Short communication

Intoxicated driving and riding with impaired drivers: Comparing days with alcohol, marijuana, and simultaneous use

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ARTICLE INFO

Keywords:
Alcohol
Drinking
Cannabis
Driving
Riding

ABSTRACT

Background: Young adults who engage in simultaneous alcohol and marijuana (SAM) use may be more likely to engage in unsafe behaviors including riding with impaired drivers and driving after alcohol and/or marijuana use.

Methods: Young adult SAM users (N = 408) self-reported their behavior for five 14-day bursts, yielding daily-level responses on a total of 14,675 substance use days. Adjusted odds ratios (AOR) estimated the likelihood of riding with an impaired driver and of driving after use on SAM use days compared to alcohol- or marijuana-only use days.

Results: More frequent SAM users were more likely to ride with an impaired driver and to drive after use than less frequent SAM users (between-persons). On SAM use days, there were greater odds of riding with an impaired driver, compared to alcohol-only days (AOR = 1.28) and marijuana-only days (AOR = 2.22), and of driving after use, compared to marijuana-only days (AOR = 1.25). Driving after use was more likely on days with non-simultaneous alcohol and marijuana use compared to SAM use (AOR = 1.59).

Conclusions: Riding with an impaired driver is common among young adult substance users, and more likely following simultaneous use of alcohol and marijuana compared to other types of alcohol and marijuana use. Driving after use is more likely after SAM use than marijuana-only use days, but most likely on days when both alcohol and marijuana were used but not simultaneously. Future research on situation-level predictors of riding and driving-related risks among young adults is warranted.

1. Introduction

Given the recent liberalization of marijuana laws in many states across the United States and high prevalence rates of marijuana use, developing a better understanding of consequences of simultaneous alcohol and marijuana (SAM) use is a public health priority. Most young adults who use both alcohol and marijuana sometimes use them at the same time (Patrick et al., 2018, 2019a, 2019b; Subbaraman and Kerr, 2015). For instance, the 2005 and 2010 National Alcohol Survey showed that 15% of young adults (ages 18–29) engaged in past-year SAM use (Subbaraman and Kerr, 2015). Recent data from Monitoring the Future indicated that 22.5% of 19–20 year olds reported past-year SAM use (Patrick et al., 2019a, 2019b).

A growing body of research documents positive associations between SAM use and a range of negative outcomes, including increased alcohol use, alcohol-related harms, and rates of alcohol use disorder, and a variety of social, legal, academic, and health consequences (Briere et al., 2011; Subbaraman and Kerr, 2015; Yurasek et al., 2017). Consequences of SAM use may be the result of additive or interactive (i.e., synergistic) effects that occur because of the pharmacological combination of substance, therefore increasing impairment compared to using either alcohol or marijuana alone (Yurasek et al., 2017).

Given its synergistic effects, driving under the influence of SAM is a public health concern. The combination of alcohol and THC severely impairs driving simulator performance (Ramaekers et al., 2000, 2004). Cross-sectional findings suggest that SAM users are at increased risk for traffic collisions and engaging in unsafe driving behaviors including driving while intoxicated (Duckworth and Lee, 2019; Subbaraman and...
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2.1.2. Substance use

Each morning participants were asked, “Did you drink any alcohol yesterday?” and “Did you use marijuana yesterday?” (0=no, 1=yes). If participants indicated using both alcohol and marijuana, they were then asked, “Yesterday, did you use alcohol and marijuana at the same time—that is, so that their effects overlapped?” (0=no, 1=yes). When participants missed a morning survey, the items were asked in the afternoon survey. Each day was then coded as alcohol-only, marijuana-only, both but not simultaneously, or SAM use.

2.1.3. Driving after use

Participants were asked, “Yesterday, did you drive a car/motor vehicle within three hours after...drinking alcohol?...using marijuana?” Responses were coded as 0=neither, 1=yes after alcohol and/or marijuana use.

2.1.4. Riding with an impaired driver

Participants were asked, “Did you ride in a car/motor vehicle with someone who was driving after they were drinking alcohol or using marijuana yesterday?” (0=no, 1=yes).

2.2. Analyses

Multilevel logistic regression models were conducted in the R package lme4 (Bates et al., 2015). Models included biological sex, age at baseline, race/ethnicity, and four-year college student status as between-person covariates, and weekend (yes/no), burst number, and day number within burst as within-person covariates. Proportion of substance use days that were SAM use days was entered as a between-person covariate, which disaggregates the within-person (i.e., day-level) effect of SAM use, relative to alcohol-only, marijuana-only, and days in which both alcohol and marijuana were used but not simultaneously (Enders and Tofighi, 2007). Coefficients from the multilevel logistic regression models were exponentiated to yield adjusted odds ratios.1

3. Results

The majority (83.1 %) of participants reported SAM use on at least one day (see Table 1). Two-thirds (66.7 %) of participants rode with an intoxicated driver at least once and nearly one-third (32.6 %) drove after use during the data collection period.

Table 2 displays the results from the multilevel logistic regression models predicting riding with an impaired driver and driving after use. Level 2 (between-person) results showed that men (vs. women) were more likely to ride with an impaired driver and those who more frequently engaged in SAM use on substance use days had increased odds of both outcomes. Level 1 (within-person) covariates showed that participants had lower odds of riding with an impaired driver on days that were later in the data collection window each burst; there were no differences for driving.

Regarding the central aims of this study, participants had greater odds of riding with an impaired driver on SAM use days, relative to alcohol-only and marijuana-only days. Inverse adjusted odds ratios (supplemental tables S1 and S2) indicated that, controlling for other predictors, the odds of riding with an impaired driver on a SAM use day was 1.28 times greater than on alcohol-only days, and 2.22 times greater than on marijuana-only days. Alcohol-only days, compared to marijuana-only days, were associated with greater odds (AOR = 1.72) of riding with an impaired driver. On SAM use days, participants had greater odds of driving after alcohol or marijuana relative to marijuana-only days (AOR = 1.25), and lower odds relative to days when they used both alcohol and marijuana but not simultaneously (Table 2).

4. Discussion

The present study extends research investigating SAM use and unsafe driving behaviors by focusing on SAM use as a risk factor for both riding with an impaired driver and driving after alcohol or marijuana use. Riding with an impaired driver is quite common: in this sample of young

1 Multilevel models were specified to have a random intercept and fixed slope given no theoretical rationale for specifying complex random slopes. We nevertheless compared the reported models to models with substance use entered as a random effect and the model fit (AIC and BIC) indices were approximately the same and substantive findings were unchanged.
adult SAM users, 2/3 reported riding with an intoxicated driver during at least one of the five 14-day data collection periods. Driving after use was less common: 1/3 reported driving after alcohol or marijuana use during the same data collection period. Consistent with previous literature (Duckworth and Lee, 2019; Subbaraman and Kerr, 2015; Sewell et al., 2009; Terry-McElrath et al., 2014), young adults who engaged in SAM use more frequently were more likely to ride with an impaired driver or drive after alcohol or marijuana use on substance use days. Young adults were significantly more likely to ride in a car with an intoxicated driver on days they reported SAM use, compared to alcohol-only or marijuana-only days. Participants were more likely to drive after use on SAM days compared to marijuana-only days, but less likely to drive after use on SAM days compared to days with non-overlapping alcohol and marijuana use. This is consistent with previous literature indicating co-use days may have more negative consequences than SAM use days (Sokolovsky et al., 2020), possibly because days with drinking and marijuana use that is not simultaneous may be associated with a greater time period of intoxication and possibly in multiple contexts.

Public health messaging and prevention and intervention programming geared toward informing youth and young adults about the dangers of drinking and driving and riding with drinking drivers have been successfully implemented over the past several decades (Hingson et al., 2008; Hultgren et al., 2015; Perkins et al., 2010; Teeters et al., 2015). For example, Hultgren and colleagues (2015) tested a dual-process model of the impact of reasoned and reactive influences on riding with drinking drivers among college students. Reactive influences (i.e., willingness to ride with a drinking driver), attitudes, and peer and parent norms were salient predictors of riding with drinking drivers, suggesting that brief motivational interviews, parent-based interventions, and normative feedback interventions may be indicated in reducing riding with drinking drivers. It may be useful to adopt effective interventions and education aimed at reducing an individual’s willingness to ride with a driver who has been drinking alcohol or using marijuana for young adults who use SAM. In addition, the current results suggest that occasions of SAM use are particularly risky, so event-level interventions to help young adults get home safely after engaging in SAM use may also be needed. Such interventions could focus on helping young adults make safer choices in the moment (e.g., suggesting using a ride-sharing app instead of driving). Future research should also examine effects of policies regarding penalties for driving after use.

Limitations of this study include that the sample was based on SAM users in one metropolitan area and may not generalize to less frequent users, or to young adults in different geographic areas. In addition, intoxication is subjective, and the perceived degree of the driver’s and rider’s possible intoxication from alcohol and/or marijuana is not considered in this analysis. Future research could explore how people make decisions about riding with drivers who have been using substances, how they determine whether another driver is intoxicated, and the impact of the relative level of impairment of each individual. The strengths of the study include daily reports of substance use and related risks from the same individuals over time to identify event-related risks.

Table 2

Multilevel logistic regression model estimating odds of riding with an impaired driver on SAM use days compared to alcohol only days, marijuana only days, and both but non-simultaneous days.

<table>
<thead>
<tr>
<th>Level-1 Variables: Within-Person</th>
<th>Riding with Impaired Driver (13,070 substance use days; N = 408)</th>
<th>Driving after Alcohol or Marijuana Use (13,070 substance use days; N = 408)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adj Odds Ratio</td>
<td>95% CI</td>
</tr>
<tr>
<td>Sex (female = 0, M = 1) ( \gamma_1 )</td>
<td>1.40</td>
<td>[1.06, 1.84]</td>
</tr>
<tr>
<td>Age at baseline ( \gamma_2 )</td>
<td>1.03</td>
<td>[0.96, 1.11]</td>
</tr>
<tr>
<td>College student (0 = No, 1 = Yes) ( \gamma_3 )</td>
<td>1.20</td>
<td>[0.84, 1.70]</td>
</tr>
<tr>
<td>Proportion of SAM use days ( \gamma_4 )</td>
<td>4.34</td>
<td>[1.53, 12.30]</td>
</tr>
</tbody>
</table>
| Level-2 Variables: Between-Person | Ridin...  

Note: Models also controlled for ethnicity/race as a categorical covariate, but these non-significant estimates are not shown to keep this table concise.
Riding with an intoxicated driver has been an understudied risk behavior associated with substance use among young adults. However, a striking two-thirds of young adult substance users in this study rode with an impaired driver during the data collection period. A greater understanding of the prevalence and predictors of riding-related risks is needed to develop interventions to protect young adults.

Role of funding source

Data collection and manuscript preparation were supported by a grant from the National Institute on Alcohol Abuse and Alcoholism (R01AA025037: MPI: Christine M. Lee and Megan E. Patrick). The content of this manuscript is solely the responsibility of the author(s) and does not necessarily represent the official views of the National Institute on Alcohol Abuse and Alcoholism and the National Institutes of Health.

Contributors

Patrick drafted the manuscript and supervised data collection and analysis. Graupensperger and Dworkin conducted data analysis and drafted sections of the manuscript. Abdallah and Duckworth drafted sections of the manuscript. Lee supervised data collection and drafted sections of the manuscript. All authors have approved the final article.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgements

Data collection and manuscript preparation were supported by the National Institute on Alcohol Abuse and Alcoholism (R01AA025037 to C. Lee & M. Patrick, R00AA026317 to Dworkin, and T32AA007455 to M. Larimer). The content of this manuscript is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2021.108753.

References
