Title

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Journal

Addiction Research & Theory, 30(2)

ISSN

1606-6359

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Publication Date

2022-03-04

DOI

10.1080/16066359.2021.1936511

Peer reviewed

HHS Public Access

Author manuscript

Addict Res Theory. Author manuscript; available in PMC 2023 January 01.

Published in final edited form as:

Addict Res Theory. 2022 ; 30(2): 89–95. doi:10.1080/16066359.2021.1936511.

Patterns of same-day alcohol and cannabis use in adolescents and young adults with risky alcohol use

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Abstract

Same-day alcohol and cannabis use is relatively common in adolescents and young adults, constituting a higher-risk behavior relative to single-substance use. However, the association between quantity of alcohol and cannabis use on co-use days is understudied. We examined the association between the quantity of alcohol and same-day cannabis use with a multilevel regression analysis in a sample of youth (16–24 years old) with risky alcohol use. Participants reported one or more days of alcohol and cannabis over the past month ($N = 468$). Quantity

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Disclosure of interest

The authors do not have any personal financial interests related to this manuscript, with two exceptions related to Facebook ad recruitment: a) MW is a minor shareholder in Facebook and has a conflict of interest plan monitored and approved by the University of Michigan; and b) SY received an unrestricted gift from Facebook, on file at the University of California, Los Angeles (his prior employer).

of cannabis use was highest on heavy drinking days [M = 0.91 grams, SD = 0.68] followed by moderate drinking days (M = 0.78 grams, SD = 0.63), and lowest on days without alcohol use (M = 0.74 grams, SD = 0.64, $p < 0.001$). In multilevel modeling analyses, adjusted for clustering within individuals, greater quantity of drinking on a given day was associated with greater cannabis use (estimate = 0.03, $p < 0.001$). When using alcohol and cannabis on the same day, greater alcohol use was associated with greater cannabis use. Preventing days of heavy use of multiple substances, particularly among at-risk drinkers, may complement interventions addressing co-use generally to prevent substance-related consequences.

Keywords

Alcohol and cannabis co-use; polysubstance use; cannabis use; alcohol use; adolescents; young adults

1. Introduction

Substance use commonly initiates and peaks during adolescence and young adulthood (NSDUH 2018), a period of heightened risk for development of substance use disorders and substance-related high-risk behaviors (e.g. driving when impaired, fighting, unprotected sex). Alcohol and cannabis are the most commonly used substances among adolescents and young adults (Miech et al. 2018; Schulenberg et al. 2018), with an estimated 21.0% and 23.2% of 16 to 24-year-olds reporting alcohol and cannabis use in the past month, respectively (Substance Abuse and Mental Health Services Administration (SAMHSA) 2020). Recent trends show the prevalence of young adult alcohol use has decreased, yet cannabis use among young adults has increased. As a result, the proportion of young adults who drink alcohol and use cannabis on the same day or at the same time is on the rise (Terry-McElrath and Patrick 2018). For example, the Monitoring the Future survey defines simultaneous use by asking questions about using different substances such that the 'effects overlap,' and based on this definition, approximately 21% of high school seniors and 30% of 19- to 22-year-olds report simultaneous alcohol and cannabis use in the past year (Terry-McElrath et al. 2014; Terry-McElrath and Patrick 2018).

Patterns of combined alcohol and cannabis use is a growing public health concern; however, there is a lack of precision in the literature regarding terms and definitions. Operational definitions of simultaneous (vs. concurrent) use vary widely across studies (Sokolovsky et al. 2020). Definitions related to combined alcohol and cannabis use include same-day co-use (Metrik et al. 2018), use in combination (Pakula et al. 2009), use at the same time (Agrawal et al. 2009; Brière et al. 2011), or use such that the individual reports the effects overlap, as mentioned above, (Terry-McElrath et al. 2014; Terry-McElrath and Patrick 2018), among others. Often simultaneous use, regardless of definition, is contrasted with concurrent use or use of both substances, but at different times (e.g. on separate days or such that the effects do not overlap). Despite distinctions between simultaneous and concurrent use, recent evidence suggests that same-day co-use of alcohol and cannabis, regardless of the proximity of use of each substance to the other, is often related to increased substance-related risks and consequences (Sokolovsky et al. 2020). Further, use of alcohol and cannabis at the same

time may lead to additional deleterious consequences, beyond those already associated with use of both substances at different times, in some contexts, such as enhancing the risk of impaired driving (Yurasek et al. 2017; Sokolovsky et al. 2020). Herein, we refer to the use of alcohol and cannabis on the same day, irrespective of reports of substance effects overlapping, as same-day co-use.

In general, adolescents and young adults who report same-day co-use of alcohol and cannabis, compared to those who only use substances on different days, experience greater substance use-related consequences. When looking at acute effects of alcohol and cannabis same-day co-use, adolescents and young adults are more likely to feel adverse effects (e.g. dizziness, clumsiness, trouble focusing; Lee et al. 2017) and to drive under the influence (Terry-McElrath et al. 2014; Subbaraman and Kerr 2015; Arterberry et al. 2017). Regarding longer-term effects, co-use of alcohol and cannabis is associated with lower overall educational attainment (Midanik et al. 2007), more substance-related social, relational, health, and legal consequences (Brière et al. 2011), and greater likelihood of developing a substance use or other mental health disorder (Yurasek et al. 2017).

Prior investigations into patterns of alcohol and cannabis use among adolescents and young adults have primarily focused on alcohol use characteristics. For example, among young adults reporting past-month alcohol use, those who used alcohol and cannabis at the same time reported greater quantity and frequency of alcohol use compared to an alcohol-use only group (Linden-Carmichael et al. 2019). Concerning cannabis, Linden-Carmichael and colleagues found that frequency of co-use was positively associated with cannabis use; however, their study only included young adults who used alcohol and cannabis on the same day (excluding those that exclusively used on different days) and only considered between-person use without investigating within-person patterns of use that may vary depending on if one or more substances is consumed at a given time (Linden-Carmichael et al. 2019). Another study using Monitoring the Future data from high school seniors identified four latent classes of alcohol and cannabis use: an alcohol only class, an alcohol and cannabis use class who used substances at different times, and two classes of same-day, effects overlapping co-use of alcohol and cannabis, differentiated by the presence (yes/no) of past two-week binge drinking (Patrick et al. 2018) and there was no assessment of quantity of cannabis use.

Prior work has shown that same-day co-use of alcohol and cannabis is associated with greater alcohol consumption (Linden-Carmichael et al. 2019) raising the question whether same-day co-use is also associated with concomitant increases in the quantity of cannabis use. It is possible that intensity of use varies day to day and is correlated in the same direction between substances suggesting they function as complements; alternatively, it is also possible that people substitute more use of one substance with less use of the other. Distinguishing between these hypotheses is important to inform prevention of consequences of co-use. In addition, the current study adds to prior research on the association between same-day co-use of alcohol and cannabis and associated consequences of use (Brière et al. 2011; Lee et al. 2017). Here, in a sample of adolescents and young adults that use alcohol and cannabis enrolled as part of a randomized controlled trial (RCT) on risky alcohol use, we examine the daily-level associations between amount of alcohol use on the quantity

of same-day cannabis consumption and the association between frequency of same-day co-use and past three-month consequences of use. This study focuses on young adults who drink in a risky manner because of this subpopulation's potential for experiencing greater consequences from use when also using cannabis (Patton et al. 2007; Patrick et al. 2017).

2. Methods

2.1. Participants

The current report is a secondary analysis of a subset of baseline data from a larger sample of adolescents and young adults (ages 16–24) recruited using Facebook ads, who screened positive for past three-month risky alcohol use (AUDIT-C positive: 16–17: three or more or four or more for females/males; ages 18–24: four or more or five or more for females/males). Participants were recruited between January 6, 2017 and April 20, 2019. Participants completed a baseline assessment, and were enrolled in an RCT of a fully online, eight-week group-based behavioral intervention rooted in Motivational Interviewing to reduce risky drinking. Procedures were approved by the University of Michigan Institutional Review Board. The full study protocol, including detailed descriptions of the intervention, has been detailed elsewhere (Bonar et al. 2020). We sampled across regions of the United States for race/ethnic representation similar to the National Epidemiological Survey on Alcohol and Related Conditions, namely oversampling African-Americans and Hispanics by posting ads featuring images of individuals from diverse racial/ethnic backgrounds, to ensure representation of these diverse groups. The analytic sample for the current study (N = 468; 49% of total sample) included those risky-drinking adolescents and young adults that reported at least one day of alcohol use and one day of cannabis use on a baseline 30-day Timeline Follow Back (TLFB) (Sobell et al. 1979).

2.2. Measures

An electronically delivered 30-day TLFB was used to measure the quantity and frequency of alcohol and cannabis consumption each day over the past month (Sobell and Sobell 1992; Dennis et al. 2004; Hjorthøj et al. 2012; Pedersen et al. 2012). Alcohol use was measured in standard drinks, defined as 12 oz. of beer, 5 oz. of wine, or 1.5 oz 80-proof distilled spirits, displayed with an image for reference. Cannabis use was measured as the number of grams of use, with participants asked to report their daily cannabis use (including cannabis used by 'smoking, vaping edibles, dabs, etc.'). Participants were shown an image of 0.5 grams of loose cannabis in a person's hand for reference (Collins et al. 2014), where 0.5 grams was estimated as one joint (Zeisser et al. 2012). TLFB responses were used to calculate the average number of daily drinks, percent days of alcohol use, and to categorize alcohol use into no drinking (0 drinks), moderate drinking (1–3 drinks for women and 1–4 drinks for men), and heavy drinking (4+ drinks for women, 5+ drinks for men). Heavy drinking days were defined based on gender-adjusted quantity of drinks of 5 drinks for males and four drinks for females. Also, days of high-intensity drinking (8+/10+ drinks for females/males) were calculated. Concerning cannabis use, TLFB responses were used to determine percent days of cannabis use, quantity (grams) of cannabis use on cannabis use days, and percentage of same-day alcohol and cannabis use days in the past 30.

Consistent with other measures in the larger trial, we assessed past three-month substance-related consequences and impaired driving. A modified 24-item Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; see Bonar et al. 2020 for details; Kahler et al. 2005) measured alcohol use consequences. The 21-item Brief Marijuana Consequences Questionnaire (BMCQ) was modified to assess both cannabis or other drug use-related consequences (Simons et al. 2012). Response options for both the BYAACQ and BMCQ ranged from 'none' (0) to 'more than 5 times' (3), and each was scored as the total of all responses. Past three-month driving under the influence used five alcohol items from the Young Adult Driving Questionnaire, and one cannabis item (modified to: drove within 1 hour after using cannabis) scored as the total of six responses using response options ranging from never (0), 1–2 times (1), 3–5 times (2), 6–10 times (3), or 10+ times (4) (Donovan 1993).

Other substance use was measured using a slightly modified version of the Tobacco, Alcohol, Prescription medications and other Substances (TAPS) assessment to descriptively ascertain presence of past three-month illicit substance use (Schwartz et al. 2014).

2.3. Data analysis

Descriptive analyses of sample characteristics were completed using SAS version 9.4 (SAS Institute Inc., 2013), including Chi-square comparisons between average quantity of alcohol and cannabis use across demographic characteristics. To adjust for covariates and account for nesting of daily data within individuals, quantity of cannabis use was evaluated with multilevel modeling (Snijders and Bosker 1999; Raudenbush and Bryk 2002) using MPlus version 6.11 (Muthén and Muthén 2011). The multilevel model tested the association between daily quantity of alcohol use on quantity of cannabis use. In addition to the within-person fixed effect of the quantity of alcohol use, the model also included fixed effects for average daily alcohol use (between-person) to account for person-level alcohol use. Age, sex, and day of the week (binary: weekend [Friday, Saturday, Sunday] or weekday), and random effects for individual were also included in the multilevel model. Day of the week was included as a fixed effect since prior work has supported day of the week as a predictor of alcohol and cannabis use in college-aged samples (Jackson et al. 2010; O'Hara et al. 2016; Patrick et al. 2016). Finally, correlations between frequency of same-day co-use and past-three month consequences were assessed using Pearson's r.

3. Results

3.1.1. Demographic and substance use characteristics at baseline

Demographic and clinical characteristics of the current sample (N = 468) are presented in Table 1. Half were men (50.4%) and the was 20.13 years (SD = 2.63, range 16–24). Three quarters (75.9%) resided in states where medical use of cannabis was legal and 20.5% were in states where the recreational (non-medical) and medical use of cannabis was legal at baseline. Alcohol use was reported on approximately 8 out of the 30 days (M = 8.04, SD = 6.84), and cannabis use was reported on approximately 9 out of the 30 days (M = 9.24, SD = 9.71) at baseline. Cannabis use was reported on 50.8% of alcohol use days, and alcohol use was reported on 44.3% of cannabis use days.

When comparing the average number of daily drinks across demographic characteristics, males consumed more drinks than females (male $M = 5.04$, SD = 2.81, female $M = 3.66$, SD = 2.14, $p < 0.001$) with no differences detected by age, race, ethnicity, or employment status. Regarding average quantity of cannabis use, younger participants (age 16–20 years old $M = 0.71$, SD = 0.50; age 21–24 $M = 0.62$, SD = 0.45; $p < 0.05$), males (male $M = 0.71$, SD = 0.53; female $M = 0.62$, SD = 0.42; $p < 0.05$), and people identifying as racial minorities (Black/African-American $M = 0.77$, SD = 0.52; White $M = 0.63$, SD = 0.45; Other race $M = 0.71$, SD = 0.52; $p < 0.05$) reported use of larger average daily quantities of cannabis use. No differences in quantity of cannabis use were observed based on ethnicity or employment status. No significant differences were observed between drinks per day or grams of cannabis used per day for people living in states where cannabis use was legal for medical or recreational purposes.

In this sample of adolescents and young adults who reported past-month use of alcohol and cannabis, approximately 5 out of 6 (393 participants out of 468; 84%) reported any same-day co-use, with an average of 4.87 days ($SD = 5.85$) of same-day co-use in the past month. Overall, participants consumed an average of 4.33 drinks on drinking days ($SD = 3.41$), 4.21 drinks ($SD = 3.36$) on alcohol-only days, and 4.44 drinks ($SD = 3.46$) on co-use days. High-intensity drinking was reported on 12.4% of drinking days among those with same-day co-use and 1.6% of drinking days for those who only used alcohol and cannabis on separate days. Other substance use included the following portions of the sample: 10.7% with illicit stimulant use (e.g. cocaine), 12.6% with use of ecstasy or molly, 20.5% with other illicit drug use (e.g. LSD, mushrooms), 12.2% misused prescription opioids, 15.0% misused prescription sedatives, and 20.5% misused prescription stimulants.

Among days where cannabis use was reported, participants reported an average of 0.74 g of cannabis ($SD = 0.64$) on nondrinking days, 0.78 g ($SD = 0.63$) on moderate drinking days, and 0.91 g ($SD = 0.68$) on heavy drinking days ($F = 20.18$, $p < 0.001$). On average, participants who reported alcohol and cannabis same-day co-use reported significantly more alcohol-related consequences (co-use: $M = 15.17$, $SD = 11.72$ vs. no co-use $M = 12.21$, $SD = 11.17$, $t = -2.02$, $p = 0.04$) and greater frequency of driving under the influence (co-use: $M = 3.04$, $SD = 4.10$ vs. no co-use $M = 1.76$, $SD = 3.49$, $t = -2.52$ $p = 0.01$) compared to those who used alcohol and cannabis without same-day co-use. No significant differences were detected between the amount of cannabis/other drug-related consequences (co-use: $M = 10.83$, $SD = 11.41$ vs no co-use $M = 9.53$, $SD = 12.93$, $t = -0.88$, $p = 0.38$).

3.2. Analyses focused on association between quantity of alcohol and cannabis use

Daily and average levels of alcohol use were positively associated with the quantity of cannabis use, with the daily (within-person) quantity of drinking emerging as statistically significant (estimate = 0.03, $p < 0.01$; see Table 2).

3.3. Frequency of same-day co-use and substance-related consequences

Frequency of same-day co-use was positively correlated with alcohol-related consequences (r = 0.24, p < 0.01), cannabis and other drug-related consequences ($r = 0.26$, $p < 0.01$), and frequency of driving under the influence of alcohol and/or cannabis ($r = 0.36$, $p < 0.01$).

4. Discussion

The current study aimed to extend understanding of same-day alcohol and cannabis co-use among adolescents and young adults using day-level data. We examined the relationship between same-day co-use and the quantity of cannabis consumption in addition to looking at the association between frequency of same-day co-use (in the past-month) and consequences of use over the past three months. Adolescents and young adults who use these substances on the same-day account for an increasing proportion of young people who drink alcohol (Pape et al. 2009; Terry-McElrath and Patrick 2018). Epidemiological evidence shows that same-day co-use is associated with greater risk of substance-related consequences than alcohol or cannabis alone (Brière et al. 2011; Terry-McElrath et al. 2014; Subbaraman and Kerr 2015), which was supported here.

We found that same-day co-use was associated with a larger quantity of cannabis use, with the amount of cannabis consumed increasing systematically. The smallest amount of cannabis was used on non-drinking days and the largest quantity was used on heavy drinking days (see Table 1). Adverse impacts on memory, learning, and subjective reports of drug effects are evident at modest increases in cannabis consumption (Curran et al. 2002), consistent with the differences found herein for quantity of (Curran et al. 2002) consumption on heavy drinking days versus other days. This indicates that the differences evidenced in this sample (approximately one-third of a joint) are likely to be clinically impactful and have the potential to lead to increased drug-related consequences. Similarly, when adjusting for covariates and repeated measures among individuals, the amount of cannabis used on a given day increased as the number of drinks increased, providing evidence for these substances being complements instead of substitutes for one another. These findings are in contrast to a recent daily diary study of young adults with two or more heavy drinking episodes in the past two weeks, wherein differences in quantity of cannabis use on single-use and co-use days were not observed (Linden-Carmichael et al. 2019).

Assessment reactivity, in addition to differences in sample size and sample age, added to differences in measurement of quantity of cannabis use (measured in grams in the current study and hits in Linden-Carmichael et al. 2019) likely contributes to differences in study findings. For example, the current study includes a larger sample size ($N = 468$ vs. $N = 154$), increasing the power to detect effects, and consists of both adolescents and young adults initially enrolled based on past three-month risky drinking using a clinical screener, compared to only young adults in the Linden-Carmichael et al. (2020) study who had two or more heavy drinking episodes in the past two weeks. We also used a 30-day retrospective TLFB survey to measure use; whereas, Linden-Carmichael et al. (2020) asked about use daily prospectively over 14 days. Evidence suggests that more frequent assessment ofsubstance use can cause assessment reactivity, suppressing usualuse patterns (Clifford et al. 2007; Maisto et al. 2007; Kaminer et al. 2008; Schrimsher and Filtz 2011). Thus, more research is needed to better understand the relationship between alcohol and cannabis co-use in young adults and the risk trajectories associated with these use patterns.

Consistent with prior work (Kelly et al. 2004; Terry-McElrath et al. 2014; Patrick et al. 2017; Linden-Carmichael et al. 2019) frequent same-day co-use was associated with

increased substance-related consequences over the past three months. Co-use of alcohol and cannabis may have additive physiological and psychological effects such that more frequent combined use increases the risk for short- (e.g. over-dose, injury) and longer-term consequences (e.g. development of substance use disorders, negative health effects).

Another possibility is that same-day co-use may be a marker of severity that results in greater consumption of one or both substances, leading to greater intensity of effects and greater risk for adverse consequences. In this case, using one substance may increase impulsivity, leading to greater consumption of the other substance. The strongest association between frequency of co-use and consequences was with frequency of past three month impaired driving in the current study. These findings add to prior work showing increased risk of impaired driving among adolescents and young adults with more severe substance misuse (Dora-Laskey et al. 2020), and among those that report using alcohol and cannabis at the same time (Subbaraman and Kerr 2015), with more frequent co-use associated with riskier driving practices (e.g. more crashes, more tickets) compared to less co-use (Midanik et al. 2007; Pape et al. 2009; Terry-McElrath and O'Malley 2013; Terry-McElrath et al. 2014; Subbaraman and Kerr 2015; Arterberry et al. 2017; Lee et al. 2017; Patrick et al., 2017).

Some patterns of substance co-use are especially hazardous. One epidemiological study found that among high school seniors that report high-intensity drinking, the odds of alcohol and cannabis co-use were 11 times higher than those that did not drink in a risky manner (Patrick et al. 2017). Similarly, among those that reported smoking a joint or more of cannabis a day, the odds of co-use were greater than 20 times higher (Patrick et al. 2017). In this sample of adolescents and young adults with cannabis use and risky alcohol use, high-intensity drinking episodes were more common among those who used cannabis on the same-day as alcohol compared to those who exclusively used alcohol and cannabis on separate days (12.44% vs. 1.58% of drinking days for adolescents and young adults that report same-day vs. no same-day co-use, respectively). Patterns of risky use were not limited to alcohol, with reports of past three month misuse of other substances ranging from 10–20% in the current sample.

Interventions specifically targeting reductions in frequency of same-day co-use and quantity of use during co-use episodes may aid in reducing substance-related consequences, even if use of both substances continues on separate days. In light of evidence presented here and elsewhere (Pape et al. 2009; O'Hara et al. 2016) supporting that the quantity of alcohol and cannabis both increase during co-use days, future research should expand on prior interventions (Woolard et al. 2013; Bonar et al. 2021) to see if reductions in one substance are associated with the hypothesized reductions in the other on co-use days, consistent with substances functioning as complements. Furthermore, interventions personalized based on time-varying motives for co-use may be most successful in fostering change and reducing consequences from use (Arterberry et al. 2021).

A strength of the current study is the use of daily-level data to assess alcohol and cannabis use, providing a finer level of precision and reducing risk of recall bias relative to epidemiological surveys and retrospective questionnaires assessing presence or absence

of use over longer time periods (e.g.,Patrick et al. 2018; Terry-McElrath and Patrick, 2018; Linden-Carmichael et al. 2019). Nonetheless, there are limitations of the current approach and future work may benefit from using finer-grained prospective assessments to minimize recall bias, providing information about the temporality of co-use, assessing daily use of other substances beyond alcohol and cannabis, and identifying times and contexts for interventions to reduce use. The tradeoff between assessment reactivity and participant burden with risk of recall bias should be carefully considered when designing these studies, using weekly assessments (past seven-day TLFB) to potentially balance these two concerns (Rabbi et al. 2018). Given this study was designed before more recent changes in cannabis policy and product availability, the current study did not assess in a detailed manner the broad array of different cannabis products (e.g. vape liquids, gummies) that may be available to youth, although youth were prompted to consider varied modalities when estimating overall grams. In future studies, more detailed inquiry into other cannabis products and quantity of use by modality will inform precise measurement of co-use, although to date, such approaches are challenging given the lack of standard measures (Barrus et al. 2016; Spindle et al. 2019; Loflin et al. 2020). The current sample only included adolescents and young adults who drink alcohol in a risky manner, which is an important population in terms of clinical need and allocation of prevention resources, although the focus on this population potentially limits the findings' generalizability to older adults and people with different alcohol use patterns. Finally, cannabis consequences were measured in conjunction with other drug use consequences as this was important to the larger RCT from which we obtained these data for analysis. Thus, these findings should be interpreted with caution given the lack of specificity regarding substance type preceding consequences.

Despite limitations, our findings add to the growing literature on patterns and consequences of alcohol and cannabis use among adolescents and young adults. Among adolescents and young adults who use both alcohol and cannabis, the vast majority use both substances on the same-day. More frequent same-day co-use is associated with more negative consequences, including the high-risk behavior of driving under the influence. The quantity of cannabis use increases as drinking intensifies. Future investigations of interventions targeting reductions in adolescent and young adult alcohol (or cannabis) use should identify if these lead to concomitant decreases in cannabis (or alcohol) use. Furthermore, to the degree interventions can reduce same-day co-use frequency, negative substance-related consequences may be lessened.

Funding

This work was funded by the National Institute on Alcohol Abuse and Alcoholism under grant #024175 and LNCs was supported by grant #028232.

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Table 1.

Sample characteristics ($N = 468$).

Demographic characteristics	***N* (%) or *M* (SD)**
Male sex	236 (50.4%)
Age in years	20.12 (2.63)
Race	
White	313 (66.9%)
Black	95 (20.3%)
Other	60 (12.8%)
Ethnicity (Hispanic/Latinx)	103 (22.0%)
Employment status (not exclusive)	
Employed	274 (58.6%)
Unemployed	16 (3.4%)
Student	280 (59.8%)
Past 30-day alcohol and cannabis use	
Average number of alcohol use days	8.04 (6.84)
Average number of cannabis use days	9.24 (9.71)
% of alcohol days with same-day cannabis use	50.8%
% of cannabis days with same-day alcohol use	44.3%
Standard drinks of alcohol on drinking days	4.35 (2.59)
Grams of cannabis on cannabis use days	0.67 (0.48)
Quantity of cannabis by drinking day	
Amount of cannabis on non-drinking days	0.74g (0.64 g)
Amount of cannabis on moderate drinking days	0.78g (0.63 g)
Amount of cannabis on heavy drinking days	0.91g (0.68 g)

Note: Black and White racial categories are inclusive of those that endorsed other racial identities. Participants that chose both Black and White racial categories were coded as Black. Participants were categorized as “other” if they did not endorse Black or White race. SD = Standard deviation; ANOVA of amount of cannabis use across alcohol drinking categories: $F = 20.18$, $p < 0.001$.

Table 2.

Multilevel regression analysis of quantity of cannabis use on alcohol and cannabis co-use days.

Variable	Estimate	*SE*	*p* Value
Within			
Number of drinks	0.03	<0.01	<0.01
Weekend (vs. weekday)	−0.01	0.01	0.26
Between			
Age	<−0.01	0.01	0.76
Gender (ref = female)	0.02	0.03	0.63
Average drinks per day	0.04	0.02	0.07

Note. Average drinks per day = total drinks/number of days in recall period.