Alcohol and Cannabis Use Predicted by Affect-Urgency Interactions in Everyday Life

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Abstract

The hypothesis that urgency, a trait quantifying individual differences in impulsive behaviors driven by intense emotions, moderates associations between affect and alcohol use has received inconsistent support in ecological-momentary-assessment research. In this Registered Report, we tested whether trait- and state-level urgency moderate affect-substance use (alcohol and cannabis use) associations in young adults. Four hundred ninety-six adults (ages 18–22) completed ecological-momentary-assessment surveys five times daily across 32 days over 8 weekends. Positive affect was associated with increased alcohol-use probability, and negative affect was associated with decreased alcohol-use probability; cannabis use showed minimal associations with daily affect. Contrary to hypotheses, we found minimal evidence that urgency moderated daily affect-substance-use associations. Interaction effects were consistently estimated around the null value with narrow credible intervals. Results challenge theoretical predictions about urgency's role in emotion-driven substance use and support simpler affect-substance-use models.

Both alcohol and cannabis use peak in young adulthood (Schulenberg et al., 2020) and are associated with short-term and long-term adverse consequences (e.g., Jennison, 2004; Merrill et al., 2018; Pearson et al., 2017). Problematic alcohol and cannabis use are often thought of as forms of emotion regulation (Baker et al., 2004; Conger, 1956; Cooper et al., 2016; Cox & Klinger, 1988; Koob & Le Moal, 2008), wherein people use these substances to cope with negative affect and enhance positive affect. Thus, over time, people may consume more alcohol and cannabis when they experience high negative affect because of the substances' mood-enhancing effects. In a similar vein, substance use has been theoretically linked to urgency, a personality trait reflecting individual differences in reflexive responses to emotions (Smith & Cyders, 2016).

Also referred to as "emotional impulsivity" (Johnson & Carver, 2016), urgency is usually measured via a

well-validated self-report instrument (UPPS-P impulsive behavior scale; Whiteside & Lynam, 2001) with items such as "When I am upset I often act without thinking" and "I am surprised at the things I do while in a great mood." There is strong psychometric evidence that negative and positive urgency are traits distinct from related personality facets, such as neuroticism (Cyders & Smith, 2007; Whiteside & Lynam, 2001). Meta-analyses indicate that urgency is associated with broad risk for externalizing behaviors, including attention-deficit/hyperactive disorder and borderline personality disorder (Berg et al., 2015; Pedersen et al., 2016), and internalizing symptoms, such as anxiety and depression (King et al., 2022). Thus, urgency may represent a

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transdiagnostic risk factor underlying risk for multiple forms of psychopathology (Carver et al., 2017; Johnson et al., 2013).

According to the theory of urgency, experiencing intense emotions (of both negative and positive valence) is hypothesized to motivate people to do things to regulate that emotion (Cyders & Smith, 2008). For example, experiencing anger may lead to aggression (Nesbit et al., 2007), and experiencing boredom may lead to disengagement from the current activity (Dora et al., 2021; Westgate & Wilson, 2018). At the same time, experiencing intense emotions (of both negative and positive valence) is thought to impair "rational" decision-making via a reduction in cognitive resources and the valuation of short-term over long-term interests (Bechara, 2004; Dreisbach, 2006; Shiv et al., 2005). Taken together, these two fundamental processes should increase the likelihood that people engage in behaviors with long-term addictive potential, such as alcohol and cannabis use, when they experience strong emotions. This phenomenon of responding to intense emotions with impulsive behavior is thought to be reinforcing because the behavior successfully regulates the emotion, and in that way, the behavior is conditioned by the emotional experience (Cyders & Smith, 2008). This line of reasoning mirrors theoretical models of alcohol use and addiction (Baker et al., 2004; Conger, 1956; Cox & Klinger, 1988; Koob & Le Moal, 2008). It is thought to be especially relevant during adolescence and early adulthood (Hussong et al., 2011; Wills & Filer, 1996) because this developmental stage is characterized by intense emotional experiences (Larson & Richards, 1994) and high rates of heavy substance use (SAMHSA, 2021). Thus, understanding the role urgency plays in the development of substance use is critical to improving targeted efforts aimed at preventing and reducing the harm of substance use and substance use disorders (Pepe et al., 2023).

Meta-analytic research at the trait level has generally supported the prediction that people higher in urgency also report higher frequency of alcohol use (Coskunpinar et al., 2013; Stautz & Cooper, 2013) and cannabis use (Stautz & Cooper, 2014; Um et al., 2019) in cross-sectional survey studies. Longitudinal research has also supported an association between urgency traits and subsequent alcohol use (Levitt et al., 2021; Settles et al., 2014; Waddell et al., 2022). For instance, Waddell et al. (2022) showed in a sample of nearly 400 adolescents that participants reporting higher negative urgency at an average age of 16 were more likely to have started drinking alcohol a year later. However, both cross-sectional and traditional longitudinal research designs tell researchers little about how trait urgency manifests itself in real-world situations because these designs can only demonstrate that people who report generally responding reflexively to emotion also generally report more substance use. They cannot demonstrate that people higher on urgency actually engage in more substance use shortly following the experience of intense emotions.

Prior studies have used ecological momentary assessment (EMA; Shiffman et al., 2008) to test whether people high on urgency exhibit stronger momentary associations between emotions and impulsive behaviors. For example, several recent studies have shown that trait urgency did not explain individual differences in the associations between the experience of negative emotions and momentary perceptions of impulsivity (Feil et al., 2020; Sharpe et al., 2020; Sperry et al., 2016, 2018). However, because the theory of urgency states that impulsive behaviors are reinforced over time (Cyders & Smith, 2008), it may be more informative to predict a specific behavior (e.g., alcohol or cannabis use) in a sample of people who have been reinforced for that behavior over time (e.g., regular alcohol or cannabis users).

Three previous EMA studies have tested such a specific Affect × Urgency interaction among regular alcohol users, although none have focused on cannabis use. These studies asked participants to report on their trait levels of urgency (Whiteside & Lynam, 2001) at a baseline session and reported on their emotional experience one to several times per day for multiple weeks and on their alcohol use either in the moment or the next morning. Two studies (Bold et al., 2017; J. S. Simons et al., 2010) reported that momentary negative affect was associated with same-day alcohol use for people high in trait negative urgency. In a recent preregistered test, we failed to replicate these findings (Dora et al., 2022). Although the study by Bold and colleagues (2017) was conducted among people enrolled in a placebo-controlled trial of naltrexone, which might explain the differential effects (Koob & Le Moal, 2008), both the study by J. S. Simons and colleagues (2010) and our study sampled moderate- to heavy-drinking college students.

What could explain these disparate results? It is possible that one of the two studies produced a false-positive or false-negative result. However, there are also two crucial differences between the projects. First, whereas we computed indicators of general levels of negative and positive affect (Dora et al., 2022), J. S. Simons et al. (2010) focused on more specific affective states, such as anxiety, sadness, and joviality (and only the State Anxiety × Trait Negative Urgency interaction was significant regarding negative-affect regulation). In a recent project, we found evidence that some discrete emotions might be stronger predictors of substance use than others in EMA data (Dora, Piccirillo, et al., 2023).

Affective states differ in terms of the valence and arousal of their emotional experience and thus may differentially motivate behavior (Lench et al., 2011). For example, both sadness and anxiety are negative affective states, but sadness is a low-arousal state, and anxiety is a high-arousal state. Such differences so far have received little attention in the EMA literature on affect and substance use (J. S. Simons et al., 2010, is a notable exception), at least in part because most research has relied on the positive and negative affect schedule (PANAS) model (Watson et al., 1988) and averaged varying sets of discrete negative and positive emotions into daily or momentary measures of general negative and positive affect. Second, whereas we focused on predicting the number of alcoholic drinks consumed, J. S Simons et al. (2010) predicted a composite score made up of number of alcoholic drinks consumed, estimated blood alcohol concentration (eBAC) at the end of the drinking episode, and subjective levels of intoxication. Thus, we (Dora et al., 2022) may have missed an effect in our narrower set of analyses.

Another way to understand the role of urgency in substance use would be to examine urgency at the state level, which measures how well people perceive themselves to be controlling their impulses in a given moment. Our recent research has shown that items adapted from trait measures of urgency exhibit substantial within-persons variation in EMA data, are highly correlated with prior measures of state impulsivity, and are moderately to highly correlated with trait measures of urgency (Halvorson et al., 2021). They also have evidence of convergent validity: Several recent EMA studies have indicated that people report higher urgency in moments when they experience more negative emotions (Feil et al., 2020; Sharpe et al., 2020) and more stress (Seldin et al., 2022).

Moments or days characterized by negative emotions might not necessarily lead to alcohol or cannabis use if people have alternative and effective means of regulating those emotions. In other words, in moments or on days when people report more urgency and intense negative emotions, they are more likely to use alcohol or cannabis because they are having difficulties regulating their emotions and behavior. This would indicate that it is not the general tendency to report emotional impulsivity that may explain who exhibits the hypothesized association between negative affect and substance use but that it is the momentary report of emotional impulsivity that explains when intense negative emotions lead to substance use. To date, only two studies have tested this hypothesis regarding alcohol use, but neither reported significant effects (Dora et al., 2022; Stamates et al., 2019).

Nearly all this prior research has focused on the effect of negative affect and urgency on alcohol use. This naturally stems from the theoretical emphasis that has been placed on negative affect predicting substance use (e.g., Baker et al., 2004; Cox & Klinger, 1988) despite the failure of negative-affect-regulation models in EMA data for both alcohol (Dora, Piccirillo, et al., 2023) and cannabis use (Dora, Smith, et al., 2023). On the other hand, the evidence for positive affect predicting alcohol use in EMA data is much stronger, especially in samples of college students and young adults (Dora et al., 2022; Dora, Piccirillo, et al., 2023; Dvorak et al., 2016; Emery & Simons, 2020). Our meta-analytic model estimated that on days participants reported positive affect 1 *SD* higher than their own average, they were estimated to be 20% to 25% more likely to drink. Furthermore, both Bold et al. (2017) and we (Dora et al., 2022) found some evidence that the association between positive affect and alcohol use was stronger for people reporting higher trait positive urgency, but these results were far from conclusive.

No prior studies testing an Affect × Urgency (trait or state level) interaction have been conducted among regular cannabis users even though similar emotion-regulation functions have been hypothesized to motivate both alcohol and cannabis use (Cooper et al., 2016) and associations between affect and cannabis use in EMA data have been frequently reported. Overall, findings from studies with larger sample sizes indicate similarly that cannabis use is more likely following reports of higher positive affect rather than negative affect (Chakroun et al., 2010; Dora, Smith, et al., 2023; Testa et al., 2019), especially in nonclinical samples of young adults (Wycoff et al., 2018). People higher on trait positive urgency may be more likely to use alcohol or cannabis in moments or on days when they experience stronger positive emotions because they generally become more dysregulated in the face of positive emotions. Alternately, moments or days characterized by higher positive emotions may be more likely to lead to alcohol or cannabis use when they are also marked by momentary urgency. Taken together, these findings highlight the need to place more emphasis on the role positive affect and positive urgency play in the decision to consume alcohol and cannabis in young adults.

In this Registered Report, we aimed to provide strong evidence testing specific Affect × (Trait- and State-Level) Urgency interactions in a sample of young adults who regularly use alcohol or cannabis. We attempted to provide strong evidence either for or against these interactions by improving in two ways on previous studies. First, in this study, we were able to predict multiple alcohol- and cannabis-use outcomes from multiple negative and positive affective states. Second, we performed these tests in a large community sample (*N* = 496) of regularly using young adults who provided

EMA data on 32 days across 8 weekends (Thursday–Sunday). This large data set combined with the exhaustive list of ways in which we were able to test affect-urgency interactions provided us with the ability to draw more definitive conclusions, at least regarding the population that we sampled from. We tested the following hypotheses:

Hypothesis 1a: Trait negative urgency moderates the daily within-persons association between negative affect and subsequent alcohol use so that the association is more positive for people reporting higher negative urgency.

Hypothesis 1b: Trait negative urgency moderates the daily within-persons association between negative affect and subsequent cannabis use so that the association is more positive for people reporting higher negative urgency.

Hypothesis 2a: State urgency moderates the daily within-persons association between negative affect and subsequent alcohol use so that the association is more positive on days participants report higher urgency.

Hypothesis 2b: State urgency moderates the daily within-persons association between negative affect and subsequent cannabis use so that the association is more positive on days participants report higher urgency.

Hypothesis 3a: Trait positive urgency moderates the daily within-persons association between positive affect and subsequent alcohol use so that the association is more positive for people reporting higher positive urgency.

Hypothesis 3b: Trait positive urgency moderates the daily within-persons association between positive affect and subsequent cannabis use so that the association is more positive for people reporting higher positive urgency.

Hypothesis 4a: State urgency moderates the daily within-persons association between positive affect and subsequent alcohol use so that the association is more positive on days participants report higher urgency.

Hypothesis 4b: State urgency moderates the daily within-persons association between positive affect and subsequent cannabis use so that the association is more positive on days participants report higher urgency.

Transparency and Openness

Following Stage 1 in-principle acceptance, we preregistered the study at https://osf.io/jw6sf/. Our anonymized data, materials, and code can also be found on the OSF. We preregistered and report how we determined our sample size, all data exclusions, and all measures in the study. The study was approved by the local institutional review board under Study ID 00006424.

Method

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

Sample-size justification

The sample size of this EMA study ($N = 496$) was based on a power analysis for a different set of analyses than the ones reported here. For that reason, we conducted a set of simulations to determine statistical power. We performed these simulations testing for a cross-level interaction between negative affect and trait-level negative urgency on the number of drinks consumed on drinking days because this should be the analysis for which the largest sample size is required. That is because for this analysis, we can use data only from days on which participants drank alcohol and the interaction involves a variable on the participant level. We had to make a few assumptions in this analysis. First, based on previous EMA research by our group (Dora et al., 2022; Dora, Piccirillo, et al., 2023), we conservatively expected participants to contribute 10 drinking episodes on average across the 32 days of participation and that participants consume 4.5 alcoholic drinks per drinking episode on average. Second, because we were interested in simulating the interaction, we had to make assumptions about the two main effects in the model. For simplicity, we assumed two very small effects in opposite directions (affect: $b = 0.05$; urgency: $b = -0.05$). Third, we had to make assumptions regarding the uncertainty surrounding multiple model parameters (random intercept, random slopes, error term). We based these values on our previous work predicting number of drinks in EMA data. Using these assumptions, we simulated a .02 interaction effect, and the 95% credible interval (CI) for this interaction excluded 0 in 97.6% of simulations. We illustrate an intuitive interpretation of this effect size along two hypothetical individuals, one whose urgency score is 1 *SD* above the sample mean and one whose urgency score is 1 *SD* below the sample mean. For the first individual, the model would estimate that the individual consumes an additional ≈0.12 drinks when negative affect increases by 1 *SD* compared with the individual's own mean; for the second individual, the model would estimate that the individual consumes ≈0.07 fewer drinks when

negative affect increases by 1 *SD*; thus, we had 97.6% power to detect a difference in change between the two individuals (who differ in their urgency score) of one-fifth of a standard alcoholic drink. For the code for the power simulations, see https://osf.io/jw6sf/.

Participants and procedure

Participants were young adults (*N* = 496,[1] ages 18–22, 55.8% assigned female sex at birth) and were recruited from King, Pierce, and Snohomish Counties from both college and noncollege sources to ensure a diverse sample of young adults in Washington State. Recruitment began in August 2020 and was completed in November 2022. Participants were required to be between the ages of 18 and 22 at study screening, own a smartphone, be fluent in English, and report drinking alcohol or using cannabis at least "about once per week" over the past 3 months. The sample was stratified along sex and age (we attempted to recruit equal number of male and female participants at each age). Participants were excluded if they were not fluent in English or they moved to the United States after age 12 to screen out participants who were not acculturated to U.S. norms of substance use. We used several recruitment methods (e.g., social media ads, university registrar lists and high school list-servs, newspaper ads, flyers) and sampled from a wide variety of neighborhoods with differential aggregate socioeconomic status (as indicated by the 2020 census) to achieve a diverse sample in terms of gender identity and race/ethnicity. Thus, although our sample is not a representative one, it can be considered a high-risk community sample broadly reflecting Washington census data from counties in which participants were recruited. We achieved this aim in terms of gender identity (47.2% cisgender female, 43.8% cisgender male, 12.9% nonbinary/genderqueer/gender nonconforming, 4.0% transgender male or female, 0.06% nongendered) and race/ethnicity (69.6% non-Hispanic White, 26.2% Asian, 6.7% African American, 8.5% Hispanic/Latino, and 9.9% who endorsed more than one ethnicity).

Following screening and training on the EMA protocol, participants first completed a baseline assessment in exchange for $50. For the next 8 weekends (Thursday–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-min and 40-min reminders after 2 months of data collection to increase participation rates. Participants were paid $1 per completed EMA survey and a $5 bonus for completing 80% of EMA surveys for a given weekend. Participants completed a total of 104 EMAs on average, with a completion rate of 62%.

Measures

These measures come from a more extensive battery. Below, we report the measures relevant to the proposed study. For the codebook for this study, see https://osf.io/jw6sf/.

Baseline assessment

Trait negative and positive urgency. Participants completed the 12-item negative-urgency and 14-item positive-urgency subscales of the UPPS-P Impulsive Behavior scale (Lynam et al., 2006). Items included "When I am upset, I often act without thinking" and "I tend to act without thinking when I am really excited." Response options ranged from 1 = *disagree strongly* to 4 = *agree strongly* for all items. Internal consistency was high for both subscales (αs > .85, ωs > .87). We averaged 12 items of the negative-urgency subscale and 14 items of the positive-urgency subscale, respectively.

EMA

Negative and positive affect. We included a total of 39 items in our study, which reflect seven affective states (anger, anxiety, sadness, general distress, joviality, attentiveness, serenity; Table 1). We chose these seven states to cover people's emotional experience based on work examining the within-persons structure of affect (Jacobson et al., 2023). Across three large samples, two to three of these items loaded onto the same factor. We then added additional items to each state based on the PANAS-X scale (Watson & Clark, 1999). At each assessment, participants were randomly presented with two items from each of these seven states, for a total of 14 emotion items. We used this planned-missing-data design to reduce participant burden, increase data validity, and reduce unplanned missing data (Rhemtulla & Little, 2012). Participants reported to what extent they experienced each emotion in the past hour on a visual analogue scale ranging from 0 = *not at all* to 100 = *very much*. Negative- and positive-affect variables showed high reliability across items and time (RkFs > .95). We calculated daily scores for each of the seven states. All EMAs filled in during the day and before the onset of alcohol/cannabis use (to temporally separate reports of emotions and substance use) were averaged into daily scores of anger, sadness, anxiety, other negative affect, joviality, attentiveness,

Table 1. Negative and Positive Affective States and Items

Negative affect				Positive affect		
Anger	Sadness	Anxiety	Other	Joviality	Attentiveness	Serenity
Angry	Unhappy	Anxious	Upset	Happy	Alert	Calm
Irritated	Sad	Afraid	Distressed	Cheerful	Attentive	Relaxed
Hostile	Blue	Nervous	Guilty	Delighted	Determined	At ease
Annoyed	Alone	Jittery	Ashamed	Joyful	Concentrating	
Scornful	Lonely	Shaky		Enthusiastic		
Disgusted	Downhearted	Frightened		Energetic		
Loathing		Scared		Lively		
				Excited		

and serenity on use days. On nonuse days, we averaged affect reports before the median onset of alcohol/cannabis use on use days.

State urgency. At each assessment, participants were randomly presented four out of six items of the urgency subscales of the UPPS-P (Halvorson et al., 2021; Whiteside & Lynam, 2001). In line with previous work from our lab (Feil et al., 2020), these items were adapted by changing the language from general trait descriptors to past-tense statements that participants rated based on their experience in the past hour. Furthermore, affect content was removed from urgency items when appropriate to make the items affect-independent (e.g., "I acted without thinking"). Participants responded to these items on a visual analogue scale ranging from 0 = *strongly disagree* to 100 = *strongly agree*. This state-urgency construct was highly reliable across items and time (RkF = .90) and exhibited excellent factor structure in an earlier study from our lab (Halvorson et al., 2021). The varying items that were answered were averaged for each EMA. All EMAs filled in during the day and before the onset of alcohol/cannabis use were averaged into a daily state-urgency score on use days. On nonuse days, we averaged state-urgency reports before the median onset of alcohol/cannabis use on use days.

Alcohol and cannabis use. Participants reported on their alcohol and cannabis use during morning assessments or at the second assessment of the day in case the morning assessment was missed. Participants reported how many drinks they had the night before on a visual analogue scale ranging from 0 to 30 or more drinks. The scale was presented together with a definition of a standard alcoholic drink. Participants also reported how intoxicated they got on a visual analogue scale ranging from 0 = *not at all/I didn't drink* to 100 = *very drunk*. The eBAC at the end of the drinking episode was calculated using the formula by Matthews and Miller (1979): eBAC = [(number of standard drinks / 2) × (sex constant of 9.0 for female sex assigned at birth or 7.5 for male sex assigned at birth/weight in pounds)] − (0.017 g/dl for the rate of alcohol metabolism per hour × time in hours from first sip of alcohol).

Participants also reported how much cannabis they used on a visual analogue scale ranging from 0 g to 28 g and how intoxicated they got on a visual analogue scale ranging from 0 = *not at all/I didn't use cannabis* to 100 = *very high*. Participants also reported the time at which they began drinking alcohol and using cannabis on the previous day. All substance-use variables were reverse lagged to line up with the affect assessments of the previous day.

Data analysis

We conducted all of our analyses in R (R Core Team, 2021) with the *brms* package (Bürkner, 2017). In our hypothesis tests, we focused on predicting the likelihood and quantity of alcohol and cannabis use, which we consider the primary outcomes of interest. Models predicting intoxication and eBAC were treated as secondary and exploratory tests. We fit multiple models to inform each hypothesis because we predicted alcohol and cannabis use from multiple negative and positive affective states. We drew two kinds of inferences. First, to arrive at one overall test of each hypothesis, for each hypothesis, we performed a mini meta-analysis (Goh et al., 2016) among the models that inform it. We report the posterior probability that the pooled effect size across these models relating to one hypothesis is larger/smaller than our smallest effect size of interest. This approach allows us to integrate information across multiple translations of one verbal hypothesis into statistical tests. Second, we interpreted each model individually and noted to what extent each model indicates evidence in favor of an Affect × Urgency interaction.

Missing data. We initially addressed planned missing data at the item level and unplanned missing data at the

observation level via multilevel multiple imputation with the *mice* (van Buuren & Groothuis-Oudshoorn, 2011) and *countimp* (Kleinke & Reinecke, 2019) packages in R. Multiple imputation handles missing data by defining a joint distribution for all variables, from which missing data values can be generated via Bayesian estimation. We used a mix of information from the baseline survey (i.e., demographics, UPPS-P scores, validated scales relating to emotions and substance use) and EMA surveys (i.e., affect and related items, substance use and related items) in our imputation model. Mirroring our analyses, information from EMA surveys was nested in participants in this imputation model. In this way, we created 20 imputed data sets and initially fit our models on these 20 data sets. However, because of computational constraints (see Deviations from preregistration section below), we ultimately conducted our primary analyses on observed data only after confirming that results were consistent across both approaches.

Individual model specification. We fit Bayesian mixed-effects models with the *brm* function (*brms* package; Bürkner, 2017). In all models, the day was the unit of analysis, and we modeled random intercepts and slopes for affect and state urgency to account for differences in substance use and the effect of affect and urgency on substance use between participants (Barr et al., 2013). Affect and state urgency were person-mean unit standardized so that they have a mean of 0 and a standard deviation of 1. Trait urgency was sample-mean standardized so that it has a mean of 0 and a standard deviation 1. Given that alcohol and cannabis use are variables that we expected to be zero-inflated, we specified mixtures models that accounted for this zero inflation. Model convergence was checked via the R-hat statistic, effective sample sizes, and trace plots (Dora, McCabe, et al., 2024). Model fit was checked via posterior predictive checks.

We controlled in all models for racial identity, gender identity, and college-enrollment status because we expect these variables to predict substance use. We additionally controlled for differences in COVID-19 restrictions throughout the data-collection period by including a variable in the model that indicates in which of the four stages of the "Safe Start Washington: A Phased Approach to Recovery" the data were collected (Stage 1: no social gatherings, closed restaurants, bars, and nightclubs; Stage 2: gatherings with up to five people, restaurants at 50% capacity, bars and nightclubs closed; Stage 3: gatherings with up to 50 people, restaurants at 75% capacity, bars at 25% capacity, nightclubs closed; Stage 4: no restrictions).

Individual model priors. We used normally distributed priors with a mean of 0 and a standard deviation of 0.5 on all fixed main and interaction effects of our models. We used a half-normally distributed prior with a mean of 0 and a standard deviation of 0.25 on the standard deviations and sigma parameter. We used the LKJ(2) prior for all random-effects correlations (Lewandowski et al., 2009; McElreath, 2020).

Mini meta-analysis model specification. We extracted the effect size and standard error from each model that informs a hypothesis and predict the effect size (weighted by the standard error so that effects with higher precision are given a greater weight) from an intercept-only model with a random intercept nested in affective state.

Mini meta-analysis model priors. For this model, we specified a normally distributed prior with a mean of 0 and a standard deviation of 0.25 for the distribution of effect sizes and a half-normally distributed prior with a mean of 0 and a standard deviation of 0.125 on the effect size heterogeneity.

Exploratory and sensitivity tests. We performed these tests (predicting subjective intoxication and eBAC from Affect × Urgency interactions) in the same way as our primary tests. We also performed sensitivity analyses to test whether our results are robust to the possibility of alcohol and cannabis co-use. For that reason, we computed conditional effects predicting alcohol use on days participants used and did not use cannabis and conditional effects predicting cannabis use on days participants used and did not use alcohol (McCabe et al., 2022; Rohrer & Arslan, 2021).

Deviations from preregistration. While conducting the preregistered analyses, we encountered three situations that required deviations from our original plan. First, we preregistered the use of hurdle negative binomial models for both alcohol- and cannabis-use outcomes. This was based on a misunderstanding on the part of the J. Dora; because cannabis use was assessed on a continuous slider scale (0–28 g) rather than as discrete counts, the negative binomial distribution is inappropriate. To properly model the continuous, zero-inflated nature of cannabis-use data, we instead used hurdle gamma models (which we confirmed fit the data well via posterior predictive checks).[2] Second, we preregistered conducting Bayesian analyses on multiply imputed data sets. Although we successfully implemented this approach initially, the resulting model objects were extremely large (exceeding 20 GB per model), creating substantial challenges for data storage, sharing, and computational processing. To address these practical constraints while maintaining analytical rigor, we analyzed all Bayesian

models using observed data only. We verified that results were consistent between the imputed and observed data approaches before proceeding with the observed data analyses. This ensured that this deviation did not alter our substantive conclusions. Third, we preregistered reporting Bayes's factors to quantify evidence for our hypotheses. However, computing stable Bayes's factors for our complex mixed-effects mixture models required substantially more iterations than initially anticipated, leading once again to excessive object sizes and model-fitting times. Therefore, we focused our interpretations on CIs and posterior distributions, which provide information about parameter uncertainty and effect-size estimates. These deviations were made to ensure methodological appropriateness (Deviation 1) and computational feasibility (Deviations 2 and 3) while preserving the core analytical framework and interpretive approach outlined in our preregistration.

Results

Descriptive statistics

Participants reported trait negative-urgency scores of $M = 3.31$ ($SD = 0.61$, range = 1.33–4.92) and trait positive-urgency scores of $M = 2.88$ ($SD = 0.61$, range = 1.00–5.00). Across all EMAs, participants reported using alcohol on 33.7% of days ($M = 4.03$ drinks on use days, $SD = 3.51$, range = 1–30) and cannabis on 28.9% of days ($M = 2.09$ g on use days, $SD = 2.95$, range = 0.02–21.96).[3] The average reported state urgency was 11.85 ($SD = 19.20$, range = 0–100). The final observed data set included 9,491 person-days of data from 496 participants (19.14 EMA days per participant on average).

The multiple-imputation model converged successfully as indicated by R-hat statistics, trace plots, and comparisons between observed and imputed variable distributions. All Bayesian models (on imputed and observed data) converged as indicated by R-hat statistics, effective sample sizes, trace plots, and posterior predictive checks. Relevant diagnostic materials are available on the OSF.

Hypothesis 1a (Negative Affect × Trait Urgency interaction predicting alcohol use)

We tested this hypothesis using five operationalizations of negative affect: anger, sadness, anxiety, distress, and general negative affect. Figure 1 displays the results in a 2 × 2 grid of forest plots showing meta-analytic estimates and individual model results for the main effects of negative affect and the Negative Affect × Trait Negative Urgency interactions on both the hurdle and negative binomial components of the models. The bottom panels

illustrate these interactions by plotting the predicted probability of alcohol use (left) and predicted number of drinks consumed on use days (right) as general negative affect increases, stratified by low, average, and high levels of trait negative urgency.

For the probability of alcohol use, the meta-analytic estimate for the main effect of negative affect was odds ratio [OR] = 0.90, 95% CI = [0.84, 0.96], indicating that higher negative affect was associated with a ≈10% decrease in the odds of drinking. The product term was $OR = 0.99$, 95% CI = [0.92, 1.05], meaning higher negative affect was associated with a ≈5% to 15% decrease in the odds of drinking for participants both high (+1 SD) and low (−1 SD) in trait urgency.

For alcohol quantity on use days, the meta-analytic estimate for the main effect of negative affect was incidence rate ratio [IRR] = 1.01, 95% CI = [0.99, 1.03], and for the product term, it was IRR = 0.99, 95% CI = [0.96, 1.01]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that trait negative urgency does not moderate the association between negative affect and alcohol use.

The estimates for the main effects of trait negative urgency were $OR = 0.99$ (95% CI = [0.88, 1.13] and IRR = 1.10 (95% CI = [1.02, 1.17]), respectively. Individual model results showed generally consistent patterns across the five operationalizations such that negative affect was associated with slightly lower probability of drinking but minimal evidence for moderation by trait negative urgency. The interaction effects were consistently small and included the null value across all individual models. Exploratory analyses predicting alcohol intoxication and eBAC and sensitivity analyses examining conditional effects by cannabis co-use similarly showed no evidence for Negative Affect × Trait Negative Urgency interactions.

Hypothesis 1b (Negative Affect × Trait Urgency interaction predicting cannabis use)

We tested this hypothesis using the same five operationalizations of negative affect (Fig. 2). For the probability of cannabis use, the meta-analytic estimate for the main effect of negative affect was $OR = 0.98$, 95% CI = [0.94, 1.02], and for the interaction, it was $OR = 1.01$, 95% CI = [0.97, 1.06].

For cannabis quantity on use days, the meta-analytic estimate for the main effect of negative affect was IRR = 0.99, 95% CI = [0.97, 1.01], and for the interaction, it was IRR = 1.00, 95% CI = [0.98, 1.02]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that trait negative urgency does not moderate the association between negative affect and cannabis use.
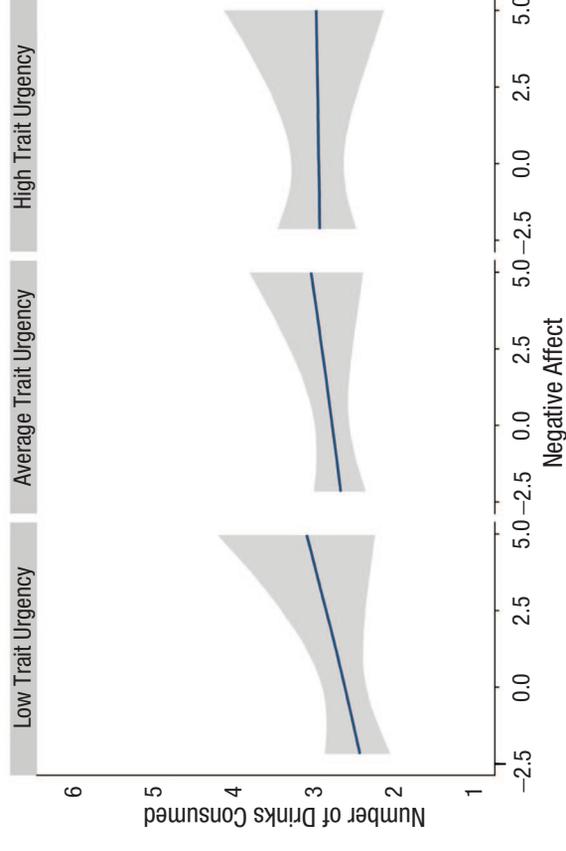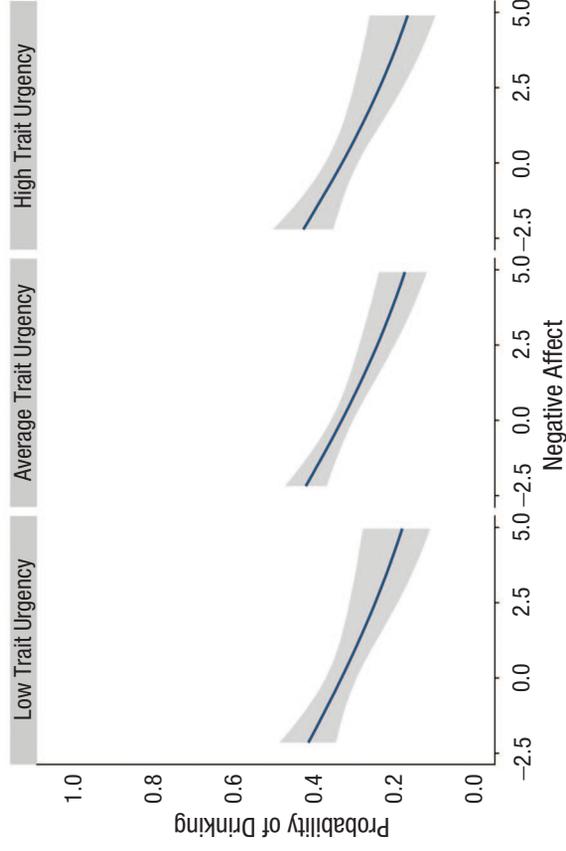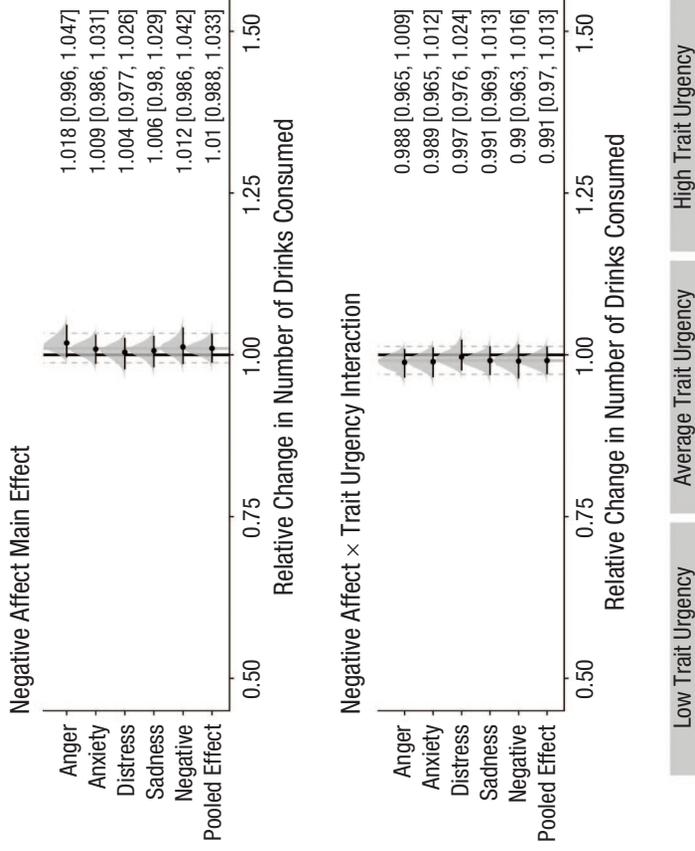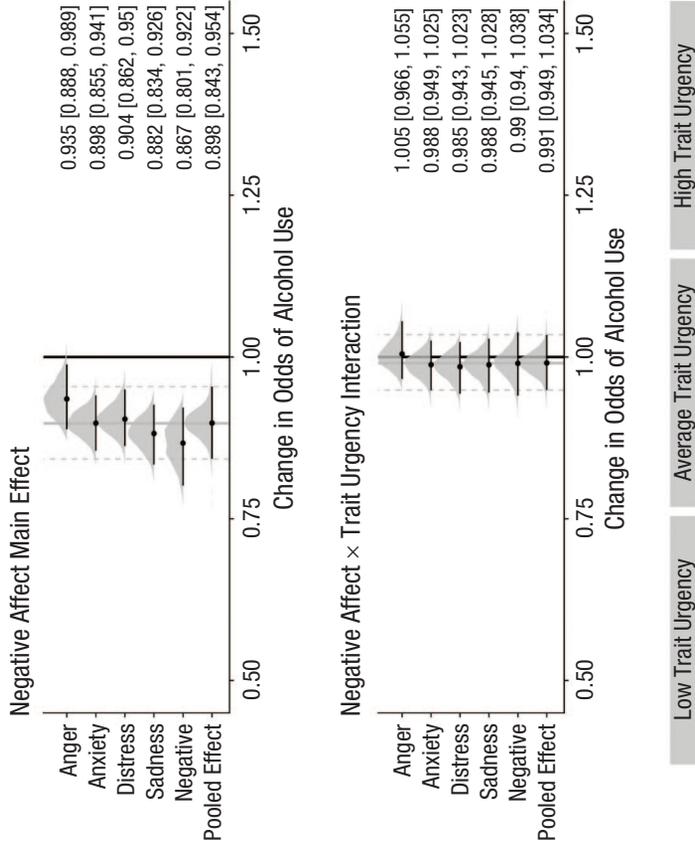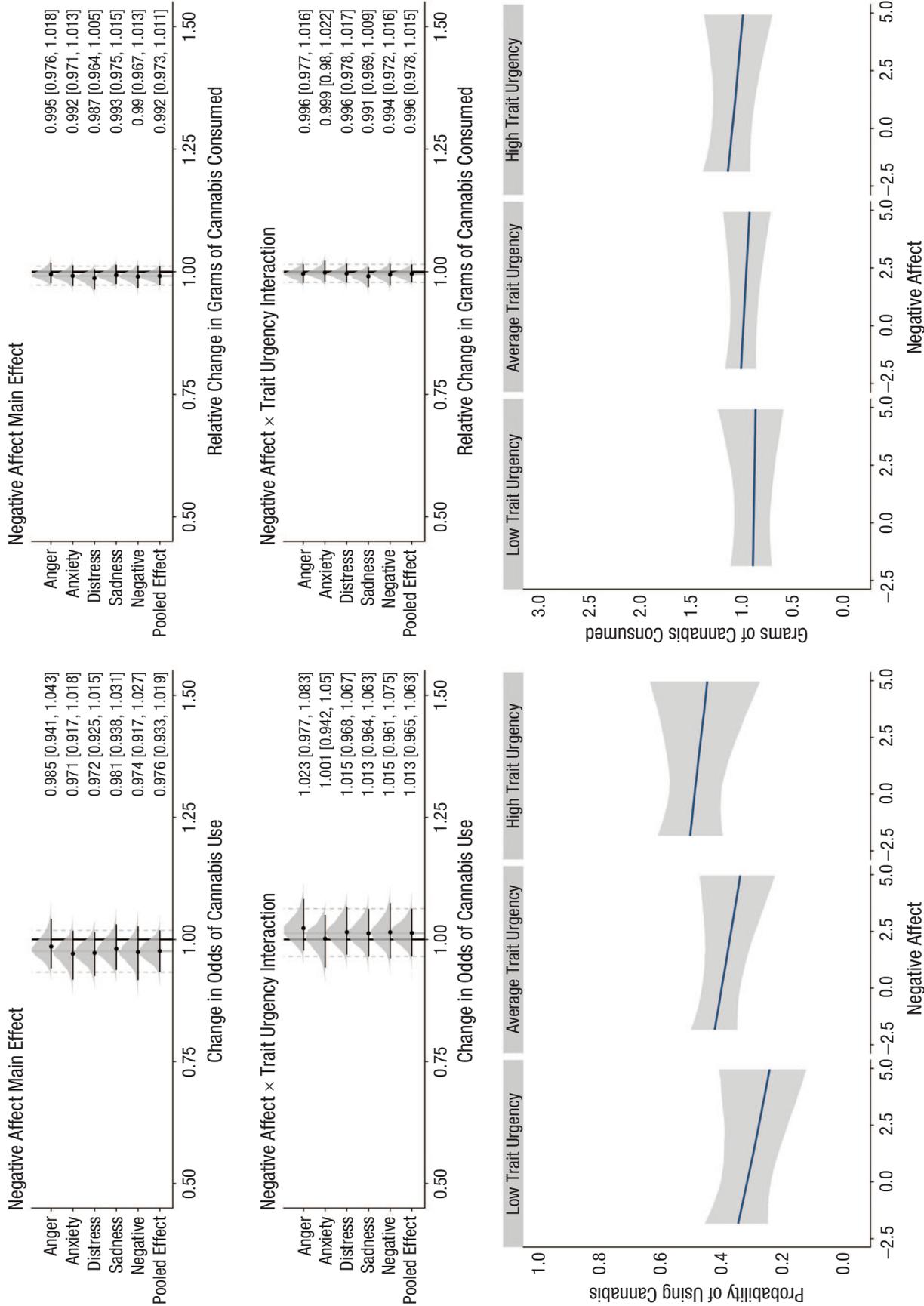
Fig. 1. Forest plots of meta-analytic estimates and individual model results for main effects of negative affect on (top left) probability of alcohol use and (top right) quantity consumed on use days and for (bottom left) Negative Affect × Trait Negative Urgency interactions on probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (*ORs*) for probability of use and incidence rate ratios (*IRRs*) for quantity consumed. Bottom panels display (left) predicted probability of alcohol use and (right) predicted number of drinks consumed on use days as negative affect increases, stratified by trait negative-urgency levels at −1 *SD* (low), mean (average), and +1 *SD* (high). Shaded areas represent 95% credible intervals around predictions.

Fig. 2. Forest plots of meta-analytic estimates and individual model results for main effects of negative affect on (top left) probability of cannabis use and (top right) quantity consumed on use days and for Negative Affect × Trait Negative Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (ORs) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of cannabis use and (right) predicted grams consumed on use days as negative affect increases, stratified by trait negative-urgency levels at −1 SD (low), mean (average), and +1 SD (high). Shaded areas represent 95% credible intervals around predictions.

The estimates for the main effects of trait negative urgency were $OR = 1.24$ (95% CI = [0.97, 1.60]) and $IRR = 1.09$ (95% CI = [0.97, 1.21]), respectively. Individual model results showed consistent patterns across operationalizations, with minimal main effects of negative affect and no evidence for moderation by trait negative urgency across all models.

Hypothesis 2a (Negative Affect × State Urgency interaction predicting alcohol use)

We tested this hypothesis using the same five operationalizations of negative affect (Fig. 3). The meta-analytic estimate for the interaction effect for the probability of alcohol use was $OR = 1.01$, 95% CI = [0.96, 1.04].

For alcohol quantity on use days, the interaction was $IRR = 0.99$, 95% CI = [0.97, 1.01]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that state urgency does not moderate the association between negative affect and alcohol use.

The estimates for the main effects of state urgency were $OR = 1.01$ (95% CI = [0.95, 1.07]) and $IRR = 1.00$ (95% CI = [0.97, 1.04]), respectively. Individual model results showed consistent patterns across operationalizations, with a small negative main effect of negative affect on probability of drinking but no evidence for moderation by state urgency across all models. Exploratory analyses predicting alcohol intoxication and eBAC and sensitivity analyses examining conditional effects by cannabis co-use similarly showed no evidence for Negative Affect × State Urgency interactions.

Hypothesis 2b (Negative Affect × State Urgency interaction predicting cannabis use)

We tested this hypothesis using the same five operationalizations of negative affect (Fig. 4). For the probability of cannabis use, the meta-analytic estimate for the interaction was $OR = 0.93$, 95% CI = [0.89, 0.99].

For cannabis quantity on use days, the interaction was $IRR = 0.99$, 95% CI = [0.97, 1.02]. The CI for the interaction effect on probability of cannabis use barely excluded 1.0, providing some evidence that state urgency moderated the association between negative affect and cannabis-use probability, although in the opposite direction than hypothesized. The model estimated that in moments high in urgency (+1 *SD*), participants were 5% less likely to use cannabis for every 1 *SD* increase in negative affect, and in moments low in urgency (−1 *SD*), they were 7% more likely to use cannabis for every 1 *SD* increase in negative affect.

The estimates for the main effects of state urgency were $OR = 1.06$ (95% CI = [0.98, 1.16]) and $IRR = 1.02$ (95% CI = [0.98, 1.05]), respectively. Individual model results showed consistent patterns across operationalizations, with minimal main effects of negative affect but some evidence for a negative interaction with state urgency on cannabis-use probability across several models.

Hypothesis 3a (Positive Affect × Trait Urgency interaction predicting alcohol use)

We tested this hypothesis using four operationalizations of positive affect: joviality, attentiveness, serenity, and general positive affect (Fig. 5). For the probability of alcohol use, the meta-analytic estimate for the main effect of positive affect was $OR = 1.16$, 95% CI = [1.02, 1.31], indicating that higher positive affect was associated with a ≈16% increase in the odds of drinking. The interaction effect was $OR = 0.96$, 95% CI = [0.92, 1.02], meaning higher positive affect was associated with a ≈12% to 24% increase in the odds of drinking for participants both high (+1 *SD*) and low (−1 *SD*) in trait urgency.

For alcohol quantity on use days, the meta-analytic estimate for the main effect of positive affect was $IRR = 1.00$, 95% CI = [0.95, 1.05], and for the interaction, it was $IRR = 1.00$, 95% CI = [0.97, 1.03]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that trait positive urgency does not moderate the association between positive affect and alcohol use.

The estimates for the main effects of trait positive urgency were $OR = 1.07$ (95% CI = [0.95, 1.21]) and $IRR = 1.20$ (95% CI = [1.12, 1.27]), respectively. Individual model results showed considerable variability in main effect sizes across operationalizations, ranging from the strongest positive effect for joviality ($OR = 1.27$, 95% CI = [1.20, 1.34]) to the smallest for attentiveness ($OR = 1.04$, 95% CI = [0.99, 1.10]). This variability resulted in wide CIs for the meta-analytic estimate. No evidence for moderation by trait positive urgency was observed across any models. Exploratory analyses predicting alcohol intoxication and eBAC and sensitivity analyses examining conditional effects by cannabis co-use similarly showed no evidence for Positive Affect × Trait Positive Urgency interactions.

Hypothesis 3b (Positive Affect × Trait Urgency interaction predicting cannabis use)

We tested this hypothesis using the same four operationalizations of positive affect (Fig. 6). For the probability
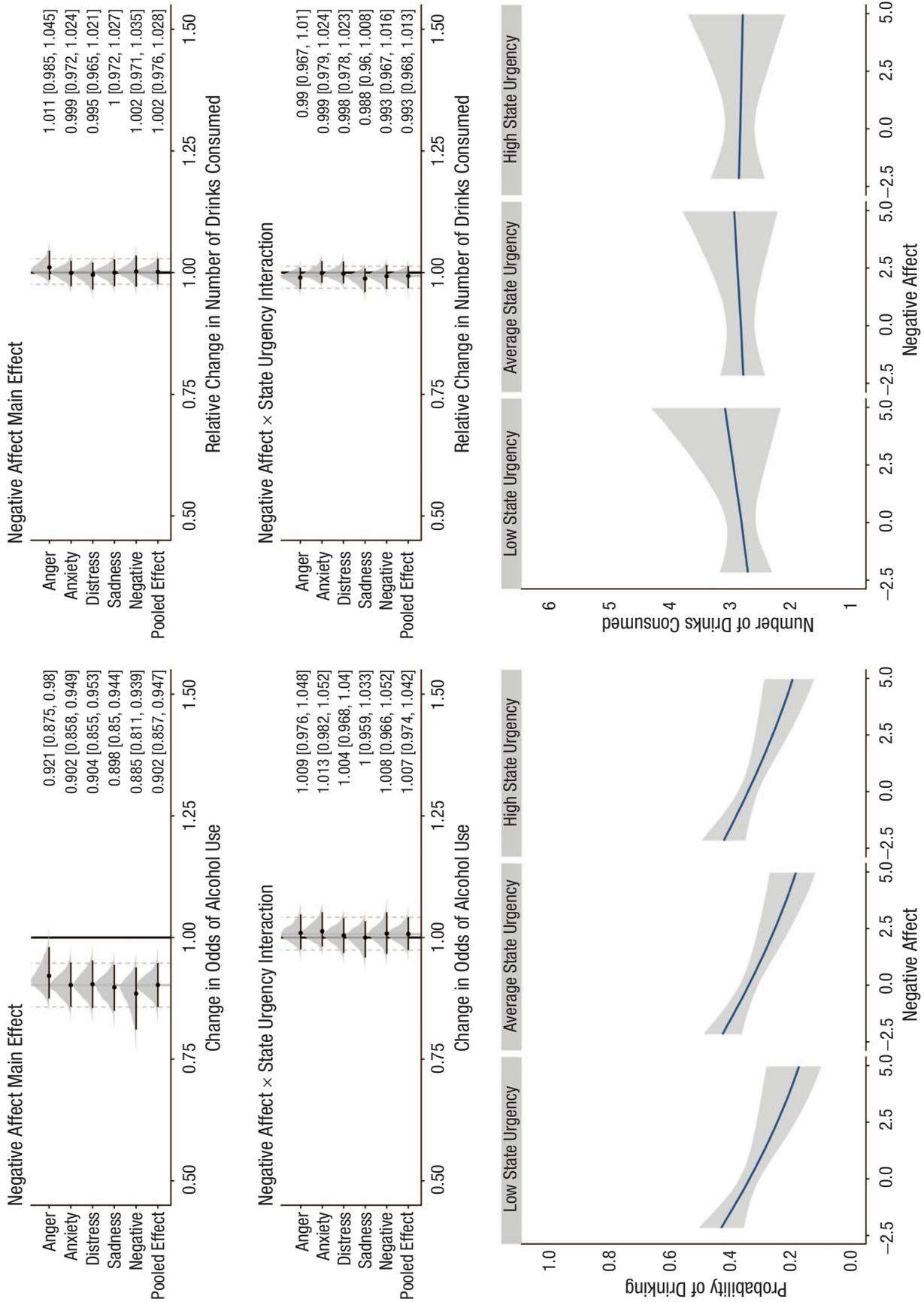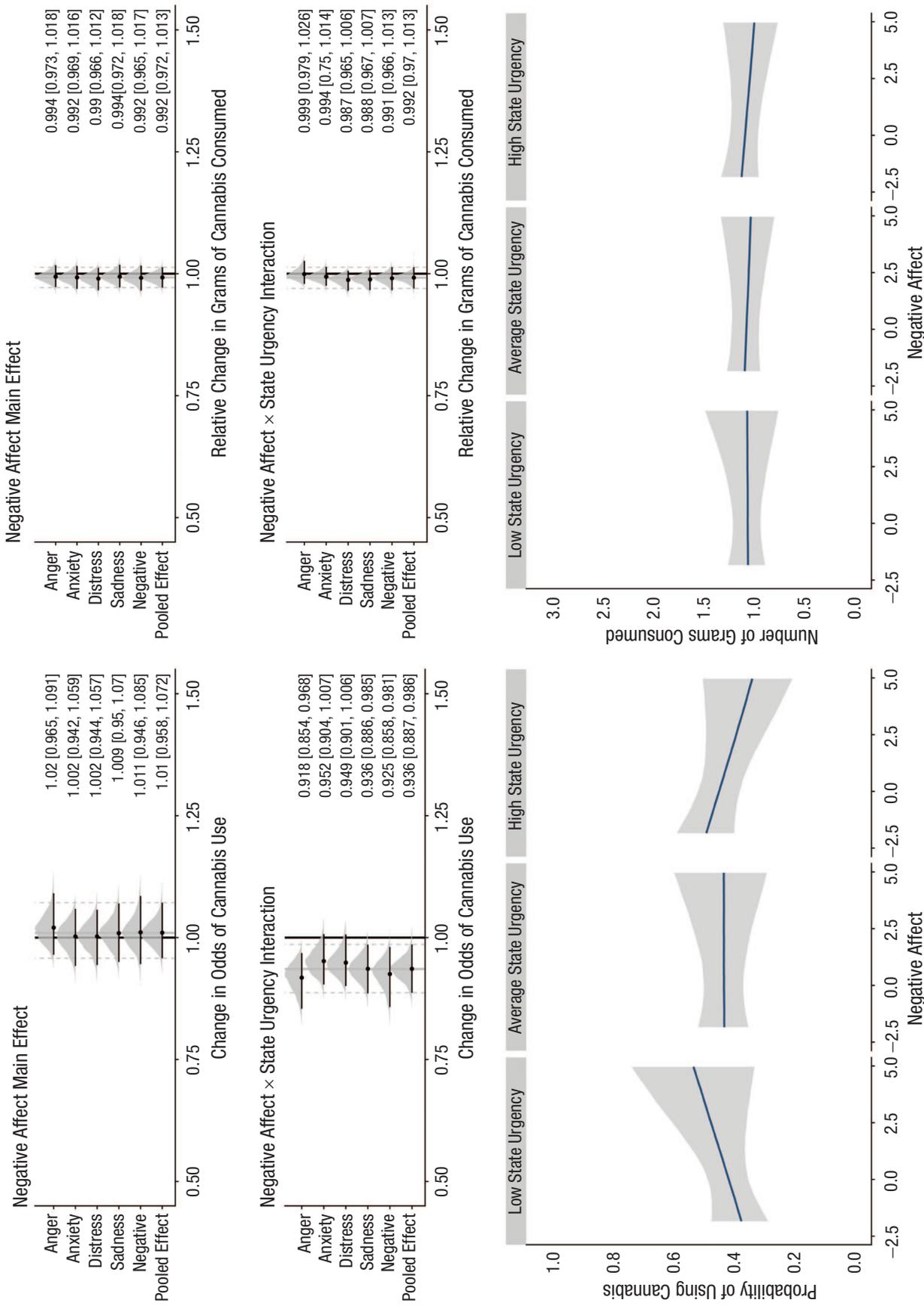
Fig. 3. Forest plots of meta-analytic estimates and individual model results for main effects of negative affect on (top left) probability of alcohol use and (top right) quantity consumed on use days and for Negative Affect × State Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (*ORs*) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of alcohol use and (right) predicted number of drinks consumed on use days as negative affect increases, stratified by state urgency levels at −1 *SD* (low), mean (average), and +1 *SD* (high). Shaded areas represent 95% credible intervals around predictions.

Fig. 4. Forest plots of meta-analytic estimates and individual model results for main effects of negative affect on (top left) probability of cannabis use and (top right) quantity consumed on use days and for Negative Affect×State Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (ORs) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of cannabis use and (right) predicted grams consumed on use days as negative affect increases, stratified by state urgency levels at −1 SD (low), mean (average), and +1 SD (high). Shaded areas represent 95% credible intervals around predictions.
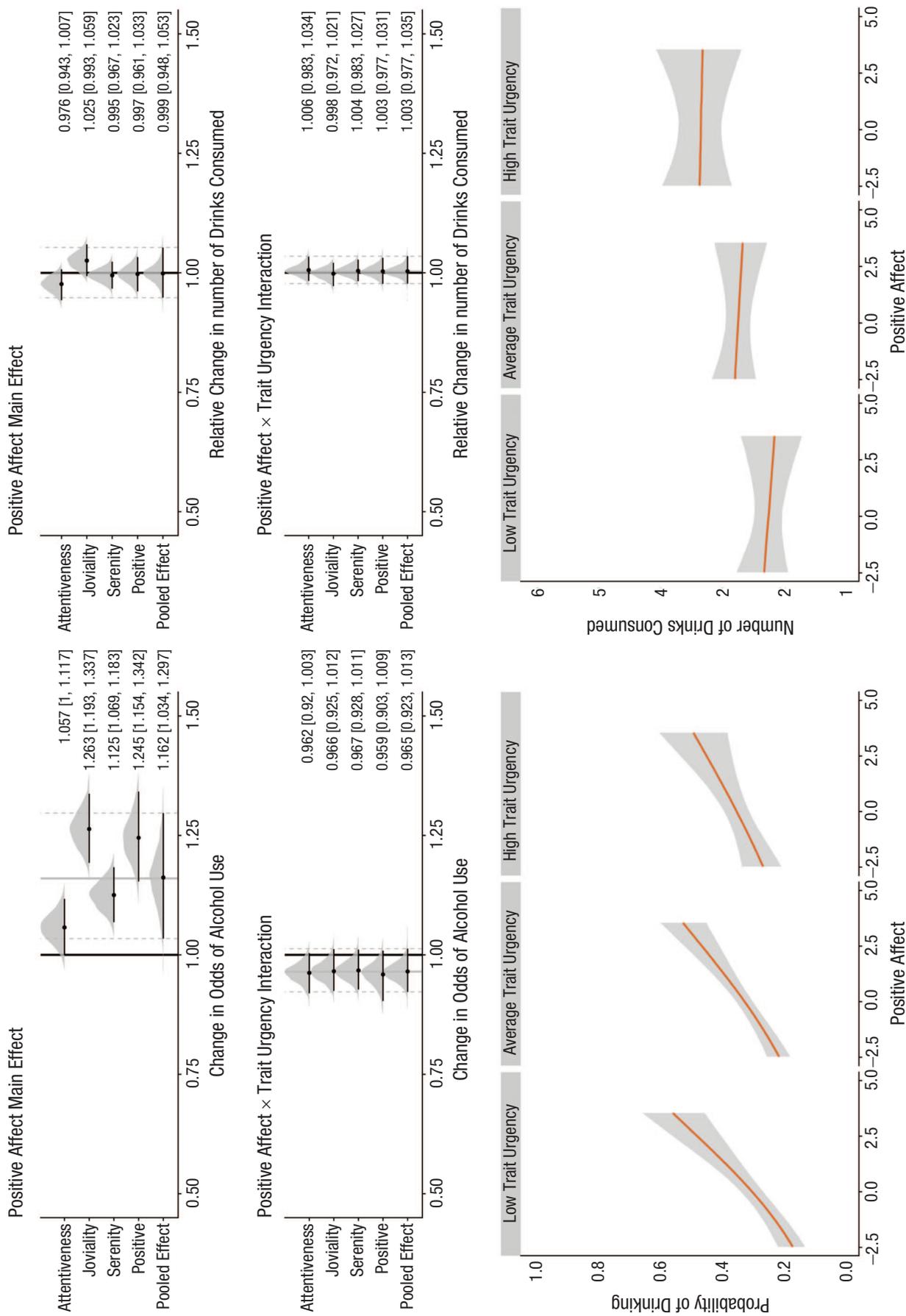
Fig. 5. Forest plots of meta-analytic estimates and individual model results for main effects of positive affect on (top left) probability of alcohol use and (top right) quantity consumed on use days and for Positive Affect × Trait Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (*ORs*) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of alcohol use and (right) predicted number of drinks consumed on use days as positive affect increases, stratified by trait urgency levels at −1 *SD* (low), mean (average), and +1 *SD* (high). Shaded areas represent 95% credible intervals around predictions.
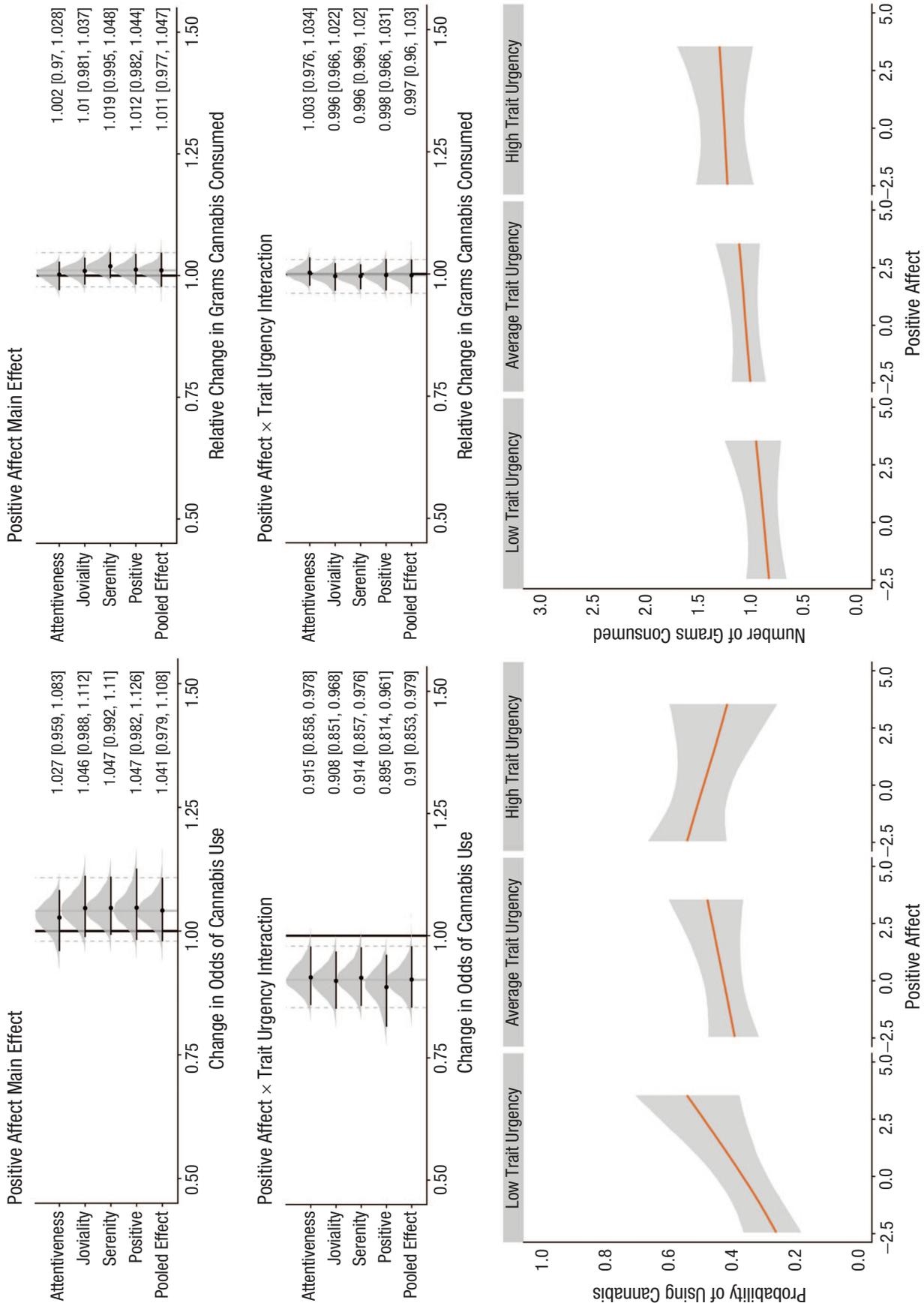
Fig. 6. Forest plots of meta-analytic estimates and individual model results for main effects of positive affect on (top left) probability of cannabis use and (top right) quantity consumed on use days and for Positive Affect × Trait Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (ORs) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of cannabis use and (right) predicted grams consumed on use days as positive affect increases, stratified by trait urgency levels at −1 SD (low), mean (average), and +1 SD (high). Shaded areas represent 95% credible intervals around predictions.

of cannabis use, the meta-analytic estimate for the interaction was *OR* = 0.90, 95% CI = [0.84, 0.97].

For cannabis quantity on use days, the interaction was IRR = 1.00, 95% CI = [0.96, 1.03]. The CI for the interaction effect on probability of cannabis use barely excluded 1.0, providing some evidence that trait positive urgency moderated the association between positive affect and cannabis-use probability, although in the opposite direction than hypothesized. The model estimated that for people high in urgency (+1 *SD*), participants are 14% less likely to use cannabis for every 1 *SD* increase in positive affect, and participants low in urgency (−1 *SD*) are 3% more likely to use cannabis for every 1 *SD* increase in positive affect.

The estimates for the main effects of trait positive urgency were *OR* = 1.15 (95% CI = [0.89, 1.49]) and IRR = 1.10 (95% CI = [0.98, 1.22]), respectively. Individual model results showed consistent patterns across operationalizations, with minimal main effects of positive affect but evidence for a negative interaction with trait positive urgency on cannabis-use probability across all models.

Hypothesis 4a (Positive Affect × State Urgency interaction predicting alcohol use)

We tested this hypothesis using the same four operationalizations of positive affect (Fig. 7). For the probability of alcohol use, the meta-analytic estimate for the interaction effect was *OR* = 0.99, 95% CI = [0.95, 1.05].

For alcohol quantity on use days, the meta-analytic estimate for the interaction was IRR = 1.01, 95% CI = [0.95, 1.07]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that state urgency did not moderate the association between positive affect and alcohol use.

Individual model results showed variable patterns across operationalizations, with the strongest positive effect for joviality on probability of drinking and smaller or negative effects for other operationalizations but consistently no evidence for moderation by state urgency across all models. Exploratory analyses predicting alcohol intoxication and eBAC and sensitivity analyses examining conditional effects by cannabis co-use similarly showed no evidence for Positive Affect × State Urgency interactions.

Hypothesis 4b (Positive Affect × State Urgency interaction predicting cannabis use)

We tested this hypothesis using the same four operationalizations of positive affect (Fig. 8). For the

probability of cannabis use, the meta-analytic estimate for interaction was *OR* = 1.04, 95% CI = [0.90, 1.02].

For cannabis quantity on use days, the meta-analytic estimate for the interaction was IRR = 1.02, 95% CI = [0.98, 1.06]. The CIs for both interaction effects were precisely estimated around 1.0, providing evidence that state urgency does not moderate the association between positive affect and cannabis use.

Individual model results showed consistent patterns across operationalizations, with minimal main effects of positive affect and no evidence for moderation by state urgency across all models.

Discussion

In this study, we examined whether urgency, measured as both a personality trait reflecting individual differences in impulsive responses to intense emotions and momentary states of emotional impulsivity, moderates the daily associations between affect and substance use in young adults. Using EMA data from 496 young adults across 32 days, we tested eight preregistered hypotheses regarding Affect × Urgency interactions predicting alcohol and cannabis use. Trait urgency is often described as reflecting deficits in emotion regulation that lead to reflexive action or inaction (King et al., 2018), and problematic alcohol and cannabis use are often described as resulting from emotion-regulation processes, such as coping with negative emotions or enhancing positive ones (Cooper et al., 2016; Koob & Le Moal, 2008). People high on trait urgency are thought to exhibit a broad range of psychopathology (Berg et al., 2015) because they are especially likely to exhibit that psychopathology when they experience strong emotions. Our recent work with this same sample showed that broadly, trait urgency did not predict stronger within-persons associations between negative or positive affect and state urgency (King et al., 2025). However, measures of state urgency describe relatively general behaviors (e.g., "lost control" or "acted on impulse") that could reflect a broad range of impulsive behaviors. Using a sample of young adults who regularly engaged in alcohol or cannabis use provides a specific test of the hypothesis that people high on urgency are especially likely to engage in substance use in the face of strong emotions.

Contrary to our hypotheses, we found minimal evidence that urgency, either at trait or state level, positively moderated the associations between negative or positive affect and substance-use outcomes; both instances of moderation we found were in the direction opposite from the expected, discussed below. The meta-analytic estimates for negative Affect × Urgency interactions were consistently closely distributed around *OR*s and IRRs of 1.0, with narrow CIs that clearly
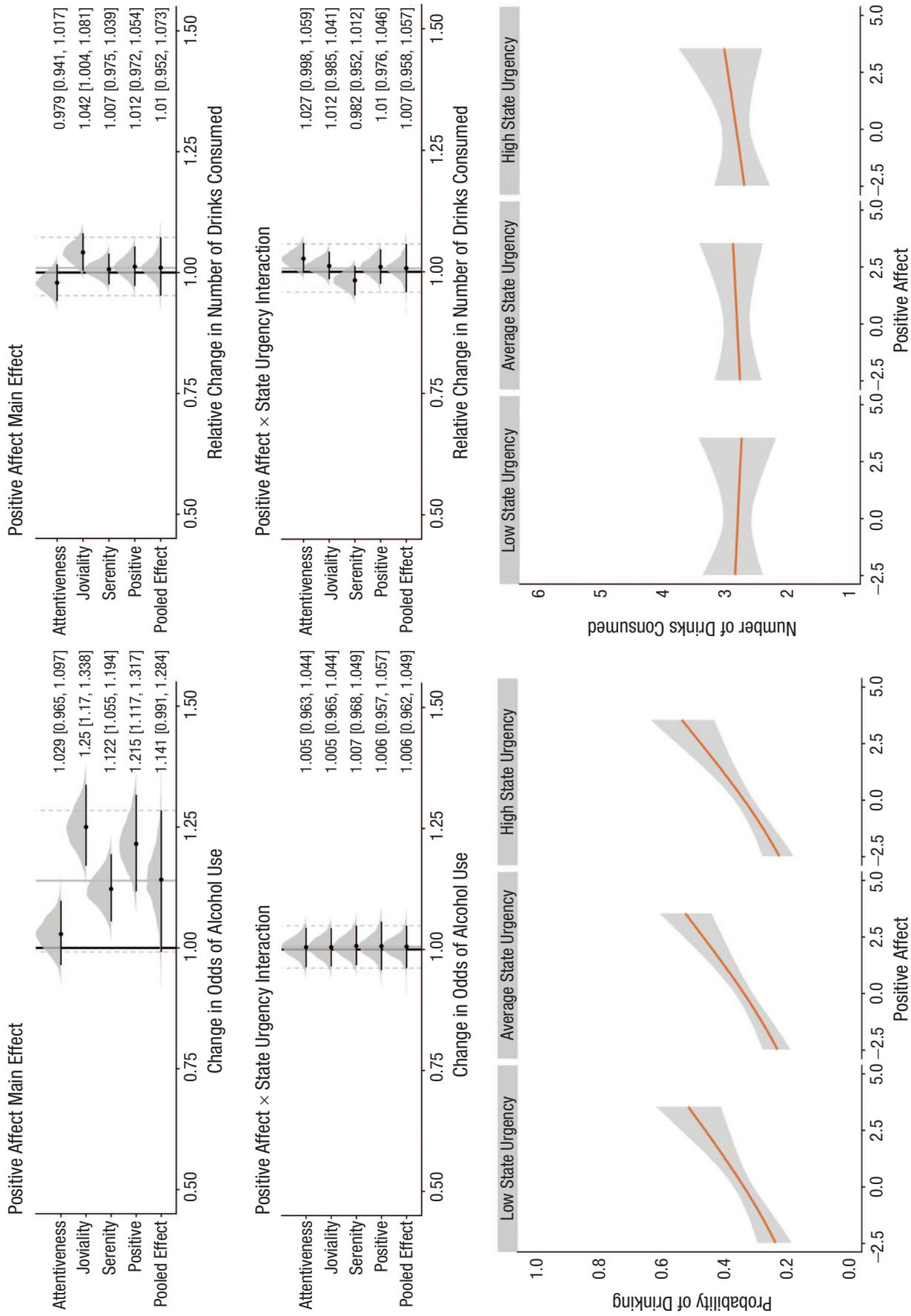
Fig. 7. Forest plots of meta-analytic estimates and individual model results for main effects of positive affect on (top left) probability of alcohol use and (top right) quantity consumed on use days and for Positive Affect × State Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (*ORs*) for probability of use and incidence rate ratios (*IRRs*) for quantity consumed. Bottom panels display (left) predicted probability of alcohol use and (right) predicted number of drinks consumed on use days as positive affect increases, stratified by state urgency levels at −1 *SD* (low), mean (average), and +1 *SD* (high). Shaded areas represent 95% credible intervals around predictions.
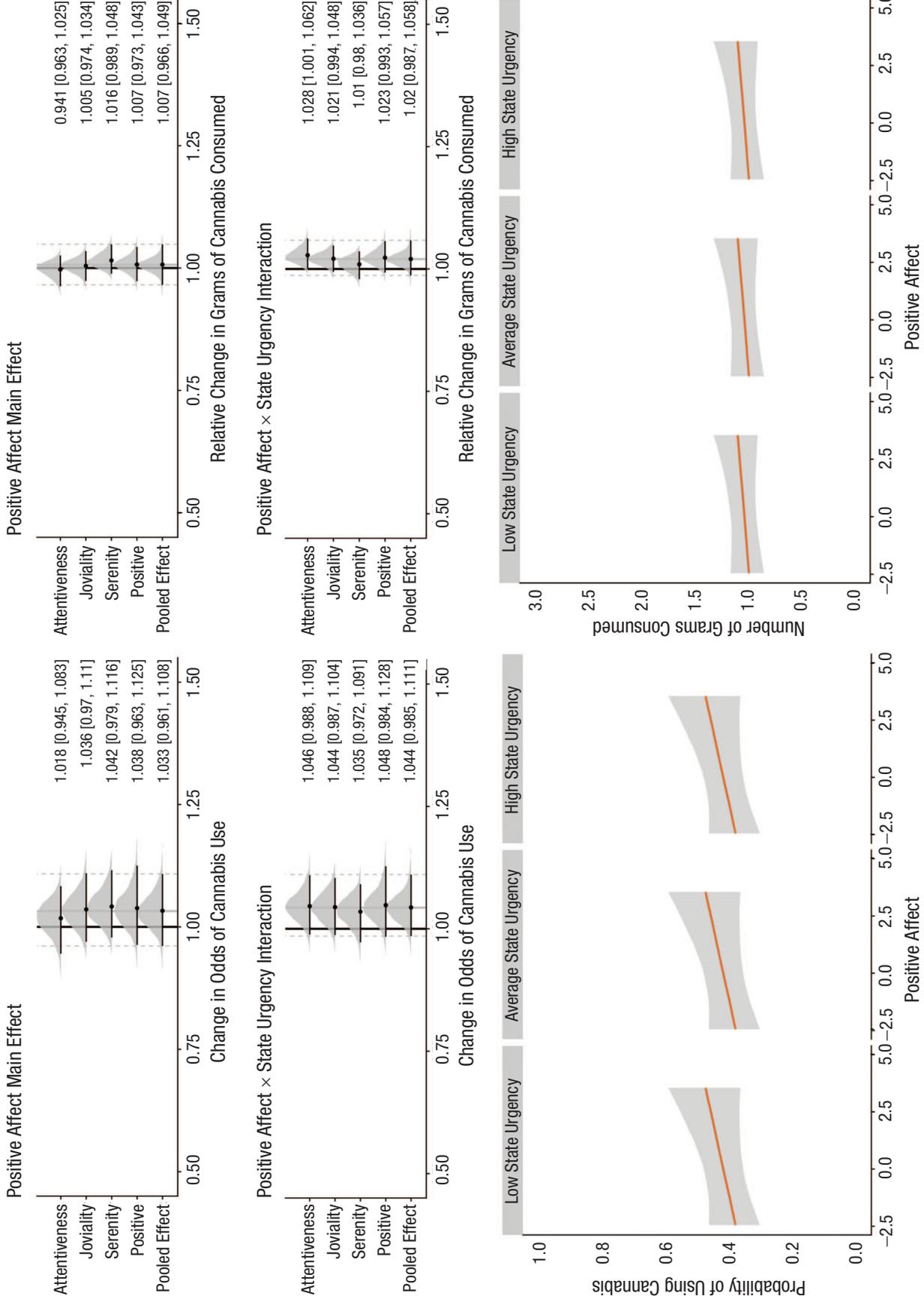
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Fig. 8. Forest plots of meta-analytic estimates and individual model results for main effects of positive affect on use days and for Positive Affect × State Urgency interactions on (bottom left) probability of use and (bottom right) quantity consumed. Effect sizes are presented as odds ratios (ORs) for probability of use and incidence rate ratios (IRRs) for quantity consumed. Bottom panels display (left) predicted probability of cannabis use and (right) predicted grams consumed on use days as positive affect increases, stratified by state urgency levels at −1 SD (low), mean (average), and +1 SD (high). Shaded areas represent 95% credible intervals around predictions.

included the null value. The lack of moderation effects was consistent across all operationalizations of negative affect (anger, sadness, anxiety, distress, and general negative affect), suggesting that the null findings are not contingent on the measurement of discrete emotional states. These findings challenge fundamental assumptions about urgency's role in emotion-driven substance use (Cyders & Smith, 2007, 2008); instead of amplifying emotional reactivity playing a role in substance use, people high and low in urgency showed remarkably similar patterns of substance use in response to emotional fluctuations.[4] Despite previous tentative evidence for Positive Affect × Positive Urgency interactions (Bold et al., 2017; Dora et al., 2022), we found no evidence that urgency moderated positive-affect-alcohol associations, with meta-analytic estimates consistently close to 1.0. This comprehensive test in a larger, preregistered sample provides stronger evidence against these interactions than our previous work.

These results replicate and strengthen our previous findings (Dora et al., 2022), which also failed to find the Negative Affect × Trait Urgency interactions reported by J. S. Simons et al. (2010). Because J. S. Simons and colleagues used a composite outcome including subjective intoxication and eBAC and we focused on drink quantity, we hypothesized our null findings might have resulted from differences in outcome measurement. To address this possibility, we included subjective intoxication and eBAC as exploratory outcomes in the current study, testing whether these might be more sensitive to urgency moderation effects. However, our exploratory analyses of these outcomes similarly showed no evidence for Affect × Urgency interactions, providing no support for the measurement-difference explanation. The consistency of null findings across drink quantity, subjective intoxication, and eBAC combined with our substantially larger sample size, more comprehensive assessment of affective states, and detailed preregistration suggests that the findings by J. S. Simons et al. likely represented a false-positive result. Our current findings and our previous work provide compelling evidence that urgency does not moderate daily associations between negative affect and alcohol use in young adults who drink regularly.

Beyond the absence of moderation effects, the main effects of urgency provide important insights into its role in substance use. Trait urgency showed consistent positive associations with alcohol quantity consumed on use days, indicating that individuals higher in urgency consumed approximately 10% to 20% more drinks when they chose to drink. However, trait urgency showed minimal associations with the probability of drinking on any given day. For cannabis use, trait-urgency effects were less consistent and generally smaller in magnitude. State urgency showed no main effects across all outcomes, with effect sizes consistently close to 1.0. These patterns suggest that substance use in young adults may be less impulsive than traditionally theorized and/or more contextually driven. This may be explained by the planned or habitual nature of many substance-use events (Stevens et al., 2022), with recent research suggesting that planned drinking occasions are characterized by higher, not lower, levels of use (Howard et al., 2024). The weak state-urgency effects align with our recent work showing that daily urgency reflects broad rather than specific emotion dysregulation (Feil et al., 2020; King et al., 2025) and the broader literature showing null associations between negative affect and substance use (Dora, Piccirillo, et al., 2023). Our null state-urgency effects are also consistent with some prior EMA work that found momentary lack of premeditation but not state urgency predicted alcohol use in daily life (Griffin & Trull, 2021) while contrasting with studies examining broader constructs, such as general daily impulsivity (Stamates et al., 2019), dysregulated emotion regulation (Weiss et al., 2022), or behavioral inhibition (Jones et al., 2018), that did predict alcohol use in daily life. Taken together, this pattern suggests that state urgency may be distinct from other forms of momentary impulsivity in its relationship with substance use, with emotion-driven impulsivity being less predictive of daily substance-use behaviors than deficits in planning or general impulsive tendencies.

These patterns align with cross-sectional and longitudinal research demonstrating robust associations between trait urgency and substance-use frequency and problems (Coskunpinar et al., 2013; Stautz & Cooper, 2014) but suggest a more nuanced role than previously theorized. Rather than urgency primarily functioning as a moderator that amplifies emotional reactivity, our findings suggest urgency may operate more as a general risk factor that influences consumption patterns once the decision to use has been made. This interpretation implies an impulsive tendency to escalate consumption once drinking has been initiated rather than emotion-triggered initiation of use. The stronger effects for alcohol quantity compared with cannabis may reflect differences in how these substances are typically consumed, differences in their pharmacological effects, and/or differences in the regulatory mechanisms involved in limiting consumption once use has begun.

The cannabis-use findings were particularly surprising and diverged from our expectations based on prior research. Unlike previous work showing negative associations between negative affect and cannabis-use probability and positive associations between positive affect and cannabis use (Dora, Smith, et al., 2023; Wycoff

et al., 2018), in the current study, we found minimal main effects of affect on cannabis use. The meta-analytic estimates for both negative- and positive-affect main effects were always close to 1.0, suggesting little systematic association between daily affective states and cannabis use in this sample.

Two unexpected interaction effects emerged that warrant cautious interpretation. First, we found a small negative interaction between negative affect and state urgency on cannabis-use probability, suggesting that the association between negative affect and cannabis use became slightly more negative on days when participants reported higher state urgency. Second, we found a small negative interaction between positive affect and trait positive urgency on cannabis-use probability, suggesting that individuals higher in trait positive urgency are slightly less likely to use cannabis when experiencing high positive affect. These interactions, although statistically distinguishable from the null, were relatively small in magnitude and in the opposite direction of our hypotheses. Rather than urgency amplifying affect-cannabis associations, these results suggest small opposing effects. Given that they contradict both theoretical predictions and prior empirical work, these findings should be interpreted with considerable caution. The divergence between our current cannabis findings and prior work raises questions about the consistency of affect-cannabis associations across samples and contexts. Factors such as differences in cannabis-use patterns or data-collection timing may have influenced these associations. Given the overall pattern of results, we do not place too much confidence in these two interactions.

Limitations, constraints on generality, and future directions

Several constraints on generality should be considered when interpreting these findings (D. J. Simons et al., 2017). Although our sample included individuals across the spectrum of substance-use severity, with 40.1% meeting criteria for alcohol use disorder (AUD) (21.6% mild, 14.7% moderate, 3.8% severe), an average alcohol use disorder identification test (AUDIT) score of 7.66, and an average cannabis use disorder identification test (CUDIT) score of 7.44, the majority of participants had mild to moderate substance-use patterns rather than severe substance use disorder (SUD). Thus, our findings may not generalize to older adults or individuals with more severe AUD, who may exhibit different patterns of emotion regulation and substance use. Individuals with more severe substance-use problems may show different moderating effects of urgency than observed in our community sample, as suggested by previous

work in clinical populations (Bold et al., 2017). The developmental period of young adulthood may also influence how urgency manifests in daily life (Hussong et al., 2011), and emotion-regulation strategies may differ substantially between young adults and older populations who have had more time to develop coping mechanisms or whose substance use has progressed to more severe levels. Second, our focus on data collection on the social weekend (Thursday–Sunday) may have influenced the urgency-related findings. Although this is speculative, substance use during weekends may be more planned and socially motivated, whereas weekday substance use might be less planned (Stevens et al., 2022). Given that urgency specifically relates to impulsive responses to emotions, our sampling schedule may have underestimated urgency's moderating role by capturing periods when substance-use decisions are more deliberate and less reactive. An additional temporal consideration is that we lacked temporally proximal affect data for substance-use episodes initiated late at night, after our last daily EMA survey. Although such episodes appear rare based on our data, if late-night substance use represents more impulsive alcohol/cannabis consumption, our design may have undersampled occasions in which urgency-related processes are most relevant. Future research could examine whether urgency shows stronger moderating effects during weekdays or in contexts in which substance use is less normative and potentially more impulsive.

A critical question emerges from our findings: If urgency consistently predicts substance use in cross-sectional and longitudinal research (Coskunpinar et al., 2013; Waddell et al., 2022) but does not moderate daily emotion-substance use associations, what accounts for these between-persons associations? We can think of several plausible explanations. First, urgency may be an indicator of broader neuroticism or emotion dysregulation, creating confounding at the between-persons level (King et al., 2018; Whiteside & Lynam, 2001). Individuals high in neuroticism may have chronically elevated negative affect and attempt to use substances to regulate this tonic emotional state even if such regulation is ineffective, a pattern that would not manifest in daily within-persons associations but would explain the associations of urgency with alcohol use and coping motives for drinking at the between-persons level (Cooper et al., 2016). Second, criterion contamination may occur when individuals recall impulsive or out-of-control moments of alcohol use as examples of urgency when completing trait measures, artificially inflating between-persons correlations. Understanding these mechanisms is critical for developing more precise theories about when and how urgency influences substance-use decisions.

Third, urgency may operate on different timescales than captured in our EMAs (Kaurin et al., 2023). For example, urgency might predict substance-use escalation over weeks or months following emotional periods (Waddell et al., 2022) rather than immediate same-day effects. Alternatively, urgency might influence substance use through accumulated effects; individuals high in urgency may experience more frequent minor emotion-driven substance-use episodes that although individually small, aggregate into meaningful differences over time. Future research could test these hypotheses using repeated EMA bursts (e.g., 1 month of intensive daily assessment every 6 months over 2 years) to examine both immediate emotion-substance-use associations within bursts and longer-term escalation patterns between bursts, particularly following periods of high emotional stress.

Fourth, urgency might influence substance use through pathways other than direct emotion-triggered consumption. For example, individuals high in urgency might be more likely to place themselves intentionally (or end up unintentionally) in substance-using contexts (social situations, locations with easy access), make impulsive decisions about substance availability (purchasing alcohol or cannabis during emotional states), or show poor planning around substance use that leads to heavier consumption (Feil et al., 2020; King et al., 2022; Seldin et al., 2024; Sharpe et al., 2020). Future research could examine these behavioral pathways using EMA of location, social context, and substance-related decision-making. Urgency might influence substance use through complex interactions with other psychological processes. For instance, urgency could amplify the effects of peer influence, reduce the effectiveness of coping strategies during emotional episodes, or increase the likelihood of polysubstance use. Examining urgency within broader networks of risk factors could reveal indirect pathways to substance use not captured in our moderation models.

Conclusion

This comprehensive examination of affect-urgency interactions in predicting substance use found minimal evidence supporting theoretical predictions about urgency as a moderator of affect-substance-use associations. Although positive affect was associated with increased alcohol use and negative affect was associated with decreased alcohol use, these associations were not moderated by individual differences in urgency. For cannabis use, we found minimal main effects of affect and similarly no evidence for urgency moderation. The findings suggest that urgency may not function as a critical moderator of momentary affect-substance-use associations as commonly theorized. Instead, the results support simpler models in which people are more likely to drink alcohol on days they report high positive emotions and less likely to drink on days they experience high negative emotions, whereas cannabis use appears largely independent of daily affective fluctuations in this sample. These findings have important implications for understanding the role of personality traits in addiction models and highlight the need for more nuanced theories of when and how urgency influences substance-use decisions.

Transparency

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Acknowledgments

study. Processed de-identified participant data and analysis scripts are available at https://osf.io/jw6sf/.

Notes

1. We collected data from 505 participants. Nine participants were excluded from the sample because they were identified to be ineligible during data cleaning.

2. Sensitivity analyses modeling cannabis use as rounded counts rather than continuous quantities produced nearly identical estimates and CIs, confirming the robustness of our findings to this decision.

3. Participants reported co-use of alcohol and cannabis on 11.6% of days. Because our EMA design has limited temporal granularity, we cannot determine with precision whether substances were consumed at the same time or whether an alcohol-use episode closely preceded or followed a cannabis-use episode.

4. For a detailed examination of affect main effects and their implications for emotion-regulation models of substance use, see our companion article (Dora, Kuczynski, et al., 2024).

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