Psychology of Addictive Behaviors

Examining Daily Associations Between Mental Health Symptoms and Simultaneous Alcohol and Marijuana Use and Consequences Among Young Adults

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CITATION

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Objective: The present study examined daily associations between mental health symptoms (i.e., depression and anxiety symptoms) and simultaneous alcohol and marijuana (SAM) use and use-related negative consequences among young adults. Method: Participants were a community sample of 409 young adults between the ages of 18–25 who drank alcohol at least three times in the past month and reported SAM use in the past month (Mage = 21.6, 50.9% female). A baseline assessment included a measure of SAM use motives, after which participants completed five 14-day bursts reporting daily mental health symptoms and alcohol/marijuana use. Results: Daily mental health symptoms were not associated with SAM use likelihood. However, baseline SAM coping motives moderated the association between mental health symptoms and use such that young adults with stronger coping motives showed a stronger positive association between mental health symptoms and SAM use. Further, on SAM use days, reporting more mental health symptoms relative to one’s average was associated with experiencing more use-related negative consequences, even after controlling for daily levels of alcohol and marijuana use (RR = 1.03, 95% CI = 1.01–1.05, p = .002). Conclusions: The association between daily mental health symptoms and SAM use depended on whether the young adults had coping motives for use. Daily fluctuations in mental health were associated with negative use-related consequences experienced on SAM use days regardless of motives. These findings highlight the potential importance of prevention and intervention strategies particularly on days when young adults are experiencing increased mental health symptoms.

Public Health Significance Statement
This study documented that mental health symptoms (i.e., symptoms of depression and anxiety) on a given day were associated with simultaneous alcohol and marijuana (SAM) use that day only for young adults with stronger baseline SAM coping motives. On SAM use days, greater mental health symptoms were associated with more negative consequences, regardless of motives for use. Elevated mental health symptoms on a given day are an indicator of substance use-related risk.

Keywords: alcohol, cannabis, marijuana, mental health, simultaneous

Supplemental materials: https://doi.org/10.1037/adb0000791.supp
Alcohol and marijuana use are common, with national surveys of young adults indicating that 82% have used alcohol and 42% have used marijuana in the past year (Schulenberg et al., 2021). Combined alcohol and marijuana use is associated with more negative consequences (Briève et al., 2011; Pape et al., 2009) and greater subjective intoxication relative to consumption of either alcohol or marijuana alone (Lee et al., 2017). Combined use is associated with consuming greater quantities of alcohol and marijuana use (Patrick et al., 2017) and with negative consequences including motor vehicle collisions and drunk driving (Jackson et al., 2020; Terry-McElrath et al., 2014). In one study of young adults, on days when alcohol and marijuana were used at the same time, there was a 28% increase in negative alcohol-related consequences compared to alcohol-only days (Lee, Patrick, et al., 2020). Days when both substances were used, compared to marijuana-only use days, have also been associated with greater negative consequences (Sokolovsky et al., 2020).

Although research has begun to identify potential risk factors for SAM use—which we define as using the substances at the same time so that their effects overlap—most of this work has focused on person-level risk factors and less is known regarding daily-level risk factors for use within individuals. Person-level risk factors related to SAM use include being male, being a full-time college student, and not living with one’s parents (Patrick, Terry-McElrath et al., 2019). Other risk factors for SAM use in cross-sectional studies include higher levels of sensation seeking and risk taking (Linden-Carmichael et al., 2019) and a greater willingness to spend resources on alcohol (Ramirez et al., 2020). Two-week ecological momentary assessment data identified being around peers who are also under the influence as risk factor of SAM use among adolescents (Lipperman-Kreda et al., 2017), and a 10-year longitudinal study found increases in positive expectancies, time spent around peers who engage in SAM use, and steeper decreases in resistance self-efficacy were associated with greater likelihood of SAM use at age 21 (D’Amico et al., 2020).

More recent research has started to examine mental health as a contributing vulnerability related to SAM use. For the present study, we define mental health symptoms as depressive and anxiety symptoms (e.g., depressed or anxious mood, lack of interest/pleasure, uncontrollability of worry). Although there are high rates of comorbid substance use disorders and mental health disorders in young adults broadly (Arterberry et al., 2020), only one known study has tested associations between SAM use and mental health symptoms specifically. In a longitudinal study of young adults, individuals who endorsed any SAM use (compared to those who only used alcohol) and those who engaged in frequent SAM use experienced lower levels of anxiety symptoms (but not depression) 2 years later (Thompson et al., 2021). Although these findings are somewhat consistent with prior studies examining alcohol and marijuana use behaviors separately (e.g., Cranford et al., 2009), cross-sectional work has found that young adults who reported mental health symptoms were more likely to report alcohol and marijuana co-use (i.e., use of marijuana and use of alcohol within the past month, but not necessarily at the time) than alcohol only use (Cohn et al., 2018). Moreover, cross-sectional work consistently shows that even subclinical mental health symptoms (assessed as depressive or anxiety symptoms) can be associated with risky substance use patterns when alcohol and marijuana use behaviors are tested separately (e.g., Acuff et al., 2018; Buckner et al., 2010; Geisner et al., 2018; Villarosa-Hurlock et al., 2019). Although the Thompson et al. (2021) study is an important first step in understanding the relationship between SAM use and mental health symptoms, it did not examine the association of acute (i.e., daily) mental health symptoms and SAM use or the role of other important proximal predictors of substance use that are salient among those with mental health problems (i.e., coping motives).

### Mental Health Symptoms

Daily-level studies of substance use tend to test baseline or trait-level mental health symptoms as a grouping variable or as a moderator for alcohol and marijuana use behaviors independently. In alcohol-only studies, young adults with higher levels of baseline depressive and anxiety symptoms reported greater average intentions to drink (Slavish et al., 2019) and greater mood benefits when drinking (Gorka et al., 2017). In marijuana-only studies, individuals with higher and more severe anxiety and depression symptoms at baseline were more likely to endorse higher-risk marijuana use patterns (i.e., taking 6 or more “hits” of marijuana per use occasion, higher levels of subjective marijuana intoxication; Shrir et al., 2013), and individuals with higher baseline social anxiety symptoms and high levels of craving were most likely to use marijuana (Buckner et al., 2012). Taken together, these findings suggest that baseline mental health symptoms can impact alcohol and marijuana use behaviors at the daily level.

However, the extent to which daily changes in mental health symptoms are associated with SAM use remains unclear. Mental health symptoms assessed as daily-level composites of negative affect (e.g., feelings of sadness, irritation, nervousness) vary across days (Armeli et al., 2000; Dvorak et al., 2016; Gottfredson & Hussong, 2013; Hussong et al., 2001). However, findings are consistently mixed on daily-level associations between mean ratings of negative affect and substance use outcomes (Armeli et al., 2000; Bresin & Fairbairn, 2019; Peacock et al., 2015). Thus, examining daily assessments of mental health symptoms (e.g., depressed or anxious mood, lack of interest/pleasure, uncontrollability of worry) may offer unique insights about higher-risk substance use behaviors like SAM use. In the current manuscript, we examine daily mental health symptoms as predictors of SAM use that day.

### Coping Motives

Motivations for alcohol and marijuana use are understood to be among the strongest antecedents of use. Young adults who use substances for coping reasons (e.g., to relieve negative emotions) have poorer coping skills and are at risk for more negative substance-related consequences (Blevins et al., 2016). Using alcohol for coping reasons is associated with more depressive symptoms and depressed mood (Cadigan et al., 2015; Kuntsche et al., 2005). Using marijuana for coping reasons has been found to be positively associated with higher depressive symptoms (Moitra et al., 2015) and higher anxiety symptoms (Bonn-Miller et al., 2008) among young adults.

There are mixed findings on the association between drinking to cope, mental health symptoms, and alcohol use. Daily anxious and depressed mood have been associated with drinking to cope motives and in turn, greater alcohol use and more negative consequences (Steevenson et al., 2019). Among young adults with stronger
drinking to cope motives, less alcohol was consumed on days when feelings of sadness were endorsed; however, greater alcohol use was consumed on days when feelings of fear and shyness were endorsed (Hussong et al., 2005). Other recent studies have found that drinking to cope motives mediated the relationship between depressed mood and alcohol problems among college students (Bravo et al., 2016; Kenney et al., 2018; Vernig & Orsillo, 2015), but not among noncollege young adults (Kenney et al., 2018). Greater quantities of marijuana use have also been reported on days when higher coping motives for marijuana are endorsed (Bonar et al., 2017).

Notably, motives for SAM use are distinct from motives for alcohol- or marijuana-only use (Patrick et al., 2018). That is, motives for alcohol, marijuana, and SAM use are moderately correlated, and even after controlling for alcohol and marijuana motives, SAM motives are associated with SAM use (Patrick et al., 2018). Engaging in SAM use for calming/coping motives (e.g., “to calm me down”; “to cope with anxiety”), in particular, has been associated with greater odds of SAM use cross-sectionally (Patrick et al., 2018) and across days (Patrick, Fairlie et al., 2019). Consistent with motivational and affective-motivational models of substance use (Cooper et al., 1995; Simons et al., 2005), associations between mental health symptoms and alcohol and/or marijuana use that day may vary according to whether individuals engage in SAM use for coping reasons. Thus, SAM may be used in an effort to manage daily variations in mental health symptoms, especially for those who use these substances to cope. In effect, people who often report SAM use to cope may be especially likely to report SAM use on days they are experiencing higher levels of mental health symptoms.

The Present Study

The present study examined daily associations between mental health symptoms (operationalized as a composite of depression and anxiety symptoms, as measured by the Patient Health Questionnaire, PHQ-4; Kroenke et al., 2009) and SAM use and use-related negative consequences among young adults. To date, we are not aware of any study to examine daily mental health symptoms as potential risk factors for SAM use. Our aims were to examine the extent that (a) mental health symptoms on a given day were associated with likelihood of SAM use that day, (b) mental health symptoms on a given SAM use day were associated with use-related negative consequences, and (c) these associations were moderated by baseline SAM use coping motives.

Method

Participants

Participants (N = 409, 50.9% female) were young adults in a longitudinal study on health behaviors (Lee, Patrick, et al., 2020; Patrick, Fairlie et al., 2019; Patrick et al., 2020). Eligibility criteria included being between the ages of 18 and 25, reporting SAM use in the past month, reporting drinking alcohol at least three times in the past month, living within 60 miles of the study office, agreeing to complete daily surveys and receive text reminders, and agreeing to visit the study office for study participation. The sample was 48.2% non-Hispanic/Latínx White, 15.9% Hispanic/Latínx, 15.9% Asian/ South Asian, 4.4% Black/African American, 11.2% identified with more than one race, and 4.2% with another race. At baseline, 48.9% were enrolled in a 4-year college, 6.7% were enrolled in a 2-year or vocational college, 35.7% had a college degree (2 or 4 years) but were not currently a student, and 8.4% were not currently a student and had not obtained a college degree.

Procedure

Procedures were reviewed and approved by the University’s Institutional Review Board. Participants were recruited from the greater Seattle metropolitan area in Washington State, where nonmedical marijuana use is legal for individuals ages 21 and older. Recruitment occurred predominantly online via social media and was supplemented by print advertisements, outreach at community colleges and community agencies that employ young adults, posting flyers, and friend referrals. Interested individuals completed an online screening survey to determine eligibility, and eligible individuals were asked to attend an in-person baseline session at the local study offices. A total of 3,636 individuals completed screening with 810 (22.3%) meeting eligibility criteria. In efforts to stratify enrollment to include relatively equal numbers of women and men and representation across ages and educational statuses, 736 were invited to participate in the baseline session, 410 participants completed baseline, and one participant opted out of the study after completing the baseline session. The in-person session consisted of identity verification, informed consent procedures, a training session for the daily surveys, and baseline assessments. The entire session typically took 1½–2 hr and participants received a $40 Amazon.com gift card for their participation. The day following the in-person session, participants began their first 14-day burst of twice-daily online surveys. Each day, participants were instructed to complete a morning assessment and an afternoon assessment, each within a 3-hour window (e.g., 9 a.m.–12 p.m., 3 p.m.–6 p.m.) that they were able to choose to best fit their schedule. Participants completed a total of five 14-day bursts, with 4-month intervals between consecutive bursts. Each daily survey was designed to take 5–10 min to complete, and links were sent to participants via email and text at the opening of a survey window with reminder texts to complete surveys if they had not already. Following each burst, participants received Amazon.com gift card codes with totals accounting for $2.50 for each daily survey completed and a $10 bonus per burst if completing at least 25 of the 28 possible surveys (up to $80). Out of 14 possible days in each burst, on average participants completed assessments on 13.59 (SD = 1.11) days in Burst 1, 12.50 (SD = 3.34) days in Burst 2, 12.55 (SD = 3.51) days in Burst 3, 12.21 (SD = 3.90) days in Burst 4, and 11.98 (SD = 4.06) days in Burst 5.

Measures

Mental Health Symptoms

Participants were asked about symptoms of depression and anxiety from the Patient Health Questionnaire (PHQ-4; Kroenke et al., 2009) adapted for daily use. Each afternoon, participants were asked “today, to what extent have you been bothered by any of the following problems?” with regard to (a) little interest or pleasure in doing things, (b) feeling down, depressed, or hopeless, (c) feeling nervous, anxious, or on edge, and (d) not being able to stop or
control worrying. Each item was scored on a 0 (Very slightly or not at all) to 4 (Extremely) scale, and scores were summed on each day such that greater scores represented greater mental health symptoms. Cronbach’s α for the 4-item scale was calculated for each of the 70 days across the study period, and alphas ranged between 0.83 and 0.90 across all days with a mean of 0.86.

**SAM Use**

Each morning, participants were asked, “Did you drink any alcohol yesterday?” “Did you use marijuana yesterday?” and “Yesterday, did you use alcohol and marijuana at the same time—that is, so that their effects overlapped?” SAM use was operationalized as answering yes to all three questions in the morning assessment.

**Use-Related Negative Consequences**

On days participants reported alcohol and marijuana use on the previous day, they were asked if they experienced 15 possible negative consequences as a result of their alcohol use (e.g., “had a hangover,” “felt nauseated or vomited,” “damaged property on purpose”) and 10 possible negative consequences as a result of their marijuana use (e.g., “had a racing heart or increased heart rate,” “had difficulty concentrating”). Items come from previous studies assessing alcohol consequences at the daily level (Lee, Patrick, et al., 2017) and from adapted marijuana consequences measures that aim to measure acute harms from marijuana use (Lee, Kilmer, et al., 2020). Sum scores were created by summing the total number of alcohol- and marijuana-related negative consequences on days with SAM use.

**Coping Motives**

At baseline, participants completed a 22-item measure of SAM use motives (Patrick et al., 2018). In the present analyses, we used a single subscale mean score for SAM coping motives (3 items; α = 0.78, e.g., “to calm me down”) that could range from 0–4. In supplemental analyses, we also examine reports from the revised Drinking Motives Questionnaire (Cooper et al., 1995) that included a five-item drinking coping motives subscale (α = 0.89) and the 36-item Comprehensive Marijuana Motives Questionnaire (Lee et al., 2009) that included a three-item marijuana coping motives subscale (α = 0.89).

**Covariates**

All models included person-level covariates for birth sex (coded as female = 0, male = 1), age at baseline, race/ethnicity, and whether participants were attending a 4-year college at baseline (coded as not attending = 0, attending = 1). All models also included time-varying covariates for burst number, day number within a burst, and the weekend status for the day of substance use (coded as Sunday–Thursday = 0, Friday–Saturday = 1). Models predicting use-related consequences also controlled for the number of standard drinks consumed on a given day (if participants reported drinking) and total number of hours high (if participants reported using marijuana).

**Data Analysis Plan**

First, descriptive statistics assessed variation in mental health (i.e., depression/anxiety) symptoms and the extent to which the overall variability was attributed to within- relative to between-person variability by calculating an intraclass correlation coefficient. Two sets of multilevel models were estimated in SPSS (IBM SPSS, Version 27.0. Armonk, NY, USA) to assess daily associations between mental health symptoms and (a) the likelihood of SAM use across all monitoring days, and (b) the number of negative consequences experienced on days with SAM use. Variables were lagged to allow for examination of relationships between mental health symptoms reported in afternoons with SAM use and consequences reported the following mornings but referring to previous day (i.e., same day as time-varying covariates and when mental health symptoms were reported). Given our primary interest in potential within-person effects of mental health symptoms, we included two variables into each model to disaggregate between- from within-person effects (Curran & Bauer, 2011). To account for the between-person effect, we included each participant’s mean PHQ-4 score across all days as a deviation from the grand mean of all participants’ PHQ-4 scores (i.e., grand-mean centered). To aid in interpretability, these grand-mean centered variables were then standardized as z-scores such that the mean was 0 and standard deviation was 1. To account for the within-person effect, we included each participant’s daily PHQ-4 score as a deviation from the participant’s mean PHQ-4 score across all days (i.e., person-mean centered) and again standardized these daily deviations as z-scores. In models predicting negative consequences, we similarly included between- and within-person effects for standard drinks consumed and number of hours high from marijuana. Models with SAM use as a binary outcome used a logistic regression form of the multilevel model to estimate adjusted odds ratios (AORs). Because the negative consequences outcome is a discrete non-negative integer showing positive skew and evidence of over-dispersion where the variance exceeds the mean, a negative binomial form of the model was used to estimate rate ratios (RRs; also known as count ratios) that describe the proportional change in the outcome associated with a one-unit increase in the covariate. To assess moderation of associations by baseline coping motives, additional models included coping motives as a main effect and as a cross-level interaction with daily mental health symptoms.

Supplemental analyses followed the same multilevel model analytic plan but instead assessed daily associations between mental health symptoms and (a) the likelihood of alcohol or marijuana use separately (i.e., not SAM use), and (b) the number of negative consequences experienced on days with any alcohol or marijuana use separately. Drinks consumed and baseline drinking coping motives were included in models involving alcohol use days and hours high and baseline marijuana use coping motives were included in models involving marijuana use days.

**Results**

**Descriptive Statistics**

A total of 18,873 daily observations were used in analyses that make use of all days (i.e., not limited to SAM use days). Of the 409
participants who provided daily data, 303 reported at least one day with SAM use. There were a total of 1930 daily observations (9.1% of days with valid reports) with SAM use across the monitoring period. On days with SAM use, participants reported drinking an average of 4.17 (SD = 2.92) drinks per day, being high 3.54 (SD = 2.67) hours per day, and experiencing an average of 2.00 (SD = 2.39) negative consequences per day with a range of 0–15 negative consequences across days.

With regard to daily reporting of mental health symptoms, daily PHQ-4 scores ranged from 0–16 (spanning the range of total possible scores) with a mean of 2.71 (SD = 3.23). The intraclass correlation coefficient for the PHQ-4 was 0.53, suggesting similar attribution of overall variability to both within-person and between-person variability.

**Same-Day Use as a Function of Daily Mental Health Symptoms**

Table 1 presents estimates from models testing whether the likelihood of SAM use was associated with levels of daily mental health symptoms. In models without baseline coping motives (i.e., Model 1), there was no statistically significant association at the within-person level between daily mental health symptoms and the likelihood of same-day use of alcohol and marijuana. As shown in Model 2, however, the daily association between mental health symptoms and same-day use was moderated by coping motives such that the association between mental health symptoms and same-day use was more positive for individuals that endorsed stronger coping motives at baseline.

Among between-person variables, SAM use was more likely among males and less likely among Asian/Asian-American participants relative to White/non-Hispanic participants. Among within-person variables, SAM use was less likely among later bursts in the data collection period and more likely on weekends.

**SAM Use Consequences as a Function of Daily Mental Health Symptoms**

Table 2 presents estimates from models testing whether the number of negative consequences on days with SAM use was associated with levels of daily mental health symptoms. Prior to including SAM coping motives (i.e., Model 1), reporting more daily mental health symptoms relative to one’s average was associated with more negative consequences reported on days with SAM use, even when accounting for number of drinks and hours high on a given day. This association was not moderated by baseline endorsement of coping motives (Model 2).

Pertaining to between-person associations, being male was associated with fewer consequences, while being Asian/Asian-American (relative to White/non-Hispanic), and having higher levels of mean mental health symptoms across the monitoring period were associated with more consequences. Among within-person variables, more drinks consumed and more hours high from marijuana on a given day were both associated with more negative consequences reported that day.

**Supplemental Analyses**

For supplemental analyses examining alcohol use as a separate outcome, reporting more daily mental health symptoms on a given day was associated with lower likelihood of consuming any alcohol on a given day (Supplemental Table 1). However, having more daily mental health symptoms on a given day was associated with more negative consequences on alcohol use days (Supplemental Table 2). Baseline drinking coping motives did not moderate these associations. For marijuana use, there was no significant association at the within-person level between daily mental health symptoms and the likelihood of marijuana use (Supplemental Table 3). Having more daily mental health symptoms on a given day was associated with more negative consequences on marijuana use days (Supplemental Table 4).

**Table 1**

Multilevel Binary Logistic Regression Model Examining Associations Between Daily Mental Health Symptoms and Likelihood of SAM Use

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Model 1</th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR [95% CI]</td>
<td>p</td>
<td>OR [95% CI]</td>
<td>p</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental health symptoms (person-mean)</td>
<td>1.13 [1.00, 1.29]</td>
<td>.049</td>
<td>1.05 [0.92, 1.20]</td>
<td>.442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male sex</td>
<td>1.38 [1.05, 1.81]</td>
<td>.020</td>
<td>1.40 [1.07, 1.83]</td>
<td>.015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at baseline</td>
<td>1.02 [0.96, 1.08]</td>
<td>.592</td>
<td>0.99 [0.94, 1.05]</td>
<td>.828</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-year college student (0 = No, 1 = Yes)</td>
<td>0.68 [0.50, 0.93]</td>
<td>.017</td>
<td>0.66 [0.48, 0.90]</td>
<td>.010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity (ref = White/non-Hispanic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian/Asian-American</td>
<td>0.50 [0.33, 0.77]</td>
<td>.002</td>
<td>0.51 [0.34, 0.77]</td>
<td>.002</td>
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<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.19 [0.80, 1.76]</td>
<td>.392</td>
<td>1.20 [0.82, 1.77]</td>
<td>.355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other race</td>
<td>1.00 [0.71, 1.40]</td>
<td>.993</td>
<td>0.97 [0.69, 1.36]</td>
<td>.867</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAM coping motives endorsed at baseline</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1.31 [1.12, 1.54]</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Day level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental health symptoms</td>
<td>1.01 [0.96, 1.07]</td>
<td>.622</td>
<td>1.00 [0.94, 1.06]</td>
<td>.906</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burst number</td>
<td>0.84 [0.80, 0.90]</td>
<td>&lt;.001</td>
<td>0.85 [0.80, 0.90]</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day number</td>
<td>0.98 [0.96, 0.99]</td>
<td>.002</td>
<td>0.98 [0.96, 0.99]</td>
<td>.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekend</td>
<td>1.28 [1.14, 1.44]</td>
<td>&lt;.001</td>
<td>1.28 [1.14, 1.44]</td>
<td>&lt;.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAM coping motives × Mental health symptoms</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1.05 [1.00, 1.10]</td>
<td>.047</td>
<td></td>
</tr>
</tbody>
</table>

Note. OR = Odds ratio. Weekend was dummy-coded (0 = Sun–Thurs, 1 = Fri–Sat); Burst number was coded 0–4; Day number reflects the day within a burst and was coded 0–13; Mental health symptoms were derived from daily PHQ-4 sum. Number of days analyzed in both models was 18,873 across 409 participants.
Note
day, Marijuana use variables were derived from hours high on each day. Number of days analyzed was 1,742 across 303 participants.

Discussion

Given the high prevalence of alcohol and marijuana use among young adults (Schulenberg et al., 2021), and evidence that this is a high-risk developmental period for mental health symptoms (Cadigan et al., 2019), the present study used daily data to better understand how mental health (i.e., depression and anxiety) symptoms may relate to SAM use on a given day. Overall, there was no statistically significant association between mental health symptoms and SAM use likelihood on a given day. Given that previous studies have found mixed evidence for the effects of mental health symptoms on alcohol use only or marijuana use only (e.g., Gottfredson & Husson, 2013; Stevenson et al., 2019), it is not surprising that we found a null main effect of mental health symptoms on SAM use. Similarly, our supplemental analyses showed that days with greater mental health symptoms were associated with no difference (marijuana) or lower (alcohol) likelihoods of substance use, but more alcohol and marijuana-related consequences on substance use days.

However, there was a significant interaction showing that the association between mental health symptoms and SAM use likelihood on a given day was stronger for those reporting greater SAM coping motives at baseline. That is, among the subset of young adults who tend to use a combination of alcohol and marijuana as a means of coping, days with relatively higher symptoms of depression and anxiety were associated with a greater likelihood of SAM use. Taken together, within-person fluctuations in mental health symptoms may not be associated with an increased likelihood of SAM use on average across the entire sample, but for young adults who do turn to using substances to cope, mental health symptoms may be a proximal risk factor for substance use.

Days with substance use are problematic for young adults given the range of negative consequences they may experience as a result of use. As such, we also examined how daily-level fluctuations in mental health symptoms may contribute to use-related negative consequences (e.g., damaging property, difficulty concentrating). We found that on SAM use days (and on alcohol use days and marijuana use days, in Supplementary Analyses section), young adults reported experiencing more negative consequences on days with more mental health symptoms. Importantly, this significant association for SAM use held even when accounting for number of drinks and hours high, indicating that poorer mental health may explain daily-level variability in negative consequences above and beyond the effects directly due to the levels of alcohol and marijuana use. Although additional studies are needed to identify potential mechanisms explaining this association, it is plausible that days young adults experience relatively poorer mental health they may be using substances in riskier patterns or settings. For example, a between-person study found that depressive symptoms inversely predicted the use of protective behavioral strategies (Martens et al., 2008) and it follows that young adults may engage in fewer protective behaviors on days with increased depressive symptoms. Another possibility is that poorer mental health days are associated with less use of emotion regulation strategies (McMahon & Naragon-Gainey, 2019; Vanderlind et al., 2021), as it is well established that emotion dysregulation is associated with risky behaviors (Weiss et al., 2015).

Table 4). Baseline marijuana coping motives did not moderate these associations.

Table 2: Negative Binomial Multilevel Model Examining Associations Between Daily Mental Health Symptoms and Negative Consequences on SAM Use Days

<table>
<thead>
<tr>
<th>Predictor</th>
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<tr>
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<td>RR</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mental health symptoms (person-mean)</td>
<td>1.33</td>
<td>[1.21, 1.46]</td>
</tr>
<tr>
<td>Male sex</td>
<td>0.80</td>
<td>[0.66, 0.98]</td>
</tr>
<tr>
<td>Age at baseline</td>
<td>0.96</td>
<td>[0.92, 1.01]</td>
</tr>
<tr>
<td>4-year college student (0 = No, 1 = Yes)</td>
<td>1.06</td>
<td>[0.84, 1.35]</td>
</tr>
<tr>
<td>Race/Ethnicity (ref = White/non-Hispanic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian/Asian-American</td>
<td>1.34</td>
<td>[1.00, 1.80]</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.01</td>
<td>[0.78, 1.31]</td>
</tr>
<tr>
<td>Other race</td>
<td>0.91</td>
<td>[0.71, 1.17]</td>
</tr>
<tr>
<td>Drinks consumed (person-mean)</td>
<td>1.03</td>
<td>[0.97, 1.10]</td>
</tr>
<tr>
<td>Hours high (person-mean)</td>
<td>0.97</td>
<td>[0.92, 1.04]</td>
</tr>
<tr>
<td>SAM coping motives endorsed at baseline</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Day level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental health symptoms</td>
<td>1.07</td>
<td>[1.01, 1.12]</td>
</tr>
<tr>
<td>Burst number</td>
<td>0.98</td>
<td>[0.95, 1.02]</td>
</tr>
<tr>
<td>Day number</td>
<td>0.99</td>
<td>[0.98, 1.01]</td>
</tr>
<tr>
<td>Weekend</td>
<td>0.92</td>
<td>[0.81, 1.04]</td>
</tr>
<tr>
<td>Drinks consumed</td>
<td>1.11</td>
<td>[1.08, 1.13]</td>
</tr>
<tr>
<td>Hours high</td>
<td>1.05</td>
<td>[1.02, 1.08]</td>
</tr>
<tr>
<td>SAM coping motives × Mental health symptoms</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. RR = Rate ratio. Weekend was dummy-coded (0 = Sun–Thurs, 1 = Fri–Sat); Burst number was coded 0–4; Day number reflects the day within a burst and was coded 0–13; Mental health symptoms were derived from daily PHQ-4 sum; Alcohol use variables were derived from standard drinks consumed on each day, Marijuana use variables were derived from hours high on each day. Number of days analyzed was 1,742 across 303 participants.
Counter to our expectations, the association between mental health symptoms and negative consequences was not moderated by SAM coping motives. This may indicate a more direct effect of mental health symptoms on use-related negative consequences that is not amplified by coping motives. Supplemental analyses revealed similar main effects from mental health symptoms to alcohol-related consequences on drinking days and to marijuana-related consequences on marijuana use days that were not moderated by coping motives for these substances. However, the present study used baseline SAM motives as a person-level moderator of daily mental health symptoms. Daily SAM coping motives were not assessed; to reduce participant burden, day-level SAM motives only included a subset of use motives which did not include a subscale on coping motives. However, there is evidence that motives for using alcohol and/or marijuana vary from day-to-day, and that days with elevated coping motives are associated with greater use of alcohol and marijuana simultaneously (Patrick, Fairlie et al., 2019). Future studies could examine how mental health symptoms co-vary with day-level SAM motives, intensity of use, and consequences.

As the first study (to our knowledge) examining daily-level associations between mental health symptoms and SAM use, the findings reported herein make a novel contribution to the literature on the role of mental health on substance use. There are also important limitations. First, due to the novel assessment of mental health symptoms on a daily level, the PHQ-4 was adapted for this study to be asked in the afternoon and may not have captured mood later in the day. Future research should continue to explore methods for measurement of daily predictors of SAM use. Second, the community sample of young adults resided in a state with legal recreational marijuana use and findings may not generalize to other policy contexts. Finally, the burst number and day number were each associated with decreased use across the study period. Future research should examine possible effects of maturation and decreased reporting due to self-monitoring.

Young adult mental health remains a salient and ever-increasing concern during the COVID-19 pandemic (Graupensperger et al., 2020; Lee, Cadigan, & Rhew, 2020). Results from the present study reveal that day-to-day variation in mental health symptoms has important implications. In particular, having more mental health symptoms on a given day was associated with greater likelihood of SAM use for young adults with coping motives. In addition, more symptoms on a given day were associated with more negative consequences, regardless of motives for use. A targeted approach to intervening with young adults with mental health problems and/or coping motives for use may be warranted for SAM users. Interventions could challenge the widely held (but dangerous) expectations that substance use is effective in alleviating symptoms of depression and anxiety (Carrigan & Randall, 2003; Turner et al., 2018). On the contrary, while use of substances to cope may provide temporary relief, it is likely to make mental health problems worse over time (Colder et al., 2019; Cutler et al., 2018; Glodosky & Cutler, 2020; Gobbi et al., 2019). Moreover, intervention approaches could highlight the fact that young adults are at risk for more negative consequences of substance use on days they are experiencing more mental health symptoms and equip young adults with more constructive coping strategies.

References


substance use correlates of alcohol, marijuana, and tobacco use and co-use in U.S. young adults and adults: Results from the population assessment for tobacco and health. *The American Journal on Addictions*, 27(6), 491–500. https://doi.org/10.1111/ajad.12766


