Published in final edited form as:

Drug Alcohol Depend. 2018 October 01; 191: 187–194. doi:10.1016/j.drugalcdep.2018.07.005.

Differences in alcohol cognitions, consumption, and consequences among first-time DUI offenders who co-use alcohol and marijuana

Rosanna Smart*, Karen Chan Osilla, Lisa Jonsson, and Susan M. Paddock

RAND Corporation, 1776 Main Street, PO Box 2138, Santa Monica, CA 90407-2138, United States

Abstract

Background: A significant portion of alcohol-related DUI offenders engage in co-use of alcohol and marijuana (AM). Given expanding marijuana legalization and the impaired driving risks associated with co-use, it is of increased importance to understand how characteristics of AM co-users compare to those who use alcohol only (AO) in order to inform DUI interventions and prevent recidivism.

Methods: Participants were 277 first-time DUI offenders enrolled in a first-time DUI offender program across three locations. Using well-established measures, we evaluated differences in alcohol-related cognitions (positive expectancies and self-efficacy), frequency and quantity of alcohol consumption, and alcohol-related consequences between AO users and AM co-users by running a series of multivariate generalized linear models.

Results: Compared to AO users, AM co-users reported lower self-efficacy to achieve abstinence and avoid DUI. Differences in abstinence self-efficacy largely explain higher relative rates of average and peak drinking quantity and higher odds of binge drinking among AM co-user. Despite lower self-efficacy and higher drinking quantity, there were no significant differences between AM and AO-users on alcohol-related consequences and past month reports of drinking and driving.

Conclusions: Our results provide preliminary evidence that DUI offenders who co-use alcohol and marijuana have higher alcohol use and lower self-efficacy than AO-users, and long-term consequences for this group should be monitored in future research. DUI programs may screen and identify co-users and consider tailoring their interventions to build self-efficacy to address the risks associated with AM co-use uniquely.

Keywords

Marijuana; Cannabis; Alcohol; Alcohol cognitions; Driving under the influence

*Corresponding author at: RAND Corporation, 1776 Main St., Santa Monica, CA 90407, United States. rsmart@rand.org (R. Smart).
Contributors

RS, KCO, and LJ were responsible for research question development and preparation of the manuscript. LJ cleaned and prepared the dataset for analysis, and RS performed the statistical analysis with assistance from SMP. All authors were responsible for interpretation of findings, organization of results, and critical revisions of the manuscript. All authors have reviewed and approve the final manuscript.

Conflict of interest
No conflict declared.

1. Introduction

Driving under the influence (DUI) is a significant public health issue, with alcohol-related crashes accounting for nearly one-third of traffic fatalities (National Academies of Sciences Engineering and Medicine, 2018; National Highway Traffic Safety Administration, 2016) and generating estimated economic costs of \$52 billion in 2010 (Blincoe et al., 2015). While most DUI offenders are arrested for driving under the influence of alcohol, a significant proportion of offender's co-use other substances, most commonly marijuana (Logan et al., 2014; Maxwell, 2012; Pilkinton et al., 2013), and co-occurring drug use significantly increases the likelihood of DUI recidivism (Mullen et al., 2015; Nochajski and Stasiewicz, 2006) and motor vehicle crashes (C'de Baca et al., 2009). Marijuana is the most frequently detected drug other than alcohol among crash-involved drivers (Brady and Li, 2014; Dubois et al., 2015; Walsh et al., 2005) and the general driving population (Berning et al., 2015). Among DUI offenders in treatment, research has shown those with marijuana as their primary substance problem are least likely to complete treatment, despite reporting less impairment and mental health disorders compared to offenders who use other drugs (Maxwell, 2012).

There is growing concern over the co-use of alcohol and marijuana (AM) because their combined effects on psychomotor and cognitive functions have additive or possibly synergistic effects on impairment (Dubois et al., 2015; Hartman et al., 2015; Ramaekers et al., 2000; Ronen et al., 2010; Sewell et al., 2009), significantly increasing crash risk compared to the use of either substance alone (Bramness et al., 2010; Chihuri et al., 2017; Li et al., 2017; Ramaekers et al., 2000). These effects underscore the importance of evaluating the prevalence of co-use among those who drive while under the influence, as well as the extent to which the underlying cognitive or behavioral risk factors contribute to these associations. Unfortunately, very little is known about the characteristics and outcomes associated with AM co-use among DUI offenders. However, in the general population, those reporting AM co-use have greater likelihood of alcohol-related problems, consequences, and unsafe driving behavior relative to alcohol-only (AO) users (Arterberry et al., 2017; Lipperman-Kreda et al., 2017; Magill et al., 2009; Shillington and Clapp, 2001; Subbaraman and Kerr, 2015; Terry-McElrath et al., 2014; Yurasek et al., 2017a). Clinical outcomes have also been shown to differ among co-users in alcohol treatment, who report greater levels of medication nonadherence and non-planning impulsivity (Peters et al., 2012), higher alcohol consumption and consequences (Yurasek et al., 2017b), and lower likelihood of alcohol abstinence (Mojarrad et al., 2014; Subbaraman et al., 2017) relative to their AO-using counterparts.

Understanding whether DUI offenders who co-use AM exhibit distinct underlying psychosocial or behavioral risk factors is key for the development of successful DUI intervention strategies for this group. The DUI population is heterogeneous and unique from both general population and alcohol treatment samples (LaBrie et al., 2007; Lapham et al., 2001; Mullen et al., 2015; Nochajski and Stasiewicz, 2006; Osilla et al., 2017). DUI offenders exhibit higher rates of alcohol use disorders, co-occurring drug use problems, and psychiatric comorbidities relative to the general population (Lapham et al., 2006, 2001), but

are less likely to meet criteria for severe substance use disorders than those in alcohol treatment programs (Caetano and McGrath, 2005; DiStefano and Hohman, 2007). DUI offenders may be more reluctant to change than those in residential substance use treatment programs because they generally report less alcohol-related consequences as well as fewer financial, labor market, emotional, and relationship problems (Carruth et al., 2016; Cavaola and Wuth, 2002). DUI interventions traditionally focus on addressing factors such as alcohol expectancies and abstinence self-efficacy as they are established predictors of alcohol use, DUI recidivism, and responsiveness to treatment (Litt et al., 2009; Oei and Morawska, 2004; Schell et al., 2006; Shaw and DiClemente, 2016). Evaluating how these factors are similar or different between AM-users and AO users would fill significant research gaps.

This study examines the characteristics of AM co-users (i.e., those who report the use of both alcohol and marijuana in the past month) and AO users in a diverse sample of first-time DUI offenders. We compare patterns of alcohol- and DUI-related cognitions (expectancies and self-efficacy), alcohol and marijuana use, and alcohol-related behaviors (consequences and DUI behaviors) between participants who do and do not report marijuana co-use in the past month, controlling for individual characteristics.

2. Methods

2.1. Participants and procedures

Participants were part of a randomized controlled trial evaluating cognitive behavioral therapy (CBT) in three first-time DUI offender program sites in Ventura County (Osilla et al., 2016). Eligible individuals were 21 and older entering a DUI program for a first-time offense who screened positive for at-risk drinking in the past year (AUDIT-C score above 3; Dawson et al. (2005)) and reported fifth grade education or higher. Research staff approached individuals awaiting their intake appointment, described the study, screened interested clients for eligibility, and consented interested and eligible individuals. After eligibility screening, participants were randomized to CBT or usual care and completed a baseline paper survey, for which they received \$25 remuneration. Surveys were completed at the DUI program, which has a zero-tolerance policy to ensure clients were not intoxicated during survey completion.

Over the 50-week recruitment period from July 2016 to June 2017, staff approached 793 DUI clients at intake for eligibility screening (10% refused to be screened). Of the 402 (57%) eligible, 351 (87%) completed a baseline survey, and a total of 346 were retained (five were excluded due to study ineligibility). For this study, we included participants if they reported in the baseline survey that they used alcohol within the past 30 days, yielding a final analytic sample of 277 individuals. Procedures were approved by the institution's Internal Review Board and each of the three programs. We also obtained a certificate of confidentiality from the funding institute.

2.2. Measures

2.2.1. Sociodemographic characteristics—Background characteristics included age, gender, race and ethnicity, relationship status, labor market participation, total income, and education level.

2.2.2. Alcohol- and DUI-related cognitions: expectancies and self-efficacy—

We measured positive alcohol expectancies using items from the Health Attitudes and Practices Scale (Perrine, 1993). For each of five emotional states (relaxed, sad, moody, argumentative, happy), participants rated “How often do you generally feel each of the following effects when you are drinking?” on a five-point scale (“Never” to “Always”). Positive alcohol expectancy scores were computed by subtracting each participant’s average response for *sad*, *moody*, and *argumentative* from their average response to *happy* and *relaxed* (Schell et al., 2006). The scale could range from −4 to 4, with higher scores indicating more positive alcohol expectancies; scale reliability was fair as calculated by Cronbach’s α ($\alpha = 0.61$).

Two measures of self-efficacy were obtained. Alcohol abstinence self-efficacy was assessed using the brief Abstinence Self-Efficacy Measure (McKiernan et al., 2011), a shortened version of the Alcohol Abstinence Self-Efficacy Scale (AASE; DiClemente et al. (1994)). The brief measure consists of 12 items measuring a respondent’s perceived confidence in their ability to avoid drinking in high-risk situations (Confidence) and the degree to which a respondent feels tempted to drink in such situations (Temptation). For each item, respondents used a five-point rating scale ranging from 1 (not at all confident or tempted) to 5 (extremely confident or tempted). Following prior work (Litt et al., 2009; Shaw and DiClemente, 2016), we calculated abstinence self-efficacy scores by subtracting the temptation score from the confidence score for each item and then summing over items. Total abstinence self-efficacy scores could range from −16 to 16, with higher scores corresponding to higher self-efficacy ($\alpha = 0.84$). Situation-specific abstinence self-efficacy scores were also calculated separately for the four AASE subscales: negative affect, social situations and positive emotions, physical and other concerns, and withdrawal and urges.

Self-efficacy for avoiding DUI was assessed using a subset of measures from the Behaviors & Attitudes Drinking & Driving Scale (BADDS), which has demonstrated retest reliability and internal consistency (Jewell et al., 2004; Jewell and Hupp, 2005; Jewell et al., 2008). Specifically, we used items assessing the likelihood of driving a short distance after drinking, asked separately for various levels of drinking and rated on a five-point Likert scale (“very unlikely” to “very likely”). Given the distribution of responses, we operationalized self-efficacy for avoiding DUI as a binary variable equal to one if the respondent endorsed being “very unlikely” to drive after a given number of drinks.

2.2.3. Alcohol and marijuana use—Alcohol and marijuana use frequency was assessed using participants’ self-reported number of days of use over the preceding 30 days (Center for Behavioral Health Statistics and Quality, 2017). Alcohol-only (AO) use was defined as reporting days of drinking in the past month but no days of marijuana use.

Alcohol and marijuana (AM) co-use was defined as reporting both alcohol and marijuana use in the past 30 days.

A typical number of drinks per week in the past month was calculated by summing participant responses for a typical number of drinks consumed each day of a typical week (Collins et al., 1985). Peak drinking quantity was defined as the largest number of standard drinks consumed on a given day during a typical week of the past month (Center for Behavioral Health Statistics and Quality, 2017). Binge drinking was operationalized as a binary variable equal to one if participants reported they consumed five or more drinks on a single occasion at least monthly (Dawson et al., 2005). Finally, the Alcohol Use Disorders Identification Test (AUDIT), a 10-item screener was used to describe the severity of the sample (WHO Assist Working Group, 2002). There are four AUDIT zones corresponding to increasing alcohol severity (scores of 0–7, 8–15, 16–19, and 20–40).

2.2.4. Alcohol-related consequences and DUI behavior—Alcohol-related consequences across social, psychological, physical, and occupational domains were assessed using the 15-item Short Inventory of Problems (SIP; Blanchard et al. (2003)), which has shown good psychometric properties in previous work with comparable populations (Feinn et al., 2003; Kiluk et al., 2013; Marra et al., 2014). Participants reported how often they experienced each consequence during the past 30 days using a four-point Likert scale (“not at all,” “a little,” “somewhat,” or “very much”) scored from zero to three, and the SIP total score was calculated by summing across all items ($\alpha = 0.92$).

We also separately considered driving under the influence of alcohol. Participants were asked the number of times in the past month they drove after drinking 1) one or two drinks in the previous hour, or 2) three or more drinks in the previous hour. These were combined into a dichotomous indicator for whether a participant drove under the influence in the month preceding the survey (Jewell and Hupp, 2005). While defining DUI as driving after any drinking sets a lower DUI threshold than alternative measures (Begg et al., 2003), we employ this broader definition because most participants in the study were subject to zero-tolerance regulations such that any amount of alcohol while driving was considered a probation violation.

2.3. Analysis procedures

Data were first examined for completeness, outliers, and normality. Missing items were sparse on each measure (1–5%) and were handled by averaging over observed items or imputing the average of the observed items (i.e., SIP). Winsorization was used to reduce the influence of a few extreme outliers (< 1%) for typical and peak quantity of alcohol use measures. Independent sample t-tests and Pearson chi-square tests compared sociodemographic characteristics and outcomes of interest between AO users and AM co-users.

To explore whether AM co-users exhibited significantly different alcohol- and DUI-related cognitions than AO users, we then estimated the associations between co-use status, positive alcohol expectancies, drinking refusal self-efficacy, and DUI avoidance self-efficacy. For each outcome, adjusted models included an indicator for AM co-use in the past month and

controlled for sociodemographic characteristics (un-adjusted models, not presented, yielded similar findings). We then evaluated whether alcohol use behaviors and consequences differed between AO users and AM co-users by running generalized linear models. Since outcome measures were either dichotomous or over-dispersed count or integer variables, regressions were modelled as logistic or negative binomial (with log link) distributions. For each outcome, we ran a series of sequential regressions including an indicator for AM co-user and: (1) adjusting for sociodemographic characteristics, (2) additionally controlling for alcohol cognition variables significantly associated with co-use status. For all models, we also conducted sensitivity analyses that included as covariates DUI program site or whether the baseline survey was conducted following marijuana legalization in California to confirm these factors did not affect AM co-use reporting or change results.

All analyses were conducted in Stata/MP version 15.1. To account for multiple statistical testing, we examined the robustness of our significance findings under the Benjamini and Hochberg (1995) approach to determine the p-value threshold that corresponds to a false discovery rate (FDR; the proportion of all significant findings that are false positives) of 10%. Thus, for significance testing results in all tables, p-values less than 0.067 are associated with an FDR of 10%.

3. Results

3.1. Participant characteristics

The sample was 72.1% male, 55.1% Hispanic, 35.9% non-Hispanic White, 4.0% Black, and 5.0% multiethnic or other, with an average age of 32 (SD = 11.7). Of the 277 participants who reported past month use of alcohol, 120 (43.3%) reported marijuana co-use. Among AM co-users, average days of marijuana use in the past month was 15 (Median = 12.5; SD = 11.52), with 27.5% of co-users reporting daily marijuana use (i.e., use on 30 of the past 30 days).

Table 1 compares sociodemographic characteristics between AO and AM users. While AO users and AM co-users were similarly distributed in terms of gender, race/ethnicity, and education, co-users were significantly younger ($p = 0.003$), and hence significantly more likely to be unmarried, have lower income level, and work part-time. The younger profile of AM co-users may partially explain some of the significant differences between AM co-users and AO users from bivariate comparisons of alcohol- and DUI-related measures shown in the lower panels of Table 1. AM co-users exhibited significantly lower abstinence and DUI avoidance self-efficacy, as well as significantly higher drinking quantity and SIP scores. In addition, AM co-users on average had AUDIT scores that were 2.2 points higher than AO users ($p = 0.004$), driven primarily by a higher proportion of AM co-users in the AUDIT Zone II risk level (45.4% of AM co-users vs. 29.0% of AO users).

3.2. Alcohol- and DUI-related cognitions

Table 2 reports associations of alcohol use cognition measures with AM co-use, relative to AO use and controlling for sociodemographic factors. While AM co-users did not exhibit significantly different alcohol expectancies than AO users ($p = 0.111$), AM co-users had

significantly lower abstinence self-efficacy scores ($p < 0.001$). Focusing on situational specific factors showed that differences in total self-efficacy scores between AM co-users and AO users were driven primarily by the negative relationship between co-use and abstinence self-efficacy in negative affect situations. AM co-users had negative affect abstinence self-efficacy scores that were about 1.0 point lower on average relative to AO users ($p < 0.001$), equivalent to a 0.516 standard deviation decrease.

Table 3 explores differences in self-efficacy with respect to avoiding DUI after various levels of alcohol consumption. Results from the four logistic regressions are presented as odds ratios, describing the relative odds of endorsing strong self-efficacy to avoid driving a short distance after drinking for AM co-users relative to AO users, controlling for sociodemographic differences. For all levels of drinking, past-month AM co-users had significantly lower odds of self-reported ability to avoid DUI relative to AO users. Differences were most pronounced at the highest level of alcohol consumption. Odds of reporting self-efficacy to avoid driving after 5–6 drinks were two-thirds lower among AM co-users relative to AO users ($OR = 0.33$, $p = 0.001$).

3.3. Alcohol use and consequences

Table 4 evaluates whether AM co-users differed significantly from AO users in their drinking patterns and drinking consequences. Results are presented as exponentiated coefficients (i.e., odds ratios or incident rate ratios), representing the relative risk or odds of alcohol-related outcomes among AM co-users relative to alcohol-only users. Model 1 presents results from models controlling for sociodemographic factors, and Model 2 additionally controls for drinking refusal self-efficacy given its estimated association with co-use in the previous analysis (Table 2).

While AO users and AM co-users showed no significant differences in past month drinking frequency, AM co-use was associated with significantly greater typical and peak drinking quantity in the past month across all measures in Model 1. Relative to AO use, AM co-use was associated with 33.7% higher typical number of drinks per week (Average Marginal Effect (AME) = 3.9; $p = 0.002$) and 19.2% greater number of drinks during peak occasions (AME = 0.84; $p = 0.017$). Co-use was also associated with nearly 2.5 times the odds of monthly binge drinking ($p = 0.002$). However, once differences in alcohol-related cognitions were controlled for (Model 2), differences between AM co-users and AO users across all alcohol use outcomes were attenuated; binge drinking was the only outcome for which a statistically significant relationship with AM co-use remained. Even controlling for their lower levels of drinking refusal self-efficacy relative to AO users, AM co-users were nearly twice as likely to report binge drinking at least monthly.

Interestingly, despite having significantly higher drinking quantity and lower self-efficacy, AM co-users did not significantly differ from AO users with respect to alcohol-related consequences or driving after drinking in either model. However, the coefficients on AM co-use were signed in the expected direction, with the point estimates from models controlling for sociodemographic differences (Model 1) suggesting 30 percent higher rates of alcohol-related consequences ($p = 0.054$) and 50 percent higher odds of past-month DUI ($p = 0.177$) among AM co-users relative to AO users. As with the alcohol consumption models,

controlling for differences in abstinence self-efficacy (Model 2) attenuated differences between AM and AO users in alcohol-related consequences and past-month DUI.

4. Discussion

The current study provides important insights on how first-time DUI offenders who co-use alcohol and marijuana compare with DUI offenders who use only alcohol. Relative to AO users, AM co-users had comparable alcohol expectancies but lower self-efficacy to achieve abstinence, with most pronounced differences for self-efficacy related to negative affect situations. Lower abstinence self-efficacy among co-users contributed significantly to their higher rates of typical and peak drinking quantity, as well as the higher likelihood of binge drinking, relative to AO users. Controlling for differences in abstinence self-efficacy reduced the magnitude and significance of associations of AM co-use with alcohol consumption and consequences, suggesting the potential importance of abstinence self-efficacy for explaining the riskier drinking profile of AM co-users. Co-users also exhibited significantly lower self-efficacy for avoiding DUI, although they did not have significantly higher rates of DUI and alcohol-related consequences compared to AO users. These findings extend research in the general population and alcohol treatment samples that show more risk with AM co-use, and they highlight the significant role abstinence self-efficacy plays.

There are several clinical implications to these findings. First, we find nearly half of first-time DUI offenders who continue to use alcohol also report the past-month use of marijuana. Given evidence that combined use of marijuana and alcohol while driving increases crash risk (Bramness et al., 2010; Chihuri et al., 2017; Li et al., 2017) and that co-occurring drug use is positively associated with DUI recidivism (Mullen et al., 2015; Nochajski and Stasiewicz, 2006), our findings of significantly lower DUI avoidance self-efficacy among AM co-users suggest that methods to screen and identify AM co-use at DUI program intake may be warranted. Given the expansion of marijuana legalization policies, and the rise in public health and regulatory concerns about how to detect, prevent, and intervene in incidents of marijuana-impaired driving (Davis et al., 2016; Huestis, 2015; Pacula et al., 2014; Watson and Mann, 2016), monitoring rates of AM co-use and its effects may help inform future policy.

Second, DUI programs may consider tailoring their intervention materials to meet the unique needs of the co-using population. Given well-documented heterogeneity in DUI offender populations (LaBrie et al., 2007; Mullen et al., 2015), it is impossible to tailor programming to all their unique needs, but our research suggests that skills to increase self-efficacy to abstain and avoid DUI may be important foci, especially in situations where negative affect is involved. Self-efficacy has been found to mediate effects of substance use interventions among youth (Orlando et al., 2005; Walker et al., 2011) and embedding more strategies to increase self-efficacy within DUI programming may be particularly relevant for supporting AM users. AM users were also younger and thus more likely to be unmarried, have a lower income level, and work part-time. Future programming could, therefore, tailor content appropriate for a younger demographic.

Last, while DUI offenders who co-used alcohol and marijuana consumed higher quantities of alcohol and were more likely to binge drink, they did not exhibit significantly greater alcohol-related consequences or drinking and driving behavior. It is difficult to say how the DUI experience (e.g., being in a crash, getting arrested) and DUI program enrollment confounds these findings. However, given evidence from the general population showing AM users tend to have greater alcohol-related problems and unsafe driving (Midanik et al., 2007; Subbaraman and Kerr, 2015), interventions targeting AM co-use and impaired driving among the first-time DUI offender population may offer a critical opportunity to mitigate future consequences.

These findings should be considered alongside the study's limitations. Our data rely on self-report which, while a common data collection method in clinical intervention research (Klimas et al., 2014), is subject to social desirability bias (Krumpal, 2013). If differential willingness to self-report marijuana reflects a differential willingness to report alcohol- or DUI-related behaviors or cognitions, this may bias our results. While we used measures from national surveillance studies that include AM co-users (Center for Behavioral Health Statistics and Quality, 2017) and conducted sensitivity analyses to mitigate this concern, biological verification or other interview methods could be used to increase validity. Furthermore, self-reported assessments were collected when participants were sober, and future studies may explore whether cognitions and behaviors vary when intoxicated, as has been indicated by prior studies of drinkers and marijuana users (Allen et al., 2016; Kuitunen-Paul et al., 2018; Morris et al., 2014).

In addition, while we did not find significant differences in alcohol-related consequences and DUI behavior among AO-users and co-users, there are a few ways to interpret this result. First, while our estimates did not reach conventional levels of significance, they were signed in the expected direction indicating higher rates of alcohol-related consequences and likelihood of DUI among the co-use group. Future studies would be helpful to explore the strength and direction of this association further. Second, while we did not observe significant differences in the prevalence of past-month DUI, AM co-users may engage in more severe DUI behavior such as driving after binge drinking, as suggested by our finding that DUI avoidance self-efficacy differs more markedly for higher drinking levels. We also only analyze cross-sectional data and do not observe whether differences in impaired driving or alcohol-related consequences emerge over time. Future studies examining this relationship longitudinally are warranted.

Finally, we were unable to delve further into differences among marijuana-using DUI offenders. We could not separately examine marijuana-only users given low rates of past-month marijuana use without concurrent alcohol use in our sample ($n = 9$), which is consistent with low prevalence estimates from other populations (Green et al., 2016; Terry-McElrath et al., 2014). We also could not specifically examine simultaneous AM co-use (i.e., consuming both substances in the same user session) as our survey only asked this question for a subset of respondents. However, of the subset of co-users who received the question ($n = 50$), 84.0% reported simultaneous use in the past month; thus, our findings are likely driven by simultaneous users. Additionally, study participants were drawn from three localized California DUI programs, which may limit generalizability.

Overall, this study provides important preliminary evidence about differences in cognition, consumption, and consequences experienced by AM co-users relative to AO users among a first-time DUI population and provide preliminary evidence that co-users may benefit from tailored programming to increase self-efficacy to achieve abstinence and prevent DUI. Interventions targeting AM co-use, self-efficacy, and impaired driving among the first-time DUI offender population may offer a key opportunity to reduce future harms. Monitoring and preventing the long-term effects of co-use on consequences among DUI offenders offers an important future area of research.

Acknowledgements

The authors would like to thank the DUI programs in this study for their collaboration in supporting this research. We also thank our survey research coordinator, Rick Garvey, and the survey research group for their hard work recruiting and retaining this sample.

Role of funding source

This work was supported by the National Institute on Minority Health and Health Disparities (NIMHD; R01MD007762, Principal Investigator: Karen Chan Osilla). The content is solely the responsibility of the authors and does not necessarily represent the official views of NIMHD or the National Institutes of Health.

References

- Allen JA, Davis KC, Duke JC, Nonnemaker JM, Bradfield BR, Farrelly MC, Novak SP, Zarkin GA, 2016 Association between self-reports of being high and perceptions about the safety of drugged and drunk driving. *Health Educ. Res* 31, 535–541. [PubMed: 27142851]
- Arterberry BJ, Treloar H, McCarthy DM, 2017 Empirical profiles of alcohol and marijuana use, drugged driving, and risk perceptions. *J. Stud. Alcohol Drugs* 78, 889–898. [PubMed: 29087824]
- Begg DJ, Langley JD, Stephenson S, 2003 Identifying factors that predict persistent driving after drinking, unsafe driving after drinking, and driving after using cannabis among young adults. *Accid. Anal. Prev* 35, 669–675. [PubMed: 12850067]
- Benjamini Y, Hochberg Y, 1995 Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J. R. Stat. Soc. Ser. B Stat. Methodol* 289–300.
- Berning A, Compton R, Wochinger K, 2015 Results of the 2013–2014 National Roadside Survey of alcohol and drug use by drivers Traffic Safety Facts Research Note. National Highway Traffic Safety Administration, Washington, DC https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812118-roadside_survey_2014.pdf.
- Blanchard KA, Morgenstern J, Morgan TJ, Lobouvie EW, Bux DA, 2003 Assessing consequences of substance use: psychometric properties of the inventory of drug use consequences. *Psychol. Addict. Behav* 17, 328. [PubMed: 14640829]
- Blincoe L, Miller T, Zaloshnja E, Lawrence BA, 2015 The Economic and Societal Impact of Motor Vehicle Crashes, 2010 (Revised) National Highway Traffic Safety Administration, Washington, DC <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013>.
- Brady JE, Li G, 2014 Trends in alcohol and other drugs detected in fatally injured drivers in the United States, 1999–2010. *Am. J. Epidemiol* 179, 692–699. [PubMed: 24477748]
- Bramness JG, Khiabani HZ, Morland J, 2010 Impairment due to cannabis and ethanol: clinical signs and additive effects. *Addiction* 105, 1080–1087. [PubMed: 20331551]
- C'de Baca J, McMillan GP, Lapham SC, 2009 Repeat DUI offenders who have had a drug diagnosis: are they more prone to traffic crashes and violations? *Traffic Inj. Prev* 10, 134–140. [PubMed: 19333825]
- Caetano R, McGrath C, 2005 Driving under the influence (DUI) among US ethnic groups. *Accid. Anal. Prev* 37, 217–224. [PubMed: 15667807]
- Carruth B, Wuth C, Cavaola AA, 2016 Assessment and Treatment of the DWI Offender. Routledge, New York.

- Cavaiaola AA, Wuth C, 2002 Assessment and Treatment of the DWI Offender. Haworth Press.
- Center for Behavioral Health Statistics and Quality, 2017 2018 National Survey on Drug Use and Health (NSDUH): CAI Specifications for Programming (English Version) Substance Abuse and Mental Health Services Administration, Rockville, MD <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbscreenerSpecs2018.pdf>.
- Chihuri S, Li G, Chen Q, 2017 Interaction of marijuana and alcohol on fatal motor vehicle crash risk: a case-control study. *Inj. Epidemiol* 4, 8. [PubMed: 28286930]
- Collins RL, Parks GA, Marlatt GA, 1985 Social determinants of alcohol consumption: the effects of social interaction and model status on the self-administration of alcohol. *J. Consult. Clin. Psychol* 53, 189. [PubMed: 3998247]
- Davis KC, Allen J, Duke J, Nonnemaker J, Bradfield B, Farrelly MC, Shafer P, Novak S, 2016 Correlates of marijuana drugged driving and openness to driving while high: evidence from Colorado and Washington. *PLoS One* 11, e0146853. [PubMed: 26800209]
- Dawson DA, Grant BF, Stinson FS, Zhou Y, 2005 Effectiveness of the derived Alcohol Use Disorders Identification Test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. *Alcohol. Clin. Exp. Res* 29, 844–854. [PubMed: 15897730]
- DiClemente CC, Carbonari JP, Montgomery R, Hughes SO, 1994 The alcohol abstinence self-efficacy scale. *J. Stud. Alcohol* 55, 141–148. [PubMed: 8189734]
- DiStefano G, Hohman M, 2007 The paradigm developmental model of treatment: a framework for treating DUI multiple offenders. *Alcohol. Treat. Q* 25, 133–147.
- Dubois S, Mullen N, Weaver B, Bédard M, 2015 The combined effects of alcohol and cannabis on driving: impact on crash risk. *Forensic Sci. Int* 248, 94–100. [PubMed: 25612879]
- Feinn R, Tennen H, Kranzler HR, 2003 Psychometric properties of the short index of problems as a measure of recent alcohol-related problems. *Alcohol. Clin. Exp. Res* 27, 1436–1441. [PubMed: 14506404]
- Green KM, Musci RJ, Johnson RM, Matson PA, Reboussin BA, Ialongo NS, 2016 Outcomes associated with adolescent marijuana and alcohol use among urban young adults: a prospective study. *Addict. Behav* 53, 155–160. [PubMed: 26517712]
- Hartman RL, Brown TL, Milavetz G, Spurgin A, Pierce RS, Gorelick DA, Gaffney G, Huestis MA, 2015 Cannabis effects on driving lateral control with and without alcohol. *Drug Alcohol Depend* 154, 25–37. [PubMed: 26144593]
- Huestis MA, 2015 Deterring driving under the influence of cannabis. *Addiction* 110, 1697–1698. [PubMed: 26264558]
- Jewell J, Hupp SD, 2005 Examining the effects of fatal vision goggles on changing attitudes and behaviors related to drinking and driving. *J. Prim. Prev* 26, 553–565. [PubMed: 16228116]
- Jewell J, Hupp S, Luttrell G, 2004 The effectiveness of fatal vision goggles: disentangling experiential versus onlooker effects. *J. Alcohol. Drug Educ* 48, 63.
- Jewell JD, Hupp SD, Segrist DJ, 2008 Assessing DUI risk: examination of the behaviors and attitudes drinking and driving scale (BADDs). *Addict. Behav* 33, 853–865. [PubMed: 18374495]
- Kiluk BD, Dreifuss JA, Weiss RD, Morgenstern J, Carroll KM, 2013 The Short Inventory of Problems-Revised (SIP-R): psychometric properties within a large, diverse sample of substance use disorder treatment seekers. *Psychol. Addict. Behav* 27, 307. [PubMed: 22642856]
- Klimas J, Tobin H, Field CA, O’Gorman CS, Glynn LG, Keenan E, Saunders J, Bury G, Dunne C, Cullen W, 2014 Psychosocial interventions to reduce alcohol consumption in concurrent problem alcohol and illicit drug users. *Cochrane Database Syst. Rev*, CD009269.
- Krumpal I, 2013 Determinants of social desirability bias in sensitive surveys: a literature review. *Qual. Quant* 47, 2025–2047.
- Kuitunen-Paul S, Obst E, Schmidt R, Sommer C, Kuitunen PT, Wittchen HU, Zimmermann US, 2018 Effects of alcohol intoxication on self-reported drinking patterns, expectancies, motives and personality: a randomized controlled experimental study. *Addict. Biol* 10.1111/adb.12604.
- LaBrie RA, Kidman RC, Albanese M, Peller AJ, Shaffer HJ, 2007 Criminality and continued DUI offense: criminal typologies and recidivism among repeat offenders. *Behav. Sci. Law* 25, 603–614. [PubMed: 17620272]

- Lapham SC, Smith E, C'de Baca J, Chang I, Skipper BJ, Baum G, Hunt WC, 2001 Prevalence of psychiatric disorders among persons convicted of driving while impaired. *Arch. Gen. Psychiatry* 58, 943–949. [PubMed: 11576032]
- Lapham SC, Baca J.Cd., McMillan GP, Lapidus J, 2006 Psychiatric disorders in a sample of repeat impaired-driving offenders. *J. Stud. Alcohol* 67, 707–713. [PubMed: 16847539]
- Li G, Chihuri S, Brady JE, 2017 Role of alcohol and marijuana use in the initiation of fatal two-vehicle crashes. *Ann. Epidemiol* 27, 342–347 e341. [PubMed: 28595738]
- Lipperman-Kreda S, Gruenewald PJ, Grube JW, Bersamin M, 2017 Adolescents, alcohol, and marijuana: context characteristics and problems associated with simultaneous use. *Drug Alcohol Depend.* 179, 55–60. [PubMed: 28755540]
- Litt MD, Kadden RM, Kabela-Cormier E, Petry NM, 2009 Changing network support for drinking: network support project 2-year follow-up. *J. Consult. Clin. Psychol* 77, 229. [PubMed: 19309183]
- Logan BK, Mohr AL, Talpins SK, 2014 Detection and prevalence of drug use in arrested drivers using the Dräger Drug Test 5000 and Affiniton DrugWipe oral fluid drug screening devices. *J. Anal. Toxicol* 38, 444–450. [PubMed: 24894458]
- Magill M, Barnett NP, Apodaca TR, Rohsenow DJ, Monti PM, 2009 The role of marijuana use in brief motivational intervention with young adult drinkers treated in an emergency department. *J. Stud. Alcohol Drugs* 70, 409–413. [PubMed: 19371492]
- Marra L, Field C, Caetano R, von Sternberg K, 2014 Construct validity of the short inventory of problems among Spanish speaking Hispanics. *Addict. Behav* 39, 205–210. [PubMed: 24148139]
- Maxwell JC, 2012 Drunk versus drugged: How different are the drivers? *Drug Alcohol Depend.* 121, 68–72. [PubMed: 21925803]
- McKiernan P, Cloud R, Patterson DA, Golder S, Besel K, 2011 Development of a brief abstinence self-efficacy measure. *J. Soc. Work Pract. Addict* 11, 245–253. [PubMed: 23559892]
- Midanik LT, Tam TW, Weisner C, 2007 Concurrent and simultaneous drug and alcohol use: results of the 2000 National Alcohol Survey. *Drug Alcohol Depend.* 90, 72–80. [PubMed: 17446013]
- Mojarrad M, Samet JH, Cheng DM, Winter MR, Saitz R, 2014 Marijuana use and achievement of abstinence from alcohol and other drugs among people with substance dependence: a prospective cohort study. *Drug Alcohol Depend.* 142, 91–97. [PubMed: 24986785]
- Morris DH, Treloar HR, Niculete ME, McCarthy DM, 2014 Perceived danger while intoxicated uniquely contributes to driving after drinking. *Alcohol. Clin. Exp. Res* 38, 521–528. [PubMed: 24033630]
- Mullen J, Ryan SR, Mathias CW, Dougherty DM, 2015 Treatment needs of driving while intoxicated offenders: the need for a multimodal approach to treatment. *Traffic Inj. Prev* 16, 637–644. [PubMed: 25664371]
- National Academies of Sciences Engineering and Medicine, 2018 Getting to Zero Alcohol-impaired Driving Fatalities: a Comprehensive Approach to a Persistent Problem. The National Academies Press, Washington, DC <https://www.nap.edu/resource/24951/Alcohol-Impaired-Driving-Report-Release-Slides.pdf>.
- National Highway Traffic Safety Administration, 2016 2015 Motor Vehicle Crashes: Overview. Traffic Safety Facts National Highway Traffic Safety Administration, Washington, DC.
- Nochajski TH, Stasiewicz PR, 2006 Relapse to driving under the influence (DUI): a review. *Clin. Psychol. Rev* 26, 179–195. [PubMed: 16364523]
- Oei TP, Morawska A, 2004 A cognitive model of binge drinking: the influence of alcohol expectancies and drinking refusal self-efficacy. *Addict. Behav* 29, 159–179. [PubMed: 14667427]
- Orlando M, Ellickson PL, McCaffrey DF, Longshore DL, 2005 Mediation analysis of a school-based drug prevention program: effects of Project ALERT. *Prev. Sci* 6, 35–46. [PubMed: 15766004]
- Osilla KC, Watkins KE, Kulesza M, Flórez K, Lara-Greenberg M, Miles JN, 2016 Study design to evaluate cognitive behavioral therapy among a diverse sample of adults with a first-time DUI offense. *Addict. Sci. Clin. Pract* 11, 1. [PubMed: 26763048]
- Osilla KC, Kulesza M, Miranda J, 2017 Bringing alcohol treatment to driving under the influence programs: perceptions from first-time offenders. *Alcohol. Treat. Q* 35, 113–129. [PubMed: 28943712]

- Pacula RL, Kilmer B, Wagenaar AC, Chaloupka FJ, Caulkins JP, 2014 Developing public health regulations for marijuana: lessons from alcohol and tobacco. *Am. J. Public Health* 104, 1021–1028. [PubMed: 24825201]
- Perrine M, 1993 Health Attitudes and Practices Survey. Unpublished survey instrument.
- Peters EN, Leeman RF, Fucito LM, Toll BA, Corbin WR, O'Malley SS, 2012 Co-occurring marijuana use is associated with medication nonadherence and nonplanning impulsivity in young adult heavy drinkers. *Addict. Behav* 37, 420–426. [PubMed: 22189052]
- Pilkinton MW, Robertson A, McCluskey DL, 2013 Drugged driving: increased traffic risks involving licit and illicit substances. *J. Drug Educ* 43, 183–201. [PubMed: 25068170]
- Ramaekers JG, Robbe HWJ, O'Hanlon JF, 2000 Marijuana, alcohol and actual driving performance. *Hum. Psychopharmacol* 15, 551–558. [PubMed: 12404625]
- Ronen A, Chassidim HS, Gershon P, Parmet Y, Rabinovich A, Bar-Hamburger R, Cassuto Y, Shinar D, 2010 The effect of alcohol, THC and their combination on perceived effects, willingness to drive and performance of driving and non-driving tasks. *Accid. Anal. Prev* 42, 1855–1865. [PubMed: 20728636]
- Schell TL, Chan KS, Morral AR, 2006 Predicting DUI recidivism: personality, attitudinal, and behavioral risk factors. *Drug Alcohol Depend* 82, 33–40. [PubMed: 16150554]
- Sewell RA, Poling J, Sofuoglu M, 2009 The effect of cannabis compared with alcohol on driving. *Am. J. Addict* 18, 185–193. [PubMed: 19340636]
- Shaw MA, DiClemente CC, 2016 Temptation minus self-efficacy in alcohol relapse: a project MATCH follow-up. *J. Stud. Alcohol Drugs* 77, 521–525. [PubMed: 27172586]
- Shillington AM, Clapp JD, 2001 Substance use problems reported by college students: combined marijuana and alcohol use versus alcohol-only use. *Subst. Use Misuse* 36, 663–672. [PubMed: 11419493]
- Subbaraman MS, Kerr WC, 2015 Simultaneous versus concurrent use of alcohol and cannabis in the national alcohol survey. *Alcohol. Clin. Exp. Res* 39, 872–879. [PubMed: 25872596]
- Subbaraman MS, Metrik J, Patterson D, Swift R, 2017 Cannabis use during treatment for alcohol use disorders predicts alcohol treatment outcomes. *Addiction* 112, 685–694. [PubMed: 27865015]
- Terry-McElrath YM, O'Malley PM, Johnston LD, 2014 Alcohol and marijuana use patterns associated with unsafe driving among US high school seniors: high use frequency, concurrent use, and simultaneous use. *J. Stud. Alcohol Drugs* 75, 378–389. [PubMed: 24766749]
- Walker DD, Neighbors C, Rodriguez LM, Stephens RS, Roffman RA, 2011 Social norms and self-efficacy among heavy using adolescent marijuana smokers. *Psychol. Addict. Behav* 25, 727. [PubMed: 21842969]
- Walsh JM, Flegel R, Atkins R, Cangianelli LA, Cooper C, Welsh C, Kerns TJ, 2005 Drug and alcohol use among drivers admitted to a Level-1 trauma center. *Accid. Anal. Prev* 37, 894–901. [PubMed: 15927139]
- Watson TM, Mann RE, 2016 International approaches to driving under the influence of cannabis: a review of evidence on impact. *Drug Alcohol Depend* 169, 148–155. [PubMed: 27810658]
- WHO Assist Working Group, 2002 The alcohol, smoking and substance involvement screening test (ASSIST): development, reliability and feasibility. *Addiction* 97, 1183–1194. [PubMed: 12199834]
- Yurasek AM, Aston ER, Metrik J, 2017a Co-use of alcohol and cannabis: a review. *Curr. Addict. Rep* 4, 184–193.
- Yurasek AM, Merrill JE, Metrik J, Miller MB, Fernandez AC, Borsari B, 2017b Marijuana use in the context of alcohol interventions for mandated college students. *J. Subst. Abuse Treat* 79, 53–60. [PubMed: 28673527]

Table 1

Differences in Demographics, Cognitions, Use, and Consequences by Alcohol and Marijuana Co-Use Status (N = 277).

	Alcohol Only (AO) (n = 157)	Co-Use Alcohol and Marijuana (AM) (n = 120)	P-value AO v AM
Sociodemographic Characteristics			
Male	115 (73.2%)	84 (70.0%)	0.555
Hispanic	83 (52.9%)	70 (58.3%)	0.366
White non-Hispanic	64 (40.8%)	35 (29.2%)	0.044 *
Age			
Less than 25 years old	39 (24.8%)	50 (41.7%)	0.005 **
25–29 years old	41 (26.1%)	35 (29.2%)	
30–44 years old	49 (31.2%)	23 (19.2%)	
45+ years old	28 (17.8%)	12 (10.0%)	
Relationship status			
Single (not dating)	75 (47.8%)	62 (51.7%)	0.000 ***
Dating	33 (21.0%)	46 (38.3%)	
Married	39 (24.8%)	7 (5.8%)	
Divorced	10 (6.4%)	5 (4.2%)	
Education level			
Less than high school diploma/GED	10 (6.4%)	8 (6.7%)	0.998
High school diploma or GED	58 (36.9%)	45 (37.5%)	
Some college, no Bachelor's degree	59 (37.6%)	45 (37.5%)	
Bachelor's degree or greater	30 (19.1%)	22 (18.3%)	
Income level			
Less or equal to \$20,000	59 (37.6%)	65 (54.2%)	0.004 **
\$20,001–\$40,000	43 (27.4%)	33 (27.5%)	
Greater than \$40,000	55 (35.0%)	22 (18.3%)	
Labor market status			
Work full time	97 (61.8%)	73 (60.8%)	0.034 *
Work part time	16 (10.2%)	24 (20.0%)	
Unemployed or not in the labor force	44 (28.0%)	23 (19.2%)	
Alcohol and DUI Cognitions			
Positive alcohol expectancies ^a	2.2 (1.10)	2.1 (1.09)	0.373
Drinking refusal self-efficacy score ^a	4.01 (5.32)	1.9 (5.02)	0.001 ***
Negative affect self-efficacy	1.0 (1.93)	0.07 (1.89)	0.000 ***
Positive/social self-efficacy	–0.6 (1.76)	–0.8 (1.54)	0.279
Physical/other self-efficacy ^a	1.9 (1.76)	1.6 (1.60)	0.094
Urges self-efficacy ^a	1.7 (1.84)	1.1 (1.76)	0.005 **
Very unlikely to drive after drinking: ^a			

	Alcohol Only (AO) (n = 157)	Co-Use Alcohol and Marijuana (AM) (n = 120)	P-value AO v AM
1 drink	59 (37.6%)	24 (20.0%)	0.001 **
2 drinks	71 (45.2%)	36 (30.0%)	0.009 **
3–4 drinks	108 (68.8%)	67 (55.8%)	0.028 *
5–6 drinks	136 (86.6%)	86 (71.7%)	0.004 **
Alcohol Use and Consequences			
Days alcohol use	10.3 (8.02)	10.8 (7.50)	0.627
Typical number of drinks per week	12.0 (11.23)	15.1 (11.85)	0.026 *
Peak daily drinking quantity	4.4 (2.93)	5.4 (3.30)	0.013 *
Binge drink (5+ drinks)	73 (46.5%)	82 (68.3%)	0.000 ***
AUDIT score	8.8 (5.98)	11.0 (6.28)	0.004 **
SIP score	6.9 (7.90)	8.8 (8.12)	0.050 *
Drove after drinking	31 (19.7%)	33 (27.5%)	0.136

Mean (standard deviation) or n (column percent) shown. P-values for t-tests or Chi-squared tests of differences between AO and AM groups.

*
p < 0.05.

**
p < 0.01.

p < 0.001.

^aOne respondent from the AM co-use group is missing information about PAE and self-efficacy, and is thus dropped from the subsequent analyses.

Associations between Alcohol-Related Cognitions and Past-Month Co-Use of Alcohol with Marijuana, Relative to Past-Month Users of Alcohol Only (N = 276).

Table 2

Outcomes	Adjusted Model: Include Sociodemographic Controls β (SE)
Positive Alcohol Expectancies	
Alcohol & marijuana co-use (vs. alcohol-only)	-0.223 (0.139)
Total Drinking Refusal Self-Efficacy	
Alcohol & marijuana co-use (vs. alcohol-only)	-2.140 ** (0.685)
Negative Affect Drinking Refusal Self-Efficacy	
Alcohol & marijuana co-use (vs. alcohol-only)	-0.979 *** (0.249)
Social/Positive Drinking Refusal Self-Efficacy	
Alcohol & marijuana co-use (vs. alcohol-only)	-0.102 (0.211)
Physical/Other Drinking Refusal Self-Efficacy	
Alcohol & marijuana co-use (vs. alcohol-only)	-0.422 (0.219)
Urges Drinking Refusal Self-Efficacy	
Alcohol & marijuana co-use (vs. alcohol-only)	-0.637 ** (0.233)

Results from linear regressions presented. Alcohol-only (AO) and co-users of alcohol and marijuana (AM) are mutually exclusive categories. Reference group is those with past-month alcohol use only. Sociodemographic controls include binary variables for male, Hispanic, white non-Hispanic, and categorical variables for relationship status, age, income, and labor market status.

* p < 0.05.
** p < 0.01.
*** p < 0.001.

Table 3:

Associations of Self-Efficacy to Avoid DUI with Past-Month Alcohol Use, with and without Marijuana Co-Use, Relative to Past-Month Users of Alcohol Only (N = 276)

Outcome	Adjusted Model: Include Sociodemographic Controls OR (SE)
Self-Efficacy to Avoid DUI Very unlikely to drive short distance after 1 drink	
Alcohol & marijuana co-use (vs. alcohol-only)	0.422 ** (0.317)
Very unlikely to drive short distance after 2 drinks	
Alcohol & marijuana co-use (vs. alcohol-only)	0.510 * (0.287)
Very unlikely to drive short distance after 3–4 drinks	
Alcohol & marijuana co-use (vs. alcohol-only)	0.528 * (0.279)
Very unlikely to drive short distance after 5–6 drinks	
Alcohol & marijuana co-use (vs. alcohol-only)	0.327 ** (0.352)

Logistic regression and odds ratio (OR) presented. Alcohol-only (AO) and co-users of alcohol and marijuana (AM) are mutually exclusive categories. Reference group is those with past-month alcohol use only. Sociodemographic controls include binary variables for male, Hispanic, white non-Hispanic, and categorical variables for relationship status, age, income, and labor market status.

*
p < 0.05.

**
p < 0.01.

p < 0.001.

Table 4:

Regression Results for Differences in Alcohol-Related Outcomes between Past-Month Drinkers with and without Co-Use of Marijuana (N = 276).

Outcome	Model 1: Adjusted for socio-demographic factors	IRR/OR (SE)	Model 2: Adjusted for socio-demographics & self-efficacy	IRR/OR (SE)
Number of alcohol use days in past month^a				
Alcohol & marijuana co-use (vs. alcohol-only)	1.149 (0.088)		1.080 (0.087)	
Typical number of drinks per week^a				
Alcohol & marijuana co-use (vs. alcohol-only)	1.337 ^{**} (0.093)		1.188 (0.091)	
Peak drinking quantity^a				
Alcohol & marijuana co-use (vs. alcohol-only)	1.192 [*] (0.073)		1.104 (0.072)	
Binge drink (5+ drinks) in past month^b				
Alcohol & marijuana co-use (vs. alcohol-only)	2.460 ^{**} (0.293)		1.893 [*] (0.312)	
SIP score^b				
Alcohol & marijuana co-use (vs. alcohol-only)	1.304 (0.138)		1.078 (0.133)	
Drove after drinking in past month^b				
Alcohol & marijuana co-use (vs. alcohol-only)	1.535 (0.317)		1.233 (0.322)	
Sociodemographic Controls	X		X	
Control for Abstinence Self-Efficacy Score			X	

*
p < 0.05.**
p < 0.01.***
p < 0.001.^aNegative binomial regression and incident rate ratio (IRR) presented.^bLogistic regression and odds ratio (OR) presented. Standard errors (SE) in parentheses. Sociodemographic controls are binary variables for male, Hispanic, white non-Hispanic, and categorical variables for age group, relationship status, income, education, and labor market status.