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Co-Occurring Marijuana Use is Associated with Medication Nonadherence and Nonplanning Impulsivity in Young Adult Heavy Drinkers

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Abstract

Few studies have examined the co-occurrence of alcohol and marijuana use in clinical samples of young adults. The present study investigated whether co-occurring marijuana use is associated with characteristics indicative of a high level of risk in young adult heavy drinkers. Individuals between the ages of 18 and 25 years ($N = 122$) participated in an ongoing 8-week randomized clinical trial that tested the efficacy of placebo-controlled naltrexone plus brief individual counseling to reduce heavy drinking. At intake participants completed self-report assessments on alcohol consumption, alcohol-related negative consequences, motivation to reduce drinking, trait impulsivity, expectancies for alcohol-induced disinhibition, use of cigarettes, and history of medication nonadherence. In univariate tests heavy drinkers with and without co-occurring marijuana use did not differ on alcohol consumption, most alcohol-related negative consequences, and motivation to reduce drinking. In multivariate tests controlling for demographic characteristics, co-occurring heavy alcohol and marijuana use was significantly associated with nonplanning impulsivity ($\beta = 2.95$) and a history of both unintentional (adjusted odds ratio [aOR] = 3.30) and purposeful (aOR = 3.98) nonadherence to medication. Findings suggest that young

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Contributors

Drs. O'Malley, Corbin, Toll, and Leeman designed the study and wrote the protocol. Drs. Peters, Leeman, and Fucito designed the analysis and managed the literature searches and summaries of previous related work. Dr. Peters undertook the statistical analysis and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of Interest

Dr. O'Malley declares the following conflicts: member, the American College of Neuropsychopharmacology workgroup, the Alcohol Clinical Trial Initiative, sponsored by Alkermes, Abbott Laboratories, Eli Lilly & Company, GlaxoSmithKline, Johnson & Johnson Pharmaceuticals, Lundbeck, and Schering Plough; partner, Applied Behavioral Research; medication supplies, Pfizer; contract, Nabi Biopharmaceuticals; Advisory Board, Gilead Pharmaceuticals; consultant, Alkermes, GlaxoSmithKline, Brown University, University of Chicago; Scientific Panel of Advisors, Hazelden Foundation. All other authors declare that they have no conflict of interest.

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adult heavy drinkers with co-occurring marijuana use exhibit a high-risk clinical profile and may benefit from interventions that increase adherence to medications.

Keywords

alcohol; marijuana; co-occurring; impulsivity; college drinking; medication adherence

1. Introduction

Use of alcohol and illicit drugs among young adults continues to be a significant public health problem. More than 41% of young adults (i.e., individuals aged 18-25) engage in binge drinking (5 or more standard drinks of alcohol for men and 4 or more standard drinks for women; Wechsler, Dowdall, Davenport, & Rimm, 1995), and almost 14% report heavy drinking, defined as binge drinking on at least 5 occasions in the prior 30 days (Substance Abuse and Mental Health Services Administration [SAMHSA], 2011). The prevalence of past-month marijuana use among young adults has increased to 18.5% in recent years (SAMHSA, 2011). Use of marijuana among young adults has been associated with several negative outcomes, including impaired respiratory functioning (Brook, Stimmel, Zhang, & Brook, 2008), decreased educational achievement (Brook et al., 2008; Fergusson, Horwood, & Beaudrais, 2003), and psychosocial difficulties (e.g., anxiety and depression; de Dios et al., 2010; Fergusson, Horwood, Swain-Campbell, 2002).

In non-clinical samples of young adults, use of alcohol and marijuana, relative to use of alcohol only, is associated with several high-risk behaviors, including binge drinking, alcohol-related negative consequences, and unprotected sex (Bell, Wechsler, & Johnston, 1997; Hammer & Pape, 1997; Jones, Oeltmann, Wilson, Brener, & Hill, 2001; Labouvie, 1990; Mohler-Kuo, Lee, & Wechsler, 2003; Shillington & Clapp, 2001, 2002, 2006; Simons, Gaher, Correia, Hansen, & Christopher, 2005; Simons & Carey, 2006; Simons, Maisto, & Wray, 2010; Stenbacka, 2003). The few studies that have examined clinical samples of young adult heavy drinkers have reported that between 25% and 55% also use marijuana (Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009; White, Morgan, Pugh, Celinska, Labouvie, & Pandina, 2006). One of these studies (Magill et al., 2009) compared heavy drinkers with and without co-occurring marijuana use and found that those with co-occurring marijuana use consumed more alcohol and other illicit drugs than those without marijuana use. These preliminary data suggest that heavy drinkers who also use marijuana may present a higher-risk clinical profile related to alcohol and drug use.

However, it is unknown what other high-risk clinical characteristics young adult heavy drinkers who use marijuana possess. A comprehensive understanding of high-risk clinical characteristics that describe this subgroup of young adult heavy drinkers may suggest what factors interfere with treatment delivery and may inform how interventions can be intensified and/or tailored to achieve favorable clinical outcomes. To describe the clinical profile of young adult heavy drinkers who use marijuana, we compare high-risk clinical characteristics between young adult heavy drinkers with and without co-occurring marijuana use who are participating in an ongoing randomized controlled trial of a pharmacotherapy to reduce heavy drinking. We consider "high-risk clinical characteristics" to be those that have indicated more severe alcohol use or predicted poorer treatment outcomes in prior studies. Clinical characteristics indicating more severe alcohol use include heavier alcohol consumption and greater alcohol-related negative consequences (Read, Kahler, Strong, & Colder, 2006), greater trait impulsivity (Anderson, Smith, & Fischer, 2003; Baer, 2002; Dick, Smith, Olausson, Mitchell, Leeman, O'Malley, & Sher, 2010; Grano, Virtanen, Vahtera, Elovainio, & Kivimaki, 2004; Katz, Fromme, & D'Amico, 2000; Nagoshi, Wilson,

& Rodriguez, 1991; Simons & Carey, 2006), greater expectancies for alcohol-induced disinhibition (Leeman, Toll, & Volpicelli, 2007; Leeman, Toll, Taylor, & Volpicelli, 2009), and current and past cigarette use (Daeppen et al., 2000; Weitzman & Chen, 2005). Clinical characteristics predicting worse treatment outcome include lower motivation to change (Carey, Henson, Carey, & Maisto, 2007; Fromme & Corbin, 2004; Kaysen, Lee, LaBrie, & Tollison, 2009; c.f., Borsari, Murphy, & Carey, 2009; Collins, Carey, & Otto, 2009; Collins, Logan, & Neighbors, 2010) and history of medication nonadherence (Toll, McKee, Martin, Jatlow, & O'Malley, 2007). Although history of medication nonadherence has not been examined in young adult drinkers, it has predicted both treatment adherence to medications for smoking cessation and smoking treatment outcome (Toll et al., 2007). Given that this is the first large-scale clinical trial to test the efficacy of a pharmacotherapy expressly in young adult heavy drinkers, investigating history of medication adherence in this population is warranted. Medication adherence may be worse for some subgroups relative to others (Osterberg & Blaschke, 2005), and because marijuana users report low adherence to medications to aid marijuana reduction (Carpenter, McDowell, Brooks, Cheng, & Levin, 2009; Levin et al., 2004), they may be a subgroup of young adult heavy drinkers that report worse adherence to medication in general.

2. Methods

2.1 Participants

Participants in the current study ($N = 122$) were recruited to participate in an ongoing, non-abstinence-oriented, randomized, double-blind, placebo-controlled clinical trial of naltrexone in combination with brief motivational counseling for reduction of heavy drinking. All participants who met initial eligibility requirements and completed an intake assessment battery were included in the analyses, regardless of whether or not they were ultimately enrolled in the trial. The majority of participants (mean age = 21.40, standard deviation [SD] = 2.14) were male (70%), Caucasian (81%), current students (66%), and unmarried and not cohabiting (99%). Twenty-seven percent lived on campus, 31% lived with parents, and 43% lived in a house or apartment with roommates or a significant other.

2.2 Procedures

All procedures were approved by the Institutional Review Board of the Yale University School of Medicine, and all participants provided written informed consent prior to completing any study procedures. Young adults between the ages of 18 and 25 years were recruited via flyers, television, newspaper and online advertisements to participate in the 8-week trial. Compensation up to \$500 in the course of participation was advertised and no explicit motivation to change drinking behavior was required in order to participate. Individuals deemed preliminarily eligible based on pre-screening by phone or web questionnaire were invited to attend an in-person intake appointment. At intake, following informed consent, participants underwent: a) clinical interviews, including diagnostic evaluations for alcohol and substance use disorders and other psychiatric issues; b) routine blood work and a physical exam including a detailed medical history and administration of the Clinical Institute of Withdrawal Assessment (CIWA) scale [Sullivan et al., 1989]; c) instant urine drug testing; and d) pregnancy tests for women. It was verified that participants met minimum levels of heavy drinking for inclusion in the trial (i.e., 5 or more standard drinks of alcohol for men and 4 or more standard drinks for women on 4 or more days within the 28 days preceding intake). Participants then completed a battery of self-report assessments on the web, either at the research site or in their home environment. The measures included in the present report were completed as part of this initial self-report battery. Individuals who could definitively be excluded at the intake appointment did not complete the self-report battery. Reasons for exclusion were: a) failure to meet heavy

drinking inclusion criteria; b) current DSM-IV diagnosis of alcohol dependence that was clinically severe (i.e., a history of medically-assisted detoxification or a CIWA score > 8); c) current DSM-IV diagnosis of non-nicotine substance dependence; d) serious psychiatric illness (e.g., schizophrenia, substantial suicide risk); e) serious and uncontrolled medical condition; f) instant urine test results indicating pregnancy or non-marijuana illicit drug use; and g) for women, current lactation or being sexual active and unwilling to use birth control.

2.3 Measures

2.3.1 Alcohol Use—The Daily Drinking Questionnaire-Revised (DDQ-R), adapted from the original DDQ (Collins, Parks, & Marlatt, 1985), assessed typical drinking behavior in the prior 3 months. Participants reported the number of times in the prior 13 weeks they consumed any alcohol and the number of standard drinks they tended to have on a typical day of the week. The drinks per drinking day variable was calculated by taking the mean of the number of drinks typically consumed on each day of the week, weighted according to the number of days out of the prior 13 when drinking occurred. Binge alcohol drinking was assessed with a self-report of the frequency with which participants consumed 5 or more alcohol drinks (4 or more for females) within a single day and within a 2-hour period and were scored such that: 1 = 1 or 2 days in the past 3 months; 2 = 1 day/month; 3 = 2-3 times/month; 4 = 1 day/week; 5 = 2 days/week; 6 = 3-4 times/week; 7 = 5-6 times/week; and 8 = every day. Peak alcohol drinking was assessed with a self-report of the highest number of alcohol drinks participants consumed within a 24-hour period in the past 3 months and during their lifetime.

2.3.2 Alcohol Consequences—The 48-item version of the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al., 2006) assessed alcohol consequences in the past 3 months. Items were rated dichotomously (0 = no, 1 = yes) and summed to yield 8 subscale scores (α s for the present study): Social/Interpersonal Consequences ($\alpha = .73$), Impaired Control ($\alpha = .73$), Self-Perception ($\alpha = .82$), Self-Care ($\alpha = .82$), Risk Behaviors ($\alpha = .73$), Academic/Occupational Consequences ($\alpha = .67$), Physical Dependence ($\alpha = .43$), and Blackout Drinking ($\alpha = .80$). Items were also summed to yield a total score. Because of the low reliability of the Physical Dependence subscale in the current sample, it was analyzed as a binary variable (1 = endorsement of at least one item, 0 = endorsement of 0 items).

2.3.3 Motivation to Reduce Drinking—The Contemplation Ladder (Biener & Abrams, 1991) was modified to assess motivation to reduce drinking on a scale from 1 to 10, with 1 corresponding to “no thought of reducing my alcohol use” and 10 corresponding to “taking action to reduce my alcohol use.”

2.3.4 Trait Impulsivity—The Barratt Impulsivity Scale, Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995) is a 30-item measure with items scored on a 4-point scale (1 = rarely/never, 2 = occasionally, 3 = often, 4 = almost always/always) that are summed to yield 3 factors of Attentional Impulsiveness ($\alpha = .52$), Motor Impulsiveness ($\alpha = .66$), and Nonplanning Impulsiveness ($\alpha = .68$). The UPPS+P Impulsive Behavior Scale (UPPS +P; Whiteside & Lynam, 2001; Cyders, Smith, Spillane, Fischer, & Annus, 2007) is a 59-item measure with items rated on a 5-point scale (0 = not at all, 4 = very much) that are averaged to yield 5 dimensions of impulsivity: (Lack of) Premeditation ($\alpha = .77$), Positive Urgency ($\alpha = .84$), Negative Urgency ($\alpha = .83$), Sensation-Seeking ($\alpha = .83$), and (Lack of) Perseverance ($\alpha = .58$).

2.3.5 Expectancies of Alcohol-Induced Disinhibition—The 9-item Drinking-Induced Disinhibition Scale (DIDS; Leeman et al., 2007) assessed expectancies for alcohol-induced disinhibition, conceptualized as expectancies that behaviors, thoughts, and feelings

typically restricted in one's everyday life will occur while drinking. Participants indicated on a scale of 1 to 6 how likely they were to experience each effect either while drinking or as a direct result of consuming alcohol (1 or 2 = either never or have very rarely experienced in conjunction with drinking; 5 or 6 = often experience during the course of drinking or as a consequence of alcohol consumption). Items were averaged to yield 3 subscale scores: Euphoric/Social ($\alpha = .70$), Dysphoric ($\alpha = .76$), and Sexual Disinhibition ($\alpha = .84$).

2.3.6 Use of Marijuana and Cigarettes—Participants were asked the number of days per week on average they used marijuana in the past 3 months. They were asked if they currently smoked cigarettes at least once a week (0 = no, 1 = yes). Those who indicated current cigarette use were asked the 6-item Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Scores on the FTND range from 0 to 10, with higher scores indicating more severe nicotine dependence. Those who denied current cigarette use were asked if they had ever smoked a cigarette (0 = no, 1 = yes).

2.3.7 Medication Nonadherence—The 4-item Medication Adherence Questionnaire (MAQ; Morisky, Green, & Levine, 1986) assessed history of medication nonadherence. Examples of items include “Do you ever forget to take your medicine?” and “When you feel better, do you sometimes stop taking your medicine?” Items have response options of 0 = no and 1 = yes. The MAQ yields 2 subscale scores of Unintentional Nonadherence and Purposeful Nonadherence (Toll et al., 2007). Consistent with prior work (Morisky et al., 1986; Toll et al., 2007), participants were categorized as adherent if they answered no to all items and as nonadherent if they answered yes to 1 or both items on each subscale.

2.4 Data Analysis

Because of the lack of prior studies examining clinical samples of young adult heavy drinkers with and without co-occurring marijuana use, a data-driven, rather than a theory-driven, approach was used to compare the 2 groups. First, independent-samples *t*-tests and chi-square tests compared young adult heavy drinkers who used marijuana at least once per week to those who denied using marijuana at least once per week in the past 3 months on continuous and categorical characteristics, respectively. Then, a multivariate analysis of covariance (MANCOVA) assessed differences in continuous characteristics between the 2 groups of young adult heavy drinkers (i.e., 1 = with co-occurring marijuana use, 0 = without co-occurring marijuana use). A series of logistic regression models assessed differences in categorical characteristics between the 2 groups. Only those characteristics that significantly differed in univariate tests were included as dependent variables in the MANCOVA and logistic regression models. All demographic characteristics (age, gender [0 = female, 1 = male], race [0 = non-Caucasian, 1 = Caucasian], educational status [0 = not currently a student, 1 = currently a student], and current living status [0 = with parents, 1 = on campus or in house or apartment with roommates or a significant other]) were included as covariates in the MANCOVA and logistic regression models.

3. Results

Of 122 young adults who completed the intake interview, 71 (58%) reported not using marijuana in the past 3 months, 27 (22%) reported using marijuana once per week in the past 3 months, and 24 (20%) reported using marijuana twice per week or more in the past 3 months. Because of sample size (and consequent statistical power) considerations, we compared the sample of 51 individuals who used marijuana *at least* weekly to the 71 individuals who did not use marijuana in the past 3 months.

3.1 Univariate Tests

Table 1 highlights differences in clinical characteristics between the 51 heavy drinkers with co-occurring marijuana use and the 71 heavy drinkers without marijuana use. In comparison to those without marijuana use, young adult heavy drinkers with co-occurring marijuana use reported significantly higher scores related to YAACQ Risk Behaviors; DIDS Dysphoric and Sexual Disinhibition; BIS Nonplanning Impulsiveness; and UPPS+P (Lack of) Perseverance. A significantly greater percentage of heavy drinkers with vs. without co-occurring marijuana use reported a history of both unintentional and purposeful medication nonadherence and a history of cigarette smoking. Of note, the 2 groups did not differ in alcohol consumption, most alcohol-related consequences, motivation to reduce drinking, and demographic characteristics.

3.2 Multivariate Tests

In the MANCOVA holding demographic characteristics constant, there was a statistically significant omnibus effect for the comparison between young adult heavy drinkers with and without co-occurring marijuana use, $F(5,109) = 2.56, p = .03$ (Table 2). When the results for the dependent variables were considered separately, the only differences to achieve statistical significance were BIS Nonplanning Impulsiveness and YAACQ Risk Behaviors, such that co-occurring alcohol and marijuana users reported significantly higher scores related to both characteristics than non-marijuana users. After holding demographic characteristics constant, differences related to UPPS+P (Lack of) Perseverance and DIDS Dysphoric and Sexual Disinhibition scores did not significantly differ between heavy drinkers with and without co-occurring marijuana use.

In a logistic regression model holding demographic characteristics constant, the dichotomization of young adult heavy drinkers based on co-occurring marijuana use was significantly associated with history of ever smoking a cigarette (model: $\chi^2(6) = 23.57, p < .01$), such that those with co-occurring marijuana use were almost 4 times more likely to have ever smoked a cigarette than those without co-occurring marijuana use (adjusted odds ratio [OR] = 3.67, 95% confidence interval [CI] = 1.28 - 10.51, $p = .02$).

In logistic regression models holding demographic characteristics constant, the dichotomization of young adult heavy drinkers based on co-occurring marijuana use was significantly associated with history of both unintentional and purposeful medication nonadherence. As Table 3 shows, heavy drinkers with co-occurring marijuana use were 3 times more likely to report a history of unintentional medication nonadherence and almost 4 times more likely to report a history of purposeful medication nonadherence than those without marijuana use. In the absence of prior studies on correlates of medication nonadherence in young adult heavy drinkers, a subsequent analysis examined if any clinical characteristics might confound the relation between co-occurring marijuana use and medication nonadherence. No characteristics were significant bivariate correlates of history of purposeful medication nonadherence, but history of unintentional medication nonadherence was significantly correlated with YAACQ Total scores (Spearman $r = .25, p < .01$) and DIDS Dysphoric Disinhibition scores (Spearman $r = .19, p = .04$). Even after holding YAACQ Total scores, DIDS Dysphoric Disinhibition scores, and demographic characteristics constant, heavy drinkers with co-occurring marijuana use were still almost 3 times (adjusted OR = 2.67, 95% CI = 1.07 - 6.65, $p < .04$) more likely to report a history of unintentional medication nonadherence than were those without marijuana use (model: $\chi^2(8) = 18.79, p < .02$).

4. Discussion

Among a clinical sample of young adult heavy drinkers, several characteristics emerged to differentiate those with vs. without co-occurring marijuana use. Our results expand upon those of a prior study of a clinical sample of young adult heavy drinkers (Magill et al., 2009) by describing risky personality traits and behaviors associated with co-occurring alcohol and marijuana use. Young adult heavy drinkers with co-occurring marijuana use present a unique, high-risk clinical profile and, thus, may benefit from interventions that target those characteristics that distinguish them from other young adult heavy drinkers.

One high-risk clinical characteristic that differentiated heavy drinkers with versus without co-occurring marijuana use was the nonplanning facet of impulsivity. Although this aspect of impulsivity was associated with co-occurring marijuana use, other related constructs (e.g., sensation-seeking) were not. The association between marijuana use and specific facets of impulsivity supports the need to distinguish between different types of impulsivity, as they may represent different pathways to risky behavior (Smith, Fischer, Cyders, Annus, Spillane, & McCarthy, 2007), and highlights the unique association between lack of planning and marijuana use (Zapolski, Cyders, & Smith, 2009). A recent review of impulsivity and alcohol use hypothesized that nonplanning impulsivity may be linked to problem drinking for a subset of alcohol drinkers (Dick et al., 2010), and results from the current study suggest that one such subset of alcohol drinkers may be those with co-occurring marijuana use.

Another high-risk clinical characteristic that differentiated heavy drinkers with versus without co-occurring marijuana use was history of unintentional and purposeful medication nonadherence. Although these results were gathered from a self-report questionnaire at intake, these retrospective data may have implications for prospective data on naltrexone adherence that we are gathering in this ongoing clinical trial. We have previously shown that history of purposeful medication nonadherence predicts adherence to naltrexone and to cessation outcomes among smokers trying to quit (Toll et al., 2007). Thus, we plan to examine whether history of medication nonadherence among young adult heavy drinkers predicts treatment adherence to naltrexone and treatment outcomes and whether these effects are moderated by co-occurring marijuana use. Another important future study may be the examination of mechanisms underlying poor medication adherence in this subgroup of young adult heavy drinkers [e.g., marijuana's impairment of cognitive abilities (Crean, Crane, & Mason, 2011; Solowij & Battisti, 2008)].

In contrast to prior literature showing that, among non-clinical samples, young adult drinkers who also use marijuana consume more alcohol and experience worse alcohol-related consequences than those who only drink alcohol (Bell et al., 1997; Hammer & Pape, 1997; Jones et al., 2001; Labouvie, 1990; Magill et al., 2009; Mohler-Kuo et al., 2003; Shillington & Clapp, 2001, 2002, 2006; Simons et al., 2005; Simons & Carey, 2006; Stenbacka, 2003), young adult heavy drinkers in this clinical sample did not show similar patterns. The inconsistency between prior literature and this study may be due to the nature of the current sample. Most of the prior studies that have revealed an association between co-occurring marijuana use and more severe drinking have examined young adults who report any alcohol and marijuana use in a given time period, whereas individuals in the present study were only selected for inclusion if they reported heavy alcohol use (i.e., >5 standard drinks of alcohol for men and >4 standard drinks for women on 4 or more days within the 28 days preceding intake). It is possible that a "ceiling effect" occurred, i.e., these heavy drinkers were drinking in such high quantities and experiencing such problematic drinking that marijuana use did not make their drinking significantly worse. Although the current study does not support an association between weekly marijuana use and worse

drinking problems, future studies with young adults that report more frequent (i.e., daily) marijuana use might reveal different patterns.

The fact that co-occurring alcohol and marijuana users did not report more severe drinking than non-marijuana users in this study raises questions about whether future treatment studies of young adult heavy drinkers might include individuals who endorse marijuana use. With a few exceptions (McCambridge & Strang, 2004; Magill et al., 2009; White et al., 2006), treatment studies of young adult drinkers either do not include marijuana users or do not report outcomes related to marijuana use, most likely because these studies primarily aim to determine the efficacy of treatments to reduce drinking. However, it is unclear how results from efficacy studies generalize to young adults who both drink alcohol and use marijuana. Future studies may consider the utility of including marijuana users so that we can better understand the effectiveness of treatments to reduce drinking in young adults.

Although the results regarding drinking characteristics suggest it might be reasonable to include young adult heavy drinkers with co-occurring marijuana use in clinical trials, this population might require tailoring of treatment approaches to their unique characteristics. For example, because young adult heavy drinkers with co-occurring marijuana use report greater nonplanning impulsivity, they may benefit from strategies that guide them in behaving with forethought (e.g., learning how to identify and anticipate situations where drinking would be dangerous; Dimeff, Baer, Kivlahan, & Marlatt, 1999). Because they are more likely to report a history of cigarette smoking, they may need interventions that address the relations between alcohol, marijuana, and cigarettes. Because they are more likely to report a history of medication nonadherence, they may benefit from strategies that facilitate treatment adherence to medication, such as psychoeducation about medication and contingency management approaches (Carroll et al., 2006; Correia & Benson, 2006) to reinforce adherence. If marijuana users are included in future clinical trials of treatments for young adult heavy drinkers, the assessment of co-occurring marijuana use at intake may serve as a proxy indicator of other high-risk characteristics, similar to the assessment of cigarette smoking status as a clinical indicator of alcohol misuse (McKee, Falba, O'Malley, Sindelar, & O'Connor, 2007).

Limitations of the current study include the cross-sectional nature of data collection among a relatively small clinical sample of heavy-drinking young adults seeking participation in a pharmacotherapy treatment trial. Future studies may consider investigating whether findings from this sample would generalize to other samples of heavy-drinking young adults (e.g., those who also report current daily marijuana use). These data were collected from self-report measures only, and future studies may also incorporate clinician-rated measures on alcohol-related problems and behavioral tasks of impulsivity (e.g., delay discounting tasks, go/no-go tasks). Individuals reported on their current (i.e., past 3 months) use of marijuana, but we did not collect data on their lifetime history of marijuana use. Finally, this report does not demonstrate whether heavy drinkers with co-occurring marijuana use report worse treatment outcomes (e.g., less success reducing drinking, worse adherence to study medication, increased use of marijuana during drinking reduction), though these data will ultimately be available for future study.

In conclusion, young adult heavy drinkers with co-occurring marijuana use presenting for an alcohol reduction clinical trial reported several high-risk clinical characteristics that may portend worse treatment outcomes. Future studies should investigate whether heavy drinkers with co-occurring marijuana use report more difficulty reducing drinking in comparison to those without marijuana use.

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Highlights

- Co-occurring heavy alcohol and marijuana use may relate to high-risk characteristics.
- We compared young adult heavy drinkers who do and do not use marijuana.
- Co-occurring alcohol and marijuana use is associated with history of medication nonadherence.
- Co-occurring alcohol and marijuana use is associated with nonplanning impulsivity.
- Heavy users of alcohol and marijuana are more high-risk than non-marijuana users.

Table 1

Univariate Comparison of Heavy Drinkers With and Without Co-Occurring Marijuana Use.

	With Co-Occurring Marijuana Use (<i>n</i> = 51)	Without Co-Occurring Marijuana Use (<i>n</i> = 71)	Statistic	<i>p</i>
Alcohol Consumption				
Frequency of Drinking (Days/Week)	3.61 (1.17)	3.57 (1.28)	<i>t</i> (120) = -0.13	.90
Quantity of Drinks on Drinking Days	6.75 (3.77)	5.91 (2.82)	<i>t</i> (120) = -1.40	.16
Frequency of Binge Drinking in 2-Hour Period	4.84 (1.45)	4.82 (1.54)	<i>t</i> (120) = -0.10	.92
Frequency of Binge Drinking in 1 Day	5.76 (0.99)	5.68 (0.98)	<i>t</i> (120) = -0.49	.63
Peak Quantity of Drinks (Past 3 Months)	16.41 (6.61)	16.48 (7.11)	<i>t</i> (120) = 0.05	.96
Peak Quantity of Drinks (Lifetime)	20.27 (7.19)	20.96 (7.81)	<i>t</i> (120) = 0.49	.62
Young Adult Alcohol Consequences Questionnaire				
Total	22.80 (9.91)	20.25 (10.34)	<i>t</i> (120) = -1.37	.18
Social-Interpersonal Consequences	3.65 (1.74)	3.06 (1.89)	<i>t</i> (120) = -1.75	.08
Impaired Control	3.47 (1.73)	3.65 (1.78)	<i>t</i> (120) = 0.55	.58
Self-Perception	1.71 (1.58)	1.49 (1.53)	<i>t</i> (120) = -0.75	.46
Self-Care	3.14 (2.58)	2.90 (2.40)	<i>t</i> (120) = -0.53	.60
Risk Behaviors	3.25 (2.11)	2.48 (1.87)	<i>t</i> (120) = -2.14	.04
Academic/Occupational Consequences	1.37 (1.34)	1.41 (1.46)	<i>t</i> (120) = 0.14	.89
Physical Dependence (% endorsed any items)	76	70	$\chi^2(1) = 0.46$	.50
Blackout Drinking	4.98 (1.98)	4.28 (2.18)	<i>t</i> (120) = -1.81	.07
Contemplation Ladder Score	5.08 (2.58)	5.23 (1.95)	<i>t</i> (89) = 0.34	.73
Cigarette Use				
Ever Smoked a Cigarette (%)	86	63	$\chi^2(1) = 7.57$	< .01
Currently Smoke Cigarettes (%)	42	28	$\chi^2(1) = 2.51$	.11
FTND (among current cigarette smokers)	1.37 (2.41)	2.26 (2.60)	<i>t</i> (36) = 1.10	.28
Trait Impulsivity				
BIS-11 Attentional Impulsiveness	17.74 (3.76)	16.67 (3.85)	<i>t</i> (120) = -1.54	.13
BIS-11 Motor Impulsiveness	23.69 (5.58)	22.87 (4.56)	<i>t</i> (120) = -0.89	.38
BIS-11 Nonplanning Impulsiveness	25.69 (4.56)	22.57 (5.39)	<i>t</i> (120) = -3.35	<.01
UPPS+P Negative Urgency	2.46 (0.44)	2.36 (0.46)	<i>t</i> (120) = -1.27	.21
UPPS+P (Lack of) Premeditation	2.23 (0.45)	2.28 (0.45)	<i>t</i> (120) = 0.56	.58
UPPS+P (Lack of) Perseverance	2.00 (0.50)	1.79 (0.48)	<i>t</i> (120) = -2.26	.03
UPPS+P Sensation-Seeking	2.89 (0.54)	2.79 (0.61)	<i>t</i> (120) = -0.98	.33
UPPS+P Positive Urgency	2.08 (0.44)	2.00 (0.44)	<i>t</i> (120) = -0.99	.32
Drinking-Induced Disinhibition Scale				
Euphoric/Social	4.11 (1.18)	3.91 (1.13)	<i>t</i> (120) = -0.96	.34
Dysphoric	2.54 (1.11)	2.14 (1.05)	<i>t</i> (120) = -2.02	< .05
Sexual Disinhibition	3.92 (1.49)	3.25 (1.54)	<i>t</i> (120) = -2.39	.02
Medication Adherence Questionnaire				
Unintentional Nonadherence (% nonadherent)	48	23	$\chi^2(1) = 7.49$	< .01

	With Co- Occurring Marijuana Use (<i>n</i> = 51)	Without Co- Occurring Marijuana Use (<i>n</i> = 71)	Statistic	<i>p</i>
Purposeful Nonadherence (% nonadherent)	59	31	$\chi^2(1) = 8.63$	< .01

Note. Unless otherwise noted, means (standard deviations) are presented. Items on frequency of binge drinking were rated such that: 1 = 1 or 2 days in the past 3 months; 2 = one day/month; 3 = 2-3 times/month; 4 = 1 day/week; 5 = 2 days/week; 6 = 3-4 times/week; 7 = 5-6 times/week; and 8 = every day. FTND = Fagerström Test for Nicotine Dependence, BIS-11 = Barratt Impulsivity Scale, Version 11, UPPS+P = UPPS+P Impulsive Behavior Scale.

Table 2

Multivariate Test of Differences between Heavy Drinkers With and Without Co-Occurring Marijuana Use.

Dependent Variable	<i>F</i> statistic	β
BIS Nonplanning Impulsiveness	$F(1, 113) = 9.14, p < .01$	2.95
YAACQ Risk Behaviors	$F(1, 113) = 5.16, p = .03$	0.82
UPPS+P (Lack of) Perseverance	$F(1, 113) = 3.47, p = .07$	0.17
DIDS Sexual Disinhibition	$F(1, 113) = 2.74, p = .10$	0.44
DIDS Dysphoric Disinhibition	$F(1, 113) = 1.52, p = .22$	0.25

Note. Results from a multivariate analysis of covariance (MANCOVA) that assessed differences in clinical characteristics between the two groups of young adult heavy drinkers (i.e., 1 = with co-occurring marijuana use, 0 = without co-occurring marijuana use). Only those characteristics that significantly differed in univariate tests were included as dependent variables. All demographic characteristics (age, gender [0 = female, 1 = male], race [0 = non-Caucasian, 1 = Caucasian], educational status [0 = not currently a student, 1 = currently a student], and current living status [0 = with parents, 1 = on campus or in house or apartment with roommates or a significant other]) were included as covariates. BIS-11 = Barratt Impulsivity Scale, Version 11; YAACQ = Young Adult Alcohol Consequences Questionnaire; UPPS+P = UPPS+P Impulsive Behavior Scale; DIDS = Drinking-Induced Disinhibition Scale.

Table 3

Association between Co-Occurring Alcohol and Marijuana Use and History of Medication Nonadherence.

Predictors	History of Unintentional Medication Nonadherence			History of Purposeful Medication Nonadherence		
	Adjusted Odds Ratio	95% Confidence Interval for aOR	p	Adjusted Odds Ratio	95% Confidence Interval for aOR	p
Step 1: $\chi^2 (5) = 3.87, p = .57$				Step 1: $\chi^2 (5) = 6.21, p = .29$		
Age	0.92	0.73 – 1.14	.44	1.11	0.90 – 1.37	.35
Gender	1.01	0.40 – 2.59	.98	1.71	0.67 – 4.36	.26
Race	0.81	0.28 – 2.35	.70	0.36	0.12 – 1.06	.07
Education Status	0.40	0.14 – 1.09	.07	1.81	0.67 – 4.89	.24
Current Living Status	1.60	0.60 – 4.28	.35	0.51	0.19 – 1.36	.18
Step 2: $\chi^2 (1) = 7.40, p < .01$				Step 2: $\chi^2 (1) = 10.04, p < .01$		
Co-Occurring Marijuana Use	3.30	1.48 – 7.92	< .01	3.98	1.63 – 9.67	< .01

Note. Results from separate logistic regression models where history of unintentional and purposeful nonadherence to medication (1 = history of nonadherence, 0 = no history of nonadherence) were the dependent variables. Codings for predictor variables were: gender [0 = female, 1 = male], race [0 = non-Caucasian, 1 = Caucasian], educational status [0 = not currently a student, 1 = currently a student], current living status [0 = with parents, 1 = on campus or in house or