HHS Public Access

Author manuscript

*Subst Use Misuse*. Author manuscript; available in PMC 2021 January 01.

Published in final edited form as:

*Subst Use Misuse*. 2020 ; 55(4): 658–665. doi:10.1080/10826084.2019.1696820.

# The Relationship Between Negative Affect and Alcohol and Marijuana Use Outcomes Among Dual Users

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## Abstract

**Background:** Past research with college students has found that substance use motives, particularly coping motives, mediate the relationship between negative affect and alcohol- and marijuana-related outcomes.

**Objectives:** This study aimed to investigate substance use motives of dual users of both substances (past 30-day use; not necessarily simultaneous use) and identify any mediation effects that are either common to both substances or substance-specific.

**Methods:** The majority of dual users ($n$=2,034) identified as being White, non-Hispanic (63.8%), female (69.08%), and reported a mean age of 20.24 ($SD$=3.16) years. To test study aims, path models were conducted such that negative affect (stress, depressive and anxiety symptoms) were independently modeled as predictors of substance use outcomes (i.e., quantity and consequences) via substance use motives.

**Results:** All three negative affect symptoms were indirectly related to both alcohol and marijuana consequences via coping motives, such that higher negative affect was associated with higher coping motives; which in turn were positively associated with consequences. Substance-specific effects were also found: (a) stress was indirectly related to both alcohol and marijuana use

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Conflict of Interest
No conflict declared.

quantity via enhancement motives, (b) depressive/anxiety symptoms were indirectly related to alcohol use quantity via expansion motives, and (c) all three negative affect symptoms were indirectly related to both marijuana use quantity and negative consequences via expansion motives.

**Conclusions:** Findings suggests that dual users of alcohol and marijuana with negative affect symptoms engage in substance use for similar reasons as single substance users with negative affect symptoms. Intervention efforts should examine ways to replace substance-related coping and expansion methods with non-substance-related methods.

### Keywords

college students; negative affect; substance use motives; alcohol; marijuana; dual use

## Introduction

Multiple theories/models (e.g., stress-dampening model, Sher & Levenson, 1982; tension-reduction model, Greeley & Oei, 1999; self-medication hypothesis, Khantzian, 1997; affective-motivational model of drug addiction, Baker, Piper, McCarthy, Majeskie, & Fiore, 2004) posit that individuals engage in substance use because they expect that using that substance provides immediate coping benefits by alleviating their negative affect. In support of these theories, multiple studies among college students have found that substance use motives (for a review of substance use motives, see Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016), particularly coping motives, mediate the associations between negative affect and both alcohol (Blevins, Abrantes, & Stephens, 2016; Bravo & Pearson, 2017; Bravo et al., 2018; Kenney, Jones, & Barnett, 2015; Kenney, Merrill, & Barnett, 2017) and marijuana (Farris, Metrik, Bonn-Miller, Kahler, & Zvolensky, 2016) outcomes. Taken together, existing research has supported coping-motivated substance use for these students when examining alcohol- and marijuana-related problems separately.

The next step is to determine whether students dealing with negative affect who use both substances do so for similar or different reasons. A recent review showed that alcohol and marijuana concurrent use (i.e., use of both substances within a given time period) is associated with higher rates of marijuana and alcohol use disorders and appears to negatively impact treatment effects for both substances (Yurasek, Aston, & Metrik, 2017). Moreover, there is some evidence that motives may function differently for dual users than for single-substance users when dealing with negative affect (Simons, Gaher, Correia, Hansen, & Christopher, 2005; White, Anderson, & Beardslee, 2018). For example, O'Hara, Armeli, and Tennen (2016) found that among college student dual users, those reporting social and enhancement motives tended to use the two substances in a complementary fashion, such that higher consumption of alcohol on a given evening led to higher consumption of marijuana on the same evening. However, for those reporting coping motives, there was a pattern of substitution wherein higher consumption of alcohol on a given evening was associated with a lower likelihood of engaging in subsequent marijuana use on the same evening. Thus, for those motivated by coping, one substance may be sufficient to alleviate negative affect, obviating the need to use the other substance.

Furthermore, dual users endorse differing alcohol and marijuana motives compared to single substance users. Skalisky, Wielgus, Aldrich, and Mezulis (2019) found that dual users reported higher levels of enhancement and coping motives, greater alcohol use frequency, and greater alcohol impairment than did the alcohol-only users. In a study that compared a new measure of motives for simultaneous use of alcohol and marijuana to existing measures of alcohol and marijuana motives, Patrick, Fairlie, and Lee (2018) found that although coping motives for simultaneous use were conceptually similar to coping motives for alcohol use and for marijuana use, there were only moderate correlations between the subscales used to measure alcohol, marijuana, and simultaneous motives. Given that multiple studies have found differential endorsements of alcohol versus marijuana motives and associations with substance use outcomes for dual users, finding common (i.e., consistent effects across both substances) or unique (substance-specific effects) mediation effects could have important implications for interventions targeting college student dual alcohol and marijuana users.

In an extension of previous research, the present study examined whether negative affect (i.e., stress, depressive and anxiety symptoms) relate to alcohol and marijuana outcomes (use quantity and negative consequences) via alcohol and marijuana use motives similarly among a large group of dual college student users (past 30-day use; not necessarily simultaneous use). Given that prior investigations of mood and anxiety-related symptoms in relation to substance use among college students has revealed differential associations depending on the substance(s) used and the frequency, severity, and comorbidity of other mental health symptoms (Sumstine, Cruz, Schroeder, Takeda, & Bavarian, 2017; Shafer, Koenig, & Becker, 2017), we examined three independent models (one for each negative affect symptom). Based on previous findings, we expected that negative affect symptoms would primarily be associated with higher coping motives for both substances; which in turn would be associated with higher negative alcohol and marijuana-related consequences.

## Method

### Participants/Procedures

College students (N=7,307) were recruited from Psychology Department Participant Pools at ten universities across ten U.S. states to participate in an hour-long online survey for research participation credit. To ensure that data collection was standardized at each site, all data were collected using the same software (i.e., Qualtrics). To minimize burden on participants, we utilized a planned missing data design, also known as matrix sampling (Graham, Taylor, Olchowski, & Cumsille, 2006; Schafer, 1997). Specifically, each participant received and completed a battery of core measures that focused on substance use (i.e., alcohol and marijuana) and the DSM-5 Self-rated Level 1 Cross-Cutting Symptom Measure (APA, 2013). After completing the core measures, each participant received a random sample of 10 measures from a larger pool (19 total measures) that assessed mental health (e.g., depression, anxiety, stress, self-esteem, suicide, posttraumatic stress), physical health (i.e. sleep quality, sexual experiences, eating habits), and personality (i.e., impulsivity-like traits, Big Five personality traits, antisocial behavior, and temperament) constructs (for more details, see Bravo, Villarosa-Hurlocker, Perason, & Protective

Strategies Study Team, 2018). This protocol was approved by institutional review boards at each participating university.

For the present study, we limited our analytic sample to students who consumed both alcohol and marijuana in the previous month ($n$=2,034). Among college student dual alcohol and marijuana users, the majority of participants identified as being White, non-Hispanic ($n$=1,297; 63.8%), female ($n$=1,405; 69.08%), and reported a mean age of 20.24 (*Median*=19.00; *SD*=3.16) years. Nearly one-fourth of our dual users exceeded the cutoff for hazardous drinking (23.2%; based on an AUDIT score of 16 or higher; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) and hazardous marijuana use (21.9%; based on a CUDIT-R score of 13 or higher; Adamson et al., 2010).

## Measures

**Negative affect.—**Negative affect was assessed using the 21-item Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995) which assesses past week symptoms of three distinct (i.e., subscales) syndromes: depression (dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, inertia), anxiety (autonomic arousal, skeletal musculature effects, situational anxiety, subjective experience of anxious affect), and stress (difficulty relaxing, nervous arousal, easily upset/agitated, irritable/over-reactive, impatient). Items for each subscale were summed (7 items per subscale; Range: 0-28), and higher scores indicated higher endorsement of each negative affect.

**Substance use motives.—**Drinking motives were assessed using the 28-item Modified Drinking Motives Questionnaire-Revised (M-DMQ-R; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007) which assesses reasons for drinking within four domains: social, conformity, enhancement, and coping (split into coping with anxiety [DTC-anxiety; $M$ = 2.47, $SD$ = 0.96, $\alpha$ = .74] and coping with depression [DTC-depression; $M$ = 1.84, $SD$ = 0.93, $\alpha$ = .94]). Marijuana use motives were assessed using the 25-item Marijuana Motives Questionnaire (MMQ; Simons, Correia, Carey, & Borsari, 1998) which assesses five distinct marijuana motives: enhancement, conformity, expansion, coping, and social motives. Items for each subscale of each measure were averaged (Range: 1-5), and higher scores indicated higher endorsement of each substance use motive.

**Substance use outcomes.—**Using a modified version of the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985), participants indicated how many standard drinks they consumed during a typical week in the past 30 days using a 7-day grid from Monday to Sunday, which we summed to create a measure of alcohol use quantity. Using the Marijuana Use Grid (Pearson & Marijuana Outcomes Study Team, 2019), participants indicated how many grams of marijuana they consumed during a typical week in the past 30 days using a 7-day grid broken down into six 4-hour blocks of time (12a-4a, 4a-8a, etc.) per day, which we summed to create a measure of marijuana use quantity. Negative consequences were assessed using the 24-item Brief-Young Adult Alcohol Consequences Questionnaire (Kahler, Strong, & Read, 2005) for alcohol, and the 21-item Brief Marijuana Consequences Questionnaire (Simons, Dvorak, Merrill, & Read, 2012) for marijuana.

Because of the dichotomous scoring structure, the total score reflects the total number of consequences that the individual has experienced in that period for each measure (alcohol Range: 0-24; marijuana Range: 0-21). Both measures assess social-interpersonal consequences, academic/occupational consequences, physical dependence, blackout use, risk behaviors, impaired control, self-perception, and self-care and have been validated among college student samples from various countries (alcohol: Bravo et al., 2019, Pilatti et al., 2016; marijuana: Bravo, Pearson, Pilatti, Mezquita, & Cross-Cultural Addictions Study Team, 2019).

**Data analysis plan.—**To test study aims, path models were conducted using M*plus* 7.4 (Muthén & Muthén, 1998-2018), such that negative affect (stress, depressive and anxiety symptoms) were independently modeled (i.e., 3 path models) as predictors of substance use outcomes (i.e., alcohol and marijuana use quantity and consequences) via substance use motives. Although all substance use variables were simultaneously entered into the models (all motives were correlated with each other and all substance use outcomes were correlated with each other), the models were not fully saturated such that specific substance use variables only predicted that specific substance use outcome (e.g., alcohol enhancement motives→negative alcohol-related consequences). Further, previous research has shown suppression effects when modeling both DTC-anxiety and DTC-depression in the same model (Bravo & Pearson, 2017); thus a latent alcohol coping motives variable was estimated with DTC-anxiety and DTC-depression as indicators of the latent variable. Gender was entered as a covariate in each of the three models. Missing data were handled using full information maximum likelihood (Muthén & Muthén, 1998-2018). We examined the total, direct, and indirect effects using bias-corrected bootstrapped estimates (Efron & Tibshirani, 1993), which provides a powerful test of mediation (Fritz & MacKinnon, 2007) and is robust to small departures from normality (Erceg-Hurn & Mirosevich, 2008). Statistical significance was determined by 99% bias-corrected bootstrapped confidence intervals not containing zero.

## Results

Bivariate correlations, descriptive statistics, and internal consistency of all study variables are presented in Table 1. The comprehensive mediation models provided an acceptable fit to the data based on most fit indices (Hu & Bentler, 1999): stress symptoms model, CFI=.954, RMSEA=.088 (90% CI [.082, .095], SRMR=.027; depressive symptoms model, CFI=.953, RMSEA=.089 (90% CI [.083, .096], SRMR=.028; anxiety symptoms model, CFI=.954, RMSEA=.089 (90% CI [.082, .095], SRMR=.027. The total, indirect, and direct effects for the mediation models are summarized in Tables 2 (alcohol outcomes) and 3 (marijuana outcomes).

### Shared Mediation Effects Across Both Substances and Negative Affect

Even when controlling for all other predictors, coping motives were significantly positively associated with both alcohol and marijuana consequences, and enhancement motives were significantly positively associated with both alcohol and marijuana use quantities. Across models, all three negative affect symptoms were indirectly related to both alcohol and

marijuana consequences via coping motives, such that higher negative affect was associated with higher coping motives; which in turn were associated with more alcohol and marijuana-related consequences. Although there were several other significant indirect effects, caution must be taken given non-significant associations between several motives and substance use outcomes (see Tables 2 and 3).

### Unique Mediation Effects Across Substances and Negative Affect

Stress/depressive/anxiety symptoms were indirectly related to alcohol use quantity via enhancement motives, such that higher negative affect was associated with higher enhancement motives; which in turn were associated with higher alcohol use quantity. In examining marijuana, only stress was indirectly related to both alcohol and marijuana use quantity via enhancement motives (due to depressive and anxiety symptoms not being significantly associated with enhancement motives).

While only assessed for marijuana, expansion motives were significantly positively associated with both marijuana use quantity and consequences. Further, all three negative affect symptoms were indirectly related to both marijuana use quantity and negative consequences via expansion motives, such that higher negative affect was associated with higher expansion motives; which in turn were associated with more marijuana use quantity and related consequences. Finally, it is important to note that even after controlling for all other predictors, both depressive and anxiety symptoms had significant positive direct effects on marijuana-related consequences.

### Exploratory Test of Differences in Coefficients

To determine whether there were any statistically significant differences across substances for matched paths (e.g., depressive symptoms alcohol conformity motives vs. depressive symptoms marijuana conformity motives), we applied equality constraints on the parameter estimates and tested for decrements in model fit (i.e., a significant test indicates unequal relationships) using Wald's tests (Muthén & Muthén, 1998-2018). Of the direct paths that were tested for equality that made up mediation effects (i.e., we exclude differences on gender as a predictor) in the three models, only four were significantly different ($p<.01$) across substances: 1) conformity substance use problems (both non-significant but in opposite directions: alcohol $\beta=.08$; marijuana $\beta=-.01$), 2) depressive symptoms social motives (both positive but only significant for marijuana: alcohol $\beta=.03$; marijuana $\beta=.16$), 3) anxiety symptoms social motives (both positive but only significant for marijuana: alcohol $\beta=.07$; marijuana $\beta=.19$), and 4) stress symptoms social motives (both positive but only significant for marijuana: alcohol $\beta=.04$; marijuana $\beta=.19$).

## Discussion

Consistent with previous studies on substance use motives for single substance users of alcohol or marijuana (Blevins et al., 2016; Bravo & Pearson, 2017; Farris et al., 2016; Kenney et al., 2015, 2017), the present study found that for college students who use both alcohol and marijuana, substance use motives mediate the relationship between negative affect and substance use outcomes. In particular, coping motives were found to mediate the

association between depressive/anxiety/stress symptoms and alcohol and marijuana consequences, lending further support to the negative reinforcement models that assert that people use substances as a means of mitigating negative affect (e.g., Baker et al., 2004; Greeley & Oei, 1999; Khantzian, 1997; Sher & Levenson, 1982). Although only assessed for marijuana but consistent with prior research suggesting expansion motives are related to marijuana use and consequences (Bonn-Miller, Zvolensky, & Bernstein, 2007; Bravo, Prince, Pearson, & MOST, 2017; Simons, Correia, & Carey, 2000), expansion motives were a unique mediator of each negative affect variable and both marijuana outcomes. It may be that students search for expansion of self-awareness or self-understanding, and perceptual and cognitive experiences using marijuana may compensate for chronic feelings of emptiness, which represent an important aspect of negative affect. Moreover, enhancement motives were found to mediate the associations between stress and both alcohol and marijuana use quantity as well as depressive/anxiety symptoms and alcohol use quantity.

Although there was an overall pattern of consistency across our alcohol and marijuana models, there were also some notable differences between the two models. Specifically, negative affect variables were non-significantly associated with social motives for alcohol, yet they were each significantly associated with social motives for marijuana. Based on these path differences, one may suspect that social motives for marijuana are more problematic than social motives for alcohol; however, we did not find social motives to have significant effects on either alcohol or marijuana outcomes. We are unsure what these different patterns across substances could mean. One plausible explanation, which requires rigorous testing prior to adoption, is that marijuana use is often pragmatically social in that individuals often can only use marijuana with peers (i.e., they may not have access to it otherwise), whereas this is unlikely the case for alcohol. Stated differently, although social motives are not in themselves predictive of alcohol/marijuana use or consequences, negative affect may set the stage for individuals to seek socially-motivated marijuana use more than alcohol use. Nevertheless, additional research is needed to clarify these differences.

## Clinical Implications

In light of the significant direct effect that negative affect was shown to have on coping motives and the direct effect of coping motives on alcohol- and marijuana-related problems, one obvious target of intervention for dual users of alcohol and marijuana who have negative affect symptoms might be developing coping mechanisms other than substance use. Previous research (Bravo, Pearson, & Henson, 2017, Bravo et al., 2018) suggests that ruminative thinking is one mechanism linking depressive symptoms to drinking to cope motives, so addressing an underlying ruminative cognitive style may also be advised. Previous research (Emery, Simons, Clarke, & Gaher, 2014; Kauffman et al., 2018) also suggest that negative urgency (tendency to act rashly in response to negative emotions) is a mechanism linking stress/anxiety to drinking consequences and is also associated with drinking to cope motives (Anthenien, Lembo, & Neighbors, 2017), so addressing impulsive tendencies towards negative emotions may also be advised. For marijuana specifically, it may be worth exploring interventions that provide alternative means of meeting expansion motives such as creative pursuits, meditation, athletics, and outdoor activities. A psychoeducational approach that explores the connections between expansion motives and marijuana use and marijuana-

related outcomes might also prove beneficial in helping college students avoid unintended consequences of their marijuana use.

### Limitations and Future Directions

Several limitations of the current study are worth noting. The cross-sectional/non-experimental design prevents making causal inferences, thus additional research is needed to extend our findings using experimental and longitudinal (e.g. event-level) designs. Furthermore, our assessment windows of our measures differed slightly (i.e., negative affect was assessed for past week while marijuana variables were assessed for past 30-day or "typical week") and future studies should examine these associations during a similar time window assessment. Moreover, measures of careless responding or insufficient effort responding (Ward, Meade, Allred, Pappalardo, & Stoughton, 2017; Ward & Pond, 2015) were not included in the online survey. Further, our convenience sampling method (i.e., use of Psychology Department pools) limits the generalizability of our results. Although we examined the associations between negative affect, substance use motives, and substance use outcomes in a mediational framework, other studies have examined these associations with a moderation framework (e.g., White et al., 2018). Additional research is needed to determine whether mediation or moderation best characterizes the relationships among these constructs. Finally, we were not able to discern whether participants' dual use was simultaneous (i.e., within the same substance use episode) and future research should examine whether motives for simultaneous use (see Patrick, Fairlie, & Lee, 2018 for an overview) differentially mediate the associations between negative affect and substance use outcomes.

### Conclusions

The current study suggests that dual users of alcohol and marijuana with negative affect symptoms engage in substance use for similar reasons as single substance users with negative affect symptoms. For this population, coping motives are a primary mediator between negative affect symptoms and both substance-related outcomes. Intervention efforts should examine ways to replace substance-related coping and expansion methods with non-substance-related methods.

## Acknowledgments

Author Disclosures

Role of Funding Sources

Dr. Bravo was supported by a training grant (T32-AA018108) from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in the United States during the duration of the study. Dr. Pearson is supported by a career development grant (K01-AA023233) from the NIAAA. NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

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**Table 1.**

Bivariate correlations and descriptive statistics among all study variables

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | M | *SD* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Stress Symptoms | .89 | | | | | | | | | | | | | | | | | 4.28 | 4.37 |
| 2. Depressive Symptoms | **.81** | .93 | | | | | | | | | | | | | | | | 3.64 | 4.64 |
| 3. Anxiety Symptoms | **.82** | **.76** | .86 | | | | | | | | | | | | | | | 3.54 | 3.99 |
| 4. ALC: Social Motives | .04 | .03 | .07 | .85 | | | | | | | | | | | | | | 3.63 | 0.89 |
| 5. ALC: Coping Motives (latent) | **.42** | **.45** | **.44** | **.39** | --- | | | | | | | | | | | | | --- | ---- |
| 6. ALC: Enhancement Motives | **.10** | **.10** | **.11** | **.63** | **.54** | .80 | | | | | | | | | | | | 3.16 | 0.93 |
| 7. ALC: Conformity Motives | **.29** | **.29** | **.31** | **.16** | **.56** | **.18** | .89 | | | | | | | | | | | 1.42 | 0.70 |
| 8. MJ: Social Motives | **.19** | **.16** | **.19** | **.31** | **.33** | **.26** | **.26** | .88 | | | | | | | | | | 2.36 | 1.10 |
| 9. MJ: Coping Motives | **.39** | **.39** | **.38** | **.16** | **.62** | **.21** | **.31** | **.53** | .89 | | | | | | | | | 2.07 | 1.08 |
| 10. MJ: Enhancement Motives | **.08** | .07 | **.09** | **.26** | **.14** | **.37** | −.01 | **.49** | **.39** | .87 | | | | | | | | 3.45 | 1.10 |
| 11. MJ: Conformity Motives | **.26** | **.26** | **.28** | **.12** | **.41** | **.13** | **.63** | **.38** | **.39** | .02 | .89 | | | | | | | 1.37 | 0.72 |
| 12. MJ: Expansion Motives | **.21** | **.18** | **.24** | **.18** | **.34** | **.20** | **.20** | **.44** | **.52** | **.45** | **.28** | .92 | | | | | | 2.38 | 1.21 |
| 13. ALC: Use Quantity (drinks) | .01 | .04 | .05 | **.19** | **.18** | **.24** | **.06** | .04 | .01 | **.08** | **.07** | .06 | --- | | | | | 8.39 | 8.02 |
| 14. MJ: Use Quantity (grams) | .07 | .07 | .09 | −.02 | .07 | .04 | **.08** | **.18** | **.18** | **.17** | **.09** | **.20** | **.16** | --- | | | | 7.29 | 14.13 |
| 15. ALC: Consequences | **.18** | **.17** | **.19** | **.22** | **.37** | **.26** | **.25** | **.10** | **.17** | .03 | **.25** | **.10** | **.44** | **.12** | .90 | | | 6.98 | 5.50 |
| 16. MJ: Consequences | **.21** | **.22** | **.22** | **.09** | **.14** | **.08** | **.11** | **.19** | **.29** | **.19** | **.15** | **.26** | **.11** | **.26** | **.29** | .89 | | 3.43 | 4.11 |
| 17. Gender | .02 | −.05 | .01 | −.02 | .01 | −.01 | −.05 | −.08 | .02 | **−.07** | −.05 | −.08 | **−.22** | **−.15** | −.00 | **−.14** | --- | --- | ---- |

*Note*. Gender was coded 0 = male, 1 = female. Significant correlations are in bold typeface for emphasis and were determined by a 99% (i.e., $p < .01$) bias-corrected bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. ALC = Alcohol; MJ = Marijuana. For alcohol coping motives, a latent variable was created with drinking to cope for depression and anxiety as indicators of the latent variable. Cronbach's alphas are underlined and shown on the diagonals.

**Table 2.**

Summary of total, indirect, and direct effects of negative affect and alcohol use motives on alcohol outcomes

| **Outcome Variables:** | ***Alcohol Use Quantity*** | | ***Alcohol-related Consequences*** | |
|---|---|---|---|---|
| Predictor Variable: *Depressive Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.03 | −0.05, 0.11 | **0.16** | **0.08, 0.25** |
| Total indirect[a] | **0.05** | **0.01, 0.10** | **0.15** | **0.10, 0.21** |
| Social Motives | 0.002 | −0.002, 0.01 | 0.002 | −0.003, 0.01 |
| Coping Motives | 0.04 | −0.01, 0.09 | **0.12** | **0.06, 0.18** |
| Enhancement Motives | **0.02** | **0.002, 0.04** | **0.01** | **0.000, 0.02** |
| Conformity Motives | −0.01 | −0.04, 0.02 | 0.02 | −0.001, 0.05 |
| Direct | −0.02 | −0.11, 0.07 | 0.02 | −0.09, 0.12 |
| Predictor Variable: *Anxiety Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.04 | −0.03, 0.12 | **0.18** | **0.09, 0.28** |
| Total indirect[a] | **0.05** | **0.004, 0.09** | **0.15** | **0.10, 0.21** |
| Social Motives | 0.004 | −0.001, 0.02 | **0.004** | **0.000, 0.01** |
| Coping Motives | 0.03 | −0.02, 0.09 | **0.11** | **0.06, 0.17** |
| Enhancement Motives | **0.02** | **0.004, 0.04** | **0.01** | **0.000, 0.02** |
| Conformity Motives | −0.01 | −0.04, 0.02 | 0.02 | −0.001, 0.05 |
| Direct | −0.002 | −0.09, 0.09 | 0.04 | −0.07, 0.15 |
| Predictor Variable: *Stress Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.01 | −0.07, 0.08 | **0.17** | **0.08, 0.25** |
| Total indirect[a] | **0.05** | **0.01, 0.10** | **0.14** | **0.09, 0.19** |
| Social Motives | 0.002 | −0.002, 0.01 | 0.003 | −0.002, 0.01 |
| Coping Motives | 0.04 | −0.01, 0.09 | **0.11** | **0.06, 0.17** |
| Enhancement Motives | **0.02** | **0.002, 0.03** | **0.01** | **0.000, 0.02** |
| Conformity Motives | −0.01 | −0.03, 0.02 | 0.02 | −0.001, 0.05 |
| Direct | −0.04 | −0.13, 0.04 | 0.03 | −0.07, 0.13 |
| Predictor Variable: *Social Motives* | β | 99% CI | β | 99% CI |

| Outcome Variables: | *Alcohol Use Quantity* | | *Alcohol-related Consequences* | |
|---|---|---|---|---|
| Direct | 0.06 | −0.02, 0.13 | 0.06 | −0.003, 0.12 |
| Predictor Variable: *Coping Motives* | β | 99% CI | β | 99% CI |
| Direct | 0.09 | −0.03, 0.20 | **0.26** | **0.14, 0.37** |
| Predictor Variable: *Enhancement Motives* | β | 99% CI | β | 99% CI |
| Direct | **0.17** | **0.08, 0.25** | 0.07 | −0.004, 0.14 |
| Predictor Variable: *Conformity Motives* | β | 99% CI | β | 99% CI |
| Direct | −0.03 | −0.11, 0.05 | 0.08 | −0.01, 0.16 |

*Note.* Significant associations are in bold typeface for emphasis and were determined by a 99% bias-corrected unstandardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero.

[a]Reflects the combined indirect associations. Effects of gender (i.e., covariate) are not reported for parsimony but are available upon request. Depressive symptoms were significantly positively associated with coping motives (β = .44), enhancement motives (β = .10), and conformity motives (β = .29); but not significantly associated with social motives (β = .03). Anxiety symptoms were significantly positively associated with coping motives (β = .44), enhancement motives (β = .11), and conformity motives (β = .31); but not significantly associated with social motives (β = .07). Stress symptoms were significantly positively associated with coping motives (β = .42), enhancement motives (β = .10), and conformity motives (β = .29); but not significantly associated with social motives (β = .04).

**Table 3.**

Summary of total, indirect, and direct effects of negative affect and marijuana use motives on alcohol outcomes

| **Outcome Variables:** | ***Marijuana Use Quantity*** | | ***Marijuana-related Consequences*** | |
|---|---|---|---|---|
| Predictor Variable: *Depressive Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.06 | −0.03, 0.16 | **0.20** | **0.11, 0.28** |
| Total indirect[a] | **0.06** | **0.03, 0.11** | **0.09** | **0.06, 0.13** |
| Social Motives | **0.01** | **0.000, 0.03** | 0.001 | −0.001, 0.01 |
| Coping Motives | **0.03** | **0.000, 0.07** | **0.07** | **0.04, 0.11** |
| Enhancement Motives | **0.004** | **0.000, 0.01** | **0.004** | **0.000, 0.01** |
| Conformity Motives | −0.001 | −0.03, 0.03 | −0.004 | −0.03, 0.02 |
| Expansion Motives | **0.02** | **0.004, 0.03** | **0.02** | **0.01, 0.04** |
| Direct | −0.002 | −0.10, 0.10 | **0.10** | **0.004, 0.20** |
| Predictor Variable: *Anxiety Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.09 | −0.01, 0.19 | **0.20** | **0.12, 0.28** |
| Total indirect[a] | **0.07** | **0.03, 0.11** | **0.10** | **0.06, 0.14** |
| Social Motives | **0.01** | **0.000, 0.03** | 0.00 | −0.01, 0.01 |
| Coping Motives | 0.03 | −0.002, 0.06 | **0.07** | **0.04, 0.11** |
| Enhancement Motives | **0.01** | **0.000, 0.02** | **0.01** | **0.00, 0.02** |
| Conformity Motives | −0.002 | −0.03, 0.03 | −0.004 | −0.03, 0.02 |
| Expansion Motives | **0.02** | **0.01, 0.04** | **0.03** | **0.01, 0.05** |
| Direct | −0.02 | −0.09, 0.12 | **0.10** | **0.004, 0.20** |
| Predictor Variable: *Stress Symptoms* | β | 99% CI | β | 99% CI |
| Total | 0.07 | −0.02, 0.16 | **0.19** | **0.11, 0.27** |
| Total indirect[a] | **0.07** | **0.03, 0.11** | **0.10** | **0.07, 0.14** |
| Social Motives | **0.01** | **0.000, 0.03** | 0.000 | −0.02, 0.01 |
| Coping Motives | **0.03** | **0.000, 0.07** | **0.07** | **0.05, 0.11** |
| Enhancement Motives | **0.01** | **0.000, 0.02** | **0.01** | **0.000, 0.02** |
| Conformity Motives | −0.002 | −0.03, 0.03 | −0.003 | −0.003, 0.02 |

| Outcome Variables: | *Marijuana Use Quantity* | | *Marijuana-related Consequences* | |
|---|---|---|---|---|
| Expansion Motives | **0.02** | **0.01, 0.04** | **0.02** | **0.01, 0.04** |
| Direct | 0.001 | −0.11, 0.10 | 0.09 | −0.01, 0.18 |
| Predictor Variable: *Social Motives* | β | 99% CI | β | 99% CI |
| Direct | 0.06 | −0.01, 0.13 | 0.002 | −0.07, 0.07 |
| Predictor Variable: *Coping Motives* | β | 99% CI | β | 99% CI |
| Direct | 0.08 | −0.003, 0.17 | **0.19** | **0.12, 0.26** |
| Predictor Variable: *Enhancement Motives* | β | 99% CI | β | 99% CI |
| Direct | **0.07** | **0.01, 0.12** | 0.06 | −0.01, 0.12 |
| Predictor Variable: *Conformity Motives* | β | 99% CI | β | 99% CI |
| Direct | −0.01 | −0.09, 0.10 | −0.01 | −0.09, 0.07 |
| Predictor Variable: *Expansion Motives* | β | 99% CI | β | 99% CI |
| Direct | **0.09** | **0.02, 0.16** | **0.12** | **0.06, 0.18** |

*Note*. Significant associations are in bold typeface for emphasis and were determined by a 99% bias-corrected unstandardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero.

[a]Reflects the combined indirect associations. Effects of gender (i.e., covariate) are not reported for parsimony but are available upon request. Depressive symptoms were significantly positively associated with coping motives (β = .40), expansion motives (β = .18), social motives (β = .16), and conformity motives (β = .26); but not significantly associated with enhancement motives (β = .07). Anxiety symptoms were significantly positively associated with coping motives (β = .37), expansion motives (β = .24), social motives (β = .19), and conformity motives (β = .28); but not significantly associated with enhancement motives (β = .09). Stress symptoms were significantly positively associated with all marijuana use motives: coping motives (β = .39), enhancement motives (β = .08), conformity motives (β = .26), social motives (β = .19), and expansion motives (β = .21).