

# Within-Day Associations Between Affect and Intentions to Drink Alcohol in Adolescents and Young Adults: A Registered Report

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**Objective:** Motivational theories hypothesizing that people drink to relieve negative affect have not been supported using data from people's daily lives. People may experience negative affect when alcohol is unavailable or when use would conflict with people's current goals, but people's thoughts about alcohol use, such as intentions to drink later in the day, are less contextually constrained. Alcohol intentions may serve as affect regulation and lead to decreases in negative or increases in positive affect prior to drinking itself.

**Method:** This registered report provides an initial test of this hypothesis across two large ecological momentary assessment samples of adolescents and young adults (total  $n = 1,511$ ). We tested whether daily drinking intentions were associated with levels and within-day changes in negative and positive affect in two large samples of adolescents and young adults and whether drinking history and motives moderated these associations. **Results:** We found evidence, replicated across studies, that positive affect was higher and increased more on days when people reported intending to drink more than usual, but negative affect was only very weakly associated with daily drinking intentions. We found no evidence of moderation that replicated across samples. **Conclusions:** Results suggest that prior research linking positive affect and alcohol use is at least in part capturing the anticipation of drinking rather than a causal association between affect and drinking behaviors among adolescents and young adults. Theories should consider how anticipation, as well as the contexts in which drinking occurs, shapes people's motives for drinking and their drinking behaviors themselves.

### Public Health Significance Statement

Findings from this study suggest that predictions about future drinking are associated with positive, but not negative, emotions.

**Keywords:** emotions, alcohol intentions, ecological momentary assessment, affect regulation

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Motivational theories of alcohol use hypothesize that people drink to decrease negative emotions or to increase positive ones (Baker et al., 2004; Cloninger, 1987; Cooper et al., 1995; Cox & Klinger, 1988). Although supporting evidence has linked affect and alcohol use behaviors using laboratory, experimental, and self-report data (Bresin et al., 2018; Leigh, 1989; Smith, 2013; Wilkie & Stewart, 2005), 2 decades of daily diary and ecological momentary assessment (EMA) studies testing these theories at the day-level produced inconclusive evidence. At the daily level, a recent individual participant data meta-analysis with over 12,000 participants observed over 350,000 days provided evidence that people do not drink or drink more on days when *negative affect* is higher than usual, while they are more likely to drink when *positive affect* is higher than normal (Dora et al., 2023). Taken together, these findings suggest that it may be important to refine motivational models of alcohol use to better understand how affect might predict specific cognitions known to precede alcohol use.

EMA studies of drinking episodes show that people do report increased positive mood while drinking (Dvorak et al., 2018), and evidence from studies of daily life (such as EMA and daily diary studies) have also consistently indicated that people are more likely to drink and to drink heavily after a day wherein they felt happier and more enthusiastic than usual. For example, our recent meta-analysis suggested that on a day wherein an individual's positive affect was 1 *SD* higher than their own mean, they were 16%–28% more likely to drink but only consumed an additional 0.04–0.07 drinks (Dora et al., 2023). However, motivational theories hypothesize that people drink for the positive affective benefits of alcohol use and explicitly state that experiencing positive emotions *prior to drinking* is not necessarily expected to motivate drinking (Cooper et al., 1995). In other words, motivational theories hypothesize that people drink to enhance their positive mood, not because of an existing positive mood (Cooper et al., 2015, p. 201). It may be that positive affect makes people more sociable or reward seeking and increases the odds that people seek out situations wherein alcohol is available (van Hoom et al., 2016). Alternatively, it could be that affective changes occur in *anticipation* of planned drinking events, either because people are looking forward to drinking itself or because of events that coincide with alcohol use and are associated with positive moods, such as the end of the work week or other celebrations (Cronce et al., 2020). Indeed, celebratory motives are frequently noted to influence young adult alcohol use (Kuntsche et al., 2005, 2006). This would explain both the consistent evidence for positive associations between daily positive affect and alcohol use and null associations of negative affect with alcohol use. Indeed, several prior studies have shown that positive affect increases, and negative affect decreases in the time leading up to drinking events (M. A. Russell et al., 2020; Stevenson et al., 2023; Treloar et al., 2015).

One marker of this anticipation may be a person's intentions to drink later in the day. Measurements of drinking intentions are informed by a decision-making model about health risk behaviors described as the theory of planned behavior (Ajzen & Fishbein, 1975). Intentions to engage in a behavior are thought to be the strongest predictor of behavior and to reflect goals that are formulated after some consideration and informed by a person's attitudes about perceptions of norms around the behavior (Armitage & Conner, 2001; Ravis et al., 2006). A substantial body of evidence suggests that people who reported higher global self-report of

drinking intentions also report more alcohol use both cross-sectionally and longitudinally (Andrews et al., 2011; Litt et al., 2014; Zimmermann & Sieverding, 2010). For example, Litt et al. (2014) showed that intentions to get drunk strongly predicted the number of days on which college students actually got drunk over spring break. These same associations have been recently shown to hold within persons as well. For example, we recently demonstrated that on days when people reported higher same-day intentions to drink, they were much more likely to (a) drink (*OR* = 2.61), (b) to drink more (Risk Ratio = 1.33), and (c) to have a higher likelihood of consequences later that day (*OR* = 2.92; Lewis et al., 2020). Momentary measures of drinking intentions themselves were associated with more positive attitudes toward drinking and more positive injunctive norms (e.g., believing that peers would view drinking more alcohol as more positive). Within-person variations in intentions likely reflect in part people's existing plans related to alcohol use (such as intending to go to a party later in the day) but may also be a product of other state factors, such as a person's affect.

For most individuals, and especially adolescents and young adults, alcohol use is both contextually and temporally constrained. As opposed to other behaviors with clear evidence of negative reinforcement (e.g., cigarettes, Gehricke et al., 2007; self-injurious thoughts and behaviors, Kuehn et al., 2022; or binge eating, Haedt-Matt & Keel, 2011), most people spend a large proportion of their days in contexts wherein alcohol use would conflict with their current or future obligations, such as in schools, caring for children, driving, or at work. Thus, many emotional experiences occur when alcohol is unavailable or interferes with future obligations, dampening the potential for alcohol to serve an affect regulation function. For example, it is much more likely that a regular drinker will be drinking at a friend's house than at work or at 8 p.m. on a Friday than 8 a.m. on a Wednesday (Arfken, 1988). Drinking is itself influenced by social contexts, such as whether or not other people are drinking (Labhart et al., 2013; Muraven et al., 2005; O'Donnell et al., 2019; Simons et al., 2005), whether a person is alone (Creswell, 2021), or whether people perceive that alcohol is normative or approved by peers (Lewis et al., 2020). Weekend drinking may often be heavier because people perceive fewer future obligations that might be impaired by drinking (Kuntsche & Labhart, 2013), although many young adults are still likely to have existing obligations such as scheduled work or upcoming exams that might add constraints on alcohol use. Thus, many stimuli that might influence alcohol use, such as affect, are temporally disconnected from the drinking behaviors that they are thought to shape, making a close-in-time temporal association between affect and alcohol use more difficult to detect.

However, people's ability to think ahead and plan their future drinking (e.g., their intentions to drink) is not necessarily contextually constrained (although their actual drinking plans are constrained). Indeed, many instances of alcohol use require at least some planning and forethought to determine what to drink, where to drink, and who to drink with, as well as some consideration of the positive and negative consequences of alcohol use. It may be that drinking intentions are an emergent property of a cognitive and behavioral cascade that results in drinking. In other words, simply knowing (or deciding) that one is going to drink later in the day may be associated with increases in positive affect or decreases in negative affect as people prepare for a future drinking episode. This

may be especially true when people drink in highly rewarding situations, such as partying with friends or going to a bar, where both the intentions to drink *and* the anticipation of other rewarding activities may be associated with mood changes. For example, Cronce et al. (2020) reported that being social and drinking were each associated with higher end-of-day positive mood. Negative affect relief, and positive affect enhancement, may begin as soon as someone decides they are going to drink rather than at the onset of alcohol use itself, and those intentions could be reinforcing if they lead to increased positive affect or decreased negative affect. For example, one might feel more excited and less angry after making a plan to go to a party to drink with friends. If the mere intention to drink itself is associated with an improvement in mood, it could obscure day-level associations of negative affect and alcohol use. One prior study of college students ( $n = 54$ ) reported that positive, but not negative, affect was increasingly associated with drinking intentions in the 2 days leading up to a heavy drinking event (Slavish et al., 2019), providing some preliminary support for the anticipatory effect of drinking intentions and some evidence against the notion that intending to drink relieves negative affect.

In this registered report, we aimed to test this cognitive–affective cascade model in samples of adolescents and young adults and to replicate and extend preliminary findings in two very large EMA data sets (total  $N = 1,505$ ). In Study 1, we tested the within-person association between drinking intentions and positive and negative affect, measured at the same midday time point. We hypothesized that people who report stronger intentions to drink later that same day would report higher concurrent positive and lower negative affect. In Study 2, we replicated and extend the models tested in Aim 1 to within-day changes in mood, testing whether midday drinking intentions predict higher same-day levels of positive affect and lower negative affect and whether people’s affect becomes more positive and less negative over the course of a day when they report higher intentions to drink that day.

It is important to note that drinking intentions are likely formed at different times in the hours and days leading up to a drinking event and may thus precede and be preceded by changes in affect. It is likely that on some occasions, anticipating a planned drinking event causes increases in positive affect and decreases in negative affect, while on other occasions, changes in affect influence the intention to drink. For example, someone might form a plan to meet friends for a happy hour on a Friday, and they might experience increases in positive affect as they look forward to that event. Others may be formed the same day that drinking occurs, such as when someone decides that they will open a nice bottle of wine to celebrate some good news they just received that raised their positive affect. Regardless of the direction of causality, understanding whether same-day drinking intentions merely exhibit within-person associations with positive and negative affect is an important step toward understanding affective motivational models of alcohol use.

We tested four potential moderators of the associations between drinking intentions and affect. First, if the association between affect and intentions reflects something about the anticipation of drinking, this association may be stronger among those who drink more intensely (e.g., more frequently and/or higher quantities overall across the study period) because those people may have been more consistently reinforced for drinking. Second, we explored whether this association varies as a function of a person’s typical drinking intentions. On the one hand, it may be that people who only

occasionally plan to drink show stronger associations between intentions and affect, while this association might be relatively weak among those who regularly intend to drink. For example, someone who regularly intends to (and does) drink on a Saturday night might exhibit weaker associations between their daily affect and drinking intentions, but those associations might be stronger among those for whom such intentions are rare. Finally, we tested whether social or enhancement motives moderate these associations. Young adults frequently report that alcohol use is influenced by celebratory motives, which are encompassed by the broader construct of social motives (Kuntsche et al., 2005). Celebrations and other social factors are associated with increased positive and lower negative moods, although evidence suggests that the alcohol–affect association is not entirely accounted for by social experiences (Cronce et al., 2020). However, it may be that drinking intentions are more strongly associated with affect for people with higher social motives because drinking intentions frequently co-occur with social and celebratory situations. Although we did not have daily measures of anticipation of socialization later in the day (which could help disaggregate the degree to which mood enhancement is a function of alcohol, the social environment, or both), if drinking intentions are associated with affect and this association is stronger for those high on social motives, this may suggest that future research should consider the anticipation of drinking and the anticipation of the drinking environment. On the other hand, because enhancement motives relate to the effects of alcohol on positive affect (Cooper et al., 2015), we hypothesized that the associations between affect and drinking intentions will not vary as a function of enhancement motives.

Finally, intentions to drink are not the only cognition that predicts later alcohol use. People who report being more willing to drink, should the opportunity arise, have also been shown to report more alcohol use in cross-sectional, prospective, and EMA studies (Lewis et al., 2020; Todd et al., 2016), even when controlling for future drinking intentions. Although willingness and intentions are highly correlated, in that people will frequently report being willing to drink when they also report intending to drink, people can and do report being willing to drink without any specific intention to do so, and people can also intend to drink a certain number of drinks, but be willing to drink a different number of drinks. For example, data from our prior research (e.g., Lewis et al., 2020) indicated that there were frequent discrepancies between the number of drinks that people were willing versus intending to drink later in the day. When people reported, for example, intending to drink 0 drinks later that day, they also reported being *willing* to drink 0 drinks in just 32% of cases (with willingness ranging from 1 to 10 drinks among those reporting not intending to drink), and the intraclass correlation (ICC) reflecting absolute agreement was .81. One prior study showed that willingness to drink was associated with increasingly positive affect the day of a heavy drinking event (Slavish et al., 2019). Thus, in the proposed study, we also tested whether affect is associated with intentions to drink after controlling for willingness. This provided a test of whether it is the planning itself that matters rather than the general openness to drinking.

The goal of the present study was to examine the within-person, within-time associations between affect and daily drinking intentions before any actual drinking has occurred. We aimed to do this across two large EMA studies of adolescents and young adults. In Study 1, we examined the within-person, same-day associations

between drinking intentions and negative and positive affect, measured in the afternoon. These “cross-sectional” analyses established whether people report more positive affect and less negative affect on days when they have stronger intentions to drink alcohol and whether these associations varied across persons according to the moderators hypothesized above. Specifically, we hypothesize the following.

### Aim 1

On days when people have greater intentions to drink than usual, they would report higher (H1) positive affect and (H2) lower negative affect compared with their own average levels.

### Aim 2

These associations would be stronger among people with greater typical drinking intensity (quantity or frequency; H3) and those with higher social motives (H4), but not those with higher enhancement motives (H5). We explored whether this effect varies as a function of a person’s typical drinking intentions (H6).

In Study 2, we examined whether within-day trajectories of negative and positive affect from morning into the evening (but prior to any alcohol use) differed as a function of drinking intentions measured in the midday. Specifically, we hypothesized the following.

### Aim 3

People would exhibit higher levels and larger increases in positive affect (H7), and lower levels and larger declines in negative affect (H8), over the course of the day, on days when they reported intentions to drink more at midday.

### Aim 4

These associations would be stronger among people with greater typical drinking intensities (H9) and those with higher social motives (H10), but not those with higher enhancement motives (H11). We explored whether this effect varied as a function of a person’s typical drinking intentions (H12).

### Aim 5

Across both studies, we tested whether these associations held after controlling for willingness to drink measured at the same time point (H13).

## Study 1

### Participants

Participants ( $N = 1,015$ ) were recruited as part of a larger longitudinal measurement burst EMA study. Participants were eligible if they were Texas residents between ages 15 and 25 and (for those 18 or older) reported drinking alcohol at least once per month over the past 6 months. Because the focus of the larger study was to study daily and yearly variation in willingness to drink, participants aged 15–17 were eligible regardless of drinking status.

### Procedure

Participants were recruited using internet advertisements and flyers; interested individuals completed a brief online eligibility survey. The EMA protocol began on Thursday immediately following a baseline survey and an online training session. Participants completed up to four EMA bursts that occurred quarterly over 12 months. Within each burst, participants completed 3 consecutive weeks of the following EMA protocol. Participants were prompted by email and text to complete one survey each on Thursday, Friday, and Saturday afternoon and one survey each on Friday, Saturday, and Sunday mornings, as well as one afternoon and one morning survey on a random weekday, for up to eight surveys each week. Participants chose a 3-hr window between 6 a.m. and 12 p.m. to complete the morning survey. This window could differ for weekdays and weekends. The afternoon survey was completed in a 1-hr window that occurred randomly anytime within the designated block of 1–6 p.m. For all 3 weeks in each burst, participants received a single afternoon survey on a random weekday between Monday and Wednesday, which was always followed by a morning survey the next day. All data for the proposed study come from the afternoon assessment across all bursts of EMAs. At the time of submission, the last few participants were completing their final burst and were finished with the bursts by the time of data analysis. Participants could earn \$4 for each EMA and a total of up to \$408 across all phases of study participation. This study was approved by the university’s local institutional review board.

### Measures

**Positive Affect.** Once per day in the afternoon, positive affect was measured from five items from the short-form Positive and negative affect schedule (Thompson, 2007) that asks participants to “Indicate to what extent you feel this way right now” related to five adjectives (“excited,” “enthusiastic,” “alert,” “inspired,” “determined”) on a scale of 0 (*very slightly or not at all*) to 4 (*extremely*). Positive affect scores were calculated by averaging the five positive affect items. We computed multilevel reliability (Lai, 2021) with the *misty* package (Yanagida, 2020). Reliability was high ( $\Omega_w = .78$ ,  $\Omega_b = .88$ ).

**Negative Affect.** Once per day in the afternoon, negative affect was measured from five items from the short-form PANAS scale (Thompson, 2007) that asked participants to “Indicate to what extent you feel this way right now” related to five adjectives (“distressed,” “upset,” “alert,” “scared,” “nervous”) on a scale of 0 (*very slightly or not at all*) to 4 (*extremely*). Negative affect scores were calculated by averaging the five negative affect items. Reliability was high ( $\Omega_w = .80$ ,  $\Omega_b = .94$ ).

**Drinking Intentions.** Once per day in the afternoon, drinking intentions were measured using the question stem: “I intend to drink ... .” Three items referred to participants’ intention to drink different amounts of alcoholic drinks tonight: (a) four, five, or more (females/males) alcoholic drinks, (b) one to three or one to four (females/males) alcoholic drinks, and (c) any alcoholic drinks. Responses were on a 5-point scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). We computed a mean score of all items. Prior research using these items indicated high reliability ( $\alpha = .92$ ) and strong within-day associations with alcohol use

episodes (Lewis et al., 2020). Reliability in the present study was high ( $\Omega_w = .91$ ,  $\Omega_b = .92$ ).

### Moderators

**Typical Alcohol Use.** At baseline, participants reported their typical frequency of alcohol use in the past 3 months across 11 options ranging from *not at all to every day*. Participants also reported their typical quantity of use across 26 response options ranging from 0 to 25+ drinks per occasion. We computed a Quantity  $\times$  Frequency Score to reflect the typical intensity of participants' alcohol use.

*Typical intentions* were computed as the person-level grand mean of drinking intentions grand mean centered across all daily surveys.

*Social and enhancement motives* were measured using items from the Modified Drinking Motives Questionnaire-Revised (Grant et al., 2007). Participants reported how often they drank in the past month for social (five items) or enhancement (five items) reasons on a 5-point Likert scale ranging from 1 (*almost never/never*) to 5 (*almost always/always*). We computed a mean score of all items. Prior research using these items has reported acceptable internal consistency for both social ( $\alpha = .61-.66$ ) and enhancement ( $\alpha = .83-.85$ ) motives, high test-retest and predictive validity, and invariance across sex (Grant et al., 2007). Reliability was high for social ( $\Omega = .84$ ) and enhancement ( $\Omega = .89$ ) motives in the present study.

### Covariates

**Day Level.** We controlled for the social weekend (coded 1 = *Thursday, Friday, or Saturday* and 0 = *otherwise*), month (coded from 0 = *January* to 11 = *December*), and week (coded 0–2).

**Daily Drinking Willingness.** Drinking willingness for the upcoming evening was measured with four items on a scale of 0 (*not at all willing*) to 5 (*extremely willing*) used in prior research (Lewis et al., 2020). Items asked about willingness paralleled the measure of intentions, measuring participants' willingness to drink different amounts of alcoholic drinks tonight if the situation arises wherein they have the opportunity to drink (a) four, five, or more (females/males) alcoholic drinks, (b) one to three or one to four (females/males) alcoholic drinks, and (c) any alcoholic drinks. Prior research using these items indicated high reliability ( $\alpha = .94$ ) and strong within-day associations with alcohol use episodes (Lewis et al., 2020). Reliability in the present study was high ( $\Omega_w = .92$ ,  $\Omega_b = .92$ ). Finally, we controlled for whether the participant reported cannabis use that day.

**Person-Level Covariates.** In the baseline survey prior to the first burst, participants reported their age and biological sex assigned at birth (coded 0 = *female* and 1 = *male*).

## Study 2 Methods

Participants were recruited for participation in a larger study on the development of alcohol and cannabis use problems during young adulthood.

### Sample

Participants were young adults at baseline ( $n = 496$ , aged 18–22,  $M_{age} = 20.3$ ,  $SD = 1.3$ , 45% cisgender female, 42% cisgender male, assigned male at birth), with the remaining participants identifying as nonbinary/gender queer/gender nonconforming (8.5%), transgender male or female (4.0%), or nongendered (0.2%). The original proposed sample at Stage 1 was 505; the final sample was 496 due to the exclusion of nine participants who were identified as ineligible during the data cleaning and processing stage. Specifically, we identified these participants as highly likely to be ineligible (e.g., scammers) for the present study during the data cleaning phase of the study. Participants were recruited from King, Pierce, and Snohomish Counties in Washington State from both college and noncollege sources to ensure a representative sample of young adults in Washington State. We recruited using internet (Facebook, Instagram, TikTok, YouTube, Twitter, Craigslist, Reddit, and emails to university registrar lists and high school listservs) and noninternet (newspaper advertisements and flyers) sources. Participants were required to be between the ages of 18 and 22 at study screening, own a smartphone, be fluent in English, and reported drinking *or* using cannabis “about once per week” or more over the past 3 months. Participants were excluded if they were not fluent in English or if they moved to the United States after age 12. Participants endorsed a variety of race/ethnicities: 54% solely non-Hispanic White, 28.5% Asian, 6.6% African American, 8.37% Hispanic/Latino, and 22.7% who endorsed more than one ethnicity. Most participants identified as heterosexual (52%), with the remaining participants either identifying as lesbian, gay, bisexual, or questioning+ (47.6%) or declining to respond ( $n = 2$ ). Finally, 9.8% of the sample was born outside the United States. Racial/ethnic proportions broadly reflected Washington census data from counties in which participants were recruited. Approximately 67% of the sample attended a 4-year college at recruitment.

### Procedure

All study procedures were online and approved by the local institutional review board. Eligible participants completed an online survey and a virtual training session on the EMA study procedures with research assistants. For the next eight social weekends (Thursday to Sunday), five times per day, participants received texts with a link to a brief EMA survey. On Monday mornings, participants received an additional EMA to capture behavior from Sunday nights. EMAs were sent within five 3-hr blocks between 9 a.m. and 11 p.m., with at least 1 hr between surveys. Participants were initially sent one reminder at 30 min if they had not completed their survey; we changed this to 20- and 40-min reminders after the first 2 months of recruitment to increase participants' response rates. Participants received \$50 for the baseline survey and could earn \$1 per EMA, with a \$5 bonus for completing 80% (i.e., 17/21) of EMAs for a given weekend (\$258 total possible).

### Measures

**Affect.** Participants completed 14 ratings of specific emotions at every EMA. We selected emotion words to reflect multiple dimensions of negative and positive affect, based on the PANAS-X

and other prior studies (Larson & Lampman-Petratis, 1989; Silk et al., 2003). One recent EMA study suggested that affect can be reliably measured and exhibits strong evidence for multidimensionality within person (Jacobson et al., 2023). *Positive affect* was measured by participants rating how much they felt specific positive emotions in the past hour using a visual analog scale scored from 0 to 100 (with the specific number not displayed) and with anchors *not at all*, *very much*, and a central anchor of *somewhat* (J. A. Russell, 1980). We administered two words each from three sets of items reflecting three positive affect dimensions (joviality, attentiveness, serenity). Positive affect was scored as the mean of all positive affect items at each observation. Reliability in the present study was acceptable ( $\Omega_w = .66$ ,  $\Omega_b = .76$ ). *Negative affect* was measured by participants rating how much they felt specific negative emotions in the past hour using a visual analog scale scored from 0 to 100 (with the specific number not displayed) and with anchors *not at all*, *very much*, and a central anchor of *somewhat* (J. A. Russell, 1980). We randomly administered two words each from four sets of items reflecting four negative affect dimensions (anger, sadness, anxiety, and general negative affect). Negative affect was scored as the mean of all negative affect items at each observation. Reliability in the present study was acceptable ( $\Omega_w = .73$ ,  $\Omega_b = .94$ ).

**Drinking Intentions.** Once per day in the morning assessment, participants reported on their drinking intentions for tonight using a single item (“How many drinks do you intend to have later today?”) responding on a slider bar from 0 to “15 or more.”

### Moderators

**Drinking Intensity.** At baseline, participants reported their typical frequency of alcohol use in the past 12 months across 12 options ranging from *not at all* to *every day*. Participants also reported their typical quantity of use across 11 response options ranging from 0 to 25+ drinks per occasion. We computed a Quantity  $\times$  Frequency to reflect the typical intensity of participants’ alcohol use.

*Typical intentions* were computed as the person-level grand mean of drinking intentions grand mean centered across all daily surveys.

*Social and enhancement motives* were measured using items from the Drinking Motives Questionnaire-Revised (Cooper, 1994). Participants reported how often they drank in the past month for social (five items) or enhancement (five items) reasons on a 5-point Likert scale ranging from 1 (*almost never/never*) to 5 (*almost always/always*). We computed a mean score of all items. Prior research using these items has reported acceptable internal consistency and good test-retest and predictive validity (Cooper, 1994; Kuntsche et al., 2006). Reliability in the present study was high for social ( $\Omega = .92$ ) and enhancement ( $\Omega = .90$ ) motives.

### Covariates

**Day Level.** As in Study 1, we controlled for month (coded from 0 = *January* to 11 = *December*) and week in study (coded 0–7). Unlike in Study 1, all observations were on the social weekend (Thursday through Monday morning).

**Daily Drinking Willingness.** Once per day in the morning, participants reported the number of drinks they would be willing to drink should the occasion arise later that day.

**Cannabis Use.** Finally, we controlled for whether or not the participant used cannabis that day.

**Person-Level Covariates.** Participants reported age and biological sex assigned at birth (coded 0 = *female* and 1 = *male*).

### Power Analysis

#### Study 1

We consider the minimum detectable effect size, given our sample size,  $\alpha$ , and desired power, rather than our power to detect hypothesized effects. To estimate the minimum detectable effect size, we computed an effective sample size (Snijders, 2005) using our total sample size and assuming we would obtain data from 70% of all possible days (1,006 participants with 33.6 days of observations, for 33,802 observation days) and ICCs ranging from .10 to .60. The effective sample size adjusts the observed sample size to account for interdependence among clustered observations. For between-person hypotheses (such as cross-level interactions), with  $n = 1,006$ , we anticipate having power ( $b = 1-.80$ ,  $a = .05$ ) to detect correlations as small as  $r = .07$ , or regression effects at the EMA level as small as  $f^2 = 0.007$ . With the largest ICC (0.60) and 33,802 observations, our effective sample size is 1,644, with power to detect correlations as small as  $r = .07$ , or regression effects at the EMA level as small as  $f^2 = 0.007$ . At the smallest ICC (0.10), our effective sample size is 7,934, with power to detect correlations as small as  $r = .031$ , or regression effects at the EMA level as small as  $f^2 = 0.0015$ .

#### Study 2

Again, we computed an effective sample size using our total sample size and assuming we would obtain data from 70% of all possible days (505 participants with 22.4 days of observations, for 11,312 observation days) and ICCs ranging from .10 to .60. The effective sample size adjusts the observed sample size to account for interdependence among clustered observations. For between-person hypotheses (such as cross-level interactions), with  $n = 505$ , we anticipate having power ( $b = 1-.80$ ,  $a = .05$ ) to detect correlations as small as  $r = .12$  or regression effects at the EMA level as small as  $f^2 = 0.022$ . With the largest ICC (0.60) and 11,200 observations, our effective sample size is 817, with power to detect correlations as small as  $r = .098$ , or regression effects at the EMA level as small as  $f^2 = 0.013$ . At the smallest ICC (0.10), our effective sample size is 3,592, with power to detect correlations as small as  $r = .046$ , or regression effects at the EMA level as small as  $f^2 = 0.003$ . Nine ineligible participants were ultimately removed from the data set; this did not change our estimates of power.

```
Power analysis scripts follow (R)
library(pwr)
```

```
#Effective sample size function
```

```
ess<-function(n,obs,icc){
  (n*obs)/(1+((obs-1)*icc))}
```

```
#Study 1.
```

```
s1n=1015
```

```
s1d=30240
```

```
#Between persons
```

```

pwr.r.test(n=s1n,r=NULL,power=.80)
pwr.f2.test(u = 3, v = s1n-3, f2 =NULL, sig.level=.05,
power=.80)

#Large ICC
pwr.r.test(n=ess(s1n,33.6,.60),r=NULL,power=.80)
pwr.f2.test(u = 3, v = ess(900,33.6,.60)-3, f2 =NULL,
sig.level=.05, power=.80)

#Small ICC
pwr.r.test(n=ess(s1n,33.6,.10),r=NULL,power=.80)
pwr.f2.test(u = 3, v = ess(900,33.6,.10)-3, f2 =NULL,
sig.level=.05, power=.80)

#Study 2.
s2n=505
s2d=11200
icclow=.10
icchi=.60
#Between persons
pwr.r.test(n=s2n,r=NULL,power=.80)
pwr.f2.test(u = 3, v = s2n-3, f2 =NULL, sig.level=.05,
power=.80)

#Large ICC
pwr.r.test(n=ess(s2n,s2d/s2n,icchi),r=NULL,power=.80)
pwr.f2.test(u = 3, v = ess(s2n,s2d/s2n,icchi)-3, f2 =NULL,
sig.level=.05, power=.80)

#Small ICC
pwr.r.test(n=ess(s2n,s2d/s2n,icclow),r=NULL,power=.80)
pwr.f2.test(u = 3, v=ess(s2n,s2d/s2n,icclow)-3, f2 =NULL,
sig.level=.05, power=.80)

```

## Analytic Plan

We conducted all analyses with generalized linear mixed models. Generalized linear mixed models are a flexible class of analyses that allows for the analysis of nonindependent (i.e., clustered) data while accommodating a range of dependent variable distributions (e.g., continuous, ordinal, binary, and count data). Data processing and analysis were conducted in R (R Development Core Team, 2016), a flexible open-source data analytic software.

## Timing of Daily Alcohol Use

In Study 1, data were not collected about the time of onset of daily drinking; thus, we could not be certain that alcohol use had not been initiated prior to the completion of self-reported affect and intentions. However, in our pilot data, only 7% of drinking occasions were reported to have begun in the afternoon or earlier. Moreover, we conducted two analyses to ensure the robustness of these results. First, we tested whether including the time of the afternoon survey as a moderator of the associations. This informed the degree to which later surveys, which were more likely to have been taken after participants began drinking, exhibit a different association between intentions and affect. If we found no evidence of moderation, we could be more confident that the relatively few alcohol use episodes that might have occurred before the afternoon survey did not impact our findings. We found no evidence of moderation of the main effects of intentions on positive (all Bayes factors [BF] < 2.26) or

negative (all BF < 2.06) affect. Second, we directly replicated Study 1 analyses in Study 2. We tested whether the within-person associations between intentions and affect, measured only at the same survey (midmorning in Study 2), were similar in magnitude to those reported in Study 1, using the region of practical equivalence test (Kruschke, 2018). This test allowed us to define a region around the prespecified value (e.g., the effects observed in Study 1) that reflects values that we believe are practically equivalent to that effect. We report these findings in the results.

In Study 2, all analyses focused on observations that occur prior to the onset of drinking that day; any days wherein participants reported drinking prior to reporting their alcohol use intentions for that day were discarded for analysis ( $n = 1,338$  of 15,872 total days, or 8.43% of total days).

To draw inferences, we interpreted each model individually and noted to what extent each model indicates evidence in favor of each hypothesis. This can be done, as Bayesian inferences do not depend on the number of tests that we run on the data (Dienes, 2011). We interpreted interactions for which the Bayes factor exceeds 6 (indicating that the evidence for a model including the interaction was six times stronger compared with a model excluding the interaction) as evidence in favor of our hypothesis to avoid retaining weak interactions that confirm our hypotheses. Where we hypothesized null effects, we will use the region of practical equivalence test, which allows us to define a region around the null value that reflects values that we believe are practically equivalent to the null (Kruschke, 2018). In the proposed study, we will set the null value to  $\pm 1$  SD and test the proportion of the posterior credible interval that falls within the range of that null value.

## Aggregation and Centering

Day level (EMA level) predictors were centered within person to separate within-person from between-person variance (Enders & Tofighi, 2007), allowing us to make accurate inferences about how state fluctuations in intentions (and willingness) were associated with affect above and beyond individual differences in a person's average level of intentions. All person-level predictors were grand mean centered. Regarding *protocol deviation*, we proposed conducting centering and other data processing functions for multilevel data using the well-vetted *bmlm* package (Vuorre & Bolger, 2017). We ultimately used packages from the *tidyverse* instead (Wickham et al., 2019).

## Treatment of Missing Data: Protocol Deviation

In the Stage 1 registered report, we proposed addressing missing data at the item level (due to random item presentation) or observation level (due to participant noncompliance) using multilevel multiple imputation (MI). Full details of how we approached MI can be found online in the Stage 1 registered report. In short, MI for both Studies 1 and 2 failed, and we proceeded with a listwise deletion at the observation level for all analyses. Below we describe the failures of the MI models.

## Protocol Deviation: Study 1

We imputed 20 data sets over 50 iterations and four imputation chains (not two as prespecified, to improve imputation results), with

passive imputation for negative and positive affect scores and all interactions. Imputation results suggested that the imputation models performed poorly, with potential scale reduction factors for key variables (such as daily intentions and willingness) never falling below 1.10 despite running 50 iterations per imputation. This suggests that the imputation model was misspecified, and we could not identify the source of the misspecification or improve the imputation modeling results.

### Protocol Deviation: Study 2

We imputed 20 data sets over 50 iterations and four imputation chains (not two as prespecified, to improve imputation results), with passive imputation for negative and positive affect scores and all interactions. We included affective circumplex items (energetic and pleasant) in the imputation model because they were measured at every EMA, as well as all model predictors and covariates, to improve the imputation of affect items. Imputations with random slopes did not converge. Results of the imputation models suggested that the chains adequately mixed and that chains converged, with all psrf < 1.10. Density plots suggested that imputed data reflected our expectations about the distribution of measures. Despite the performance of the imputation models, the imputed data performed poorly in the analytic phase, producing severely multimodal posterior distributions of the key predictors of interest (such as drinking intentions). Multimodality indicates that the parameter estimates dramatically differed across imputations. Although this suggests that the imputation model was misspecified, we could not identify the source of the misspecification. As such, we did not trust results from the imputed data, and below we report analyses based on listwise deletion at the observation level.

### Missing Data Study 1

We obtained data from 1,009 eligible and valid participants, who provided 74,798 EMAs (morning and afternoon; 77% of 96,864 total EMAs). Participants completed 36,606 observations of mood and drinking intentions in the afternoon survey (75% of the total possible afternoon surveys). The number of missing observations was weakly associated with one predictor ( $|r| = .10$ ), such that females completed somewhat more EMAs across the study.

### Missing Data: Study 2

We obtained data from 496 eligible and valid participants, who provided 43,854 eligible EMAs (60.3% of 72,670 total EMAs collected in the absence of a drinking episode). The median response rate was 99 EMAs, with a median of 70% of total possible EMAs completed (the number of possible EMAs completed by participants varied depending on how many drinking episodes they reported and when they were reported). The number of missing observations was weakly associated several predictors ( $|r| = .08-.21$ ), such that participants with lower negative affect, higher positive affect, older age, fewer drinking intentions or willingness, less alcohol use, and fewer days of cannabis use completed somewhat more EMAs across the study.

### Sensitivity and Outlier Analysis

To screen for rapid or careless responses in EMA, EMAs completed in 30 s or less (less than 1% of observations in our prior studies; Dora et al., 2022) were deleted. Because survey links expire within an hour, participants were not be able to complete EMAs outside the window. However, participants could begin the survey within the window and return to it later, meaning that some completion times were very high. For example, 1% of observations in the pilot data had completion times greater than 25 min. Because these high completion times could simply represent the participant failing to click the “submit” button on the survey, we did not automatically delete these responses. Instead, we compared analyses that did versus did not include these observations. Including such observations did not alter the parameter estimates or inferences drawn from the data, and thus we report analyses including all such responses.

Generally, our approach was to avoid winsorizing or otherwise censoring extreme values unless we have specific knowledge that the value is erroneous or impossible. We examined residual distributions for nonnormality and influential outliers using Cook’s distance (Cook’s D, or  $D_i$ ), which is appropriate for multilevel model structures (Van der Meer et al., 2010). Influential outliers were those that changed the inferences in a substantial manner, such as changing an effect from significant to nonsignificant or producing a large change in coefficients. We did not discover influential outliers that meaningfully impacted the parameter estimates or inferences drawn from the data.

### Individual Model Specification

Bayesian mixed-effects models were fit with the *brm* function (*brms* package; Bürkner, 2017) in R. In all models, we modeled random intercepts and slopes for the effects of intentions on positive and negative, as well as for the covariate willingness, to account for individual differences in the levels and slopes across participants. We specified a Gaussian distribution across all models. However, based on prior studies (Dora et al., 2023), we expected negative affect to be negatively skewed. We thus explored whether alternative distributional forms (such as skewed normal distributions) best fit the data, transparently report model fit across all forms, and base final model interpretations on the best fitting distributional form.

**Aim 1.** In Study 1, separate two-level models (i.e., days nested within participants) predicted positive (H1) and negative (H2) affect from same-day intentions while controlling for the covariates (social weekend in Study 1 only, study week, month, age, and sex) and willingness.

**Aim 2.** We then tested whether typical drinking intensities (H3), typical intentions (H4), and enhancement (H5) and social (H6) motives moderated these associations.

**Aim 3.** In Study 2, separate three-level models (i.e., observations nested within days nested within participants) predicted within-day positive and negative affect as a function of time of day and predicted daily differences in the level and slope of positive (H7) and negative (H8) affect as a function of daily intentions, controlling for covariates and willingness. We predicted that greater

intentions to drink later that same day will be positively associated with midday levels and predict increases in positive affect over the course of the day and negatively associated with midday levels of negative affect and predict decreases in negative affect over the course of the day.

**Aim 4.** We then tested whether drinking intensities (H9), typical intentions (H10), and enhancement (H5) and social (H6) motives moderated these associations.

**Aim 5.** Next, we tested whether all associations hold after controlling for same-day willingness and report the degree to which these associations are attenuated.

### Exploratory Analyses

Finally, we conducted subgroup analyses in Study 1 to test whether the replicability of findings was influenced by the different inclusion criteria across studies. First, because the 15- to 17-year-olds were recruited without regard to drinking status, while those 18 and up had to report at least monthly alcohol use, we tested whether all associations are invariant across age groups (e.g., 15–17 vs. 18+). Second, we tested whether restricting analyses in Study 1 to only those who report weekly alcohol use (similar to the inclusion criteria for Study 2) produced similar or disparate findings.

Model convergence was checked via the *Rhat* statistic, *effective sample sizes*, and trace plots. Model fit was checked via posterior predictive checks.

### Priors

Priors were normally distributed with a mean of 0 and an *SD* of 0.5 for all fixed main and interaction effects. We used a half-normally distributed prior with a mean of 0 and an *SD* of 0.25 because variances are bounded at zero. We used the Lewandowski–Kurowicka–Joe (2) prior for all random-effects correlations (Lewandowski et al., 2009; McElreath, 2020).

## Study 1 Results

### Descriptive Statistics

Across observations, participants reported relatively low negative affect ( $M = 0.66$ ,  $SD = 0.82$ , on a 0–4 scale) and somewhat higher positive affect ( $M = 1.23$ ,  $SD = 0.97$ ). Participants reported zero negative affect on 25% of occasions and zero positive affect on 15% of occasions. Participants reported a mean drinking intention of .85 ( $SD = 1.04$ ), and similar levels of willingness ( $M = 0.89$ ,  $SD = 1.09$ ), corresponding to approximately an average of *disagree* on the 5-point scale. When participants reported mean intentions greater than 0 (e.g., greater than *strongly disagree*), their intentions were  $M = 1.65$  ( $SD = 0.89$ ), as was willingness ( $M = 1.51$ ,  $SD = 1.08$ ). Participants reported cannabis use on 11% of study days. Table 1 presents descriptive statistics for the present study. Table 2 presents within- and between-person correlation matrices.

### Aim 1: Predicting Within-Day Positive and Negative Affect From Time of Day and Daily Drinking Intentions

We observed evidence of good model convergence in both models. A hurdle lognormal distribution fits both positive and negative affect well, reflecting the relatively high number of zeros

**Table 1**  
*Study 1 Descriptive Statistics*

Variable	<i>M</i>	<i>SD</i>
Age	20.00	3.21
Birth sex (0 = female, 1 = male)	0.43	0.5
Alcohol use quantity/frequency	11.52	17.86
Person mean drinking intentions (standardized)	0.0000	1.00
Social motives	1.18	1.02
Enhancement motives	1.06	1.04
Daily positive affect	1.23	0.97
Daily negative affect	0.66	0.82
Daily drinking intentions	0.85	1.04
Daily willingness	0.89	1.09
Cannabis use (yes/no)	0.11	0.31

for both outcomes. A hurdle model is a two-part model, with a logit link function (identical to logistic regression) for the hurdle (or the probability of reporting *no* positive or negative affect), while the lognormal model uses an identity link function to model nonzero responses, with parameters interpreted on the log scale. Model parameters for the hurdle part of the model are interpreted by the inverse of the logit function, as an odds ratio  $\exp(\beta)$  or in the probability metric  $\exp(\beta)/(1 + \exp(\beta))$ . Because the hurdle predicted the probability of reporting *no* positive or negative affect, we inverted the parameter estimates in the probability metric (e.g.,  $1 - \exp(\beta)/(1 + \exp(\beta))$ ) for the figures so they may be interpreted more intuitively. Parameters for the lognormal part can be exponentiated to return the scale of the outcome. Posterior predictive checks may be found in the additional online materials (<https://osf.io/dpbc2/>).

**H1: Positive Affect.** Controlling for the covariates, intending to drink more on a given day was associated with a higher level of positive affect (95% CI [0.065, 0.084],  $b = 0.074$ ,  $SE = 0.019$ ,  $BF > 1,000$ ), and a lower likelihood of reporting no positive affect (95% CI [−0.33, −0.18],  $b = -0.25$ ,  $SE = 0.05$ ,  $BF > 1,000$ ). In other words (and as illustrated by Figure 1), a person intending to drink 1 *SD* more than usual on a given day had 1.28 greater odds of reporting positive affect, and if they did report positive affect, it was expected to be 7.6% higher.

**H2: Negative Affect.** Controlling for the covariates, intending to drink more on a given day was associated with a higher likelihood of endorsing no negative affect (95% CI [0.05, 0.13],  $b = 0.09$ ,  $SE = 0.02$ ,  $BF > 1,000$ ) and predicted very slightly lower levels of negative affect (95% CI [−0.02, 0.00],  $b = -0.01$ ,  $SE = 0.01$ ,  $BF = 19.17$ ). The effects on the level of negative affect were very small: When a person's intentions to drink were 1 *SD* more than usual, their negative affect was only .01 points lower (on the 5-point scale), which translated to a 0.01 *SD* decline. Figure 2 illustrates these effects.

### Aim 2: Moderation of the Effects of Drinking Intentions

**Positive Affect.** There was evidence that drinking intensity (H3) moderated the association of daily intentions on the likelihood ( $BF = 15$ ) of reporting any positive affect, as well as the level of positive affect ( $BF = 46$ ). In short, for people with higher past-year drinking intensities, the probability of reporting any positive affect rose more steeply, and the level of positive affect was higher the

**Table 2**  
*Correlations of Analysis Variables*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	—													
2. Birth sex	.09	—												
3. Alcohol use quantity/frequency	.27	.15	—											
4. Person mean intentions	.41	.12	.39	—										
5. Social motives	.45	.05	.33	.45	—									
6. Enhancement motives	.28	-.01	.42	.49	.62	—								
7. Daily positive affect	.06	.11	.1	.13	.13	.09	—							
8. Daily negative affect	-.07	-.01	.04	.05	-.02	.04	.12	—						
9. Daily intentions	.00	.00	.00	.00	.00	.00	.11	-.02	—					
10. Daily willingness	.00	.00	.00	.00	.00	.00	.11	-.02	.66	—				
11. Cannabis use (yes/no)	.06	.02	.13	.17	.1	.21	.00	-.02	.04	.05	—			
12. Weekend/weekday	.00	.00	.00	.00	.00	.00	.05	-.02	.21	.22	.02	—		
13. Month	.00	.00	.00	.00	.00	.00	.00	.00	.04	.05	-.01	-.01	—	
14. Study week	.00	.00	.00	.00	.00	.00	.00	.00	.00	-.05	-.03	-.02	.01	—

*Note.* Correlations displayed are variables used for analysis. All variables (except affect) were between- or within-person standardized, depending on the level of measurement.

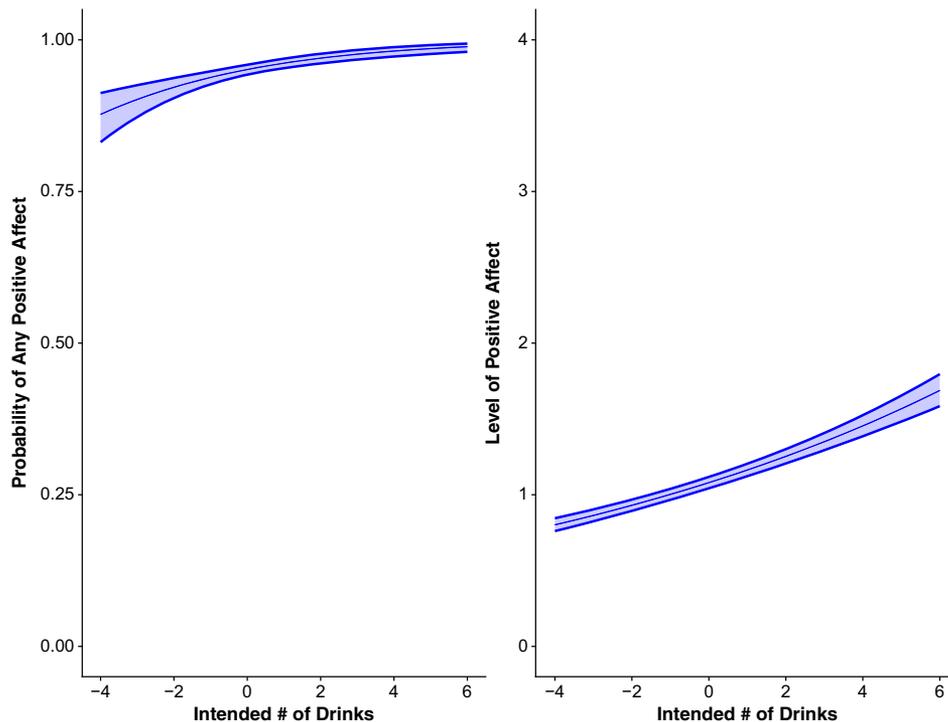
more they reported intending to drink, relative to people with lower drinking histories. Similarly, (H4) higher social motives (likelihood  $BF = 172$ ; level  $BF > 1,000$ ) and (H5) enhancement motives (likelihood  $BF = 323$ ; level  $BF > 1,000$ ) had more positive within-person associations of daily intentions and positive affect. Finally, people with higher typical drinking intentions (H6) also had stronger within-person associations of daily intentions with the level ( $BF > 1,000$ ), but not the likelihood of positive affect.

**Negative Affect.** We found evidence that drinking intensity (H3) moderated the association of daily intentions on the likelihood

of any ( $BF = 12$ ) and the level ( $BF = 7.27$ ) of daily negative affect. Intending to drink more than usual was more strongly and negatively associated with negative affect among those who reported higher past-year drinking intensities.

We observed a similar interaction of social drinking motives (H4;  $BF > 1,000$ ), enhancement motives (H5;  $BF = 35$ ), and typical drinking intentions (H6;  $BF > 1,000$ ) on the association of daily intentions and the likelihood of reporting any negative affect. We also observed evidence for moderation by all predicted moderators on the level (H4: social motives  $BF = 374$ , H5: enhancement

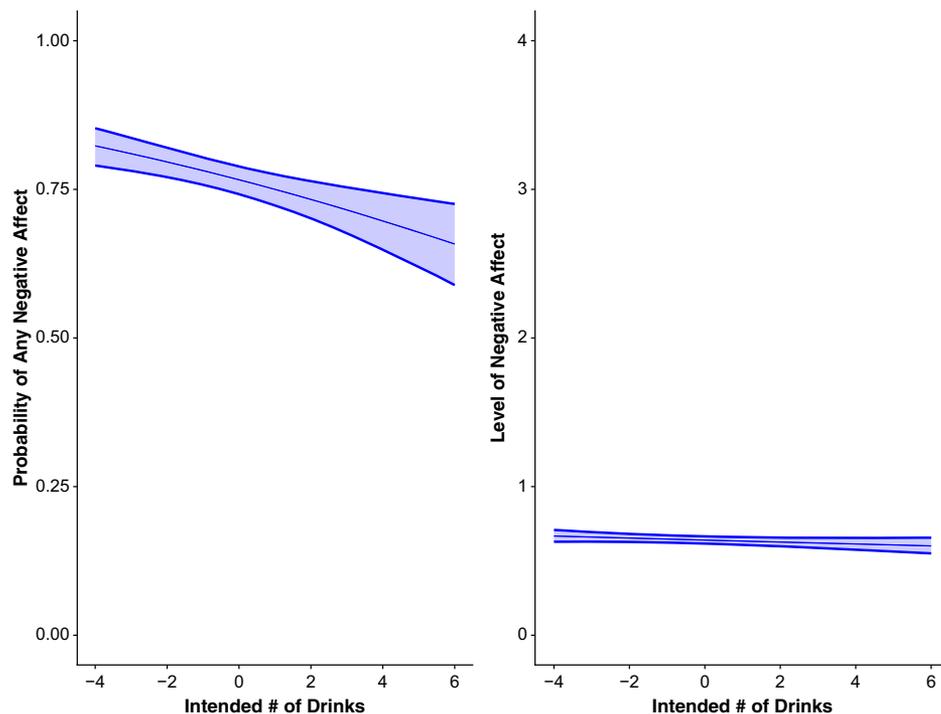
**Figure 1**  
*The Association Between Daily Drinking Intentions and the Likelihood and Level of Positive Affect*



*Note.* See the online article for the color version of this figure.

**Figure 2**

The Association Between Daily Drinking Intentions and the Likelihood and Level of Negative Affect



Note. See the online article for the color version of this figure.

motives  $BF = 145$ ; H6: typical intentions  $BF = 9.99$ ) of daily negative affect. Across all moderators, similar to drinking intensity, higher levels of the moderator were associated with a stronger negative within-person association of daily intentions and the likelihood and level of negative affect.

### **Aim 5 (H13): Were the Effects of Drinking Intentions Specific?**

In Study 1, within-person variations in daily intentions and willingness were moderately correlated ( $r = .66$ ). For positive affect, the effects of daily intentions on the level ( $BF > 1,000$ ) and likelihood ( $BF = 39.8$ ) were robust to the inclusion of daily willingness. The effects of willingness mirrored the effects of intentions: On days when participants were more willing to drink than usual, they reported a higher likelihood of and more positive affect. For negative affect, the associations between daily intentions and the likelihood ( $BF = 13$ ) were not affected by the inclusion of daily willingness, but the association with levels was reduced to below our evidence threshold ( $BF = .31$ ). Daily willingness to drink was associated with a higher likelihood of reporting no negative affect and less negative affect.

There was no evidence that including willingness changed the strength of the interactions predicting positive affect. Similarly, all interactions predicting the likelihood of negative affect and those of social and enhancement motives on the level of negative affect remained above the evidence threshold. Moderation by typical intentions ( $BF = 3.52$ ) and drinking intensities ( $BF = 5.03$ ) on the

level of negative affect fell below our evidence threshold. These results can be found in the additional online materials (<https://osf.io/dpbc2/>).

**Sensitivity Analyses.** We conducted two sensitivity analyses to estimate the comparability of the findings from Study 1 with those of Study 2. Summaries of these results can be found in the additional online materials (<https://osf.io/dpbc2/>).

**Moderation by Age.** First, we tested whether age category (coded as  $<18$  years old vs.  $18+$ ) moderated the main effects of daily intentions and whether moderation by individual differences was itself moderated by age category. Across all models, age category did not moderate the effects of intentions or its moderators on positive affect. Conversely, across nearly all models, age *did* moderate the effects of daily intentions on negative affect, including when controlling for willingness. In short, the negative effects of daily intentions on negative affect reported above were *only* observed for participants 18 and older for both the likelihood and level of negative affect ( $BF > 1,000$ ). Similarly, we only observed moderation by all moderators on the likelihood (but not the level) of negative affect among participants 18 and older. In short, the vast majority of the findings reported above applied only to those 18 and older.

**Subgroup Analysis by Drinking Status.** Second, we repeated all analyses with the subset of participants ( $n = 353$ ; five of whom were younger than 18) who reported at least weekly alcohol use at the baseline (identical to the inclusion criteria for Study 2). The main effects of daily intentions on positive and negative affect were unchanged in magnitude or direction. However, when we controlled

for willingness, there was no association of intentions with either the level or likelihood of negative affect or of intentions with the likelihood of positive affect. Moreover, nearly all moderation effects disappeared (all  $BF < 6$ ) with four exceptions. Average intentions still moderated the effects of daily intentions on the likelihood ( $BF = 53$ ) of negative affect and the level ( $BF = 12$ ) of positive affect; social motives moderated the effects of daily intentions on the likelihood ( $BF = 15$ ) of negative affect and on the likelihood ( $BF = 45$ ) and level ( $BF = 1,090$ ) of positive affect. Generally, we observed reductions in the magnitude of coefficients and (occasionally) changes in sign.

## Study 2 Results

### Descriptive Statistics

Across observations, participants reported relatively low negative affect ( $M = 9.68$ ,  $SD = 14.13$ ) and relatively high positive affect ( $M = 45.21$ ,  $SD = 22.71$ ). Participants intended to drink .58 drinks per day ( $SD = 1.45$ ) but were willing to drink 1.59 drinks per day ( $SD = 2.34$ ). At the person level, participants averaged reporting intending to drink .57 drinks across the study period ( $SD = 0.78$ ). Participants reported cannabis use on 34% of study days. On days when participants intended to drink at least one drink (16.4% of days), they intended to drink 2.75 drinks ( $SD = 1.97$ ), were willing to drink 2.41 drinks ( $SD = 2.41$ ), and used cannabis 36% of days. Table 3 presents descriptive statistics for the present study. Table 4 presents within- and between-person correlation matrices.

### Aim 1: Predicting Within-Day Positive and Negative Affect From Time of Day and Daily Drinking Intentions

We observed evidence of good model convergence in both models. A normal distribution fits positive affect well. As with Study 1, in Study 2, a hurdle lognormal fits the data for negative affect well. Posterior predictive checks may be found in the additional online materials (<https://osf.io/dpbc2/>).

Table 5 presents a comparison of the associations between affect and intentions across studies.

**Table 3**  
Descriptive Statistics for Study 2

Variable	<i>M</i>	<i>SD</i>
Age	20.22	1.34
Birth sex (0 = female, 1 = male)	0.43	0.5
Alcohol use quantity/frequency	23.13	11.61
Person mean drinking intentions (standardized)	0.00	1.00
Social motives	3.26	1.12
Enhancement motives	3.04	1.13
Daily positive affect	45.18	22.7
Daily negative affect	9.68	14.12
Daily drinking intentions	0.58	1.44
Daily willingness	1.59	2.34
Cannabis use (yes/no)	0.33	0.47

### Aim 3: Positive Affect

Controlling for the covariates, the level of positive affect (H7) was associated both with the time of day and drinking intentions within and between persons. People's positive affect was higher for later times of the day (95% CI [1.42, 3.41],  $b = 2.42$ ,  $SE = 0.50$ ,  $BF > 1,000$ ), the more drinks they reported intending to drink later that day (relative to usual; 95% CI [0.54, 0.92],  $b = 0.73$ ,  $SE = 0.12$ ,  $BF > 1,000$ ), and the more drinks they reported intending to drink on average across study days (95% CI [0.63, 2.64],  $b = 1.64$ ,  $SE = 0.62$ ,  $BF = 249$ ). On days when a person intended to drink 1 *SD* more drinks than usual, their level of positive affect was 0.04 *SD* higher than usual, and for people who reported 1 *SD* higher than average number of intended drinks, positive affect was 0.06 *SD* higher across the study period.

We observed strong evidence that people's positive affect increased (H7) more over the day as a function of drinking intentions (95% CI [0.59, 1.71],  $b = 1.15$ ,  $SE = 0.33$ ,  $BF > 1,000$ ). In brief, positive affect increased more over the course of the day prior to drinking the more that people intended to drink that same day (Figure 3).

### Aim 3: Negative Affect

The level of negative affect ( $b = -0.03$ ,  $SE = 0.01$ , lower credible limit =  $-0.041$ , upper credible limit =  $-0.009$ ,  $BF = 206.8$ ), but not the likelihood ( $BF = 0.15$ ), was associated with daily drinking intentions (H8). There was no effect of time of day on the likelihood or the level of negative affect. Neither the likelihood nor the level of negative affect changed over the course of the day ( $BF < 6$ ), and the likelihood of negative affect was not associated with daily intentions. Moreover, intentions were not associated with either the average presence or change over the day in the presence of negative affect (H8). When people reported any negative affect, it was slightly lower on days when people intended to drink more than usual, but it did not decline faster over the course of the day as a function of drinking intentions. This was a small effect: When a person intended to drink 1 *SD* more than was typical for them, their negative affect was only .17 points lower (on a 100 point scale), which translated to a 0.013 *SD* difference.

### Aim 4: Moderation of the Effects of Drinking Intentions

**Positive Affect.** We found no evidence that the effects of daily drinking intentions on the level or within-day change in positive affect were moderated by drinking intensity (H9), social motives (H10), enhancement motives (H11), or average intentions (H12; all  $BF < 6$ ).

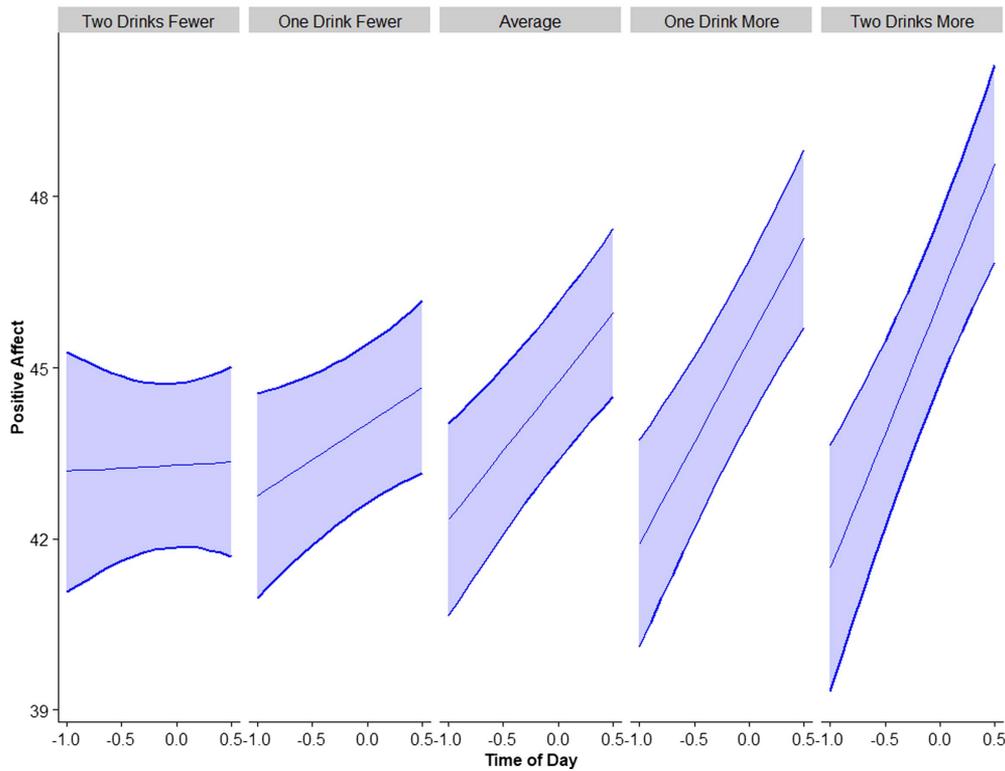
**Negative Affect.** We found no evidence that the effects of daily drinking intentions on the level or within-day change in negative affect were moderated by prior drinking intensity (H9), social motives (H10), or average intentions (H12), all  $BF < 6$ . However, the effects of drinking intentions on the level of negative affect were stronger among people with higher enhancement motives (H11;  $BF = 14.25$ ), opposite of what we predicted.

### Aim 5: Are the Effects of Drinking Intentions Specific?

Finally, we tested whether the effects we observed were specific to intentions to drink or whether they reflected the shared variance of both intentions and willingness to drink.



**Figure 3**  
Effects of Drinking Intentions on Positive Affect



Note. See the online article for the color version of this figure.

was no evidence that daily willingness to drink was associated with levels or change in daily negative affect.

For both positive and negative affect, the evidence against moderation by drinking intensity, average intentions, or motives did not change with the inclusion of willingness.

**Replication Across Studies.** As proposed, we tested the main effects of intentions on daily positive and negative affect in Study 2 *only* using the midafternoon time point to provide directly comparable estimates across studies. We standardized both the predictor (daily intentions) and the outcomes (affect) in Study 2 to force them to be on the same scale as in Study 1. We then reestimated the models, using a hurdle lognormal distribution for both positive and negative affect to make estimates directly comparable with those in Study 1. Then we compared the posterior of the distribution in Study 2 with the 95% credible interval of the posterior from Study 1 using the region of practical equivalence procedure (Kruschke, 2018). Using only the afternoon survey in Study 2, we observed associations between daily intentions and the level of positive (95% CI [0.01, 0.04],  $b = 0.03$ ,  $SE = 0.01$ ) and negative affect (95% CI [−0.11, −0.02],  $b = -0.07$ ,  $SE = 0.02$ ), as well as the likelihood of negative affect (95% CI [−0.04, 0.11],  $b = -0.03$ ,  $SE = 0.04$ ). Although both effects were *subjectively* in a similar range to what we observed in Study 1 (see Table 5), the region of practical equivalence procedure indicated that very little of the credible intervals of the posteriors overlapped (0%–34%). Thus,

according to our preregistered criteria, the effects only replicated in terms of direction and general magnitude (in that they were relatively small), but the specific parameters and interval of uncertainty did not replicate well across studies.

Similar to a previous study from our lab (Schultz et al., 2024), this was a very stringent criterion for replication, requiring that the posterior distributions from Study 2 substantially overlap with the 95% credible intervals from Study 1 using the region of practical equivalence procedure (Kruschke, 2018). While this approach appealed to us initially due to its rigor, our experience across multiple studies has revealed important limitations. As we observed in both the present study and in Schultz et al.'s (2024) study, this criterion can indicate a failure to replicate even when effects are substantively similar in direction and magnitude. The apparent “nonreplication” according to our preregistered criterion appears to be driven more by differences in precision between the studies than by meaningful differences in the underlying relationships. This pattern reinforces our previous observation that requiring substantial overlap between credible intervals may be problematically conservative, as it can suggest failed replications even when studies reveal associations consistent in direction and magnitude. As we noted in Schultz et al.'s (2024) study, this approach (a) demands an unrealistic degree of alignment between studies given natural sampling variability and (b) paradoxically penalizes increased precision in replication attempts, as narrower confidence intervals are less likely to overlap even when point estimates

are similar. While we report these results in accordance with our preregistration, we are inclined to deviate from our preregistered criterion and consider these effects to have successfully replicated given their consistent direction and magnitude across studies.

From this perspective, Table 6 presents a summary of which findings were or were not supported across samples and sensitivity analyses and whether we consider those findings replicated or not.

**Table 6**  
*Summary of Replicated Effects Across Studies and Sensitivity Analysis*

On days when people have greater intentions to drink than usual										
Aim 1, Hypothesis 1/Hypothesis 7: Main effect					Aim 5: Controlling for willingness					
Hypothesis	Study 1			Study 2	Replicated?	Study 1			Study 2	Replicated?
	Full sample	Age 18+	Alcohol	Full sample		Full sample	Age 18+	Alcohol	Full sample	
Higher positive affect	+	+	+	+	Yes	+	+	+	+	Yes
Lower negative affect	+	+	+	+	Yes	×	×	×	+	Yes
Negative affect, less likely	+	+	+	×	No	+	+	×	×	Partial
These effects are stronger among people with greater drinking intensities										
Aim 2, Hypothesis 3/Hypothesis 9: Moderation effect					Aim 5: Controlling for willingness					
Hypothesis	Study 1			Study 2	Replicated?	Study 1			Study 2	Replicated?
	Full sample	Age 18+	Alcohol	Full sample		Full sample	Age 18+	Alcohol	Full sample	
Higher positive affect	+	+	×	×	Partial	+	+	×	×	Partial
Lower negative affect	+	+	×	×	Partial	×	×	×	×	Yes
Negative affect, less likely	+	+	×	×	Partial	×	×	×	×	Yes
These effects are stronger among people with higher social motives										
Aim 2, Hypothesis 4/Hypothesis 10: Moderation effect					Aim 5: Controlling for willingness					
Hypothesis	Study 1			Study 2	Replicated?	Study 1			Study 2	Replicated?
	Full sample	Age 18+	Alcohol	Full sample		Full sample	Age 18+	Alcohol	Full sample	
Higher positive affect	+	+	+	×	No	+	+	×	×	Partial
Lower negative affect	+	+	×	×	Partial	×	×	×	×	Yes
Negative affect, less likely	+	+	+	×	No	+	+	×	×	Partial
These effects would not be stronger among people with greater enhancement motives										
Aim 2, Hypothesis 5/Hypothesis 11: Moderation effects					Aim 5: Controlling for willingness					
Hypothesis	Study 1			Study 2	Replicated?	Study 1			Study 2	Replicated?
	Full sample	Age 18+	Alcohol	Full sample		Full sample	Age 18+	Alcohol	Full sample	
Higher positive affect	+	+	×	×	Partial	+	+	×	×	Partial
Lower negative affect	+	+	×	×	Partial	×	×	×	+	No
Negative affect, less likely	+	+	×	×	Partial	+	+	×	×	Partial
(Exploratory) These effects might be stronger among people with greater average intentions										
Aim 2, Hypothesis 6/Hypothesis 12: Moderation effect					Aim 5: Controlling for willingness					
Hypothesis	Study 1			Study 2	Replicated?	Study 1			Study 2	Replicated?
	Full sample	Age 18+	Alcohol	Full sample		Full sample	Age 18+	Alcohol	Full sample	
Higher positive affect	+	+	+	×	No	+	+	+	×	No
Lower negative affect	+	+	×	×	Partial	×	×	×	×	Partial
Negative affect, less likely	+	+	+	×	No	×	×	×	×	Partial

*Note.* + = hypothesis was supported, × = hypothesis was not supported. Age 18+ = whether the hypothesis was supported among those 18 and older. Alcohol = whether the hypothesis was supported among those reporting at least weekly drinking at baseline. Replication column was coded yes (if support for the hypothesis was consistent across Study 2 and all subsamples of Study 1), partial (if support for the hypothesis was consistent across Study 2 but only some subsamples of Study 1), and no (if support for the hypothesis was not consistent across Study 2 and any subsample of Study 1).

## Transparency and Openness

This study is a registered report. The accepted Stage 1 article, preregistration, all processing and analysis scripts, as well as the codebook and study data for Study 2, are publicly available on the Open Science Framework at <https://osf.io/dpbc2/> (King et al., 2023). Participants did not consent to share data for Study 1; an anonymized version of these data is available upon request. We report (below) how we determined the sample size and the sensitivity of both studies to detect effects.

## Discussion

How are people's intentions to drink later in the day linked with their affect during that day? A wealth of evidence, predominantly (but not entirely) conducted among young adults, has suggested that people's positive affect precedes alcohol use episodes, but negative affect does not (Dora et al., 2023; M. A. Russell et al., 2020; Stevenson et al., 2023; Treloar et al., 2015). This is contrary to affect regulation theories of alcohol use, which hypothesized that at least some alcohol use episodes (at least for some people) are preceded by experiences of negative affect and that people drink to increase their positive affect (but not necessarily because of antecedent positive affect; Cooper, 1994; Cox & Klinger, 1988; Koob, 2013). One alternative explanation is that this represents anticipatory affect (Knutson & Greer, 2008): The anticipation of drinking or its contexts leads to higher levels and greater increases in positive affect and declines in negative affect, as the drinking event approaches. In this registered report, we tested this cognitive-affective cascade model of how intentions to drink might be related to negative and positive affect, replicated across two large samples of adolescents and young adults.

First, we found clear evidence, replicated across studies, that positive affect was higher (and increased more, in Study 2) on days when people reported that they intended to drink more than usual. Given reinforcement theories of alcohol use (e.g., people drink to relieve negative or enhance positive affect), the consistent finding that positive affect is *already* higher prior to drinking episodes is somewhat puzzling. The present study shed some light on this by suggesting that people's positive affect is higher and increases, leading up to drinking episodes as a function of their intentions to drink later in the day. In other words, the more that people plan to drink, the better they feel and the more that good feeling increases over the day. This finding was observed in both data sets across modeling choices, and we consider this to be the most robust and replicable finding in the present study. At the same time, we found mixed evidence that negative affect was related to daily intentions, and what evidence we did observe indicated extremely weak associations. Across both studies, days when people reported more daily drinking intentions were also characterized by lower levels of negative affect, but these effects were extraordinarily weak ( $\sim .01$  *SD* decline effects for a 1 *SD* within-person difference in intentions). Thus, we do not believe this finding should be taken as support for declines in negative affect as a function of intentions. On the other hand, we failed to replicate the finding that people were less likely to report any negative affect on days when they intended to drink more than usual in Study 2, nor did we find evidence that people's negative affect declined over the day when they intended to drink more than usual. Importantly, these differences across studies held

even when we only included participants in Study 1 that matched Study 2's inclusion criteria.

Taken together, our findings suggest that prior research connecting affect and later drinking might in part be driven by *anticipatory* affect: People are more excited and happier as they anticipate drinking (and the social contexts that come with drinking) later in the day. First, previous studies showing a strong link between daily positive affect and later alcohol use (Dora et al., 2022, 2023; Duif et al., 2020; Dvorak et al., 2018; Litt et al., 2023) may in part capture the fact that positive affect is higher as a function of the anticipation of alcohol use. Given that most studies assume a causal association between affect and drinking, our findings may also suggest that some biasing of effects occurs. In short, prior studies linking daily positive affect with later drinking may be overestimating the association because the anticipation of drinking is linked to higher positive affect. At the same time, there has been relatively little research seeking to understand how positive affect might be associated with later alcohol use, and it is important to extend this work in new directions. For example, it would be important to disaggregate people's anticipation of the alcohol use itself compared with the social contexts in which alcohol use occurs. Given that alcohol use, especially in young adults, occurs predominantly in social contexts, it is possible that people's improvements in affect are better accounted for by how they anticipate the contexts in which they drink rather than the drinking itself. It would also be important to test whether positive affect still predicts alcohol use after controlling for daily intentions. It would also be important to measure anticipation of drinking and characteristics of the social contexts of drinking more directly, as well as capture more aspects of people's expectancies about their later drinking behaviors to understand how those expectancies are related to their emotional states over the course of the day prior to drinking.

Drinking intentions and willingness are closely related constructs; in both studies they were moderately to strongly associated within person ( $r = .60-.66$ ). At the same time, there are important distinctions: People can be willing (i.e., open) to drink but not necessarily have specific intentions to do so. In the present study, we found some evidence that the associations of intentions and affect were specific to drinking intentions: Even after controlling for willingness, we observed associations between daily drinking intentions and positive affect in Study 1, on within-day increases in positive affect in Study 2. Thus, it is the specific intention to drink that largely accounts for the association between daily drinking intentions and positive affect. We did replicate the association between daily intentions and negative affect after controlling for willingness across studies, but this was not robust when we matched samples on inclusion criteria. Thus, we consider this finding less robust, and we conclude that the shared variance of people's intentions *and* willingness to drinking rather than specific intentions to drink account for the association of intentions and decreased negative affect on drinking days.

## Moderating Effects

We had conflicting findings regarding moderation across studies. In Study 1, we found strong evidence for moderation by most individual difference factors, such that people with higher average intentions, who drank more, or who had higher social or enhancement

motives (for enhancement motives, this was contrary to hypotheses) all had stronger positive associations of daily intentions with the level of positive affect and stronger negative associations with the level of negative affect. However, sensitivity analyses clarified that these findings were only relevant for those 18 and older (where the inclusion criteria required at least monthly drinking) and largely for participants who did not drink at least weekly (e.g., those who matched the inclusion criteria for Study 2). In other words, the moderating effects of drinking intensity, intentions, and motives were largely (but not entirely) confined to participants who drank at least monthly but less than weekly. If these findings replicate, this would suggest a somewhat paradoxical interpretation: Relatively light-drinking young adults, who also have more experience with drinking, generally intend to drink more, have higher social and enhancement motives and have more mood enhancement on days when they intend to drink more. However, it is important to note that this is essentially the opposite of what we predicted, which was that drinking intensity, intentions, and social motives should predict a stronger affect–intention link among those who were more regular drinkers because they have a longer reinforcement history linking affect and alcohol use.

At the same time, we *failed* to replicate any moderation finding across both studies, even when we matched samples based on inclusion criteria. It is possible that differences in the samples and methodological differences influenced this lack of replication: Each study used related, but separate, scales to measure affect, with different response options and ultimately somewhat different response distributions. For example, there was a preponderance of zero responses for positive affect in Study 1 that required the use of a hurdle lognormal model, which was not true in Study 2. Moreover, Study 1 sampled a broader age range (although analyses with participants who would have been eligible for Study 2 exhibited a similar pattern) and included observations of a random weekday. At the same time, these methodological differences did *not* produce differences in the main effects of daily intentions on positive or negative affect. Thus, the methodological differences were only substantial enough to influence moderation findings, but not the main associations between daily intentions and affect. An alternative explanation is that none of the moderated effects in the present study should be taken at face value. It is well known that moderation effects tend to be low powered and more difficult to detect (Mathieu et al., 2012) and that moderation effects are especially difficult to replicate across studies (Olsson-Collentine et al., 2020). We believe that the results from this high-powered study that aimed to replicate findings across two samples should raise additional cautions about the reliability of moderation findings in addiction research. We would urge future studies to build both in (e.g., cross-validation) and out of sample replication into their work to increase the robustness and reliability of tests of moderation (Bürkner et al., 2020; Schultz et al., 2024; Vehtari et al., 2017).

## Limitations

Although the present study has multiple strengths, including the use of large EMA samples and the preregistered nature of the hypotheses, there are also several weaknesses. First, the present study focused on adolescents and young adults aged (15–25), which means that we can be less certain as to whether our conclusions will generalize to adults and older adults. Moreover, neither sample was representative of clinical populations, and the associations of affect

and alcohol-related behaviors may differ in clinical samples. Moreover, we did not provide participants the option of reporting that they intended to drink but did not have specific intentions as to the amount, which may have increased measurement error and reduced the reliability of our effects. In addition, intentions become a stronger predictor of behavior as individuals age (Gerrard et al., 2008). A second limitation is that the MI procedures failed in both samples, for apparently different reasons. Imputation of multilevel data is exceedingly complex and challenging (Enders, 2022; Enders et al., 2016), and at the same time, relying only on the observed data may have produced biased estimates of the within-person associations between intentions and affect. It is also clear that measuring same-day intentions obscures when people set their drinking intention, and the associations between intentions and affect vary as a function of when they are set and how close that is to the drinking occasion. Our measurement of negative and positive affect was also not identical across studies: Study 1's measure of affect was largely comprised of high arousal items, while Study 2 mixed both high and low arousal items (e.g., anger, sadness, joviality, serenity).

## Conclusions

It has been puzzling to alcohol researchers that studies consistently demonstrate that positive affect precedes drinking episodes in daily life, but negative affect does not, because both effects are seemingly contradicted by theories of negative and positive reinforcement (Cooper, 1994). This study provides some of the first robust evidence that at least some of the within-day association between positive affect and later alcohol use might be explained by an association between same-day positive affect and drinking intentions. Affect regulation (Sher & Grekin, 2007) and motivational theories (Cox & Klinger, 1988) of alcohol use presume that use is reinforcing, which further implies that affect immediately prior to or after the drinking behavior is either a stimulus for drinking (in the case of negative reinforcement) or a signal of reinforcement (in the case of positive reinforcement). These theories should be revised and expanded to consider how affect may change as people anticipate both drinking and the contexts of drinking and to understand how that anticipation shapes the course and contexts of drinking episodes. For example, interventions may consider increasing protective behavioral strategies while also helping young adults evaluate the reinforcing properties of the social contexts (vs. the reinforcement of alcohol itself), which may be more effective at reducing the harm of drinking while helping people achieve their positive reinforcement goals. Moreover, many instances of drinking are not spontaneous: People form intentions to drink hours, days, or even weeks prior to the actual drinking behavior. This heterogeneity in the timing of drinking intentions and alcohol use may muddy attempts to detect affect regulation in people's daily lives because affect may be less influential on alcohol use episodes when drinking is already expected. One recent registered report showed that young adults drank *more* during planned versus unplanned drinking episodes (Howard et al., 2024), while another study reported that planned drinking episodes were associated with higher retrospective enhancement motives, but not with real-time motives or affect (Stevens et al., 2021). This implies that gaining a more precise understanding of whether and how affect that is experienced prior to alcohol use requires careful consideration of the expected and actual

context of drinking episodes. Finally, broad tests of affect regulation that fail to account for these contexts are unlikely to be informative.

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