



Published in final edited form as:

Drug Alcohol Depend. 2017 January 01; 170: 59–65. doi:10.1016/j.drugalcdep.2016.10.035.

Urgency traits moderate daily relations between affect and drinking to intoxication among young adults

Krysten W. Bold¹, Lisa M. Fucito^{1,2,3}, Kelly S. DeMartini^{1,3}, Robert F. Leeman^{1,4}, Henry R. Kranzler⁵, William R. Corbin⁶, and Stephanie S. O'Malley^{1,2}

¹Yale School of Medicine, Department of Psychiatry, New Haven, CT

²Yale Cancer Center, New Haven, CT

³Smilow Cancer Hospital at Yale-New Haven, New Haven, CT

⁴University of Florida, Department of Health Education and Behavior, Gainesville, FL

⁵Perelman School of Medicine, University of Pennsylvania and Crescenz VAMC, Philadelphia, PA

⁶Arizona State University, Department of Psychology, Tempe, AZ

Abstract

Background—Young adults with higher trait urgency (i.e., a tendency to act rashly in response to heightened affect) may be especially vulnerable to heavy drinking. The current study examined 1) the influence of urgency on daily relations between affect and drinking to intoxication, and 2) whether urgency influenced the effectiveness of naltrexone (vs. placebo) for reducing alcohol use.

Methods—This study is a secondary analysis of data from 126 (n=40 female) heavy drinking young adults, ages 18–25, enrolled in a double-blind, 8-week clinical trial comparing brief motivational intervention and either naltrexone or placebo. Multilevel models examined whether trait urgency moderated daily relations between positive and negative affect and drinking to intoxication, measured by an estimated blood-alcohol concentration (eBAC) at or above the legal limit (0.08g%). Person-level interactions examined whether naltrexone was more effective than placebo at reducing the odds of eBAC 0.08g% for individuals with higher vs. lower trait urgency.

Corresponding author: Krysten Bold, Yale School of Medicine, Department of Psychiatry, 34 Park Street CMHC-SAC New Haven, CT 06519, krysten.bold@yale.edu. Phone: 203-974-7603.

Conflicts of Interest: None.

Contributors: All authors contributed in a significant way to the manuscript and have read and approved the final manuscript.

Author Disclosures: Stephanie O'Malley is a member of the American Society of Clinical Psychopharmacology's (ASCP's) Alcohol Clinical Trials Initiative, supported by AbbVie, Alkermes, Ethypharm, Indivior, Lilly, Lundbeck, Otsuka, Pfizer, and XenoPort; Consultant/advisory board member, Alkermes, Cerecor, Amydala; Contract as a site for a multisite study, Eli Lilly; Medication supplies, Astra Zeneca, Pfizer; Scientific Panel Member, Hazelden Betty Ford Foundation. Henry Kranzler has been a consultant, advisory board member, or CME speaker for Indivior, Lundbeck, and Otsuka and is a member of the ASCP's Alcohol Clinical Trials Initiative, supported by AbbVie, Alkermes, Ethypharm, Indivior, Lilly, Lundbeck, Otsuka, Pfizer, and XenoPort. None of the other authors have conflicts to declare.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Results—On days of greater within-person positive or negative affect, young adults with higher urgency were more likely to drink to intoxication than those with lower urgency. Naltrexone reduced the odds of drinking to intoxication significantly more than placebo, independent of positive or negative urgency.

Conclusions—Although naltrexone treatment reduced drinking overall, young adults with higher trait urgency were still at increased risk for hazardous drinking following times of strong positive or negative mood. Targeted interventions are needed to reduce the risk of heavy drinking among young adults with high trait urgency.

Keywords

Alcohol; drinking; urgency; mood; affect; impulsivity

1. INTRODUCTION

Heavy drinking among young adults is a serious public health problem that has been associated with serious negative consequences, including health risk behaviors (e.g., unplanned/unprotected sex), lower academic performance, injury and death (Hingson et al., 2009; SAMHSA, 2011; White and Hingson, 2014). Furthermore, prospective research suggests that young adult heavy drinkers are more likely to develop long-term alcohol-related problems (Jennison, 2004). These findings underscore the importance of identifying predictors of heavy drinking in this population to inform intervention efforts.

Theory and evidence suggest that alcohol use is strongly motivated by positive and negative affect (Cooper et al., 1995). Young adults often cite positive mood-enhancing effects or coping with negative affect as motives for drinking, and investigations at the daily level indicate that days of higher positive or negative affect are associated with greater alcohol use (Collins et al., 1998; Hussong, 2007; O'Hara et al., 2014; Park et al., 2004; Simons et al., 2010, 2005, 2014). However, some studies have reported only weak or inconsistent associations between affect and drinking on a daily level (Armeli et al., 2008; Collins et al., 1998; Hussong et al., 2001; Simons et al., 2010). One potential explanation for the variability in study findings may be that drinking behavior is driven less by the magnitude of change in affect and more by an individual's reactivity to changes in affect. Certain individuals may be more reactive to heightened emotional states than others, a concept that has been referred to as trait urgency (Whiteside and Lynam, 2001). Individuals with a tendency to act rashly when experiencing strong positive or negative affect are considered to have high positive or negative urgency, respectively (Cyders and Smith, 2007, 2008; Lynam et al., 2007). In line with this notion, findings indicate that urgency is not related to self-reported baseline mood, but rather to limbic region activity in times of strong emotional reactivity (Cyders et al., 2010; Cyders and Coskunpinar, 2010; Smith and Cyders, 2016).

Emerging research supports an association between trait urgency and alcohol use. A recent meta-analysis showed that both positive and negative urgency are highly related to alcohol use and alcohol-related problems (Coskunpinar et al., 2013). Furthermore, longitudinal evidence indicates that urgency traits prospectively predict the onset and trajectory of substance use behavior (Cyders et al., 2009; Riley et al., 2015; Settles et al., 2014).

However, to our knowledge, only one prior study has examined whether urgency influences daily relations between affect and alcohol consumption. Simons et al. (2010) found significant daily-level effects of affect and urgency on alcohol intoxication in college undergraduates; the relation between daily anxiety (a facet of negative affect) and alcohol intoxication was stronger for individuals with greater negative urgency. In contrast, the relation between positive affect and intoxication was not significantly moderated by positive urgency. We extended prior work by examining these relations within a clinical population of heavy-drinking young adults enrolled in a placebo-controlled trial of naltrexone to reduce heavy drinking.

Naltrexone is an opioid antagonist medication approved by the U.S. Food and Drug Administration (FDA) for the treatment of alcohol dependence. Examining urgency as a moderator of affect-drinking relations within a clinical trial of naltrexone is important as it could help to personalize treatment with the medication, which is a promising treatment for young adult heavy drinkers. Naltrexone effectively reduces drinks per drinking day (Leeman et al., 2008; Miranda et al., 2014; O'Malley et al., 2015) and the percentage of days with an estimated blood alcohol concentration (eBAC) at or above the legal limit of intoxication .08g% (O'Malley et al., 2015) in samples of younger drinkers. Naltrexone works to reduce heavy drinking, in part, by decreasing the positive reinforcing effects of alcohol and slowing the rate of drinking (Anton et al., 2004; Davidson et al., 1999., 1996; O'Malley et al., 2002), resulting in lower blood alcohol concentrations. Additionally, earlier work in this sample of young adult heavy-drinkers indicated that naltrexone buffers against the indirect effects of positive affect and urge on drinking (Bold et al., 2016). Given evidence that the relation between urgency and drinking quantity is mediated by expectancies regarding mood-regulating effects (Settles et al., 2010), naltrexone may be an especially helpful treatment for reducing heavy drinking in young adults with high trait urgency. In particular, if naltrexone were to dampen the rewarding effects of alcohol or reduce drinking aimed at managing mood, it could be especially effective for individuals with high trait urgency who have difficulty inhibiting their drinking behavior in times of strong emotion.

To address these gaps in the literature, the current study examined whether trait urgency moderated the effect of daily positive and negative affect on alcohol consumption. Daily diary data were collected from young adults enrolled in a randomized, double-blind, placebo-controlled clinical trial of naltrexone. We hypothesized that individuals with higher trait urgency would be more reactive to heightened positive or negative affect and more likely to engage in hazardous drinking (i.e., drinking to intoxication) on those days. We also examined the specificity of urgency effects to determine whether affect–drinking relations were moderated by urgency alone or other facets of impulsivity (i.e., lack of premeditation, lack of perseverance, sensation seeking) measured by the UPPS-P (Cyders and Smith, 2007; Cyders et al., 2007). Additionally, we explored whether urgency moderated the effect of medication condition on drinking outcome, such that individuals with high urgency benefitted more from naltrexone than those with low urgency.

2. METHODS

2.1 Participants

This study is a secondary analysis of daily diary data from young adults who participated in a randomized, double-blind, placebo-controlled clinical trial of naltrexone plus brief motivational counseling for reducing drinking (see Bold et al., 2016; DeMartini et al., 2016; O'Malley et al., 2015 for previous publications using these data). Participants were randomly assigned to receive either naltrexone (25 mg daily + 25 mg targeted) or placebo (placebo daily + placebo targeted) for 8 weeks. Eligible participants were 18–25 years old, reported at least 4 heavy drinking days (i.e., 4 drinks/women or 5 drinks/men) in the prior 4 weeks, able to read English, without significant cognitive impairment, and not currently pregnant or breastfeeding. Participants were excluded for current serious psychiatric illness, or a past 12-month DSM-IV diagnosis of drug dependence other than nicotine.

2.2 Procedures

The Yale University Institutional Review Board approved all study procedures. Participants were recruited from the community primarily through Facebook advertisements and fliers seeking paid research volunteers for a study focused on reducing alcohol use. However, participants were not required to be motivated to reduce their alcohol use or abstain from alcohol. Participants were screened by phone or online surveys, and eligible individuals were invited for an interview, where study procedures were explained and written informed consent was obtained. Participants received a total of up to \$415 in compensation for attending appointments and completing assessments. All participants received a brief, single-session motivational intervention.

2.3 Baseline Measures

Participants completed questionnaires assessing demographics and other person-level variables such as family history of alcohol dependence (measured by a structured diagnostic assessment). Measures included in the present analyses are described below.

2.3.1 Positive and negative urgency—The tendency to act rashly when experiencing strong positive or negative emotions has been conceptualized as positive or negative urgency, respectively. Trait urgency was measured at baseline using the UPPS-P Impulsive Behavior Scale (Cyders and Smith, 2007; Cyders et al., 2007), a 59-item self-report measure of 5 facets of impulsivity: positive and negative urgency, lack of premeditation, lack of perseverance, and sensation seeking. Items were rated on a scale of 1–4 with higher scores indicating greater impulsivity. The subscales had good internal consistency in the current sample (Cronbach's $\alpha > .85$ for all subscales).

2.4 Daily Diaries

Participants completed once-daily, web-based surveys (DatStat™) for 8 weeks. Participants were asked to complete the online survey as soon as possible after waking, and daily automated email prompts were delivered from the DatStat system to remind them to complete the assessment. Brief surveys (<5 minutes) assessed mood, desire to drink, and number of drinks consumed, among other measures. Participants were compensated for

completing the daily reports (\$2 for each day, up to \$120; \$25 bonus for completing all assessments for two consecutive weeks during treatment, up to \$100). Participants were asked to provide mood ratings at the time of the assessment and to provide information about alcohol use and urge retrospectively for the previous day. For analysis, consecutive daily reports were selected to model time-lagged effects of mood earlier in the day predicting alcohol use later in the day ($n=4861$). In total, 80.9% of reports were completed, although completion rates varied by subject ($M=75.8\%$, $SD=28.6\%$). If participants were unable to access a computer, they were given paper assessments to complete each day (6.1% of reports).

2.4.1 Affect—Participants reported their current mood with 5 items rated from 1 (not at all) to 7 (extremely). Positive affect items included: “enthusiastic,” “excited,” and “happy.” Negative affect items included “distressed” and “sad.” Scores on items were averaged to create a composite daily rating of positive and negative affect ($\alpha=.92$ and $.73$ for positive affect and negative affect, respectively).

2.4.2 Alcohol use—Participants reported the number of standard drinks of alcohol they consumed and the times that they started and finished drinking each day. The primary outcome of interest was drinking to intoxication, defined as an estimated BAC $.08g\%$ on drinking days. Estimated BAC (eBAC) was based on the number of standard drinks reported, duration of drinking, and total body water (calculated from gender, age, height and weight; Curtin and Fairchild, 2003). This drinking outcome was selected because it was expected to be the best indicator of hazardous drinking among young adults, especially since abstinence was not a treatment goal. Additionally, naltrexone was shown to be effective at reducing the percent days with eBAC $.08g\%$ in the parent trial (O’Malley et al., 2015).

2.5 Data Analysis

A series of multilevel models were tested using Hierarchical Linear Modeling (HLM) software. Daily reports during the 8-week treatment period comprised level-1 variables nested within person at level-2. All models were set with a random intercept and random effects for predictors of interest (positive and negative affect) to allow regression coefficients to vary across individuals. Models were run using full information maximum likelihood estimation. Results are presented from population-average models with robust standard errors. Level one covariates included urge to drink, time (measured as treatment day), and six contrast variables dummy coded for days of the week to control for weekly drinking trends. Level-two covariates included gender, medication condition, and family history of alcohol dependence, based on research indicating greater benefit from naltrexone in individuals with a family history of alcoholism (Krishnan-Sarin et al., 2007; Monterosso et al., 2001).

Analyses specified a Bernoulli distribution with a logit link function to model the binary drinking outcome (eBAC $.08g\%$ on drinking day, yes/no). All within-person continuous variables were centered on person-specific means prior to entry in the model and person-specific means were entered at level-2. This provides an estimate of within-person

variability in affect and tests the relation between variations from individual averages and odds of intoxication. This basic level one model is shown below.

$$\text{Log}[P_{it}/1-P_{it}] = \pi 0_i + \pi 1_i(\text{PositiveAffect}_{it}) + \pi 2_i(\text{NegativeAffect}_{it}) + \pi 3_i(\text{Urgency}_{it}) + \pi 4_i(\text{Time}_{it}) + e_{it},$$

Where P_{it} is the probability of person i having an estimated BAC $.08\text{g\%}$ on day t ; $\pi 0_i$ is the intercept, which estimates person i 's log odds of drinking to intoxication when all other predictors are 0 (or at the mean, given person-specific centering); $\pi 1_i - \pi 4_i$ are the partial within-person regression coefficients for person i ; and e_{it} is a random residual component, which is the error term.

Next, to examine the moderating effect of urgency on affect–drinking relations, cross-level interactions were tested where urgency was added as a level-two predictor of the level-one affect coefficients:

$$\begin{aligned}\pi 1_i &= \beta_{10} + \beta_{11}(\text{PositiveUrgency}) + u_{1i} \\ \pi 2_i &= \beta_{20} + \beta_{21}(\text{NegativeUrgency}) + u_{2i}\end{aligned}$$

where β_{11} and β_{21} are the coefficients for the effect of positive and negative urgency on positive affect–drinking and negative affect–drinking relations, respectively. To examine the specificity of these effects, other domains of impulsivity were tested as moderators of affect–drinking relations in separate models. For example, negative urgency, premeditation, perseverance, and sensation seeking were examined as moderators of positive affect–drinking relations in sequential models.

Lastly, to test whether urgency influenced the effect of the pharmacotherapy on the odds of drinking to intoxication, we included the main and interactive effects of urgency and medication condition (naltrexone vs. placebo) at level 2.

3. RESULTS

Of the 140 randomized participants, a total of 126 provided daily diary data and baseline urgency data and were included in the analyses. Baseline characteristics did not differ significantly between those included in the current analyses and those who did not provide within-treatment and/or baseline urgency data ($n=14$). Participants in the current sample were 21.4 years old on average ($SD=2.2$). The sample was 68.3% male and 77.8% of participants reported their race as White, 6.3% Black, 4.8% more than one race, 3.1% Asian, and 8% other. The majority of participants were single (97.6%) and highly educated: 14.2% reported high school education or less, 55.6% completed some college, and 30.2% completed college or an advanced degree. At baseline, participants were drinking on 53.1% ($SD=18.4\%$) of the past 30 days and consuming an average of 6.7 ($SD=2.7$) drinks per occasion, which did not differ significantly by gender ($p>.05$). Participants reported moderate motivation to reduce their drinking ($M=5.2$, $SD=2.2$) on the contemplation ladder (Biener and Abrams, 1991), rated from 1–10 with a value of 5 anchored as “think I should reduce my alcohol use but not quite ready”. Descriptive statistics for variables of interest are

presented in Table 1. Variables did not differ significantly by medication condition or gender ($ps > .05$), except that females ($M=46.1\%$, $SD=30.8\%$ vs. males, $M=34.6\%$, $SD=26.9\%$, $t(124)=2.13$, $p=.03$) and those in the placebo condition ($M=43.0\%$, $SD=27.8\%$ vs. naltrexone, $M=33.0\%$, $SD=28.7\%$, $t(124)=2.00$, $p=.04$) had a greater percentage of days during treatment on which they reported drinking to intoxication.

3.1 Urgency as a moderator of the effect of daily affect on drinking to intoxication

An examination of urgency as a moderator of relations between daily affect and drinking to intoxication revealed that trait urgency was a significant moderator of both positive and negative affect–drinking relations (Table 2). Specifically, individuals who had a tendency to be more reactive to positive emotional states were more likely to drink to intoxication (eBAC .08g%) on days with higher than usual positive affect (Figure 1). Similarly, individuals who had a tendency to be more reactive to negative emotional states were more likely to drink to intoxication (eBAC .08g%) on days with higher than usual negative affect (Figure 2). There were no significant main effects of urgency or average positive or negative affect on drinking outcomes, noted as the person-level effects on the overall intercept (Table 2).

Furthermore, the moderating effect of impulsive personality traits was specific to urgency, as other dimensions of impulsivity (lack of premeditation, lack of perseverance, and sensation seeking) were not significant moderators of positive or negative affect–drinking relations ($ps > .30$). There was also partial evidence that affect–drinking relations were moderated by specific aspects of urgency corresponding to the valence of affect under examination. Specifically, positive urgency moderated positive affect–drinking ($B=.19$, $SE=.08$, $p=.02$) but not negative affect–drinking relations ($B=.28$, $SE=.16$, $p=.10$). However, negative urgency was a significant moderator of both negative affect–drinking ($B=.28$, $SE=.14$, $p=.04$) and positive affect–drinking ($B=.26$, $SE=.12$, $p=.02$) relations, indicating that participants with higher negative urgency had greater odds of drinking to intoxication on days with higher than usual positive or negative affect.

3.2 Urgency as a moderator of the effect of naltrexone on drinking to intoxication

Next, an examination of whether trait urgency moderated the medication effect (naltrexone versus placebo) on the odds of drinking to intoxication showed neither a significant positive urgency x medication effect ($B=.16$, $SE=.42$, $p=.69$) or negative urgency x medication effect ($B=.20$, $SE=.42$, $p=.63$). Rather, naltrexone significantly reduced the odds of drinking to intoxication more than placebo, regardless of positive and negative urgency (Figure 3) ($B=-.66$, $SE=.20$, $p<.01$).

4. DISCUSSION

This study investigated how urgency traits influenced within-person associations between affect and drinking to intoxication in a sample of young adults enrolled in an alcohol pharmacotherapy trial of naltrexone. Urgency significantly moderated relations between daily affect and drinking to intoxication; young adults who had a tendency to be more reactive to heightened emotional states were more likely to drink to intoxication on days of

elevated positive or negative affect, compared to those with lower trait urgency. Furthermore, this is the first study to examine whether urgency traits influenced the effect of naltrexone on alcohol consumption. Naltrexone significantly reduced the odds of drinking to intoxication more than placebo regardless of trait urgency (i.e., those high and low in trait urgency benefitted equally from naltrexone). These results help advance the understanding of how affect influences alcohol use and further supports the utility of naltrexone for reducing hazardous drinking in young adults.

Our findings are consistent with positive and negative reinforcement models of alcohol use (Cooper et al., 1995) and indicate that certain young adults are at increased risk for drinking to intoxication based on their reactivity to heightened emotional states. This study adds to the growing body of literature suggesting that urgency is a risk factor for alcohol use and extends earlier work by supporting the hypothesis that urgency moderates within-person associations between affect and drinking behavior (Cyders and Smith, 2007; Cyders et al., 2007). As expected, on days with higher than usual positive affect, young adults with greater positive urgency traits were more likely to drink to intoxication (eBAC .08g%) than those with lower positive urgency traits. Similar moderating effects were seen for negative urgency, such that individuals with greater negative urgency traits were more likely to drink to intoxication (eBAC .08g%) on days characterized by higher than usual negative affect. Thus, it is not the intensity of affect alone but an individual's tendency to act impulsively when in a heightened emotional state that indicates risk for hazardous drinking. These findings were dimension specific, such that the relation between daily affect and drinking was moderated only by trait urgency, not the other aspects of impulsivity (lack of premeditation, lack of perseverance, and sensation seeking). However, the findings suggest that urgency effects may not be specific to mood state. While positive urgency moderated relations between positive (but not negative) affect and drinking, negative urgency appeared to have more generalized effects such that individuals with high negative urgency had greater odds of drinking to intoxication on days of higher than average positive or negative affect. The negative urgency scale includes items assessing general emotion-based rash action [e.g., "it is hard for me to resist acting on my feelings," "I always keep my feelings under control" (Cyders and Smith 2007; Cyders et al., 2007)], so this domain may capture a tendency to become disinhibited in the presence of either strong positive or negative affect.

The current findings differ somewhat from those reported by Simons et al. (2010), who found that positive urgency did not significantly moderate relations between positive affect and intoxication, and negative urgency moderated relations between anxiety and intoxication but not other negative affect states (sadness, hostility). Our findings may differ from those in Simons et al. (2010) in part due to the different measures of intoxication that were used. Here, we focused specifically on estimated BACs at or above the legal limit of intoxication (.08g%), while Simons and colleagues (2010) modeled a composite variable of intoxication that also included subjective level of intoxication and categorical responses to random prompts that assessed the total number of drinks consumed in the preceding 30 minutes (from 0 to 10 or more). An estimated BAC at or above .08g% may be a more sensitive and clinically meaningful measure given the elevated risk of negative consequences and impairment associated with BACs above this threshold (Curtin and Fairchild, 2003; Jewett et al., 2015; Stubig et al., 2012; WHO, 2007). Additionally, it is possible that urgency only

moderates relations between certain aspects of affect and drinking behavior. Further research examining how urgency interacts with multiple domains of positive and negative affect to influence daily alcohol use is warranted.

Although our hypotheses regarding urgency as a moderator of affect-drinking relations were largely supported, our hypothesis that urgency would moderate the effects of naltrexone on drinking outcomes was not supported. Naltrexone reduced the odds of hazardous drinking more than placebo across individuals regardless of urgency level. In other words, young adults high and low in trait urgency benefitted equally from naltrexone. These results add to the emerging literature supporting the effectiveness of naltrexone for reducing heavy drinking among young people (Leeman et al., 2008; Miranda et al., 2014) and build on previous analyses with these data (Bold et al., 2016; DeMartini et al., 2016; O'Malley et al., 2015) by examining the effect of naltrexone on drinking at the daily level, and identifying a significant effect of pharmacotherapy regardless of trait urgency level. However, individuals with high trait urgency were still at greater risk for drinking to intoxication than those with low trait urgency in the context of strong positive or negative moods.

The lack of a moderating effect of urgency on naltrexone's effects on drinking may reflect the underlying neurobiology of trait urgency. As reviewed by Cyders and Smith (2008), low levels of serotonin and high levels of dopamine may facilitate the development of positive and negative urgency. Although naltrexone can reduce the increase in dopamine that follows ethanol exposure, it does not exert similar effects on serotonin levels (Benjamin et al. 1993). Thus, additional targeted interventions may be needed to optimize treatment outcomes for individuals with high trait urgency. These might include either combination pharmacotherapies or behavioral interventions combined with medications. According to urgency theory, strong positive and negative emotions relate to increased "bottom-up" responding to emotional cues and reduced "top-down processing," which result in rash responses to emotional experiences and a focus on short-term goals (Cyders and Smith, 2008). Thus, targeted behavioral interventions offering skills for managing or responding adaptively to strong affect, such as mindfulness or cognitive reappraisal to focus on long-term goals and interests, may be critical for enhancing treatment success for individuals with high trait urgency.

The results add to our understanding of the interplay among urgency, daily affect, and drinking behavior and have potentially important clinical implications, although the findings should be interpreted with the following limitations in mind. First, the participants were mostly Caucasian, young adult heavy drinkers who were willing to participate in a randomized pharmacotherapy clinical trial and were compensated for their participation, although they did not have to be motivated to reduce or abstain from alcohol. Thus, the results may not generalize to other samples that differ on demographics or abstinence motivation, or individuals attempting to stop or reduce drinking on their own. In particular, our sample was restricted to young adults without current serious psychiatric illness and different associations among affect, urgency, and drinking might be seen in those with current mood or anxiety disorders. Additionally, as noted above, our results are restricted to the specific affect items that were assessed, which did not cover the full range of possible mood states (e.g., angry) or arousal levels (e.g., energetic). In the current study, affect items

were kept intentionally brief to reduce the burden of daily diary assessments and enhance completion rates. However, replicating these findings using other dimensions of affect that may be key predictors of drinking is warranted. Lastly, our outcomes relied on self-reported daily alcohol use and used estimated BAC levels. However, despite limits of self-reports, we believe that modeling heavy drinking according to estimated BAC is likely to be more sensitive and clinically meaningful than heavy drinking definitions used in most prior studies. Additionally, this outcome is a measure of hazardous drinking that is of particular utility in the current analyses because it is theoretically linked to trait urgency and disinhibited drinking behavior.

This study provides new information on the impact of high levels of positive and negative affect on the likelihood of heavy drinking among young adults. Individuals high in trait urgency are at greater risk for hazardous drinking (i.e., drinking to intoxication) on days of higher than average positive or negative affect. This finding was dimension specific, such that the relation between daily affect and drinking was moderated only by urgency and not by UPPS-P dimensions unrelated to affect (premeditation, perseverance, and sensation seeking). Additionally, this study was the first to examine whether trait urgency influenced the effect of naltrexone versus placebo on reducing hazardous drinking among young adults. Results indicated that naltrexone significantly reduced the odds of hazardous drinking more than placebo regardless of urgency level. However, those with high trait urgency were still at greater risk for hazardous drinking in response to heightened mood. Thus, individuals with high trait urgency may need additional targeted interventions to optimize treatment outcome.

Acknowledgments

Funding: This research was funded by NIAAA grants R01AA016621, K01AA019694, and K23AA020000. Analyses and manuscript preparation were supported by NIDA grant T32DA019426. The content is solely the responsibility of the authors and does not necessarily represent the official views of NIH.

References

- Anton RF, Drobos DJ, Voronin K, Durazo-Avizu R, Moak D. Naltrexone effects on alcohol consumption in a clinical laboratory paradigm: temporal effects of drinking. *Psychopharmacology*. 2004; 173:32–40. [PubMed: 14722705]
- Armeli S, Todd M, Conner TS, Tennen H. Drinking to cope with negative moods and the immediacy of drinking within the weekly cycle among college students. *J Stud Alcohol Drugs*. 2008; 69:313–322. [PubMed: 18299774]
- Biener L, Abrams DB. The Contemplation Ladder: validation of a measure of readiness to consider smoking cessation. *Health Psychol*. 1991; 10:360. [PubMed: 1935872]
- Benjamin D, Grant ER, Pohorecky LA. Naltrexone reverses ethanol-induced dopamine release in the nucleus accumbens in awake, freely moving rats. *Brain Res*. 1993; 621:137–140. [PubMed: 7693299]
- Bold KW, Fucito LM, Corbin WR, DeMartini KS, Leeman RF, Kranzler HR, O'Malley SS. Daily relations among affect, urge, targeted naltrexone, and alcohol use in young adults. *Exp Clin Psychopharmacol*. 2016; 24:367–375. [PubMed: 27690505]
- Center for Behavioral Health Statistics and Quality. Behavioral health trends in the United States: results from the 2014 National Survey on Drug Use and Health. 2015. HHS Publication No SMA 15–4927, NSDUH Series H–50

- Collins RL, Morsheimer ET, Shiffman S, Paty JA, Gnys M, Papandonatos GD. Ecological momentary assessment in a behavioral drinking moderation training program. *Exp Clin Psychopharmacol.* 1998; 6:306. [PubMed: 9725114]
- Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *J Person Soc Psychol.* 1995; 69:990.
- Coskunpinar A, Dir AL, Cyders MA. Multidimensionality in impulsivity and alcohol Use: a meta-analysis using the UPPS model of impulsivity. *Alcohol Clin Exp Res.* 2013; 37:1441–1450. [PubMed: 23578176]
- Curtin JJ, Fairchild BA. Alcohol and cognitive control: implications for regulation of behavior during response conflict. *J Abnorm Psychol.* 2003; 112:424.
- Cyders MA, Coskunpinar A. Is urgency emotionality? Separating urgent behaviors from effects of emotional experiences. *Person Individ Diff.* 2010; 4:839–844.
- Cyders MA, Flory K, Rainer S, Smith GT. The role of personality dispositions to risky behavior in predicting first year college drinking. *Addiction.* 2009; 104:193–202. [PubMed: 19149813]
- Cyders MA, Smith GT. Mood-based rash action and its components: positive and negative urgency. *Person Indiv Diff.* 2007; 43:839–850.
- Cyders MA, Smith GT. Emotion-based dispositions to rash action: positive and negative urgency. *Psychol Bull.* 2008; 134:807–828. [PubMed: 18954158]
- Cyders MA, Smith GT, Spillane NS, Fischer S, Annus AM, Peterson C. Integration of impulsivity and positive mood to predict risky behavior: development and validation of a measure of positive urgency. *Psychol Assess.* 2007; 19:107. [PubMed: 17371126]
- Cyders MA, Zapolski TCB, Combs JL, Settles RF, Fillmore MT, Smith GT. Experimental effect of positive urgency on negative outcomes from risk taking and on increased alcohol consumption. *Psychol Addict Behav.* 2010; 24:367–375. [PubMed: 20853921]
- Davidson D, Palfai T, Bird C, Swift R. Effects of naltrexone on alcohol self-administration in heavy drinkers. *Alcohol Clin Exp Res.* 1999; 23:195–203. [PubMed: 10069545]
- Davidson D, Swift R, Fitz E. Naltrexone increases the latency to drink alcohol in social drinkers. *Alcohol Clin Exp Res.* 1996; 20:732–739. [PubMed: 8800392]
- DeMartini KS, Gueorguieva R, Leeman RF, Corbin WR, Fucito LM, Kranzler HR, O'Malley SS. Longitudinal findings from a randomized clinical trial of naltrexone for young adult heavy drinkers. *J Consult Clin Psychol.* 2016; 84:185. [PubMed: 26654213]
- Hingson RW, Zha W, Weitzman ER. Magnitude of and trends in alcohol-related mortality and morbidity among US college students ages 18–24, 1998–2005. *J Stud Alcohol Drugs Suppl.* 2009:12–20. [PubMed: 19538908]
- Hussong AM. Predictors of drinking immediacy following daily sadness: an application of survival analysis to experience sampling data. *Addict Behav.* 2007; 32:1054–1065. [PubMed: 16934413]
- Hussong AM, Hicks RE, Levy SA, Curran PJ. Specifying the relations between affect and heavy alcohol use among young adults. *J Abnorm Psychol.* 2001; 110:449. [PubMed: 11502088]
- Jennison KM. The short-term effects and unintended long-term consequences of binge drinking in college: a 10-year follow-up study. *Am J Drug Alcohol Abuse.* 2004; 30:659–684. [PubMed: 15540499]
- Krishnan-Sarin S, Krystal JH, Shi J, Pittman B, O'Malley SS. Family history of alcoholism influences naltrexone-induced reduction in alcohol drinking. *Biol Psychiatry.* 2007; 62:694–697. [PubMed: 17336941]
- Leeman RF, Palmer RS, Corbin WR, Romano DM, Meandzija B, O'Malley SS. A pilot study of naltrexone and BASICS for heavy drinking young adults. *Addict Behav.* 2008; 33:1048–1054. [PubMed: 18502591]
- Lynam D, Smith G, Cyders M, Fischer S, Whiteside S. The UPPS-P: A multidimensional measure of risk for impulsive behavior. Unpublished technical report. 2007
- Miranda R, Ray L, Blanchard A, Reynolds EK, Monti PM, Chun T, Justus A, Swift RM, Tidey J, Gwaltney CJ. Effects of naltrexone on adolescent alcohol cue reactivity and sensitivity: an initial randomized trial. *Addict Biol.* 2014; 19:941–954. [PubMed: 23489253]

- Monterosso JR, Flannery BA, Pettinati HM, Oslin DW, Rukstalis M, O'Brien CP, Volpicelli JR. Predicting treatment response to naltrexone: the influence of craving and family history. *Am J Addict.* 2001; 10:258–268. [PubMed: 11579624]
- O'Malley SS, Corbin WR, Leeman RF, DeMartini KS, Fucito LM, Ikomi J, Romano DM, Wu R, Toll BA, Sher KJ. Reduction of alcohol drinking in young adults by naltrexone: a double-blind, placebo-controlled, randomized clinical trial of efficacy and safety. *J Clin Psychiatry.* 2015; 76(1): 478–213.
- O'Malley SS, Krishnan-Sarin S, Farren C, Sinha R, Kreek M. Naltrexone decreases craving and alcohol self-administration in alcohol-dependent subjects and activates the hypothalamo–pituitary–adrenocortical axis. *Psychopharmacology.* 2002; 160:19–29. [PubMed: 11862370]
- O'Hara RE, Armeli S, Tennen H. Drinking-to-cope motivation and negative mood– drinking contingencies in a daily diary study of college students. *J Stud Alcohol Drugs.* 2014; 75:606. [PubMed: 24988259]
- Park CL, Armeli S, Tennen H. The daily stress and coping process and alcohol use among college students. *J Stud Alcohol.* 2004; 65:126–135. [PubMed: 15000512]
- Riley, ER.; Rukavina, M.; Smith, GT. The Reciprocal Predictive Relationship Between Personality And Risky Behaviors: An 8-Wave Longitudinal Study In Early Adolescents. Paper presented at the annual meeting of the Research Society on Alcoholism; 2015.
- SAMHSA. The DAWN report: Trends in emergency department visits involving underage alcohol use: 2005 to 2009. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2011.
- Settles RF, Cyders MA, Smith GT. Longitudinal validation of the acquired preparedness model of drinking risk. *Psychol Addict Behav.* 2010; 24:198–208. [PubMed: 20565146]
- Settles RE, Zapolski TCB, Smith GT. Longitudinal test of a developmental model of the transition to early drinking. *J Abnorm Psychol.* 2014; 123:141–151. [PubMed: 24661166]
- Simons JS, Dvorak RD, Batien BD, Wray TB. Event-level associations between affect, alcohol intoxication, and acute dependence symptoms: effects of urgency, self-control, and drinking experience. *Addict Behav.* 2010; 35:1045–1053. [PubMed: 20685044]
- Simons JS, Gaher RM, Oliver MN, Bush JA, Palmer MA. An experience sampling study of associations between affect and alcohol use and problems among college students. *J Stud Alcohol.* 2005; 66:459–469. [PubMed: 16240553]
- Simons JS, Wills TA, Neal DJ. The many faces of affect: a multilevel model of drinking frequency/ quantity and alcohol dependence symptoms among young adults. *J Abnorm Psychol.* 2014; 123:676. [PubMed: 24933278]
- Smith GT, Cyders MA. Integrating affect and impulsivity: the role of positive and negative urgency in substance use risk. *Drug Alcohol Depend.* 2016; 163:S3–S12. [PubMed: 27306729]
- White A, Hingson R. The burden of alcohol use: excessive alcohol consumption and related consequences among college students. *Alcohol Res Curr Rev.* 2014; 35:201.
- Whiteside SP, Lynam DR. The five factor model and impulsivity: using a structural model of personality to understand impulsivity. *Person Individ Diff.* 2001; 30:669–689.

Highlights

- Urgency moderated within-person relations between daily affect and intoxication
- Higher urgency predicted greater odds of intoxication on days of heightened affect
- This relationship was consistent for high positive and negative affect
- Naltrexone effectively reduced alcohol consumption regardless of trait urgency

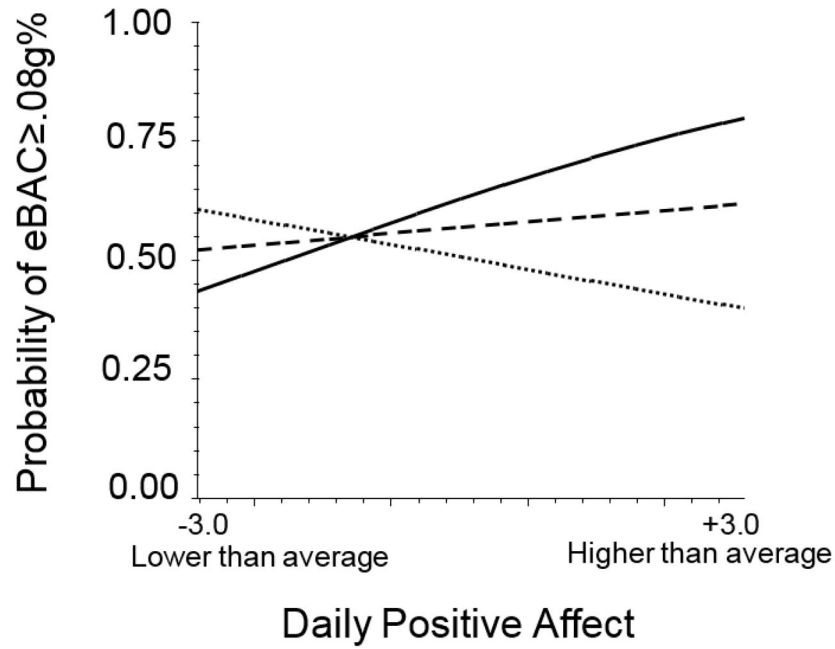


Figure 1. Positive urgency moderates relations between daily positive affect and drinking. Note: Individuals high in positive urgency were more likely to drink to intoxication on days with higher than usual levels of positive affect. Positive affect is centered at the subject mean. Positive urgency is graphed at 2 standard deviations (SD) above the mean (solid line), the mean (dashed line), and 2 SD below the mean (dotted line).

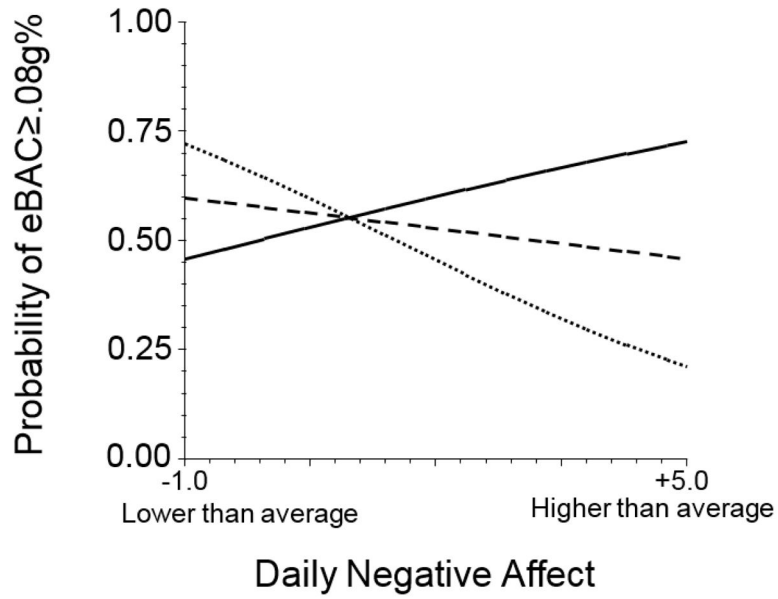


Figure 2. Negative urgency moderates relations between daily negative affect and drinking. Note: Individuals high in negative urgency were more likely to drink to intoxication on days with higher than usual levels of negative affect. Negative affect is centered at the subject mean. Negative urgency is graphed at 2 standard deviations (SD) above the mean (solid line), the mean (dashed line), and 2 SD below the mean (dotted line).

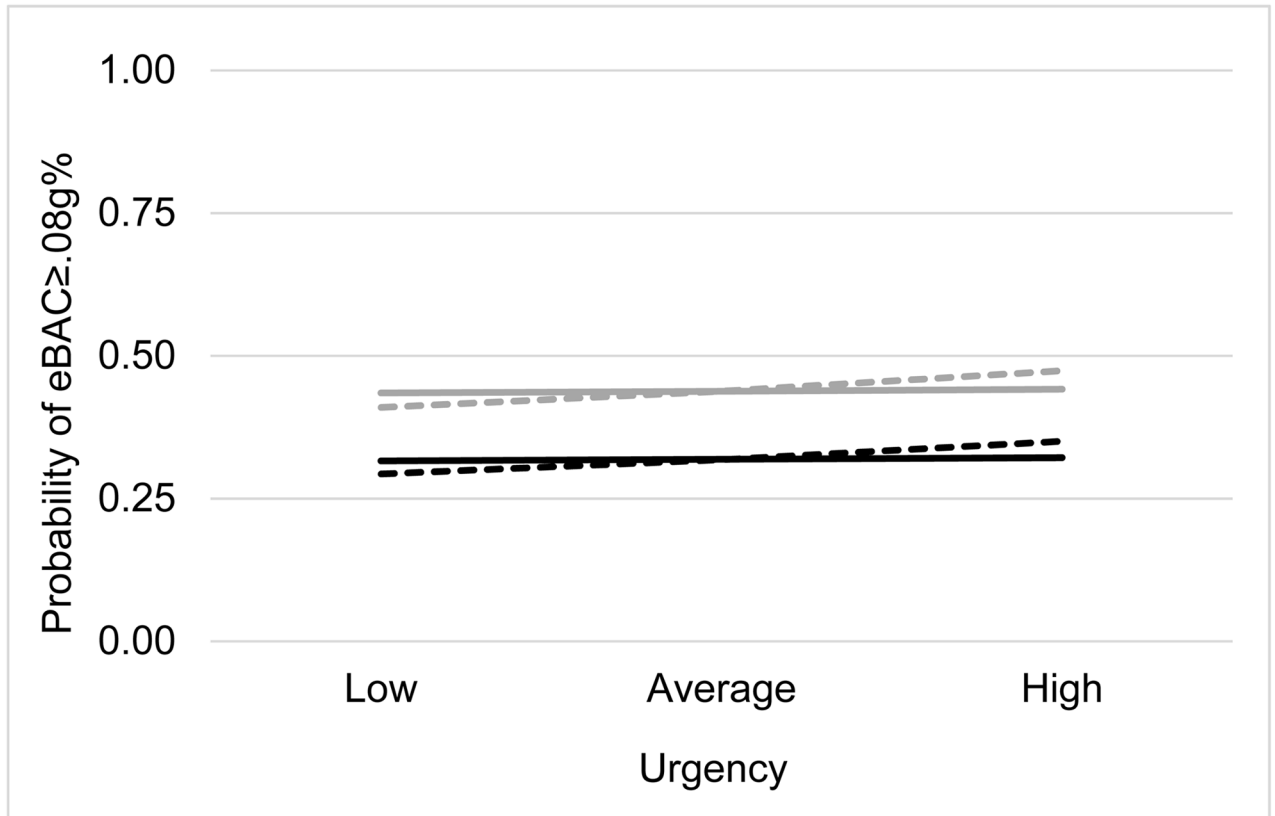


Figure 3.
 Relations Between Urgency and Drinking to Intoxication by Medication Condition.
 Note: Naltrexone significantly reduced the odds of drinking to intoxication more than placebo, independent of positive or negative urgency traits. The effect of urgency is graphed at low (2 SD below the mean), average (mean), and high (2 SD above the mean) values. Dashed lines represent positive urgency, solid lines represent negative urgency. Black lines indicate naltrexone, grey lines indicate placebo.

Table 1

Descriptive statistics for variables of interest

Variable	M (SD)	Range
Baseline UPPS-P ^a		
Positive urgency	1.84 (0.54)	1–4
Negative urgency	2.20 (0.51)	1–4
Lack of Premeditation	2.20 (0.52)	1–4
Lack of Perseverance	1.92 (0.53)	1–4
Sensation Seeking	2.93 (0.60)	1–4
Daily Measures ^b		
Positive affect	4.06 (1.26)	1–7
Negative affect	2.14 (0.95)	1–7
Percent days during treatment eBAC .08g%	38.2% (28.6%)	0–100%

Note:

^aUPPS-P Impulsive Behavior Scale (Cyders and Smith, 2007; Cyders et al., 2007).

^bDaily measure values reflect average person-level means across the 8-week treatment period. eBAC .08g% indicates estimated blood alcohol concentration at or above the legal limit of intoxication.

Table 2

Effects of urgency, daily affect, and their interaction on odds of drinking to intoxication (eBAC .08g%)

Predictors	<i>B</i>	<i>SE</i>	<i>p</i>
Person-Level Effects			
For overall intercept, π_0			
Intercept, β_{00}	0.06	0.68	0.93
Positive Urgency, β_{01}	0.28	0.26	0.30
Negative Urgency, β_{02}	-0.26	0.26	0.32
Gender, β_{03}	-0.80	0.24	0.001
Family History, β_{04}	0.28	0.21	0.19
Medication, β_{05}	-0.66	0.20	0.002
Positive Affect, β_{06}	-0.11	0.07	0.12
Negative Affect, β_{07}	0.08	0.12	0.48
Day-Level Effects			
For Positive Affect, slope, π_1			
Intercept, β_{10}	-0.28	0.17	0.10
Positive Urgency, β_{11}	0.19	0.08	0.02
For Negative Affect, slope, π_2			
Intercept, β_{20}	-0.71	0.32	0.03
Negative Urgency, β_{21}	0.28	0.14	0.04

Note: Reference categories: gender (male=1, female=0), family history (positive=1, negative=0), medication (naltrexone=1, placebo=0).

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript