Daily Motives for Alcohol and Marijuana Use as Predictors of Simultaneous Use Among Young Adults

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ABSTRACT. Objective: Research on substance use motives typically examines each substance separately. However, simultaneous alcohol and marijuana (SAM) use—that is, using alcohol and marijuana at the same time so that their effects overlap—is common among young adults. This study examines day-to-day fluctuations in motives for using alcohol and/or marijuana among young adult substance users as predictors of alcohol, marijuana, and SAM use across days. **Method:** Data were from a community sample of young adults who reported SAM use in the past month (analytic sample: $N = 399$, mean [*SD*] age = 21.63 [2.17]; 50.9% women). Participants reported alcohol, marijuana, and SAM use, and also motives "for alcohol and/or marijuana use" for 14 consecutive days. **Results:** Multilevel models showed that elevated enhancement motives were associated with heavy episodic drinking, drinking more, and more hours high from marijuana. Elevated social motives were associated with heavy episodic drinking and drinking more, and also with fewer hours high. Elevated conformity motives were associated with drinking more. SAM use was more likely: on alcohol days and on marijuana days with elevated enhancement and conformity motives, on alcohol days with elevated coping motives, and on marijuana days with elevated social motives. **Conclusions:** SAM use on a given day was primarily associated with enhancement and conformity motives. Social motives were more strongly linked to alcohol use, and to some extent coping motives were linked to marijuana use in this young adult sample. Further examination of situation-specific motives and contexts of use is needed to inform development of real-time interventions for SAM use and consequences. (*J. Stud. Alcohol Drugs, 80,* 454–461, 2019)

EPIDEMIOLOGICAL STUDIES have shown that alcohol and marijuana are the most common substances used among young adults in the United States: In 2017, 81.2% reported using alcohol and 37.5% marijuana in the past 12 months (Schulenberg et al., 2018). Motivations for substance use are among the most proximal predictors of use. Motivational models suggest that alcohol and marijuana are primarily used for coping, enhancement, and social reasons (Cooper, 1994; Cox & Klinger, 1988; Kuntsche et al. 2005; Lee et al., 2009; Simons et al., 1998), where social and enhancement motives provide positive reinforcement (i.e., to receive social benefits; enhance positive emotional states) and coping motives provide negative reinforcement (i.e., relief or reduction of negative emotions).

Substance use motives

Motives for alcohol and marijuana use among college students and young adults are well documented. Previous research has identified that motives for alcohol use are associated with drinking behavior both cross-sectionally (e.g., Carey & Correia, 1997; Merrill & Read, 2010; Patrick et al., 2011a) and longitudinally (e.g., Merrill et al., 2014; Patrick et al., 2011b; Read et al., 2003). Similarly, motives for marijuana use are associated with use in cross-sectional (e.g., Bonn-Miller et al., 2007; Lee et al., 2009; Simons et al., 1998) and longitudinal (e.g., Patrick et al., 2011b, 2016) studies. Reasons or motives for substance use have also been shown to change with age as individuals develop from adolescence to young adulthood (Patrick & Schulenberg, 2011; Patrick et al., 2011c, 2017a).

To date, most research has examined substance use motives cross-sectionally or prospectively over a longer period (e.g., months or years). However, a growing body of research has examined daily-level associations of substance use motives. Microlongitudinal studies with both college students and young adults have demonstrated that alcohol and marijuana use motives vary day to day (e.g., Arbeau et al. 2011; Armeli et al., 2016; Bonar et al., 2017; O'Hara et al., 2015; Studer et al., 2014). For example, elevated social or enhancement motives were associated with more social drinking among college students; elevated coping motives were associated with social and nonsocial drinking for men but only nonsocial drinking for women

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(O'Hara et al., 2014). Drinking motives also tend to vary between weekends and weekdays (Studer et al., 2014). Further, motives for marijuana use vary day to day (Buckner et al., 2015). On days when young adults, who were patients in the emergency department, endorsed higher enhancement, coping, or social (but not conformity) motives, they reported a greater quantity of marijuana use (Bonar et al., 2017). This literature suggests motives are not static, but rather the same people report using substances for different motives on different occasions.

Simultaneous alcohol and marijuana use

Emerging evidence points to simultaneous alcohol and marijuana (SAM) use as a prevalent behavior (Brière et al., 2011; Patrick et al., 2019; Subbaraman & Kerr, 2015), known as getting "cross-faded" (Patrick & Lee, 2018). SAM use (i.e., using alcohol and marijuana at the same time so that their effects overlap) is common among young adults. Compared with using either substance alone, simultaneous use is associated with greater subjective negative physiological and cognitive effects (i.e., feeling clumsy, confused, dizzy, difficulty concentrating), greater harm to social relationships, finances, employment, or physical health, greater incidence of motor vehicle collisions, higher rates of drunk driving, and higher rates of using alcohol and marijuana (Brière et al., 2011; Lee et al., 2017; Patrick et al., 2017b; Terry-McElrath et al., 2013, 2014; Sewell et al., 2009; Subbaraman & Kerr, 2015). However, to date no research has examined occasion-level predictors of SAM use.

As with use of alcohol or marijuana separately (e.g., Cooper, 1994; Lee et al., 2009; Simons et al., 2000), young adults engage in SAM use for different reasons, with motivations including to increase intoxication level (e.g., cross-faded effects) or reduce undesirable effects of alcohol (e.g., feeling less hungover) (Patrick & Lee, 2018; Patrick et al., 2018). Most research has examined motives for alcohol or for marijuana separately, although similar motives may drive young adults to use either substance separately or both substances together. To understand when SAM use is most likely to occur, it is important to understand the motivational context in which young adults choose to use alcohol and/or marijuana. The current study examines coping, social, enhancement, and conformity motives (i.e., motives for alcohol and/or marijuana use) on a given day. Our aims were to determine (1) the extent to which coping, social, enhancement, and conformity motives predict heavy episodic drinking (HED; 4+/5+ for women/men), alcohol use, and marijuana use on days young adults used either alcohol and/or marijuana that day (Aim 1); (2) the extent to which coping, social, enhancement, and conformity motives predict SAM use on days young adults used alcohol (Aim 2); and (3) the extent to which coping, social, enhancement, and conformity motives predict SAM use on days young adults used marijuana (Aim 3).

Method

Participants

Participants (N = 409) were young adults recruited from the community for a longitudinal study on daily alcohol and marijuana use and experiences. Eligible participants were 18–25 years old at screening, reported SAM use at least once in the past month, reported drinking alcohol at least three times in the past month, resided within 60 miles of the study office, and were willing to accept text messages from the project, complete online daily surveys and come to the study office for consent, identity/age verification, and the baseline assessment.

Of the 409 enrolled in the study, the current analyses use an analytic sample of 399. Ten participants were excluded because of missing data on motives (did not report alcohol or marijuana use on any of the 14 daily survey days). The analytic sample is diverse with 57.2% White, 15.9% Asian or South Asian, 13.9% more than one race, 5.3% African American, and 7.8% another race. In addition, 16.1% identified as Hispanic/Latino. Average age at baseline was 21.63 years (SD = 2.17), with 50.9% reporting sex at birth as female. At baseline, 41.4% were employed part time and 25.3% full time; 36.6% were currently not students; and 48.9% were in a 4-year college or university, 6.5% were in a 2-year or community college, 6.8% were in a graduate or professional program, and the remaining 1.3% were in high school, a General Educational Development (GED) credential program, or trade/vocational school.

Procedures

All procedures were approved by the university's institutional review board. Participants were recruited through a variety of methods including print, online, and social media advertisements, outreach at community colleges and local events targeting young adults, posted flyers, and friend referral. Interested individuals were asked to complete a brief confidential online eligibility survey. If a potential participant met all criteria, they were invited to schedule an in-person session (lasting 1.5–2 hours) conducted at the study's local office to verify the participant's identity and age with photo identification, obtain informed consent, and go over study protocols. The training session included practical details, such as survey length and complex questions, receiving surveys, and payments, as well as visual images for quantity of alcohol (i.e., standard drink; National Institute on Alcohol Abuse and Alcoholism, 2017) and marijuana (i.e., different quantities from $^1/_8$ g to 1 oz. of actual marijuana in various forms; Mariani et al., 2011). Last, participants completed

an online baseline assessment and were paid a $40 Amazon gift card upon completion. The survey included items on demographics, alcohol use, and marijuana use.

Beginning the next day, participants completed 14 consecutive days of twice-daily online assessments via daily email and text invitations. Participants could complete the morning survey anytime between 9 A.M. and noon and the afternoon survey anytime between 3 P.M. and 6 P.M. Daily assessments asked about the previous day's experiences, such as sleep, health, affect, and alcohol and marijuana use. The online surveys took 5–10 minutes to complete. Gift card codes were provided as compensation with participants earning $2.50 for each completed daily assessment and a $10 bonus if they completed at least 25 of the 28 surveys. Participants who completed all daily assessments in the 2-week period earned $80 in Amazon gift cards.

To encourage retention, participants received a check-in call at the end of their first week to elicit feedback from the participants about the study. Participants who missed four daily assessments in a row were first phoned asking about potential barriers, then emailed. Across the 14 days, 88.1% (n = 4,924) of the possible 5,586 morning surveys (399 participants × 14 days) were completed and an additional 2.1% (n = 120) were partial surveys. On average, participants completed 12.34 morning surveys (SD = 2.20, range: 1–14).

Measures

Alcohol and marijuana use. Each day, participants indicated whether they drank alcohol yesterday, coded 0 (*no*) or 1 (*yes*) and, if so, the number of total drinks they had yesterday with options from 1 (*1 drink*) to 25 (*25 or more drinks*). A *standard drink* was defined as 12 fluid oz. regular beer, 8–9 fluid oz. malt liquor, 5 fluid oz. wine, or 1.5 fluid oz. (shot) distilled spirits. The outcome variable for HED was coded as "1" on days that women reported 4+ and men reported 5+ drinks and "0" for other drinking days.

Each day, participants also indicated whether they used marijuana, coded 0 (*no*) or 1 (*yes*) and, if so, the total number of hours they were high with options from 0 (*<1 hour*) to 23 (*23–24 hours*). Responses were recoded by adding "1" so that "0" would reflect no hours high.

Simultaneous alcohol and marijuana use. If participants indicated both alcohol and marijuana use that day, they were asked if they engaged in SAM use, "Yesterday, did you use alcohol and marijuana at the same time—that is, so that their effects overlapped?" coded 0 (*no*) or 1 (*yes*).

Alcohol and marijuana motives. Participants reported their motives for alcohol and/or marijuana use on a 0 (*not at all*) to 4 (*extremely*) scale. The motives were adapted from the original Comprehensive Marijuana Motives Questionnaire (CMMQ; Lee et al., 2009) and Modified Drinking Motives Questionnaire–Revised (Modified DMQ-R; Grant et al., 2007) to ask about motives for alcohol and/or marijuana use for the previous day, "Yesterday, to what extent did you use alcohol and/or marijuana for the following reasons?" Mean scores were calculated for four subscales, Social (two items, α = .83; e.g., "to be social"), Enhancement (two items, α = .69; e.g., "to feel good"), Coping (six items, α = .79; e.g., "to reduce my anxiety"), and Conformity (two items, α = .70; e.g., "so I wouldn't feel left out") subscales.

Covariates. Biological sex was assessed through self-report during the screening assessment and was coded 0 (*female*) and 1 (*male*). Current education status was assessed at baseline and was coded as 1 (*attending a 4-year college or university*) and 0 (*all other options*). Day of the study was coded from 0 to 13. Weekend refers to the day on which the behavior occurred (i.e., alcohol or marijuana use) and was coded 1 (*Thursday, Friday, Saturday*) and 0 (*all other days*).

Data analysis plan

Multilevel models (MLMs) were estimated to test the extent to which coping, social, enhancement, and conformity motives for alcohol and/or marijuana use were associated with alcohol, marijuana, and SAM use. Cases (i.e., days) were included in the MLMs only if participants reported on their motives for use. Alcohol and/or marijuana use was reported on 3,220 days, but the MLMs for motives on alcohol and/or marijuana use days included 3,158 days. Thus, data were missing for only 1.93% of the days with alcohol and/or marijuana use.

HED and SAM use were each modeled with a logit function, and number of drinks and number of hours high were each modeled using a Poisson distribution. To address Aim 1, three MLMs tested motives as predictors of HED, number of drinks, and number of hours high on days with alcohol and/or marijuana use. To address Aim 2, one MLM examined motives as predictors of SAM use on days young adults used alcohol. To examine Aim 3, one MLM examined motives as predictors of SAM use on days young adults used marijuana. Days were modeled at Level 1 (daily level) and were nested within people at Level 2 (person level). In all MLMs, Level 2 covariates were male sex, current education status, and person-means for coping, social, enhancement, and conformity motives; Level 1 covariates were day in the study and weekend. In all MLMs, the four motive subscales were person-centered at Level 1 and grand-mean centered at Level 2. The intraclass correlations for the drinking motives subscales were as follows: coping motives (.53), social motives (.35), enhancement motives (.43), and conformity motives (.46), all of which indicate low to moderate between-person variation.

In each MLM, we also tested interactions between sex and each of the four Level-1 drinking motives. Results were largely the same across sex (with only 3 of 20 interactions reaching significance: two at $p < .05$ and one at $p < .01$); therefore, only main effects are presented.

Results

Descriptive findings

The majority of participants (95.49%) reported alcohol use on at least one of the 14 days, with a total of 1,917 alcohol days (Table 1). The majority of participants (81.70%) reported marijuana use on at least one of the 14 days, with a total of 2,166 marijuana days. SAM use (n = 599 days) was reported on 31.25% of alcohol days and 27.65% of marijuana days. About 42.61% of the 399 participants did not report SAM use over the 14-day reporting period; 21.30% reported SAM use 1 day, 15.04% reported SAM use 2 days, and the remaining 21.05% reported SAM use 3–11 days.

Motives predicting HED, number of drinks, and number of hours high (Aim 1)

Three MLMs were estimated to predict HED, alcohol use, and marijuana use using days on which participants reported using either alcohol and/or marijuana (Table 2). For the alcohol outcomes, 3,157 days were nested in 399 participants; for the marijuana outcome, 3,148 days were nested in 399 participants. Alcohol use findings at Level 2 showed that a higher person-mean on coping motives was associated with consuming fewer drinks but not with likelihood of HED. In contrast, a higher person-mean on social motives was associated with a higher likelihood of HED and consuming more drinks. Neither enhancement nor conformity motives were significant at Level 2 for HED or number of drinks. Alcohol use findings at Level 1 showed that days with elevated social and enhancement motives were associated with a higher likelihood of HED and consuming more drinks. Days with elevated conformity motives were associated with consuming more drinks that day but not with HED. Coping motives were not significant at Level 1 for HED or number of drinks.

For marijuana use, at Level 2, all four motive subscales were significant. Higher person-means on coping and enhancement motives were associated with more hours high. In contrast, higher person-means on social and conformity motives were associated with fewer hours high. At Level 1, only social and enhancement motives were significant. Days with elevated enhancement motives were associated with more hours high; days with elevated social motives were associated with fewer hours high.

Motives predicting SAM use on alcohol days (Aim 2)

For the MLM predicting SAM use on alcohol days (1,917 days nested in 381 participants), findings at Level 2 showed that all four motives subscales were significantly associated with SAM use (Table 3). Higher person-means for social and conformity motives were associated with a lower likelihood of SAM use on alcohol days; therefore, young adults with higher social and conformity motives, on average across sampled alcohol days, were less likely to report SAM use on a given day. Higher person-means for coping motives and enhancement motives were associated with a greater likelihood of SAM use on alcohol days; therefore, young adults with higher coping and enhancement motives, on average across sampled alcohol days, were more likely to report SAM use on a given day.

At Level 1, on days individuals had elevated coping motives, enhancement motives, and conformity motives, there was a greater likelihood of SAM use on alcohol days (i.e., more likely to use marijuana with alcohol so that effects

Table 1. Descriptive statistics for alcohol days and for marijuana days

Predictor	*N*	*M* (*SD*) or %	Range
Days with alcohol and/or marijuana use			
Level 2 (between person)			
Male sex	399	49.12%	0–1
Attending 4-year college (vs. not)	399	48.87%	0–1
Coping (person mean)	399	0.80 (0.55)	0–2.94
Social (person mean)	399	1.04 (0.80)	0–3.43
Enhancement (person mean)	399	2.01 (0.77)	0–4.00
Conformity (person mean)	399	0.89 (0.63)	0–3.57
Level 1 (within person)			
Day in study	3,158	6.21 (4.05)	0–13
Weekend (vs. not)	3,158	47.12%	0–1
Coping (daily)	3,158	0.83 (0.71)	0–4.00
Social (daily)	3,158	0.94 (1.13)	0–4.00
Enhancement (daily)	3,158	2.05 (1.06)	0–4.00
Conformity (daily)	3,158	0.85 (0.82)	0–4.00
Alcohol days			
Level 2 (between person)			
Male sex	381	47.77%	0–1
Attending 4-year college (vs. not)	381	47.77%	0–1
Coping (person mean)	381	0.81 (0.55)	0–2.94
Social (person mean)	381	1.05 (0.79)	0–3.43
Enhancement (person mean)	381	2.01 (0.76)	0–4.00
Conformity (person mean)	381	0.90 (0.62)	0–3.57
Level 1 (within person)			
Day in study	1,917	6.16 (4.02)	0–13
Weekend (vs. not)	1,917	52.43%	0–1
Coping (daily)	1,917	0.78 (0.70)	0–3.83
Social (daily)	1,917	1.21 (1.19)	0–4.00
Enhancement (daily)	1,917	2.01 (1.09)	0–4.00
Conformity (daily)	1,917	0.91 (0.86)	0–4.00
Marijuana days			
Level 2 (between person)			
Male sex	326	52.14%	0–1
Attending 4-year college (vs. not)	326	46.93%	0–1
Coping (person mean)	326	0.84 (0.55)	0–2.83
Social (person mean)	326	0.93 (0.73)	0–3.43
Enhancement (person mean)	326	2.04 (0.75)	0.20–4.00
Conformity (person mean)	326	0.85 (0.58)	0–3.57
Level 1 (within person)			
Day in study	2,166	6.21 (4.07)	0–13
Weekend (vs. not)	2,166	44.37%	0–1
Coping (daily)	2,166	0.91 (0.71)	0–4.00
Social (daily)	2,166	0.76 (1.04)	0–4.00
Enhancement (daily)	2,166	2.17 (1.01)	0–4.00
Conformity (daily)	2,166	0.80 (0.76)	0–4.00

Notes: Current education status was coded as 1 (*attending a 4-year college or university*) and 0 (*all other options*). Weekend refers to the day on which the behavior occurred (i.e., alcohol or marijuana use) and was coded 1 (*Thursday, Friday, Saturday*) and 0 (*all other days*). Motives were measured on a scale from 0 (*not at all*) to 4 (*extremely*).

TABLE 2. Motives predicting heavy episodic drinking (HED), number of drinks, and number of hours high from marijuana

Predictor	Estimate (*SE*)	*t*	*p*
Outcome: HED			
Level 2 (between person)			
Male sex	-0.38 (0.22)	-1.72	.086
Attending 4-year college (vs. not)	0.17 (0.23)	0.77	.441
Coping (person mean)	-0.45 (0.23)	-1.96	.050
Social (person mean)	0.99 (0.18)	5.58***	<.001
Enhancement (person mean)	0.10 (0.17)	0.61	.544
Conformity (person mean)	-0.06 (0.21)	-0.28	.782
Level 1 (within person)			
Day in study (0 to 13)	0.03 (0.01)	1.87	.062
Weekend (vs. not)	0.78 (0.12)	6.51***	<.001
Coping (person centered)	-0.05 (0.13)	-0.37	.708
Social (person centered)	0.98 (0.08)	12.42***	<.001
Enhancement (person centered)	0.55 (0.09)	5.95***	<.001
Conformity (person centered)	0.13 (0.10)	1.24	.216
Outcome: Number of drinks			
Level 2 (between person)			
Male sex	0.03 (0.08)	0.37	.711
Attending 4-year college (vs. not)	-0.03 (0.08)	-0.40	.692
Coping (person mean)	-0.19 (0.08)	-2.32*	<.05
Social (person mean)	0.44 (0.06)	6.88***	<.001
Enhancement (person mean)	-0.08 (0.06)	-1.26	.209
Conformity (person mean)	0.02 (0.08)	0.26	.792
Level 1 (within person)			
Day in study (0 to 13)	0.01 (0.003)	2.74**	<.01
Weekend (vs. not)	0.29 (0.03)	11.53***	<.001
Coping (person centered)	-0.02 (0.03)	-0.58	.561
Social (person centered)	0.38 (0.02)	24.75***	<.001
Enhancement (person centered)	0.09 (0.02)	4.43***	<.001
Conformity (person centered)	0.04 (0.02)	2.08*	<.05
Outcome: Number of hours high			
Level 2 (between person)			
Male sex	0.32 (0.10)	3.22**	<.01
Attending 4-year college (vs. not)	0.16 (0.10)	1.63	.105
Coping (person mean)	0.61 (0.10)	5.98***	<.001
Social (person mean)	-0.68 (0.08)	-8.44***	<.001
Enhancement (person mean)	0.48 (0.08)	6.36***	<.001
Conformity (person mean)	-0.22 (0.10)	-2.29*	<.05
Level 1 (within person)			
Day in study (0 to 13)	0.003 (0.003)	1.10	.270
Weekend (vs. not)	0.02 (0.02)	0.85	.393
Coping (person centered)	0.05 (0.02)	1.94	.052
Social (person centered)	-0.06 (0.01)	-4.03***	<.001
Enhancement (person centered)	0.22 (0.02)	12.69***	<.001
Conformity (person centered)	0.01 (0.02)	0.63	.527

Notes: Days were included in the model if participants reported either alcohol and/or marijuana use. For the two alcohol outcomes, 3,157 days were nested in 399 participants; for the marijuana outcome, 3,148 days were nested in 399 participants. HED was modeled as a binary outcome. Number of drinks and number of hours high from marijuana were modeled with a Poisson distribution. Current education status was coded as 1 (*attending a 4-year college or university*) and 0 (*all other options*). Weekend refers to the day on which the behavior occurred (i.e., alcohol or marijuana use) and was coded 1 (*Thursday, Friday, Saturday*) and 0 (*all other days*).
*$p < .05$; **$p < .01$; ***$p < .001$.

overlapped compared with using only alcohol). Social motives were not significant at Level 1.

Motives predicting SAM use on marijuana days (Aim 3)

For the MLM predicting SAM use on marijuana days (2,166 days nested in 326 participants), at Level 2 only social motives were significant (Table 3). A higher person-mean for social motives was associated with a greater likelihood of SAM use on marijuana days. At Level 1, on days with elevated social, enhancement, or conformity motives, there was a greater likelihood of SAM use on marijuana days (i.e., more likely to use alcohol with marijuana so that effects overlapped compared with using only marijuana). Coping motives were not significant at Level 1.

TABLE 3. Motives predicting likelihood of simultaneous alcohol and marijuana (SAM) use on alcohol days and on marijuana days

Predictor	Estimate (*SE*)	*t*	*p*
Multilevel model for alcohol days			
Level 2 (between person)			
Male sex	0.06 (0.20)	0.29	.771
Attending 4-year college (vs. not)	0.02 (0.20)	0.08	.939
Coping (person mean)	1.01 (0.21)	4.85***	<.001
Social (person mean)	-0.94 (0.17)	-5.67***	<.001
Enhancement (person mean)	0.81 (0.16)	5.12***	<.001
Conformity (person mean)	-0.48 (0.20)	-2.47*	<.05
Level 1 (within person)			
Day in study (0 to 13)	-0.03 (0.02)	-1.78	.076
Weekend (vs. not)	0.31 (0.13)	2.37*	<.05
Coping (person centered)	0.38 (0.14)	2.73**	<.01
Social (person centered)	0.08 (0.08)	0.96	.338
Enhancement (person centered)	0.65 (0.10)	6.66***	<.001
Conformity (person centered)	0.24 (0.11)	2.17*	<.05
Multilevel model for marijuana days			
Level 2 (between person)			
Male sex	-0.27 (0.20)	-1.36	.176
Attending 4-year college (vs. not)	-0.54 (0.20)	-2.69**	<.01
Coping (person mean)	0.13 (0.20)	0.62	.534
Social (person mean)	0.36 (0.17)	2.12*	<.05
Enhancement (person mean)	0.07 (0.15)	0.47	.638
Conformity (person mean)	-0.27 (0.20)	-1.34	.180
Level 1 (within person)			
Day in study (0 to 13)	0.01 (0.02)	0.80	.422
Weekend (vs. not)	0.62 (0.12)	5.03***	<.001
Coping (person centered)	-0.07 (0.14)	-0.53	.597
Social (person centered)	1.08 (0.09)	11.95***	<.001
Enhancement (person centered)	0.25 (0.10)	2.50*	<.05
Conformity (person centered)	0.31 (0.12)	2.62**	<.01

Notes: The model predicting any SAM use on alcohol days included 1,917 days nested in 381 participants. The model predicting any SAM use on marijuana days included 2,166 days nested in 326 participants. Current education status was coded as 1 (*attending a 4-year college or university*) and 0 (*all other options*). Weekend refers to the day on which the behavior occurred (i.e., alcohol or marijuana use) and was coded 1 (*Thursday, Friday, Saturday*) and 0 (*all other days*).
*$p < .05$; **$p < .01$; ***$p < .001$.

Discussion

Prior research has demonstrated that motivations for drinking or for marijuana use are associated with use cross-sectionally (Bonn-Miller et al., 2007; Carey & Correia, 1997; Lee et al., 2009; Merrill & Read, 2010; Patrick et al., 2011a; Simons et al., 1998), longitudinally (Merrill et al., 2014; Patrick et al., 2011b, 2016; Read et al., 2003), and from day to day (Arbeau et al., 2011; Armeli et al., 2014, 2016; O'Hara et al., 2015). However, empirical work has not examined motives for alcohol and/or marijuana use together, nor has it addressed whether motives for substance use are

associated with *simultaneous* alcohol and marijuana use on a given day. This study was the first to demonstrate that motives for alcohol and/or marijuana measured together were associated with alcohol use, marijuana use, and SAM use. Consistent with previous literature, social and enhancement motives on a given day were associated with drinking behaviors (O'Hara et al., 2014). Having higher social motives on a given day was the strongest predictor of engaging in HED and consuming more drinks, and stronger conformity motives on a given day were associated with having a greater number of drinks (but not with HED). We found that lower social and elevated enhancement (but not coping or conformity) motives were associated with spending a greater number of hours high. This somewhat contradicts previous research (Bonar et al., 2017) in which stronger enhancement, coping, and social motives were associated with marijuana use. Sample differences (community young adult users vs. emergency department patients, in states with different marijuana regulation) and measurement differences (time spent high vs. marijuana use) may explain the discrepancies. Overall, we found that when young adults had higher social and enhancement (and sometimes conformity) motives on a given day, they tended to use more alcohol; when they had higher enhancement motives on a given day, they tended to spend more time high from marijuana.

The more innovative findings compare alcohol days and marijuana days with SAM days. Having higher coping, enhancement, or conformity motives on a given day was associated with a greater likelihood of SAM use compared with just alcohol use. Having higher social, enhancement, or conformity motives on a given day was associated with a greater likelihood of SAM use compared with just marijuana use. These results regarding stronger enhancement motives predicting SAM use compared with both alcohol-only and marijuana-only days are consistent with previous cross-sectional evidence that simultaneous use was associated with a desire to increase intoxication (Patrick et al., 2018), or what young adults call getting "cross-faded" from the simultaneous effects of being drunk and high (Patrick & Lee, 2018). Further, our findings are consistent with evidence from previous research (on motives for one substance at a time) that social motives were strongly associated with alcohol use (i.e., adding alcohol to marijuana use such that there is a greater likelihood of SAM use compared with marijuana only) and that coping motives were strongly associated with marijuana use (i.e., adding marijuana to alcohol use days such that there is a greater likelihood of SAM use compared with alcohol only).

Consistent with previous research on motives for alcohol or marijuana separately, the between-person (Level 2) findings showed that people who had greater social motives on average engaged in more HED and drank more but reported fewer hours high. Young adults who reported greater coping motives, on average, reported having fewer drinks but more hours high. Average enhancement motives were associated with more hours high and average conformity motives were associated with fewer hours high, but neither average enhancement nor average conformity motives were associated with drinking outcomes. Among those who drank during the 2 weeks, having greater average social motives or conformity motives was associated with less SAM use, but greater average coping and enhancement motives were associated with more SAM use. Among those who used marijuana during the 2 weeks, having greater average social motives was associated with more SAM use, but no other average motives were predictive. That is, on marijuana use days, whether alcohol was also used was mostly situational, with greater SAM use on marijuana days on weekends and when social, enhancement, and conformity motives were elevated. This suggests that for those who use marijuana, simultaneous use with alcohol may be nearly entirely based on occasion-level variables such as current motives and contexts. Among past-2-week drinkers, simultaneous use of marijuana was associated with generally higher coping and enhancement motives (and lower social and conformity motives) on average and with occasion-specific increases in coping, enhancement, and conformity motives.

The current findings demonstrate motivational context is associated with alcohol use, marijuana use, and SAM use on a given day, suggesting real-time interventions to reduce SAM use and its negative consequences should be explored. Daily variations in all four types of motives are relevant intervention targets to reduce SAM use, particularly on weekends. App- or text-based interventions that use real-time motive information and tailored messaging to increase motivation to reduce use and harm, teach protective behavioral strategies, and provide alternative skills to achieve coping, social, and/or enhancement goals may be most effective. Brief interventions addressing these elements can be efficacious in reducing alcohol use among young adults (Bock et al., 2016; Cadigan et al., 2019; Riordan et al., 2015; Weitzel et al., 2007; Wright et al., 2018), and results of the current study support extending similar interventions for real-time use in marijuana and SAM prevention.

Limitations of the current study include that data were from a community sample of young adult SAM users in a state where recreational marijuana use was legal for those age 21 and older. Although assessed daily, motives were still retrospective and subject to recall bias (Shrier & Scherer, 2014). On days when participants used both substances and/or used on multiple sessions that day, motives for alcohol and marijuana and particular sessions of use were not differentiated. Furthermore, these results may not generalize to other ages, regions, or lighter or infrequent substance users. The strengths of the study include the intensive measurement of motives for alcohol and/or marijuana use across days, allowing examination of occasions when young adults used one or both substances.

Our results highlight that use and simultaneous use vary based on day-to-day variations in motives. In particular, when young adults are using marijuana, the addition of alcohol to engage in SAM use is largely situational when social, enhancement, and conformity motives are elevated and may be particular malleable to real-time intervention. When young adults are drinking alcohol, the addition of marijuana to engage in SAM use is associated with occasion-specific increases in coping, enhancement, and conformity motives. Understanding these variations can support the future development of interventions to reduce alcohol, marijuana, and SAM use and consequences in real time.

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