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Alcohol, Marijuana, and Nicotine Use as Predictors of Impaired Driving and Riding with an Impaired Driver among College Students who Engage in Polysubstance Use

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Abstract

Objective: While alcohol, marijuana, and nicotine are the most commonly used substances, there is limited research on the between- and within-person associations of their use and driving under the influence (DUI) and riding with an impaired driver (RWID). The current study utilized a burst design to assess how use and co-use of these substances is associated with DUI and RWID.

Methods: College student drinkers with past-year marijuana and/or nicotine use (N=367) were assessed on two consecutive weekends for three semesters. Logistic regression compared students who only reported drinking to student drinkers who used marijuana, nicotine, or all three substances on likelihood to DUI and RWID. Multilevel logistic models assessed the associations of varied combinations of substances with the daily likelihood of DUI and RWID.

Results: Compared to students who only used alcohol, students who also reported marijuana use were more likely to DUI (OR= 5.44), and students who reported use of alcohol, nicotine and marijuana more likely to DUI (OR=10.33) and RWID (OR= 10.22). Compared to occasions when only alcohol was used, DUI was more likely on marijuana only occasions (OR= 9.08), and RWID was more likely on alcohol and marijuana occasions (OR= 3.86). However, confidence intervals were wide for effects.

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Discussion: Students reporting use of all 3 substances had higher overall risk of DUI and RWID indicating prevention efforts for DUI and RWID should include all substances. Implications for prevention and intervention strategies at the individual and environmental level are discussed.

Keywords

Impaired driving; Riding with an impaired driver; Alcohol; Marijuana; Nicotine; Polysubstance use; College students

1. Introduction

In the United States, vehicle crashes are the leading cause of death among young adults aged 18-24 (CDC, 2020). Approximately 35% of vehicle fatalities for young adults occur when the driver is impaired by alcohol (e.g., having a BAC of .08 or higher; NHTSA, 2018a). College students represent a disproportionate subgroup of young adults who report alcohol-impaired driving. In fact, alcohol-impaired crashes make up 63% of all alcohol-related injury deaths in college students (Hingson et al., 2017). Research has also shown a positive association between alcohol use and riding with impaired drivers (RWID). Studies with both adolescents and young adults have observed associations between increased alcohol use and heavy episodic drinking and RWID (Li et al., 2013; Vaca et al., 2016). Passengers of alcohol-impaired drivers comprise 13% of all alcohol-related crash fatalities (NHTSA, 2018b) and young adults typically report higher rates of RWID compared to driving under the influence (DUI; O'Malley & Johnston, 2013), suggesting both DUI and RWID are important risk behaviors in need of additional research to aid in prevention efforts.

Vehicle crashes often involve substances other than alcohol, the most common being marijuana (Compton & Berning, 2015). Research indicates that compared to not using any substances, the risk of a crash is 16 times higher when using alcohol alone and 25 times higher when using alcohol and marijuana (Chuhuri et al., 2017). The polysubstance use of alcohol and marijuana results in increased impairment compared to alcohol or marijuana use alone (Bramness et al., 2010; Downey et al., 2013; Ramaekers et al., 2000; Robbe, 1998; Lukas & Orozco, 2001; Seamon et al., 2007). Specifically, the use of alcohol and marijuana together has been shown to impair the ability to divide attention between two or more tasks and engage in defensive driving strategies (Hartman & Huestis, 2013; Sewell et al., 2009; Ramaekers et al., 2011). This is an important problem among young adults and college students who have a higher likelihood to use marijuana both by itself and with alcohol (e.g. Arria et al., 2011; Gunn et al., 2018).

Nicotine is the third most used substance in the United States and commonly used in conjunction with both alcohol and marijuana, especially in young adults (Cohn et al., 2015; 2016). Nicotine itself has been associated with increased likelihood of having traffic-related injuries and collisions (Lonczak et al., 2007; Vingilis et al., 2018). Research also suggests that nicotine may interact with alcohol and marijuana to have more severe effects (Vergara et al., 2017; Roche et al., 2019).

Despite the high incidence rates of alcohol, marijuana, and nicotine use among college students and the dangerousness of DUI and RWID, a gap in the literature remains regarding:

1) between-person differences in college student use of alcohol, marijuana, and nicotine with driving-related outcomes, and 2) the within-person differences on the likelihood to DUI and RWID on co-use occasions versus occasions when alcohol is used alone. The current study utilized a daily diary burst design to assess high-risk college student drinkers on their alcohol, marijuana, and nicotine use, and driving-related outcomes. Aim 1 assessed between-person effects over the entire study to determine whether student drinkers who also use marijuana, nicotine, or both substances were more likely than students who only reported alcohol use to DUI and RWID. Based off past research suggesting an increased risk of risky driving-related outcomes for individuals who use marijuana and nicotine, it is hypothesized that student drinkers who report also using marijuana, nicotine or both substances will have increased odds of DUI and RWID compared to students who only drank alcohol. Aim 2 assessed within-person effects to examine whether co-use of alcohol with marijuana and/or nicotine in a single day is associated with an increased the likelihood of DUI and RWID on that occasion. It was hypothesized that compared to days when only alcohol was used, days that included co-use of alcohol with marijuana and/or nicotine would be associated with increased odds of DUI and RWID.

2. Method

2.1 Participants and procedure

College students (N=719) attending a large university in the northeastern United States were invited from a parent study on college student drinking and related consequences to participate in weekend assessments during the fall semester of their 3rd year (see Mallett et al., 2015 for full procedure). Students had to report use of alcohol and another substance (e.g., marijuana, nicotine) in the past year to be eligible for the current study. An email was sent to eligible students that included information on the study, and a URL and PIN to access the consent form. Students who consented to participate were asked to complete surveys on 2 consecutive weekends for 3 semesters (i.e., total of 6 weekends). Participants were sent an email and text message with the survey link on Sundays to report their behaviors that occurred the previous Thursday, Friday, and Saturday. Surveys were available for 48 hours; after this time, access was disabled. Participants were compensated with \$20 for each of the 6 weekend assessments completed (up to \$120 total). All procedures were approved by the university's institutional review board.

A total of 463 students (51.6% female) consented and completed at least one weekend survey (64.4% response rate). This response rate is similar to previous studies using web-based recruitment methods (e.g., Turrissi et al., 2013) and event-level studies (e.g., Patrick & Maggs, 2009). Each weekend response rates ranged from 79.6% to 97.4%. A total of 7,227 days of data were collected across participants over the six weekends (i.e., 18 days). Participants were an average of 20.12 years old (SD=0.34) at the first assessment. Racial and ethnic breakdown was as follows: 88.5% White or Caucasian, 2.8% Asian, 3.0% Multiracial, 2.6% Black or African American, 1.1% Other, and 3.7% Hispanic/Latinx.

2.3 Measures

2.3.1 Substance use—Students were asked to indicate if they used alcohol, nicotine, marijuana for each day (i.e., Thursday, Friday, Saturday). Students were also asked to indicate if they used any other substances (e.g., cocaine, ecstasy, opioids) each day. If students did not use any substances on a particular day, they were asked to select the response option: “I did not use any substances on ____ (e.g., Saturday).”

2.3.2 Number of drinks—Participants reported the number of alcoholic drinks they consumed on each day of the study. Person-centered means of the number of drinks per drinking day was created by adding the total number of drinks consumed over the course of the study and dividing it by number of drinking days. The grand mean of the person-centered mean was then subtracted to create the grand mean centered drinks per drinking day.

2.3.3 Driving under the influence (DUI)—Students who reported use of at least one substance (on each study day) were asked to indicate if they drove a car while high or intoxicated. Response options were *No* (0) or *Yes* (1). Since there are limited cognitive physiological changes that occur with nicotine-only use, students were not asked to report DUI behavior on days that they only used nicotine.

2.3.4 Riding with an Impaired Driver (RWID)—Similar to DUI, participants responded Yes/No to whether they “rode in a car with a driver who was high or intoxicated” for each day of the weekend that they reported using at least one substance. To reduce participant burden and due to the focus of the research questions, students did not report on RWID behavior on days that they did not use any substances or, similar to DUI, on nicotine only days.

2.3.5 Demographics—Participants reported on their birth sex (*Male*=0, *Female*=1), age, and racial identity. Age was grand mean centered. Consistent with the sample university’s student population, a large percentage of the participants identified as White/Caucasian (88.5%) and therefore racial identification was dichotomized as *White* (0) and *Racially/Ethnically Diverse* (1).

2.4 Data analysis plan

Logistic regression analyses were used to assess Aim 1 of examining the between-person effects of using alcohol, marijuana and/or nicotine on the likelihood to engage in DUI or RWID across all occasions in the study. All participants reported drinking at least one day during the study. Therefore, these analyses compared students who only used alcohol to students who used alcohol *and* marijuana and/or nicotine. First, three dummy codes were created based off of student reported substance use across all occasions: 1) used marijuana but no reports of nicotine (Alc & Mj use), 2) used nicotine, but no reports of marijuana (Alc & Nic use), and 3) used both marijuana and nicotine (Alc & Mj & Nic use). The reference group consisted of students who only reported alcohol use during the study. To control for possible effects of the other substances, we removed participants who reported any use of substances other than alcohol, marijuana, or nicotine (e.g., cocaine, ecstasy, opioids, etc.).

Next, occasions of DUI were summed across all occasions (i.e., 18 days) and dichotomized into *any DUI*(1) and *no DUI*(0). RWID was also dichotomized in this fashion. Covariates included birth sex, dichotomized racial/ethnic identity, grand mean centered age, and grand mean centered number of drinks consumed. PROC Logistic with Firth procedure within SAS was utilized to adjust for bias with the lower number of RWID and DUI cases (Firth, 1993; King & Zeng, 2001)

Next, to assess Aim 2 examining the within-person effects of the use of alcohol, marijuana, and nicotine on daily DUI and RWID two multilevel logistic models were utilized with occasions (i.e. survey day) nested within participants. Similar to Aim 1 analyses, dummy variables were created to indicate the substance(s) used that occasion: 1) marijuana only (Mj only), 2) alcohol and marijuana use in the same day, but no use of nicotine (Alc+Mj), 3) alcohol and nicotine use in the same day, but no use of marijuana (Alc+Nic), and 4) alcohol, marijuana, and nicotine use in the same day (Alc+Nic+Mj). The reference group was days where alcohol only was used. To control for general use of these substances across the study, models included Level 2 dummy codes of substance use (i.e., Alc & Mj use, Alc & Nic use, Alc & Mj & Nic use). The use of both the Level 2 and Level 1 substance use variables allowed us to examine effects of co-use at the daily level above and beyond co-use in general. Again, covariates included birth sex, dichotomized racial/ethnic identity, grand mean centered age, and grand mean centered number of drinks consumed. Additionally, a variable indicating which weekend of the study (1 through 6) was recoded (0 through 5) and added to the model to account for possible differences across different weekends and day of the week was recoded (0= Thursday, 1= Friday, 2 = Saturday) to account for differences due to day of the week. PROC GLIMMIX in SAS was used to perform the models.

3. Results

3.1 Preliminary analyses

There were a total of 5116 occasions with substance use (70.8%) across the 18 days and 463 students. All students (100%) reported using alcohol at least once during the study; 223 (48.2%) reported using marijuana, and 188 (40.6%) reported using nicotine. A total of 96 (20.7%) students reported use of substances other than alcohol, nicotine, or marijuana and were removed from analyses. The final N for analyses was 367 students with 3804 occasions of substance use. T-test results detected no differences by age ($p=0.50$) across the sample of 463 and the final analytic sample of 367. Chi-square tests detected no significant differences by sex, race, or ethnicity (all $p's>0.05$). Of the 367 students, 40.1% (N=147) reported only alcohol use, 26.4% (N= 97) reported alcohol and marijuana use, 17.4% (N=64) reported alcohol and nicotine, and 16.1% (N=59) reported using alcohol, nicotine and marijuana. A total of 4.6% (N=17) reported at least one occasion of DUI and 7.4% (N=27) of students reported at least one occasion of RWID. Within the substance use occasions, 78.0% were alcohol only, 3.2% were marijuana only, 7.7% had both alcohol and nicotine, 9.0% had both alcohol and marijuana, and 2.1% had alcohol, nicotine, and marijuana. Among the substance use occasions, 0.8% (n=29) involved a reported DUI and 1.3% (n=48) involved a reported RWID.

3.2 Aim 1: General use of alcohol, marijuana, and nicotine as predictors of the likelihood of DUI and RWID

Fixed effects and odds ratios for all predictors and covariates can be found in Table 1. When assessing DUI, compared to students who only used alcohol, students who reported using alcohol and marijuana use over the study were 5.44 times more likely to report DUI, and students who reported using alcohol, marijuana, and nicotine were 5.20 times more likely to report DUI; however, confidence intervals (CI) were wide for these effects. No other between-person associations were significant. For RWID, students who reported using alcohol, marijuana and nicotine were over 10 times more likely to have reported RWID compared to students who only reported alcohol use over the course of the study. This effect had a wide CI. There was also a trending positive association for students who reported using alcohol and nicotine but did not report marijuana use ($p = .068$). No other associations for RWID were significant.

3.3 Aim 2: Daily use or co-use of alcohol, marijuana and nicotine as predictors of the likelihood of DUI and RWID at the daily Level.

Model estimates and odds ratios for the multilevel logistic analyses are in Table 2. The results for DUI indicated, controlling for all covariates and between-person differences in substance use, occasions when marijuana-only use was endorsed was associated with an increased odds of DUI, when compared to alcohol only days. Specifically, the odds of DUI were 9.08 times higher on marijuana only occasions compared to alcohol only occasions, however the CI was again wide. No other variables showed a significant association to the likelihood of DUI at the daily level. For RWID outcome, the Level 2 between-person effect of using alcohol, marijuana, and nicotine continued to have significant association with increased odds to RWID compared to only using alcohol across the study. Controlling for between-person differences, compared to alcohol only occasions, occasions where alcohol and marijuana were used together were associated with 3.85 times increased odds of RWID. Additionally, there was a trending positive association between marijuana only occasions and RWID ($p < .06$). Day was also found to have a significant association with RWID. Saturdays had over 3 times the odds of RWID than Thursdays. Examining Friday as the reference category, Saturdays were also associated with increased odds compared to Fridays (OR = 2.53, CI = 1.16-5.56). The CIs were wide for effects. No other daily level associations were significant for RWID.

4. Discussion

Alcohol, marijuana, and nicotine are the three most commonly used substances among young adults (Johnson et al., 2014), are frequently used together, and have been associated with risky driving-related outcomes such as DUI and RWID. Prior research has not assessed the between- and within- person effects of the use and co-use of these substances with DUI and RWID. The present research sought to address this gap by assessing how use of alcohol, nicotine, and/or marijuana was associated with these driving-related outcomes among a sample of high risk college students at both the global and daily level.

It was hypothesized that students who used alcohol and marijuana and/or nicotine would have increased odds of DUI and RWID compared to students who only reported alcohol use. This hypothesis was partially supported. Students who used all three substances across the study had significant association with higher odds to DUI and RWID than students who only used alcohol. This suggests that use of alcohol, marijuana and nicotine may be a risk factor for risky transportation behaviors. Use of all three substances could increase the possibility of DUI by increasing the potential of being impaired. This rationale is further supported by the association with increased likelihood of DUI by students who use alcohol and marijuana (but not nicotine). Students who use all three substances may have increased odds of RWID because they may be around more individuals who are impaired or may they perceive RWID as less risky. Additional research should assess if between-person differences on perceived descriptive and injunctive norms and attitudes of DUI and RWID mediate the relationship between use of these substances and DUI and RWID behavior.

Aim 2 of the current study assessed how the likelihood of DUI and RWID differed depending on use of alcohol, marijuana and/or nicotine at the daily level. It was hypothesized that occasions with co-use of alcohol with marijuana and/or nicotine would be associated with increased likelihood of DUI and RWID. Instead, results suggest that an increased risk of dangerous transportation behaviors is associated with occasions when marijuana is used (with or without alcohol or nicotine) than when alcohol is used alone. Compared to alcohol-only occasions, marijuana-only occasions were associated with an increased risk for DUI, indicating students may be more likely to drive while high from marijuana than intoxicated from alcohol. Consistent with the hypothesis, occasions when marijuana and alcohol were associated with increased risk for RWID. This increased risk of DUI on marijuana-only occasions and of RWID on alcohol and marijuana occasions may reflect, as previous studies suggest, that students perceive marijuana as less harmful than alcohol and consider driving under the influence of marijuana as less risky than drinking and driving (Davis & Sloas, 2017; Danton et al., 2003). Students may also be more likely to report driving while high than driving while drunk due to lower perceived risk regarding driving while high (Davis & Sloas, 2017). Previous research has been mixed about the risk of crash while using only marijuana, with replicated meta-analyses reporting the crash risk as low to moderate, but still significant (See Rogeberg & Elvik, 2016). While the risk of a crash may be lower when using marijuana only compared to alcohol only (Compton & Bering, 2015), the increased risk still poses possible injury or fatality to the driver and others. Further in-depth daily research is needed to understand if young adults are driving impaired by marijuana more often, or if it is a function of underreporting impaired driving after using alcohol. Assessing impairment by estimates of blood alcohol content, hours after used marijuana (research suggests driving within 3-6 hours of use is impaired driving, Fischer et al., 2017;), or use of biometrics may help to elucidate this further.

The increased risk of RWID associated with occasions when alcohol and marijuana were used compared to alcohol only days, may be an effect of context. Specifically, students who use alcohol and marijuana on the same day may be around more people who are high or drunk. The combination of alcohol and marijuana use may impact judgment such that students viewed getting into a car with someone who is under the influence as less risky when they used both substances. It is interesting that at the event level alcohol and marijuana

occasions were significantly associated with increased odds of RWID, but days when all three substances were used (i.e., alcohol, marijuana, and nicotine) did not. This may be due to an issue of power. Only 2.1% of days had reported use of all three substances. It is important to note that after controlling for daily level substance use effects, the Level 2 substance use effect remained, indicating that, compared to students who only use alcohol, those who use all three substances may be at increased risk of RWID at the daily level. Research with more daily assessments or with a larger sample of participants who use all three substances may allow for increased power to fully explore this relationship.

The results from the current study may have implications on intervention and prevention efforts for DUI and RWID. Universal prevention and intervention programs directed at reducing risky transportation behaviors should focus not only on alcohol, but also marijuana and nicotine use and the co-use of these three most commonly used substances. Given the association with increased risk of DUI on marijuana only days, and of RWID on days when alcohol and marijuana were used, event-level interventions, such as ecological momentary interventions (EMI) with tailored messaging on days marijuana use is reported or intended may be efficacious at reducing these behaviors. While event-interventions are still novel and those related to substance-use have largely focused on alcohol only (e.g., Gustafson et al., 2014; Chih, 2014, Gonzalez & Dulin, 2015), they have also been utilized for marijuana only (Shrier et al., 2014) and cigarette use only (Bricker et al., 2020). Additionally, several studies have reported on the feasibility of these types of interventions with individuals who use multiple substances, including those in recovery, with preliminary evidence of reduced substance use (Dennis et al., 2015; Nguyen et al., 2020). Future research should assess the efficacy of an EMI on reducing risky transportation behaviors.

Brief interventions delivered on campuses, such as Brief Alcohol Screening and Intervention for College Students (BASICS), have shown success in reducing alcohol use and consequences (Cronce & Larimer, 2011), been adapted to address additional health concerns, such as marijuana use (Lee et al., 2013), and one study reported reducing likelihood to DUI when using materials adapted to address drinking and driving (Teeters et al., 2018). Colleges currently utilizing BASICS could provide adapted materials to students at higher risk for DUI and RWID, and results from the current study suggest screening for use of all three substances may be an easy indicator of who to provide this adapted material. Future research is needed to determine the effect of such brief interventions on RWID behavior and driving under the influence of marijuana and multiple substances.

Results may also indicate that colleges should continue or grow their environmental interventions, especially those in collaboration with their local community. Campaigns aimed at increasing knowledge of possible risk of driving under the influence of marijuana and combining alcohol and marijuana as well as decreasing normative perceptions of these behaviors may be helpful for the general student population, but more research is needed on how this may impact higher-risk students. Highly visible DUI sobriety checkpoints have shown to reduce impaired driving and crashes (Clapp et al., 2005; Erke et al., 2009) and college campuses should consider working with local police forces to increase checkpoints and provide valuable information on where and when they might be helpful. There are many considerations colleges, police forces, and communities need to take before increasing DUI

sobriety checkpoints. Twelve states in the U.S. currently prohibit the use of checkpoints. Checkpoints can place increased burden and cost to police forces (Clapp et al., 2005), however, research suggest they may provide substantial cost saving (Bergen et al., 2014). Police forces should consider increasing community-oriented policing strategies (Oliver, 2001; Peyton et al., 2019) as well as providing sessions for community input on the effects of increasing DUI checkpoints prior to making changes. Multifaceted approaches that blend environmental and individual programs may be most effective (Saltz, 2011) and more evaluation of these combined efforts is needed.

4.1 Limitations

The current study examined associations between alcohol, marijuana, and nicotine use and DUI and RWID among a sample of high-risk college students who reported using alcohol and at least one other substance in the past year. While this study provides a novel insight to the associations between use of alcohol, marijuana and nicotine with DUI and RWID the sample demographics provides limitations to the generalizability of the results. Additional research should include a wider age range of college students from more diverse backgrounds. With the current sample we were only able to examine a dichotomized racial and ethnic status indicating a need to assess potential differences among more refined racial/ethnic groups. To assess for possible disparity effects, research that over samples diverse racial and ethnic backgrounds is needed. Further, research should include young adults who are not in college to assess potential similarities or differences between these populations.

While the current study assessed substance use, DUI, and RWID at the daily level, this was asked retrospectively for each weekend of the study, which potentially could have caused more recall bias than if participants completed a separate assessment each day of the weekend. The current assessment cannot separate co-use of substances in a day from simultaneous use. Future studies should ask about overlapping use of alcohol, marijuana, and nicotine to determine if co-use or simultaneous use have differing effects on the risk of DUI and RWID. Additionally, students were not asked about RWID on days that they did not use substances. Research is needed on the likelihood of RWID on days when alcohol, marijuana, and/or nicotine are used compared to non-substance use days.

Importantly, the Firth procedure was used in Aim 1 to reduce potential bias in model estimates due to the low number of events of DUI and RWID (Firth, 1993). However, there is currently no similar procedure for multilevel models. Even with using the Firth procedure, in both analyses for Aim 1 and Aim 2, the confidence intervals odds ratios for the effects of substance use are very wide. These wide intervals indicate less confidence in the precision of the odds ratios. This may be related to the smaller number of cases of DUI and RWID, or sparse data for some participants. It could also be related to larger variability among and between participants. This may suggest there are other between-person and within-person factors that impact DUI and RWID at the daily level than what was assessed in the current study. Future studies should examine additional between-person factors such as impulsivity, availability of safe alternative transportation options, and daily-level factors such as the number of people using substances, and motivations to use alcohol, marijuana, and/or nicotine. Most importantly, additional research with larger samples or increased time

points is needed to replicate these odds ratios and their significance. If replicated, these effects have important public health considerations.

5. Conclusions

This study aimed to address a gap in the literature to assess both between-person and daily-level predictors of DUI and RWID. It is one of the few studies to assess daily substance use as a predictor of DUI (see McCarty & McCarthy, 2019 for review) and, to our knowledge, is the only study that has assessed daily-level predictors of RWID. Results suggests individual interventions such as BASICS and EMI may be adapted to address DUI and RWID impacted by alcohol, marijuana, and nicotine. Environmental prevention efforts such as media campaigns and highly visible sobriety checkpoints may additionally provide reductions in these risky transportation behaviors and potentially may be most effective when coupled with individual level efforts. This research is the first step in assessing DUI and RWID at the daily level and how alcohol, marijuana, and nicotine are associated with these behaviors. Future research on potentially malleable predictors at the daily level may help determine efficacious intervention and prevention countermeasures further.

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Highlights

- Using all three substances may increase odds of impaired driving behaviors
- Driving under the influence may be more likely when marijuana only is used
- Riding with impaired drivers may be more likely when alcohol and marijuana are used
- Additional daily level assessments of impaired driving behaviors are needed

Table 1.

Logistic Regressions Assessing Global Level DUI and RWID

| Fixed Effects | DUI | | | | RWID | | | |
|-----------------------------|------|------------|-----------------|----------------------|-------------------|------------|-----------------|----------------------|
| | OR | 95% CI | Estimate (S.E.) | Wald χ^2 | OR | 95% CI | Estimate (S.E.) | Wald χ^2 |
| Intercept | - | - | -3.83 (0.65) | 34.89 ^{***} | - | - | -3.45 (0.51) | 45.20 ^{***} |
| Avg. # Drinks | 0.89 | 0.73-1.06 | -0.12 (0.09) | 1.78 | 0.99 | 0.86-1.13 | -0.01 (0.07) | 0.02 |
| Age | 1.74 | 0.42-5.70 | 0.55 (0.63) | 0.78 | 2.42 | 0.83-6.37 | 0.88 (0.51) | 3.00 |
| Alc Only Use | REF | - | - | - | REF | - | - | - |
| Alc & Mj Use | 5.44 | 1.45-29.44 | 1.69 (0.71) | 5.68 [*] | 1.97 | 0.54-7.54 | 0.68 (0.64) | 1.13 |
| Alc & Nic Use | 2.08 | 0.31-13.86 | 0.73 (0.88) | 0.69 | 3.30 | 0.89-12.89 | 1.19 (0.65) | 3.34 ⁺ |
| Alc & Mj & Nic Use | 5.20 | 1.18-30.12 | 1.65 (0.77) | 4.63 [*] | 10.2 ₇ | 3.49-36.11 | 2.33 (0.58) | 16.25 ^{***} |
| Birth Sex | | | | | | | | |
| Males | REF | - | - | - | REF | - | - | - |
| Females | 0.40 | 0.13-1.14 | -0.46 (0.26) | 3.07 | 1.81 | 0.75-4.61 | 0.30 (0.23) | 1.72 |
| Racial Identity | | | | | | | | |
| White | REF | - | - | - | REF | - | - | - |
| Racially/Ethnically Diverse | 1.69 | 0.47-5.24 | 0.26 (0.29) | 0.79 | 1.31 | 0.42-3.56 | 0.13 (0.27) | 0.25 |

Note: Significance denoted by

⁺ p<0.07 (trending)

* p<0.05

** p<0.01

*** p<0.001

Table 2.

Multilevel Logistic Regressions Assessing Daily Level DUI and RWID

| Fixed Effects | DUI | | | | RWID | | | |
|-----------------------------|------|---------------|-----------------|-----------------------|------|---------------|-----------------|----------------------|
| | OR | 95% CI for OR | Estimate (S.E.) | F | OR | 95% CI for OR | Estimate (S.E.) | F |
| Intercept | | | -8.23 (1.27) | | | | -8.31 (0.98) | |
| Level 1 | | | | | | | | |
| Alc Only | REF | - | - | - | REF | - | - | - |
| Mj Only | 9.08 | 2.35-35.12 | 2.21 (0.69) | 10.25 ^{*,**} | 3.58 | 0.97-13.15 | 1.27 (0.66) | 3.69 [†] |
| Alc + Mj | 1.91 | 0.48-7.75 | 0.64 (0.76) | 0.81 | 3.86 | 1.39-10.69 | 1.35 (0.52) | 6.73 ^{**,†} |
| Alc + Nic | 1.00 | 0.16-6.31 | 0.00 (0.94) | 0.00 | 1.29 | 0.35-4.73 | 0.25 (0.66) | 0.14 |
| Alc + Nic + Mj | 1.60 | 0.13-19.37 | 0.47 (1.24) | 0.14 | 2.86 | 0.57-14.23 | 0.25 (0.66) | 1.64 |
| Weekend | 0.89 | 0.70-1.14 | -0.11 (0.12) | 0.80 | 0.97 | 0.79-1.18 | -0.03 (0.10) | 0.11 |
| Day | | | | 2.51 | | | | 4.52 [*] |
| Thursday | REF | - | - | - | REF | - | - | - |
| Friday | 0.28 | 0.09-0.86 | -1.29 (0.58) | | 1.28 | 0.47-3.44 | 0.24 (0.51) | |
| Saturday | 0.70 | 0.28-1.76 | -0.35 (0.47) | | 3.23 | 1.30-8.00 | 1.17 (0.46) | |
| Level 2 | | | | | | | | |
| Alc Only Use | REF | - | - | - | REF | - | - | - |
| Alc & Mj Use | 4.76 | 0.64-35.63 | 1.56 (1.02) | 2.33 | 1.77 | 0.34-9.19 | 0.57 (0.84) | 0.46 |
| Alc & Nic Use | 3.33 | 0.34-32.42 | 1.20 (1.15) | 1.08 | 4.33 | 0.76-24.55 | 1.47 (0.88) | 2.14 |
| Alc & Mj & Nic Use | 4.84 | 0.57-41.46 | 1.58 (1.09) | 2.09 | 9.00 | 1.80-44.94 | 2.20 (0.82) | 7.22 ^{**,†} |
| Avg. # Drinks | 0.85 | 0.67-1.08 | -0.16 (0.12) | 1.73 | 0.96 | 0.80-1.15 | -0.04 (0.09) | 0.18 |
| Age | 1.16 | 0.21-6.43 | 0.15 (0.87) | 0.03 | 2.75 | 0.71-10.72 | 1.01 (0.69) | 2.14 |
| Sex | | | | | | | | |
| Males | REF | - | - | - | REF | - | - | - |
| Females | 3.17 | 0.82-12.22 | 1.15 (0.69) | 2.82 | 0.71 | 0.23-2.17 | -0.34 (0.57) | 0.36 |
| Racial Identity | | | | | | | | |
| White | REF | - | - | - | REF | - | - | - |
| Racially/Ethnically Diverse | 1.52 | 0.32-7.21 | 0.42 (0.79) | 0.28 | 3.13 | 0.89-10.96 | 1.14 (0.64) | 3.19 |

Note: Significance denoted by

10.0 > d
**
5.0 > d
*
(griping) 9.0 > d
+

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