

## BRIEF REPORT

## Within- and Between-Person Associations From Mood to Alcohol Consequences: The Mediating Role of Enhancement and Coping Drinking Motives

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Between-subjects literature has established that trait-like negative mood predicts coping motives, which predict alcohol-related problems and that trait-like positive mood predicts mood enhancement motives, which then predict alcohol consumption. However, there is considerable within-person variation in drinking motives, and the relationship between mood, motives, and alcohol outcomes must be more closely examined at a daily level. The current study used ecological momentary assessment (EMA) to measure mood, motives, alcohol use, and alcohol consequences in 101 college drinkers over a 15-day period. At the between-subjects level, positive mood predicted enhancement motives, which in turn predicted alcohol consumption and consequences. Negative mood predicted coping motives, which were associated with only alcohol-related consequences. At the within-subjects level, daily anxious and depressed mood were associated with endorsing coping motives, but coping motives were not associated with alcohol consumption or problems. Positive mood was associated with enhancement motives, which was associated with both daily alcohol consumption and problems. These results corroborate previous findings that enhancement motives are most predictive of outcomes in the college population and highlight the importance of considering within-subject variance in drinking motives. The relationships between mood, motives, and alcohol outcomes differ when examined as between-subjects versus within-subject constructs.

**General Scientific Summary**


Drinking motives predict outcomes differentially when measured as stable traits versus variable states. This study suggests that, at the daily level, intending to drink to enhance one's mood is associated with drinking more and experiencing more problems. In contrast, intending to drink to cope did not predict alcohol outcomes.

**Keywords:** alcohol motives, affect regulation, ecological momentary assessment, between subjects, within subject

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Drinking motives have been thought to represent distinct patterns of drinking with unique antecedents and consequences (Cooper, 1994; Cooper, Russell, Skinner, & Windle, 1992) and have been found to be important predictors of drinking outcomes across

both nonclinical (Kuntsche, Knibbe, Gmel, & Engels, 2005; Merrill, Wardell, & Read, 2014) and clinical samples (Cooper, Hildebrandt, & Gerlach, 2014; Doyle, Donovan, & Simpson, 2011; Mezquita et al., 2011; Tragesser, Trull, Sher, & Park, 2008). The motivational model of alcohol use posits that drinking motives occur along two dimensions: internal or external source of motivation and positive or negative reinforcement (Cox & Klinger, 1988). Positive reinforcement motives include internal motivation to enhance positive mood (mood enhancement) or to gain peer acceptance (Cooper, Frone, Russell, & Mudar, 1995; Cox et al., 1988). Negative reinforcement motives include internal motivation to reduce negative mood (coping motives) as well as external motivation to reduce social pressures (Cooper, 1994).

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## Emotion and Drinking Motives

Coping and mood enhancement are internal motives used to regulate the drinker's affective state (Cooper et al., 1995). Experimental evidence shows that individuals are more likely to desire to drink or choose alcohol when induced to experience positive or negative mood (e.g., Grant & Stewart, 2007; Hull & Young, 1983). These studies support the notion that individuals sometimes drink in response to unpleasant or pleasant affect, but experimental evidence cannot reveal whether individuals' motives remain stable over time or whether naturally occurring affect prompts the same response throughout an individual's daily life.

Ecological momentary assessments (EMA) and daily diaries have been used to examine the relationships between drinking motives and real-time mood, alcohol use, and consequences (e.g., Gorka, Hedeker, Piasecki, & Mermelstein, 2017; Piasecki et al., 2014). However, most EMA studies have also measured drinking motives as stable traits, and very few have examined daily fluctuations in drinking motives. Because of this paucity of research, practitioners are often unable to accurately apply current research on drinking motives to daily life experiences with mood and drinking.

### Within- and Between-Subjects Research

In between-subjects literature, it is well established that participants who report higher trait-like negative mood also report higher coping motives, which are associated with alcohol consumption and problems (Kuntsche et al., 2005; Labhart, Kuntsche, Wicki, & Gmel, 2017). In addition, coping motives are often the only category of motive that is directly predictive of alcohol problems, even after controlling for consumption (Cooper, 1994; Kuntsche et al., 2005; Merrill et al., 2014). People higher in trait-like positive mood also report higher enhancement motives, which are then associated with alcohol consumption (Anderson, Briggs, & White, 2013; Read, Wood, Kahler, Maddock, & Palfai, 2003). Unlike coping motives, trait-like enhancement motives are typically associated with alcohol problems via consumption (Merrill et al., 2014; Read et al., 2003). The same relationships have been found between mood and drinking motives in samples with clinical drinking pathology; however, these studies also draw conclusions based on between-subjects associations (Doyle et al., 2011; Mezquita et al., 2011). To extract a clinically meaningful lesson from these between-person findings, one must infer that these between-person patterns occur temporally within-person (e.g., that negative mood throughout a person's daily life predicts coping motives, which then predicts more alcohol problems). However, the nature of within-person relationships between mood, motives, and drinking is an underinvestigated empirical question that requires intensive, momentary designs to address.

Studies examining motives at the state level have estimated that drinking motives are comprised of approximately half within-person variance and approximately half between-person variance (Dvorak, Pearson, & Day, 2014; O'Hara, Armeli, & Tennen, 2015), although these estimates may range in stability based on the number of observations in each day. Thus, it is unlikely that individuals maintain a consistent drinking motive across time but instead experience different motivations for drinking at different times and at different magnitudes across time. In one daily diary study, the difference between within-person and between-person

associations was greater for internal motives (coping and enhancement) than external motives (O'Hara et al., 2015). These researchers also found within-subject support for the previously observed between-subjects finding that higher enhancement and coping motives are associated with more drinking (O'Hara et al., 2015). Another study that measured coping motives as a state variable found that participants reported higher desire to cope by drinking on days when negative affect was high and positive affect was low, consistent with between-subjects literature (Ehrenberg, Armeli, Howland, & Tennen, 2016).

The above studies are the only studies of which we are aware that have examined drinking motives as state-like variables. However, they did not include an examination of drinking problems, the primary clinical outcome that coping motives predict (Cooper, 1994). Dvorak et al. (2014) published the only study to date that has included drinking quantity and problems as outcomes of state-like drinking motives. In that study, mood throughout the day was a poor predictor of alcohol consumed that night, enhancement motives predicted drinking problems rather than consumption, and coping motives predicted alcohol consumption but not problems (the reverse of between-subjects literature). These differences raise important questions about the utility of the construct of drinking motives to predict daily clinical outcomes and warrant further investigations to determine the nature of the within-subjects relationship between mood, motives, and alcohol outcomes.

### Study Overview

The goal of the present study is to directly compare the differences in associations between mood, drinking motives, and alcohol use and use-related consequences at two levels: within subject (daily) and between subjects (trait-like). Based on previous research, at the between-subjects level, it was expected that positive mood would predict enhancement motives, which would, in turn, predict alcohol consumption. In addition, it was expected that trait-like negative mood would predict coping motives, which would predict alcohol-related consequences. At the within-subject level, consistent with Dvorak et al. (2014), it was hypothesized that daily positive mood would predict daily enhancement motives, which would, in turn, predict alcohol-related consequences later that day. Negative mood was expected to predict daily coping motives, which would predict alcohol consumption later that day.

## Method

### Participants

Participants were college student drinkers ( $n = 101$ ; 65.35% female) from a moderate-sized Midwest university who ranged in age from 18 to 29 ( $M = 20.93$ ,  $SD = 2.89$ ). The sample was 89% White, 3% Black/African American, 2% Asian, and 8% other or did not want to respond. All participants were treated in accordance with American Psychological Association ethical guidelines for research and the institutional review board approved study procedures prior to recruitment.

### Procedure

Participants ( $n = 977$ ) completed an online screening to assess current drinking habits (i.e., use and problems), mental health

issues, and emotion regulation. Those who endorsed any alcohol consumption over the last 2 weeks and did not meet diagnostic criteria for any psychiatric condition were eligible to participate in the EMA portion of the study ( $n = 561$ ). Of eligible participants, 145 individuals were randomly selected and offered the opportunity to participate in the EMA portion of the study, and 115 enrolled.

During the EMA portion of the study, participants carried a personal data device (a Samsung tablet) for up to 15 days. During this time, participants responded to five different types of assessments: (a) random assessments occurring up to eight times per day that asked about current mood and alcohol use; (b) self-initiated drinking assessments that marked the time a person began drinking; (c) evening assessments in which individuals reported on daily drinking motivation; (d) morning assessments that asked various questions about the previous night, including whether the participant consumed alcohol (used to capture alcohol use and consequences not reported the previous evening), and (e) self-initiated mood assessments that mirrored the in situ random assessment in the event of a tablet malfunction or missed assessment. A schematic of the temporal ordering of the assessment protocol throughout each day is depicted in Figure 1. The personal data device could be set to Do Not Disturb during times participants could not respond to surveys (e.g., class, bedtime, etc.). Participants checked in at the laboratory after the first week and were offered the opportunity to continue or discontinue participation. Participants were compensated at the end of each week at a rate of \$0.25/random assessment and \$1/morning assessment.

## Measures

In situ mood was measured during random mood assessments when participants were asked: "How [e.g., happy] are you feeling right now?" Items were adapted from subscales of the Positive and Negative Affect Schedule, expanded form (Watson & Clark, 1999) and Larsen and Diener's (1987) mood circumplex. These items were used to assess indices of positive mood, anxious mood, and depressed mood. Each mood state was comprised of three different emotion items: anxious mood (anxious, nervous, worried:  $\alpha = .83$ ), depressed mood (sad, blue, downhearted:  $\alpha = .91$ ), and positive mood (happy, joyful, excited:  $\alpha = .88$ ). Each item was rated on a 5-point scale from 0 (*not at all*) to 4 (*extremely*). This approach to measuring mood has been effectively used in previous EMA research with college student drinkers to assess distinct mood domains (e.g., Dvorak et al., 2014; Dvorak, Pearson, Sargent, Stevenson, & Mfon, 2016; Simons, Dvorak, Batien, & Wray, 2010).

Drinking motives were assessed each day during the evening assessment (between 4:00 and 6:00 PM), regardless of whether or not the person intended to drink.<sup>1</sup> Internal drinking motives for mood enhancement, anxiety coping, and depression coping motives were adapted from Grant, Stewart, and Mohr (2009). Participants were prompted with the following: "Regardless of whether or not I plan to drink tonight, if I do drink tonight, it will be. . . ." After this, each person completed a sentence fragment associated with the specific motive (e.g., ". . . to reduce my anxiety"). These statements were rated on a 5-point Likert-type scale (0 = *not at all* to 4 = *extremely*). Five items that assessed mood enhancement drinking motivations were used for the enhancement motives

variable ( $\alpha = .81$ ). Anxiety coping motives were comprised of six items ( $\alpha = .89$ ) and depression coping motives were comprised of three items ( $\alpha = .81$ ). Anxiety and depression coping motives were combined to form the coping motives variable ( $\alpha = .78$ ). All motive questions are listed in the Appendix of the online supplemental materials.

Alcohol consumption was assessed using two different approaches. First, individuals could report drinks they had consumed since the previous assessment during in situ assessments. These were summed to give a total number of drinks consumed that night. For the morning assessment, if individuals reported consuming alcohol during the previous day but had not reported any drinks consumed on the previous day, we used the number of drinks reported in the morning assessment. Previous EMA research has used these and similar approaches to assess alcohol consumption (Dvorak et al., 2014, 2016; Simons et al., 2010).

Alcohol-related consequences were assessed using the Young Adult Alcohol Consequences Questionnaire, adapted to be used in a daily format similar to previous daily process studies (e.g., Pearson, D'Lima, & Kelley, 2013). Participants were asked: "Did any of the following happen to you yesterday as a result of your drinking?" They responded to 48 different consequences using a dichotomous (yes/no) scale during the morning assessments. Alcohol problems showed good internal consistency ( $\alpha = .87$ ).

## Data Preparation and Analysis Overview

Of the initial sample of 115 participants, 14 provided no data during in situ assessments for drinking, mood, or motives and were removed from the analysis, resulting in an analysis sample of 101. Excluded participants did not differ from the analysis sample in age, gender, race, or Alcohol Use Disorders Identification Test scores (see online supplemental materials for further details). In addition, on 76 days (0.75 days/person), participants reported drinking before the motives assessment scheduled between 4:00

<sup>1</sup> Motives were measured ahead of drinking initiation, a limitation and a strength of our methodological approach. We aimed to measure motives prior to drinking initiation so that motives were not reported retrospectively (i.e., after drinking initiation) and to increase our chances of receiving consistent reports (as opposed to participant-initiated reports). It is unknown how accurately participants were able to forecast their motivation to drink that evening, particularly given that sometimes participants would not know whether or not they were drinking later. Our model does show a strong relationship between positive mood and enhancement motives and between negative mood and coping motives, but the relationships between motives and drinking outcomes are stronger for enhancement motives than for coping motives. It is possible that asking participants to report motives a couple of hours before they drink interfered with accurately capturing coping motives, an important limitation noted in our discussion section. Furthermore, because motives were measured prior to drinking, it is important to differentiate drinking motives from alcohol expectancies. Alcohol expectancies and drinking motives are related constructs; distinguishing between the two depends on whether one is assessing general understanding of the potential effects of alcohol or reasons for drinking at a particular time. We measured the degree of participants' reasons for drinking if they chose to drink within the next few hours. If they did not have a particular motivation, they could select 0 (*not at all*) for any motive. Whether or not the participant consumed alcohol, the content of the questions was intended to measure their motivations for doing so. To measure expectancies, we would have asked for participants' understanding of potential alcohol effects in the absence of specifying reasons for drinking in the near future.

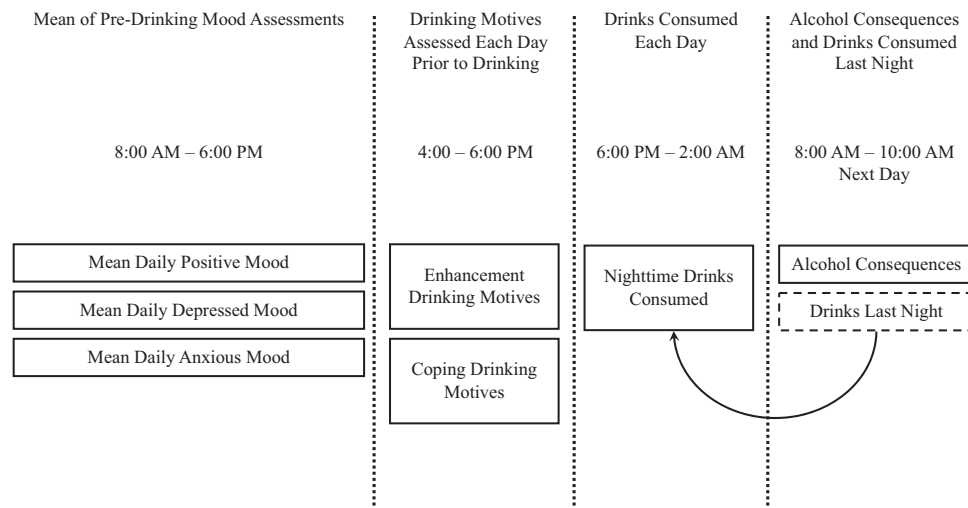


Figure 1. Temporal ordering flowchart of assessment protocol.

and 6:00 PM. We examined the model with and without these days included. There were no substantial differences between these two analyses, so we retained these days for the final analysis (this was true for both the main analyses presented here as well as the analyses in the [online supplemental materials](#)).

The alcohol use and alcohol-related consequences variables had considerable skew because of the presence of drinking and non-drinking days in the data. To address the skew, we used a Bayesian approach (Gelman, Carlin, Stern, & Rubin, 2004; Muthén, 2010). This allows for computation of Bayesian Credibility Intervals (BCIs) that do not assume a normal distribution of parameters and can be calculated from heavily skewed distributions (Muthén & Asparouhov, 2012). We specified random variance components for the model intercepts using an inverse gamma distribution and used noninformative priors for all other parameters (Gelman et al., 2004).

The primary analysis was conducted in Mplus 8.2 (Muthén & Muthén, 2017) using all days. In the model, depicted in Figure 2, mood was the mean of daily mood assessments occurring before drinking initiation. On nondrinking days, mood was the mean of mood assessments prior to each person's average drinking initiation time on drinking days. Coping and enhancement motives were included in all models and correlated at each level to control for shared variance. Pathways between negative mood and enhancement motives, and between positive mood and coping motives, were originally included in the model but were nonsignificant and dropped for parsimony. Primary conclusions drawn from these analyses were unchanged after dropping these pathways. Drinks were the number of drinks consumed that day collected from (a) the sum of in situ assessments or (b) the total number of drinks consumed last night (from the morning assessments) if there were no in situ drinking assessments. Alcohol consequences were reported the following morning.

In addition to the primary analyses, we specified supplemental negative binomial count and hurdle models. Detailed results for these analyses and rationale for model selection are available in the [online supplemental materials](#). Where supplemental and primary

analyses differ, we have highlighted discrepancies in the discussion section.

## Results

### Compliance and Descriptive Statistics

Descriptive statistics are listed in Table 1. Bivariate correlations of between-subjects data are in Table 2. Between-subjects moods are the mean of an individual's predrinking affect ratings over the course of the EMA portion of the study. Of the final analysis sample ( $N = 101$ ; for details about excluded participants, please see [online supplemental materials](#)) participants endorsed drinking on 436 days (34.14% of all days) and completed an average of 12.94 days of monitoring ( $SD = 2.89$ ; range = 7–15 days). Participants completed 4,664 random mood assessments and initiated another 1,567 for missed assessments or device errors for a total of 6,231 completed assessments (adjusted compliance 80.51%). Compliance for morning assessments was 84.30%.

### Primary Analysis

The primary analysis utilized a multilevel Bayesian structural equation model. Standardized coefficients are presented for direct effects to facilitate interpretation of effect sizes. At level 1, mood, motives, and alcohol use were person-mean centered. At level 2, mood, motives, and alcohol use were grand-mean centered. At level 1, day of the week (six dummy-coded variables) was added to all model variables to control for serial autocorrelation in mood, motives, alcohol use, and alcohol problems across the week. At level 2, sex and age were added as model covariates. The overall model showed a good fit to the data. The 95% confidence intervals (CI) for the difference between the observed and replicated  $\chi^2$  values indicated good fit (95% confidence interval =  $-34.118, 42.185$ ), as did the posterior predictive  $p$  value ( $p = .471$ ). In the present data set, the majority of the variance in alcohol use and consequences was at the within-subject level. For all other vari-

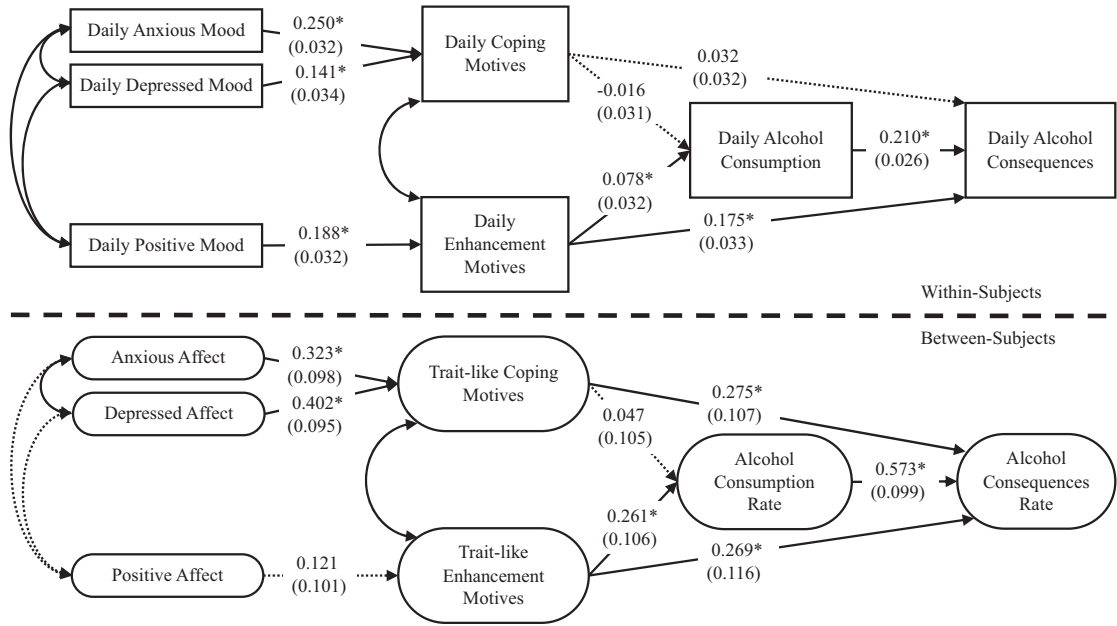


Figure 2. Final multilevel structural model of within- and between-person associations. Coefficients are standardized. Standard deviation of the posterior distribution is shown in parentheses. Dashed lines are not statistically significant. \* 95% Bayesian credibility interval does not include zero (statistically significant pathway).

ables, including drinking motives, the proportions of variance within and between subjects were approximately equal (see Table 1). The final model is depicted in Table 3 and Figure 2.

**Between subjects.** At the between-subjects level, positive affect did not predict trait-like enhancement motives ( $\beta = 0.121$ ; 95% BCI [-0.078, 0.314]) and thus had no indirect association with use or problems at the between-subjects level. However, there were direct ( $\beta = 0.269$ ; 95% BCI [0.041, 0.492]) and indirect (via use; indirect effect [IND] = 0.134; 95% BCI [0.022, 0.276]) associations between trait-like en-

hancement motives and alcohol-related consequences. Both anxious affect ( $\beta = 0.323$ ; 95% BCI [0.123, 0.507]) and depressed affect ( $\beta = 0.402$ ; 95% BCI [0.209, 0.581]) were associated with trait-like coping motives. Trait-like coping motives were not associated with alcohol consumption ( $\beta = 0.047$ ; 95% BCI [-0.160, 0.249]) but were associated with alcohol-related consequences ( $\beta = 0.275$ ; 95% BCI [0.062, 0.482]). Despite nonsignificant associations with alcohol consumption, both anxious affect (IND = 0.110; 95% BCI [0.018, 0.259]) and depressed affect (IND = 0.214; 95% BCI [0.043, 0.469]) had

Table 1  
Descriptive Statistics

Variables	M	SD	Skew	Range	ICC
1. Age	20.93	2.89	1.08	18–29	n/a
2. Gender	.65	.48	-.65	0–1	n/a
3. Daily drinks consumed	1.35	3.35	4.84	1–32	.131
4. Daily alcohol problems	.55	1.94	4.61	0–15	.083
3. Daily drinks consumed <sup>a</sup>	4.61	4.21	4.84	1–32	.295
4. Daily alcohol problems <sup>a</sup>	1.62	3.05	2.40	0–15	.257
5. Daily anxious mood	.61	.64	1.55	0–4	.543
6. Daily depressed mood	.29	.52	3.09	0–4	.400
7. Daily positive mood	1.46	.78	.28	0–4	.603
8. Daily coping motives	.33	.54	2.48	0–3.67	.582
9. Daily coping motives <sup>a</sup>	.35	.55	2.50	0–3.67	.550
9. Daily enhancement motives	1.02	.93	.78	0–4	.542
9. Daily enhancement motives <sup>a</sup>	1.10	.93	.71	0–4	.561
10. Days in study	12.94	2.89	-1.18	7–15	n/a

ICC = intraclass correlation coefficient (proportion of variance between-subjects). A lower ICC (nearing 0) indicates a greater proportion of variance is within subjects, and a higher ICC (nearing 1) indicates that a greater proportion of variance is between subjects.

<sup>a</sup> Including only drinking days.

Table 2  
Bivariate Correlations of Between-Subjects ( $N = 101$ ) Data

Variables	1	2	3	4	5	6	7	8
1. Age	1.00							
2. Gender	.13	1.00						
3. Drinks consumed	-.06	-.08	1.00					
4. Alcohol problems	-.06	.04	.59*	1.00				
5. Anxious affect	.10	.19	.08	.21	1.00			
6. Depressed affect	-.02	.10	-.01	.17	.61*	1.00		
7. Positive affect	-.23*	-.01	.02	.06	-.01	-.08	1.00	
8. Enhancement motives	-.17	-.24*	.28	.41	.07	.10	.14	1.00
9. Coping motives	.10	.12	.11	.34	.58*	.60*	-.06	.24*

\*  $p < .05$ .

significant positive total effects to alcohol-related consequences via coping motives (see Table 3 and Figure 2).

**Within subjects.** At the daily level, anxious mood ( $\beta = 0.250$ ; 95% BCI [0.186, 0.312]) and depressed mood ( $\beta = 0.141$ ; 95% BCI [0.075, 0.206]) were positively associated with subsequent coping motives. Positive mood was associated with enhancement motives ( $\beta = 0.188$ ; 95% BCI [0.124, 0.251]). There was a positive association between enhancement motives and both alcohol consumption ( $\beta = 0.078$ ; 95% BCI [0.015, 0.139]) and alcohol-related consequences ( $\beta = 0.175$ ; 95% BCI [0.109, 0.238]) at the daily level. Coping motives did not predict alcohol

consumption ( $\beta = -0.016$ ; 95% BCI [-0.076, 0.044]) or alcohol-related consequences ( $\beta = 0.032$ ; 95% BCI [-0.029, 0.096]) at the daily level. The model accounted for 10.9% (95% BCI [2.5%, 24.0%]) of the between-subjects variance in alcohol consumption and 67.4% (95% BCI [43.3%, 91.8%]) of the between-subjects variance in alcohol-related consequences. The model accounted for 2.4% (95% BCI [1.0%, 4.4%]) of the within-subjects variance in alcohol consumption and 12.2% (95% BCI [8.8%, 15.9%]) of the within-subjects variance in alcohol-related consequences. The indirect associations are depicted in Table 3. There was a significant indirect association from daily positive mood to alcohol

Table 3  
Specific and Total Indirect Associations With Alcohol Outcomes

Indirect model associations	Estimate	SD	95% BCI
<b>Within-subjects specific indirect effects</b>			
EM → use → consequences	.054 <sup>a</sup>	.023	[.011, .103]
Positive mood → EM → use → consequences	.011 <sup>a</sup>	.005	[.002, .023]
Positive mood → EM → consequences	.122 <sup>a</sup>	.032	[.067, .192]
CM → use → consequences	-.019	.037	[-.093, .051]
Anxious mood → CM → use → consequences	-.003	.007	[-.018, .010]
Anxious mood → CM → consequences	-.025	.048	[-.121, .069]
Depressed mood → CM → use → consequences	-.002	.005	[-.012, .006]
Depressed mood → CM → consequences	.021	.023	[-.020, .071]
<b>Within-subjects total indirect effects</b>			
EM → consequences	.646 <sup>a</sup>	.114	[.416, .868]
CM → consequences	.162	.183	[-.195, .529]
Positive mood → consequences	.134 <sup>a</sup>	.034	[.075, .207]
Anxious mood → consequences	-.029	.055	[-.138, .079]
Depressed mood → consequences	.019	.023	[-.024, .070]
<b>Between-subjects specific indirect effects</b>			
EM → use → consequences	.134 <sup>a</sup>	.065	[.022, .276]
Positive affect → EM → use → consequences	.016	.020	[-.012, .067]
Positive affect → EM → consequences	.029	.034	[-.022, .114]
CM → use → consequences	.035	.085	[-.129, .210]
Anxious affect → CM → use → consequences	.010	.028	[-.042, .071]
Anxious affect → CM → consequences	.110 <sup>a</sup>	.062	[.018, .259]
Depressed affect → CM → use → consequences	.020	.052	[-.080, .132]
Depressed affect → CM → consequences	.214 <sup>a</sup>	.109	[.043, .469]
<b>Between-subjects total indirect effects</b>			
EM → consequences	.388 <sup>a</sup>	.119	[.153, .622]
CM → consequences	.415 <sup>a</sup>	.175	[.071, .763]
Positive affect → consequences	.048	.049	[-.034, .163]
Anxious affect → consequences	.121 <sup>a</sup>	.070	[.015, .285]
Depressed affect → consequences	.235 <sup>a</sup>	.123	[.037, .519]

Note. EM = enhancement motives; CM = coping motives; BCI = Bayesian confidence interval.

<sup>a</sup> BCI does not include 0, indicating statistical significance.

consequences via daily enhancement motives (IND = 0.122; 95% BCI [0.067, 0.192]) and alcohol consumption (IND = 0.011; 95% BCI [0.002, 0.023]), resulting in a significant total indirect association between daily positive mood and alcohol-related consequences (IND = 0.134; 95% BCI [0.075, 0.207]). There were no indirect associations between either depressed or anxious mood and alcohol use or consequences.

### Post Hoc Analysis of Drinking-Days Only

The primary results above present the relationships between constructs on all days, regardless of whether drinking occurred. These analyses present mood and motives' ability to prospectively predict drinking. However, when analyzing drinking days only, one relationship did change: Daily coping motives robustly predicted daily alcohol consequences,  $\beta = 0.124$ ; 95% BCI [0.016, 0.226]. All other relationships in the model remained unchanged in interpretation, save that effect sizes were slightly larger in the drinking-days only model (see [online supplemental materials](#)).

### Discussion

Most of the literature on theories connecting mood, drinking motives, and outcomes have measured constructs at the between-subjects level among clinical and nonclinical samples. However, these concepts are not applicable to drinkers' daily lives without testing whether these theoretical constructs relate to one another in the same way within subjects. The current EMA study compared the relationships between mood, drinking motives, and alcohol use and problems at the between-subjects (trait-like) and within-subjects (daily) levels. The *Results* section presents the primary analysis (Bayesian model), but two supplemental analyses (negative binomial count and hurdle models) were also conducted. Relevant discrepancies between the primary analysis and supplemental analyses are included below to contextualize the results and best inform future research questions.

At the between-subjects level, we hypothesized that trait-like positive and negative mood would predict trait-like enhancement and coping motives, respectively, and that these motives would predict trait-like alcohol use and consequences, respectively. All analyses found that trait-like positive affect did not predict trait-like enhancement motives, counter to hypotheses. Although counter to hypothesis, it is generally consistent with the notion that individuals with more positive affect are less inclined to drink as a way to regulate emotion. As with other findings discussed here, the discrepancies observed between the literature and our findings on trait-like constructs could be due to our measurement of trait-like mood and motives as an average of the participant responses across the EMA monitoring period. This methodology likely results in a different construct than when motives are assessed by asking the participant how they generally feel or their motives for generally drinking alcohol. Indeed, [Dvorak et al. \(2014\)](#) also measured mood and motives as an average of EMA responses and found that the typically robust association between positive mood and enhancement motives only borne out in the trait-like EMA data for men and was not significant for women. These results suggest that positive affect or enhancement motives (or both) are reported differently by participants when reported in a one-time survey versus repeatedly measured in an EMA protocol.

Furthermore, trait-like enhancement motives were directly associated with alcohol consumption in all analyses and alcohol-related consequences in only the primary analysis. Overall, this result is consistent with previous research that has shown that trait-like enhancement motives are predominantly associated with consequences via use ([Merrill et al., 2014](#); [Read et al., 2003](#)) and provides further support for the strong association between trait-like enhancement motives and alcohol use.

Participants with higher trait-like anxious and depressed affect also reported significantly higher trait-like coping motives according to all three models. In the primary analysis, coping motives were associated with individual differences in alcohol consequences, but not consumption, consistent with previous between-subjects studies in college samples ([Cooper, 1994](#); [Kuntsche et al., 2005](#); [Merrill et al., 2014](#); [Read et al., 2003](#)) and clinical samples ([Young-Wolff, Kendler, Sintov, & Prescott, 2009](#)). The supplemental analyses did not find a significant relationship between trait-like coping motives and either alcohol outcome, inconsistent with previous literature. It is possible that this result was obtained because of differences in the measurement of trait-like constructs, similar to what is noted above.

Regarding within-subject results, we hypothesized that daily negative and positive mood would predict daily coping and enhancement motives, respectively. Results of all analyses supported this part of our hypotheses, consistent with previous within-subject motives research ([Arbeau, Kuiken, & Wild, 2011](#); [Dvorak et al., 2014](#); [Ehrenberg et al., 2016](#)). We further hypothesized daily coping motives would be associated with daily alcohol use and enhancement motives would be associated with daily alcohol problems (consistent with [Dvorak et al., 2014](#)). In all analyses, daily enhancement motives predicted both later alcohol use and alcohol-related consequences, consistent with [Dvorak et al.'s \(2014\)](#) finding that daily enhancement motives predicted later alcohol problems. This is perhaps the most consistent finding that departs from the between-subjects literature.

All of our analyses found that coping motives did not predict alcohol use that day, inconsistent with [Dvorak et al. \(2014\)](#). We first wondered if this difference could be explained by discrepant measurement of daily motives; [Dvorak et al. \(2014\)](#) measured motives only on drinking days, whereas the current study measured motives on all days. However, even our analysis of drinking days only did not find an association between coping motives and alcohol use, and a recently published examination of daily coping motives and alcohol use also did not find a significant relationship ([O'Donnell et al., 2019](#)). Coping motives may instead predict daily alcohol-related consequences. Despite the fact that our primary and hurdle supplemental analyses found that daily coping motives were not associated with daily alcohol-related consequences, the negative binomial count model found a strong, significant relationship between coping motives and later alcohol consequences. We found this relationship once more when we excluded non-drinking days from the primary analysis, such that the average number of problems increased by .97 for each increase of 1 value in coping motives beyond the mean (on a scale from 0 to 4). Although these results are in contrast to what was found by [Dvorak et al. \(2014\)](#), [Dvorak et al.](#) measured only dependence symptoms, and it is quite possible that motives differentially predict dependence symptoms, as opposed to other alcohol-related conse-

quences, especially among relatively healthy college student samples.

It is also possible that coping motives are predictive of problematic drinking only on days in which a person decides to drink, consistent with our analysis of only drinking days. When examined alongside the lack of an association between coping motives and alcohol consequences on all days, one must consider that individuals also experience motivation to drink to cope (or anticipate experiencing it) on days in which they ultimately abstain from drinking. This possibility leads to another important question that may be answered with future daily process studies: What factors lead to the decision to drink or not to drink after a person experiences motivation to drink to cope? O'Donnell et al. (2019) found that being around peers who are drinking determined drinking outcomes at the daily level more strongly than mood or motives, so future studies should include social and environmental factors in analyses of daily drinking behavior. Lastly, it is also important to note that daily coping motives in the current study were endorsed at an average of 0.33 (on a 0–4 scale), with a *SD* of 0.54, possibly resulting in too little variance to establish significant relationships between variables at the daily level. Indeed, in the prior study that found a relationship between daily coping motives and alcohol use, there was more variability in daily coping ( $M = 1.50$  and  $1.85$ ,  $SD = 1.17$  and  $1.24$ , for men and women respectively; Dvorak et al., 2014).

Overall, this study consistently found relationships between daily positive affect, enhancement motives, alcohol use, and alcohol consequences. The pathways between daily negative affect and coping motives were consistent, but unlike in between-subjects research, this pathway was not consistently related to alcohol outcomes. This discrepancy points to the importance of further studying these relationships separately at the within- and between-subjects levels. It is also possible that our results add to a growing body of literature suggesting that coping motives may not always predict the most problematic drinking (Mohr et al., 2013; Traggesser et al., 2008), especially when taken in tandem with previous findings that enhancement motives are better predictors of alcohol use and problems than coping motives in the young adult drinking population (Herring et al., 2016; Littlefield, Vergés, Rosinski, Steinley, & Sher, 2012; Read et al., 2003). However, the results of this study are in need of replication and this is ultimately an important question for future research.

Perhaps most interesting are the differences the present study found between the between-subjects and within-subject models. Models consistently found that trait-like positive affect was not related to enhancement motives, but daily positive mood predicted an individual's endorsement of enhancement motives later in the day. The lack of an association at the between-person level indicates that generally having higher positive affect across days was not predictive of enhancement motives and alcohol outcomes in this sample of college students but having higher positive affect than one's average in any given day did predict enhancement motives and alcohol outcomes. This could represent anticipatory positive mood prior to a drinking event, as the individual may be excited throughout the day for an upcoming social event. It is also possible this finding indicates that having more positive mood throughout the day increases one's likelihood to drink to enhance that mood further; however, a causal relationship cannot be supported by correlational data at the daily level.

Lastly, trait-like coping motives were associated with individual differences in alcohol-related consequences in our primary model, but daily endorsement of drinking to cope with negative mood inconsistently predicted alcohol problems. In the supplemental analyses, and in the drinking days-only analysis, trait-like coping motives were not associated with alcohol-related consequences, counter to most alcohol literature (Cooper, 1994; Kuntsche et al., 2005). In the daily analyses, coping motives predicted later alcohol-related consequences in one of the two supplemental analyses as well as the drinking-day-only analysis. Because of the lack of consistency across analyses, it is not possible to draw firm conclusions about the relationship between coping motives and alcohol outcomes. The lack of a consistent relationship between coping motives and alcohol-related consequences could be due to the demographics of our sample (i.e., college students), among whom drinking is more strongly related to enhancement motives than to coping motives (Herring et al., 2016; Littlefield, Talley, & Jackson, 2012; Read et al., 2003); however, if this were the case, one may not have expected coping motives to predict alcohol consequences in any analysis. A number of processes could partially explain these conflicting findings. First, it is possible that coping motives are difficult to anticipate. Our motives questions asked participants to provide their motivation for drinking if they drink tonight. Enhancement motives are associated with drinking at friends' houses and at parties (Blevins, Abrantes, & Stephens, 2018), which may be easier to foresee hours ahead of time than coping motives, which are associated with drinking alone (Blevins et al., 2018), possibly in response to an unanticipated stressor. Second, it is also possible that coping motives lead to problematic drinking only under select circumstances, or third, it is possible that this is part of a developmental addictive process that is easily observed between people but has a much smaller magnitude of effect within a given day. These are important questions for future daily process studies to examine, particularly studies that compare individuals with varying levels of problematic consumption.

## Limitations

First and foremost, our findings may not generalize to noncollege populations. Our sample also featured an overrepresentation of Caucasian subjects, so results may differ for subjects in other racial groups. Furthermore, our sample was not a clinical sample, consuming  $M = 1.35$  drinks per day and reporting  $M = 0.55$  alcohol-related problems per day (including nondrinking days). Because we recruited college students who did not meet criteria for psychiatric conditions, the sample's semblance to a clinical population is low. Nonetheless, the between-subjects relationships between mood, motives, and alcohol outcomes observed in this sample are similar to those observed in clinical samples in past studies (Young-Wolff et al., 2009). Currently there are few studies investigating drinking motives among clinical samples and no studies examining state-like motives predicting alcohol consequences. Despite this, studies that have examined the relationship between clinical samples and drinking motives reveal similar motives endorsement to their nonclinical counterparts (Cooper et al., 2014; Mezquita et al., 2011). Thus, we posit that the relationships we observed in our models may also be observed in a clinical sample, but this is ultimately an empirical question that must be tested in future studies.



Additionally, the study was well powered in regard to mood and motives, but because of the sample studied, there were substantially fewer days with alcohol consequences, raising questions about sufficient power to detect effects involving alcohol consequences. Our continuous measurement of alcohol use and consequences reduces some of this concern, but ultimately, insufficient power prevents us from examining problem days only. Lastly, there were instances in which individuals did not report variables in the moment (reporting alcohol-related consequences the following day, prospectively reporting drinking motives). This raises questions as to whether participants were able to accurately forecast their motivations to drink, particularly in regard to coping motives because they were not related to alcohol use or consequences at the daily level in our primary model. It is possible that coping motives may be more difficult to forecast, and future studies could test this by asking participants to also report motives at drinking initiation. Future studies should allow participants to report all variables in real time to maximize the accuracy of collected data.

## Conclusion

The current EMA study compared the relationships between mood, drinking motives, and alcohol use and consequences in college students at the between-subjects (trait-like) and within-subject (daily) levels. Results demonstrated that trait-like negative mood and coping motives were predictive of alcohol consequences, but coping motives did not predict alcohol consequences at the daily level. In contrast, enhancement motives were predictive of both alcohol use and consequences at the daily and trait-like levels. Results suggest that daily alcohol use and consequences are not preceded by the same variables as typically observed in between-subjects literature, necessitating additional EMA studies to examine within-subject processes.

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