separately always), and simultaneous users (cannabis and alcohol used usually/sometimes together). We refer to this classification as *co-use status.*

Dependent variables were drunk driving, alcohol-related social consequences, and alcohol-related harms. *Drunk driving* was measured by the following: “In the last twelve months, have you driven a car when you had drunk enough to be in trouble if the police had stopped you?” *Alcohol-related social consequences* came from 15 items in 5 areas: legal/accidents, health, work, fighting, and relationship problems; please see Appendix A for the full list of items (Midanik and Greenfield, 2000; Midanik and Clark, 1995). A cutoff of 2 or more consequences was used to indicate presence of social consequences. Our analyses focus on consequences that occurred in the past 12 months. The social consequences scale is reliable with $\alpha = 0.70$. *Alcohol-related harms* were measured using a 6-item scale that asked, “Was there ever a time when you felt your drinking had a harmful effect on your [(1) friendships and social life, (2) outlook on life, (3) home life or marriage, (4) financial position, (5) work and employment opportunities, and (6) health]?” If the respondent answered yes, the interviewer asked whether the harm had occurred in the past 12 months. Those who endorsed at least one harm in the past 12 months were classified as having experienced harm from their own drinking (Midanik and Greenfield, 2000).

We used the following demographic variables as predictor and control variables: *gender*, *age* (18–29, 30–49, 50+), *ethnicity* (African American, Hispanic, Other, White), *education* (less than high school, high school diploma or more), *employment* (full/part-time employed, unemployed), *relationship status* and (married/co-habitating, not married/co-habitating). We controlled for these demographics in all multivariable analyses, as well as *number of days drank five or more drinks* based on a graduated frequency measured (Greenfield, 2000) and *average daily number of drinks* (calculated from frequency of drinking and average number of standard drinks per drinking occasion). A standard drink in the US is 14 grams (0.6 ounces) of ethanol. We also examined *quantity and frequency of drinking in bars*, at *parties*, and at *home*, and *frequency of cannabis use* across co-use statuses. For example, participants were asked, “How often do you drink at bars, taverns, or cocktail lounges?” and, “When you drink, how many drinks do you typically have when you drink at a bar, tavern, or cocktail lounge?” Average number of drinks drank daily in each of the three contexts (in bars, at parties, at home) was calculated from the frequency and average quantity measures.

Statistical Analyses

Sampling weights were used in all analyses to adjust for the probability of selection introduced during the sampling design. In addition, post-stratification weights were constructed to match the NAS sample to the US population estimates on key demographic

distributions including gender, age, ethnicity, education and state population. All analyses were performed in Stata V.11.1 (Stata Corp., 2009).

Regressions were used in two ways. First, we assessed whether demographic and alcohol use variables predicted co-use status (i.e., concurrent and/or simultaneous cannabis use compared to drinker only status) using multinomial logistic regression. We then evaluated the associations between co-use status and drunk driving, social consequences, and harms to self; a trichotomous co-use indicator was used as the primary independent variable. Demographic and drinking pattern variables significantly associated with co-use status in bivariate tests were included in all multivariable models.

Finally, we directly compared problems between simultaneous and concurrent users by restricting the sample to individuals who had drank and used cannabis in the past 12 months. Multivariable logistic regressions were used to assess the odds of drunk driving, social consequences, and harms to self among simultaneous users relative to concurrent users. These regressions controlled for frequency of cannabis use.

RESULTS

Prevalence of co- use among demographic groups

Table 1 describes demographics and alcohol and cannabis use patterns across co-use groups. Among current drinkers, 11.4% reported using cannabis in the past 12 months; 3.9% reported always using separately (concurrent users) and 7.5% of drinkers said they usually or sometimes used cannabis with alcohol (simultaneous users). Rates of simultaneous use were almost twice as high among men (9.3%) than women (5.5%), though rates of concurrent use were similar between genders (4.5% of men and 3.2% of women). Among drinkers 18–29 years old, approximately three-quarters (77.1%) reported no use of cannabis in the past 12 months, while among those older than 50 years, 96% reported no use of cannabis in the past 12 months. Across races, 81.5% (African Americans) to 92.2% (Hispanic) reported no use of cannabis in the past 12 months. On average, alcohol only users reported the lowest levels of drinking and simultaneous users reported the highest levels of drinking in all contexts (i.e., in bars, at parties, at home), both in terms of quantity and frequency. Alcohol users also reported the lowest levels of past 12-month alcohol related social consequences (3.4% vs. 11.1% among concurrent users and 23% among simultaneous users) and harms (5.1% vs. 11.7% among concurrent users and 24.5% among simultaneous users). In terms of cannabis use, more than two-thirds of those who used cannabis at least monthly were simultaneous users and thus usually (or always) used cannabis with alcohol.

Demographic and drinking pattern predictors of co-use

Table 2 shows results from a multinomial logistic regression of co-use status on demographic and drinking pattern variables. Risk of simultaneous and concurrent use (relative to alcohol only use) did not differ by gender. Relative to drinkers age 18–29, drinkers aged 30–49 and drinkers aged 50+ had significantly lower risks of both concurrent and simultaneous use. African American drinkers were significantly more likely than White drinkers to be concurrent users (OR = 1.66, $P < 0.05$), while Hispanic drinkers were

significantly less likely than White drinkers to be either concurrent (OR = 0.39, $P < 0.05$) or simultaneous users (OR = 0.50, $P < 0.05$). Employment significantly lowered the risk of simultaneous but not concurrent use. Drinkers without partners were significantly more likely to be simultaneous users than drinkers with partners (OR = 1.56, $P < 0.05$). Frequency of drinking five or more drinks in an occasion was positively and significantly related to both simultaneous use and concurrent use; the magnitudes of associations were 2–3 times stronger for simultaneous use. An increase in average daily number of drinks was related to simultaneous but not concurrent use.

Drunk driving, social consequences, harms to self

Table 3 displays results from three separate logistic regressions comparing alcohol-related problem outcomes (i.e., drunk driving, social consequences, and harms to self) across co-use groups. Most notably, simultaneous users had higher odds of drunk driving (OR = 2.30, $P < 0.001$), social consequences (OR = 2.96, $P < 0.001$), and harms to self (OR = 2.22, $P < 0.001$) than alcohol only users. On the other hand, concurrent users only had higher odds of social consequences (OR = 2.29, $P < 0.05$) compared to alcohol only users. Other factors related to increased odds of drunk driving were younger age, being a high school graduate, being employed, greater frequency of drinking five or more drinks, and greater average number of drinks per day. Compared to White drinkers, Hispanic drinkers were less likely to report drunk driving.

Individuals aged 30–49 or 50+ had lesser odds of both social consequences and harms than individuals aged 18–29. Greater frequency of five or more drinks and greater average number of drinks per day also predicted increased odds of both consequences and harms. African American drinkers were more likely than White drinkers to have experienced harms related to their own drinking. Finally, those with at least a high school education (vs. those without) and those who were employed (vs. unemployed) had lesser odds of harms.

Direct comparison of simultaneous vs. concurrent users

Table 4 displays results from three separate logistic regressions comparing alcohol-related problem outcomes strictly between concurrent and simultaneous users; these regressions account for cannabis use frequency, which we could not include in the previous regressions because it is perfectly collinear with alcohol only (i.e., all of the alcohol only users have the same value of “never” for frequency of cannabis use). Simultaneous users had double the odds of drunk driving compared to concurrent users (OR = 2.04, $P < 0.05$), but did not differ in terms of consequences and harms.

Relationships between covariates and drunk driving remained similar in that being a high school graduate, being employed, greater frequency of drinking five or more drinks, and greater average number of drinks per day were all related to increased odds of drunk driving. In terms of consequences, only average number of drinks per day remained significant, perhaps due to changes in power. Finally, African American (vs. White) race, being unemployed (vs. employed), and quantity and frequency of drinking all remained significantly related to higher odds of harms, while the associations with age and education were no longer significant.

Notably, there were no significant demographic differences between simultaneous and concurrent users. However, greater frequency of five or more drinks in an occasion increased the odds of simultaneous (vs. concurrent) use and lesser frequency of cannabis use decreased the odds of simultaneous use (results not shown). We also ran all models using a continuous age variable to assess sensitivity; results did not change.

DISCUSSION

Key findings

In a large, general population sample, we found that the prevalence of simultaneous use was almost twice as high as the prevalence of concurrent use, implying that individuals who reported using both cannabis and alcohol tended to use them at the same time. Furthermore, simultaneous use was associated with both increased frequency of cannabis and alcohol use and quantity of alcohol use. Simultaneous use was also related to higher odds of problems than concurrent or alcohol only users. The overall set of results is particularly important to bear in mind when studying alcohol/cannabis co-users because they demonstrate that in the general population, co-users are a heterogeneous group that should be subdivided into at least two groups.

Cannabis use was more prevalent among younger drinkers (aged 18–29) than those 30–49 or 50+, as well as among African Americans (vs. other races), and unmarried/un-partnered individuals (vs. married/partnered). Younger drinkers (aged 18–29) were at significantly higher risk of any cannabis use than those 30–49 or 50+, though age does not appear to differentiate concurrent from simultaneous users. Relative to Whites, Hispanics had less risk of any cannabis use (vs. alcohol only), while African Americans had higher risk of concurrent use (vs. alcohol only). Thus, distinct demographic factors appeared to relate to what kinds of drinkers are likely to use cannabis with alcohol. These results correspond to those from previous studies (Brière et al., 2011; Höhne et al., 2014; Martin et al., 1996; Midanik et al., 2007; Terry-McElrath et al., 2014; Terry-McElrath et al., 2013).

Simultaneous use was the most detrimental: compared to alcohol only, simultaneous use approximately doubled or tripled the odds of drunk driving, social consequences, and harms to self. The magnitudes of differences in problems remained when comparing drunk driving and harms among simultaneous users to concurrent users, though the odds ratio for harms was no longer significant. Interestingly, concurrent users did not have higher odds of drunk driving or harms than alcohol only users but still had more consequences. *Post hoc* analyses showed four specific consequences reported by concurrent users more frequently than alcohol only users: (1) arguing while drinking, (2) having a physician recommend reduced drinking, (3) feeling that drinking was hurting health, and (4) getting into an accident while drinking.

Our results regarding drunk driving corroborate findings from Monitoring the Future in that simultaneous users were most likely to drive unsafely compared to alcohol only and concurrent users. Importantly, as noted by Terry-McElrath and colleagues (2013), simultaneous use occurs at all levels of cannabis and alcohol use, and is associated with the desire for a “high” specific to the combination of substances (at least among adolescents,

(Terry-McElrath et al., 2013). Simultaneous use predicted drunk driving even when controlling for alcohol and cannabis frequency, implying that the effects of combined use are not necessarily due to increases in substance quantity. Like Terry-McElrath (2013) we also found that simultaneous use was associated with drinking more in bar and party contexts (results not shown), which could also increase the likelihood of driving while intoxicated. In a substance abuse treatment sample, Pakula and colleagues similarly found the highest odds for being a simultaneous user, adjusted for age group and gender, for individuals who use cannabis at home with friends and in places like bars, taverns, parties, clubs, concerts, and sporting events (Pakula et al., 2009). The authors also asked about reasons for using and found that using when feeling stressed, angry, tired, and/or out of control all predicted simultaneous use (Pakula et al., 2009); however, the authors did not distinguish reasons for using one substance from reasons for using both, nor did they discuss differential contexts for using one vs. both. Thus understanding both contexts and motivations for simultaneous use in the general population remains a rich area for research. Furthermore, the similar pattern observed among adults and adolescents implies that simultaneous use is problematic for all age groups.

The literature on the physiologic effects of combined cannabis/alcohol use is small and with mixed results (Ronen et al., 2010). Although smoking cannabis may slow the absorption of ethanol, which subsequently reduces ethanol' s psychoactive effects (Lukas et al., 1992), plasma THC levels can be enhanced if alcohol is consumed immediately after smoking cannabis (Downey et al., 2013; Lukas and Orozco, 2001). Thus cannabis combined with alcohol can lead to greater impairment than ingestion of either substance alone with the combination yielding additive (as opposed to multiplicative) effects on measures of impairment (Chait and Perry, 1994). The combination may have the strongest effects (compared with either substance alone) in terms of impaired driving tasks, subjective sensations, and physiological measures, such as heart rate (Ronen et al., 2010). Among studies focused on driving impairment, some have shown that combining cannabis and alcohol leads to greater impairment than either alone (Bramness et al., 2010; Ramaekers et al., 2000; Ronen et al., 2010), even among regular cannabis users (Downey et al., 2013), while others have shown no differences (Ballard and de Wit, 2011; Lenné et al., 2010; Liguori et al., 2002). The divergent results may be due to inconsistent dosage amounts and/or heterogeneous samples (e.g., regular cannabis users). Furthermore, driving impairment studies are often small ($n<20$) and not generalizable to all co-use patterns.

Related to simultaneous and concurrent use are the concepts of substitution and complementarity. Studies of complementarity and substitution come from varying disciplines, each with its own jargon. Behavioral economists generally study complementarity/substitution using a real price framework, though they may account for non-monetary "costs" (e.g., illegality of cannabis makes potential criminality a cost); thus if increasing the price of alcohol increases demand for cannabis (e.g., cannabis use), the two are considered economic substitutes. Conversely, if increasing the price of alcohol decreases the demand for cannabis, then the two would be economic complements. On the other hand, clinical studies generally focus on actual substance use, defining substitution as increased use of one substance when decreasing the use of the other. The clinical definition of complementarity would thus be increased use of one substance if use of the other substance

is also increased. Although we cannot definitively say that concurrent users "substituted" and simultaneous users "complemented," we did find that concurrent users used less and had fewer problems, suggesting that substitution/complementarity may be at play. The dichotomy of substitution/complementarity may also be too limited; a spectrum of co-use patterns likely exists.

Limitations and next steps

The NAS is cross-sectional; no causal conclusions can be drawn from these data. More detailed longitudinal data regarding co-use (e.g., daily diaries) are needed to understand the spectrum of co-use patterns and the relationships between various patterns and their related consequences. Asking regular cannabis users to quit cannabis for an extended period of time and assessing subsequent alcohol use would be another way to examine potential substitution, especially given that experimental manipulation of alcohol and cannabis use would most directly address this phenomenon. The NAS does not ask about motivations or contexts for simultaneous vs. concurrent use, or about specific quantities of cannabis or routes of ingestion; these questions will be included in future studies. Finally, the NAS is a telephone interview. All responses were based on self-report and not biochemically verified.

Conclusion and implications

In states that have legalized cannabis, policymakers should consider requiring distributors to include warning labels communicating risks (especially regarding driving) associated with combining alcohol and cannabis on all cannabis packaging. The general public should be made aware that combined cannabis and alcohol use may be riskier than use of either alone, and further research into the details of these relationships is needed to increase the evidence base for such communications. Clinicians could also consider asking substance use treatment clients to detail their co-use pattern as a way of identifying potential problems.

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Appendix A: Social Consequence Items (Midanik & Clark, 1995; Midanik & Greenfield, 2000)

Interviewers told participants, "Here are some experiences that many people have reported in connection with drinking. As I read each item, please tell me if this has ever happened to you." If the participant responded "yes," the interviewers followed up with, "Did this happen in the last 12 months?"

1. I have gotten in a fight while drinking.
2. I have gotten in a heated argument while drinking.
3. A spouse or someone I lived with threatened to leave me because of my drinking.
4. A spouse or someone I lived with got angry about of my drinking or the way I behaved while drinking.

5. I have lost a job or nearly lost one because of drinking
6. Drinking may have hurt my chances for promotions, raises, or better jobs
7. People at work indicated that I should cut down on drinking
8. I had trouble with the law about drinking when driving was not involved
9. I have been arrested for driving after drinking
10. A policeman questioned or warned me because of my drinking
11. I had an illness connected with drinking which kept me from working or my regular activities for a week or more
12. A physician suggested I cut down on drinking
13. I felt that my drinking was becoming a serious threat to my physical health
14. My drinking contributed to getting hurt in an accident in a car or elsewhere
15. My drinking contributed to getting involved in an accident in which someone else was hurt or property, such as an auto, was damaged.

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Table 1

Demographics, drinking patterns and cannabis use among current drinkers in the 2005 and 2010 National Alcohol Surveys (percentages; means and 95% confidence intervals)

	Cannabis and alcohol co-use groups		
	Alcohol only	**Concurrent[a]**	**Simultaneous**
Gender Male Female	86.2% 91.3%	4.5% 3.2%	9.3% 5.5%
Age 18–29 30–49 50+	77.1% 88.5% 95.8%	7.7% 3.8% 1.8%	15.3% 7.8% 2.4%
Race/ethnicity African American White Hispanic Other	81.5% 89.0% 92.2% 88.2%	7.1% 3.6% 2.1% 5.8%	11.4% 7.4% 5.7% 6.0%
Education < High school High school or more	84.8% 88.9%	3.3% 3.9%	11.9% 7.1%
Employment Employed Unemployed	89.0% 88.0%	3.9% 4.0%	7.2% 8.1%
Relationship status Partnered Not partnered	91.8% 82.8%	3.1% 5.5%	5.1% 11.8%
Overall drinking, past 12 months Average daily # drinks Average # days drank ≥5 drinks	0.71 (0.67, 0.76) 13.9 (12.2, 15.5)	0.96 (0.73, 1.2) 22.0 (13.6, 30.4)	2.3 (1.9, 2.6) 65.7 (52.9, 78.5)
Drinking in bars, past 12 months Average # days drinking in bars Average # drinks when drinking in bars	6.3 (5.8, 6.7) 1.1 (1.0, 1.1)	10.8 (7.5, 14.0) 1.7 (1.4, 2.0)	22.5 (18.5, 26.6) 3.3 (2.4, 4.1)
Drinking at parties, past 12 months Average # days drinking at parties Average # drinks when drinking at parties	4.9 (4.6, 5.2) 1.6 (1.5, 1.7)	6.2 (4.0, 8.4) 2.1 (1.6, 2.7)	15.2 (12.0, 18.6) 4.6 (3.1, 6.1)
Drinking at home, past 12 months Average # days drinking at home Average # drinks when drinking at home	17.3 (16.6, 18.1) 1.0 (0.94, 1.1)	16.6 (12.9, 20.4) 1.2 (0.93, 1.4)	28.7 (24.2, 33.2) 3.1 (1.1, 5.1)
Experienced 2+ consequences, past 12 months	3.4%	11.1%	23.0%
Experienced 1+ harms, past 12 months	5.1%	11.7%	24.5%
Frequency of cannabis use, past 12 months 1×/week 1×/2–3 weeks 1×/1–2 months Less often than 1×/1–2 months Never in past year	0.0 0.0 0.0 0.0 100.0	23.0 22.0 32.3 47.6 0.0	77.0 78.0 67.7 52.4 0.0
Unweighted n	7,898	261	467
Weighted (%)	88.6	3.9	7.5

* $P < .05$

** $P < .01$

*** $P < .001$

[a] Concurrent and simultaneous users are mutually exclusive groups

Table 2

Adjusted relative risk ratios with 95% confidence intervals from multinomial logistic regression of alcohol/cannabis co-use groups on demographic and drinking pattern variables among current drinkers in the 2005 and 2010 National Alcohol Surveys

Predictors	***Cannabis and alcohol co-use outcomes (vs. alcohol only)***	
	Concurrent users	**Simultaneous users**
Male (vs. Female)	1.35 (0.93, 1.97)	1.11 (0.83, 1.49)
Age (vs. 18–29) 30–49 50+	0.51 (0.34, 0.76)* 0.22 (0.14, 0.35)*	0.61 (0.45, 0.84)* 0.21 (0.14, 0.32)*
Race/ethnicity (vs. White) African American Hispanic Other	1.66 (1.04, 2.66)* 0.39 (0.22, 0.68)* 1.16 (0.53, 2.52)	1.16 (0.76, 1.78) 0.50 (0.29, 0.84)* 0.62 (0.33, 1.17)
Education (vs. < High school) HS graduate	1.12 (0.52, 2.40)	0.84 (0.49, 1.43)
Employment (vs. Unemployed) Employed	0.74 (0.50, 2.52)	0.68 (0.50, 0.93)*
Relationship status (vs. Partnered) Not partnered	1.36 (0.94, 1.95)	1.56 (1.17, 2.08)*
Five or more drinks in a day (vs. Never) Less than monthly in past year Monthly or more frequent in past year	1.61 (1.09, 2.38)* 1.94 (1.10, 3.42)*	3.76 (2.67, 5.28)* 5.56 (3.43, 9.02)*
Average daily # drinks	0.98 (0.88, 1.09)	1.15 (1.08, 1.22)*

*$P < .05$

Concurrent users n = 248; Simultaneous users n = 449; Alcohol only users n = 7,360

Table 3

Adjusted odds ratios with 95% confidence intervals from multivariable logistic regressions of drunk driving, social consequences, and harms to self on alcohol and cannabis use among current drinkers, controlling for demographic variables

	Alcohol-Related Problem Outcomes		
Predictors	**Drunk driving**	**Consequences**	**Harms**
Cannabis and alcohol co-use (vs. Alcohol only) Concurrent Simultaneous	1.18 (0.65, 2.17) 2.30 (1.61, 3.30)*	2.29 (1.12, 4.70)* 2.96 (1.86, 4.71)*	1.67 (0.91, 3.05) 2.22 (1.49, 3.32)*
Gender Male (vs. Female)	1.30 (0.98, 1.73)	0.83 (0.57, 1.19)	1.01 (0.74, 1.39)
Age (vs. 18–29) 30–49 50+	0.71 (0.52, 0.98)* 0.77 (0.53, 1.12)	0.54 (0.35, 0.84)* 0.42 (0.25, 0.72)*	0.61 (0.43, 0.87)* 0.48 (0.31, 0.72)*
Race/ethnicity (vs. White) African American Hispanic Other	0.63 (0.37, 1.08) 0.63 (0.40, 0.99)* 0.92 (0.46, 1.83)	1.54 (0.91, 2.59) 1.10 (0.62, 1.96) 1.24 (0.55, 2.79)	1.81 (1.14, 2.86)* 1.42 (0.94, 2.14) 1.10 (0.52, 2.29)
Education (vs. < High school) HS graduate	1.86 (1.03, 3.38)*	0.65 (0.36, 1.16)	0.56 (0.36, 0.88)*
Employment (vs. Unemployed) Employed	1.99 (1.43, 2.78)*	1.18 (0.79, 1.78)	0.64 (0.46, 0.89)*
Relationship status (vs. Partnered) Not partnered	1.17 (0.90, 1.53)	1.01 (0.68, 1.52)	1.05 (0.77, 1.42)
Five or more drinks in a day (vs. Never) Less than monthly in past year Monthly or more frequent in past year	4.07 (2.90, 5.72)* 5.67 (3.49, 9.19)*	3.43 (2.07, 5.69)* 8.58 (4.59, 16.05)*	3.31 (2.30, 4.75)* 4.67 (2.81, 7.76)*
Average daily # drinks	1.19 (1.12, 1.27)*	1.44 (1.33, 1.57)*	1.40 (1.30, 1.50)*

*$P < .05$

Concurrent users n = 248; Simultaneous users n = 449; Alcohol only users n = 7,360

Table 4

Adjusted odds ratios with 95% confidence intervals from multivariable logistic regressions comparing drunk driving, social consequences, and harms to self among simultaneous vs. concurrent alcohol/cannabis users, controlling for demographic variables

	Alcohol-Related Problem Outcomes		
Predictors	**Drunk driving**	**Consequences**	**Harms**
Simultaneous use (vs. Concurrent use)	2.04 (1.07, 3.89)*	1.62 (0.75, 3.52)	1.67 (0.85, 3.31)
Gender Male (vs. Female)	0.94 (0.54, 1.62)	0.77 (0.41, 1.41)	1.09 (0.61, 1.94)
Age (vs. 18–29) 30–49 50+	1.05 (0.56, 1.97) 1.39 (0.65, 2.98)	0.85 (0.43, 1.70) 0.41 (0.16, 1.03)	0.73 (0.40, 1.33) 0.50 (0.23, 1.09)
Race/ethnicity (vs. White) African American Hispanic Other	0.75 (0.33, 1.73) 1.70 (0.67, 4.30) 0.99 (0.26, 3.82)	2.06 (0.87, 4.89) 1.62 (0.59, 4.42) 0.67 (0.20, 2.20)	2.39 (1.08, 5.29)* 1.34 (0.51, 3.52) 1.80 (0.57, 5.67)
Education (vs. < High school) HS graduate	7.26 (1.33, 39.59)*	1.03 (0.27, 3.91)	1.13 (0.36, 3.57)
Employment (vs. Unemployed) Employed	2.98 (1.64, 5.40)*	1.15 (0.59, 2.22)	0.51 (0.28, 0.92)*
Relationship status (vs. Partnered) Not partnered	1.85 (1.01, 3.37)*	1.16 (0.63, 2.12)	0.88 (0.49, 1.58)
Five or more drinks in a day (vs. Never) Less than monthly in past year Monthly or more frequent in past year	2.19 (1.07, 4.50)* 3.32 (1.35, 8.17)*	1.87 (0.71, 4.91) 2.62 (0.90, 7.58)	3.33 (1.51, 7.34)* 4.61 (1.79, 11.90)*
Average daily # drinks	1.15 (1.02, 1.28)*	1.45 (1.28, 1.63)*	1.32 (1.17, 1.49)*
Cannabis use frequency (vs. weekly or more) 1×/2–3 weeks 1×/1–2 months Less often than 1×/1–2 months	1.58 (0.61, 4.06) 0.96 (0.43, 2.17) 0.83 (0.45, 1.54)	1.49 (0.54, 4.06) 1.91 (0.76, 4.77) 1.54 (0.71, 3.36)	0.76 (0.32, 1.84) 2.13 (0.96, 4.75) 1.46 (0.74, 2.88)

*$P < .05$

Concurrent users n = 248; Simultaneous users n = 449