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Interpersonal Problems and Negative Mood as Predictors of Within-day Time to Drinking

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Abstract

Using data collected via handheld electronic diaries (EDs) we examined within-day associations between early day negative moods and stress and subsequent time to drinking. A sample of 97 (n = 48 women) adults recruited to participate in a drinking-reduction intervention study used EDs to record mood and interpersonal problems at randomly selected times during each of three reporting intervals and drinking as it occurred each day for twenty-one days. Using multilevel hazard models, we tested associations between early-day stress/negative mood ratings and time to drinking as well as potential moderating effects of drinking to cope (DTC) motives on these associations. Whereas previous analyses of these data showed no associations between early-day negative moods and number of drinks consumed later in the day, here we found significant associations between negative moods and time to drinking. Associations involving negative moods, DTC, and hazard for drinking varied depending on time of day, and some mood effects were moderated by DTC. These findings suggest that time to drinking may be more sensitive to the effects of acute negative mood states than is drinking quantity.

Keywords

stress; negative affect; alcohol; coping; hazard models

Two commonly accepted notions in the alcohol literature are that people drink to reduce negative affect and to distract themselves from problems (Conger, 1956; Greeley & Oei, 1999) and that certain individuals are at greater risk for using alcohol as a coping strategy. For example, Cooper and colleagues (Cooper, 1994; Cooper, Frone, Russell, & Mudar, 1995; Cooper, Russell, Skinner, Frone, & Mudar, 1992) have found that individuals who expect drinking to result in positive outcomes and who tend to use relatively more maladaptive coping

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strategies (e.g., avoidance) endorse drinking as a way to cope with stressful situations. In the theoretical models underlying some work on the roles of affect and drinking motives on alcohol use (e.g., O'Connor & Colder, 2005; Read, Wood, Kahler, Maddock, & Palfai, 2003; Stewart, Zvolensky, & Eifert, 2001), motives have been specified as mediators of the associations between trait-like (as opposed to state) negative affect and/or measures of individual differences in affective reactivity on drinking. In these models, coping-related drinking motives have been conceptualized as a set of processes that are engaged in response to negative affect, but generally have been measured as temporally stable characteristics. As such, the analyses have implied that drinking to cope is an individual difference variable and that certain individuals are relatively more likely to resort to alcohol use *when* they encounter stressors or *when* they experience negative moods.

To examine the predictions implied by these models in greater detail, researchers have turned to daily process designs (e.g., Armeli, Todd, & Mohr, 2005; Collins & Muraven, 2007; Tennen, Affleck, Armeli, & Carney, 2000). In such studies, participants typically record stressful experiences, mood states and alcohol consumption one or more times per day, over periods ranging from several days to several months. Daily process designs are ideally suited for examining not only the proximal associations among these variables as they unfold in everyday life, but also how these associations might differ systematically across individuals. To date, however, this line of research has produced mixed results regarding the associations between daily and momentary levels of stress or negative affect and drinking as well as for hypothesized moderating effects of individual differences, including individual differences in drinking to cope (DTC) motivation (Armeli *et al*., 2003; Collins *et al*., 1998; Hussong, Galloway, & Feagans, 2005; Mohr *et al*., 2001; Park, Armeli, & Tennen, 2004; Todd, Armeli, Tennen, Carney, & Affleck, 2003; Todd *et al*., 2005). In previous analyses of the data reported here (Todd *et al*., 2005), we examined prospective within-day prediction of number of drinks consumed using prior negative affect and stress. In addition, we tested interactions in which DTC motives was treated as a potential moderator of these hypothesized associations. In those analyses, we found no significant linear or "main effect" associations between number of drinks consumed and prior negative mood or stress and only very limited evidence that DTC interacted with prior negative mood or stress in predicting drinking quantity.[1]

These weak and inconsistent findings for main effect associations between daily (and momentary) assessments of stress/negative affect and subsequent drinking and for the moderating effects of DTC motives could be due in part to the analytic models used. Specifically, all of these studies (including our work) examined the association between drinking quantity during one time period and stress/negative affect intensity from the same or immediately preceding time period. Implicit in these models are the assumptions that (1) stress and negative affect act on drinking over a fixed interval that is constant across individuals and that (2) modeling covariation between intensity of stress/negative affect and drinking *quantity* is the best approach to detecting the effect of stress/negative mood on alcohol use. These assumptions may be unwarranted.

Consistent with the notion that social and physical constraints may limit opportunities for drinking in response to stress, analyses of weekly trends in stress and alcohol use show that drinking levels are at their lowest and stress levels are at their highest during the early part of the week (e.g., Hussong, Hicks, Levy, & Curran, 2001). Similarly, drinking levels are lower during typical daytime work hours than in the evening. Other studies have also found that alcohol use is lower during periods of increased stress (Breslin, O'Keeffe, Burrell, Ratliff-

[1]The central hypotheses in the Todd et al. (2005) paper focused on the expected interactions of negative mood and stress variables with DTC motives in predicting subsequent alcohol consumption. As such, tests of the linear associations between negative mood/stress predictors and drinking were not reported or discussed there. Further details regarding these findings can be obtained from first author.

Crain, & Baum, 1995; Conway, Vickers, Ward, & Rahe, 1981). These findings cast doubt on the notion that individuals necessarily increase their drinking quantity (relative to their average levels) when they encounter stressors or experience negative moods.

As an alternative to examining covariation between the amount of alcohol consumed and the intensity of negative affect and reported stress, we propose examining the *timing* of drinking within each day as a function of the intensity of early day negative affect and stressful events of the day. More specifically, drinking initiation more proximal to the experience of stressors and negative affect might be a more sensitive indicator of problematic coping-related alcohol use than covariation between negative affect intensity and amount of alcohol consumed. Indeed, drinking that occurs soon after negative affect in contravention of strong social norms (e.g., workplace anti-drinking policies) would certainly suggest stronger motivation to use alcohol to cope. Moreover, drinking with disregard to social constraints and role responsibilities is likely more problematic than drinking at times or in settings where consequences are not as negative (e.g., having drinks after dinner at home). As such, the timing of a person's drinking is not only an indicator of how likely he or she is to drink in response to stress, but might also serve as a marker of generally problematic drinking. In addition, hypotheses derived from the Stressor-Vulnerabilty Model (SVM; Cooper, Russell, & George, 1988) would predict that there are meaningful and stable individual differences in the propensity to engage in such problematic patterns of alcohol consumption.

The present study includes analyses paralleling those Todd et al. (2005). In that study, we examined the relations between negative affect/stress and drinking frequency at various fixed time lags, ranging from a few hours (e.g., time between each day's afternoon mood interview and evening data recording interval) to a few days (e.g., predicting weekend drinking from the preceding week's mood). Here, however, we are interested in modeling the time to initiation of drinking on each day. Because early day drinking, especially drinking during typical working hours, is less normative and likely more problematic than drinking later in the day, we attempted to capture as many instances of early day drinking as possible. To that end, we considered the end of each day's late morning mood interview interval as the beginning of the period during which drinking initiation could occur and used each day's earliest reports of moods and interpersonal problems as predictors in our models.

The focus of the current study is on the role of negative mood and interpersonal problems, DTC motives, and their interactions as predictors of drinking behavior. Interpersonal problems have been shown to be particularly common and potent stressors (Bolger, DeLongis, Kessler, & Schilling, 1989; Bolger & Zuckerman, 1995) and to be particularly relevant to stress-related drinking (Higgins & Marlatt, 1973, 1975). Based on predictions derived from the SVM, we anticipated that higher levels of negative mood and interpersonal conflict would be associated with earlier initiation of drinking. However, more importantly, we expected that the effects of negative affect or stress would be qualified by significant interactions such that higher levels of negative mood and interpersonal problems would predict earlier drinking onset among individuals reporting relatively higher levels of DTC compared to those reporting relatively lower DTC levels.

Method

Participants

Prospective participants were recruited through newspaper, electronic, and University of Connecticut Health Center (UCHC) bulletin board advertisements that targeted adults who were interested in participating in a study of drinking. We specifically targeted those who were not alcohol dependent, whose continued drinking did not represent an immediate health hazard, and who did not require a referral for formal treatment. A total of 510 individuals from the community responded to the advertisements. Verbal permission for initial eligibility screening was obtained over the telephone. To be considered eligible for participation, recruits had to identify themselves as (a) regular drinkers, (b) drinking at potentially hazardous levels (defined as greater than 12 drinks weekly for females and 15 drinks weekly for males; see (defined as greater than 12 drinks weekly for females and 15 drinks weekly for males; see Sanchez-Craig, Wilkinson, & Davila, 1995), and (c) express an interest in participating in both a daily monitoring and brief intervention study focused on reducing their drinking. Prospective participants deemed not to be psychologically and socially stable enough to comply with the significant demands of the ED protocol were excluded from the study. Specifically, individuals were excluded if they reported (1) current or lifetime diagnosis of alcohol dependence based on the Diagnostic Interview Schedule (DIS; Robins, Cottler, Bucholz, & Compton, 1995); (2) previous alcohol or drug abuse treatment; (3) high level of residential instability; (4) significant cognitive impairment (i.e., score of 19 or less on the Folstein Mini-Mental State Exam; Folstein, Folstein, & McHugh, 1975); (5) current psychotic, affective, anxiety, or antisocial personality disorder based on the DIS; (6) being under the age of 21 or over 60; (7) beginning (or planning) to decrease their drinking by more than 25%; (8) pending incarceration; (9) pregnancy; or (10) below 6th grade reading level based on the Slosson Oral Reading Test (Slosson, 1963). A large number of the recruits (n = 332) were ineligible or unwilling to commit to study procedures; the 178 recruits who remained interested were invited into the clinic to complete informed consent and determine final eligibility. This process resulted in an exclusion of an additional 67 prospective participants, 13 others dropped out prior to randomization, and 1 participant failed to complete all baseline questionnaires, leaving a total sample of 97 participants. (n = 48 women)

The sample was predominately Caucasian (n = 92, 95%) with a mean age of 43.5 years (SD = 8.73), a median annual income level of $60,001-$70,000, and an average of 15.9 years of education (SD = 2.73). The UCHC Institutional Review Board approved this study, and all participants provided consent to participate after the potential risks and benefits of the study were explained to them. Participants were offered incentives for completing baseline, daily monitoring, follow-up self-report, and interview assessments with special bonuses for timely data completion resulting in maximum earnings of $450. Here we present findings based on data from only the pre-treatment phase of the study, during which participants were to maintain their usual drinking patterns.

Measures and Procedure

Individual Difference Measures

Drinking to cope: We used the 4-item Use of Drugs and Alcohol subscale of the COPE (Carver, Scheier, & Weintraub, 1989) as our DTC measure. Instructions for the COPE are as follows: “Indicate what you generally do and feel when you experience stressful events.” Example items are, “I use alcohol or drugs to make myself feel better” and “I drink alcohol or take drugs in order to think about it less.” Response options for this scale ranged from 1 (*I usually don’t do this at all*) to 4 (*I usually do this a lot*). Cronbach’s α = .95.

Overall drinking level: In several studies, those reporting stronger DTC motives also reported higher levels of alcohol consumption (e.g., Cooper et al., 1988; Cooper et al., 1992; Farber, Khavari, & Douglass, 1980; Simons, Correia, & Carey, 2000).Accordingly, we computed the average number of drinks consumed per study day for each person and included this measure in models as a control variable. Methods for collecting daily drinking data are described in detail below.

Neuroticism: We included neuroticism (N) as a control variable in all analyses. High-N individuals report more distress (Bolger, 1990; Costa & McCrae, 1992; Marco, Neale, Schwartz, Shiffman, & Stone, 1999), and tend to cope less effectively than low-N individuals (Marco et al., 1999) thus we expected high-N individuals to report relatively higher levels of drinking to cope. We measured N using 12 items from the 60-item NEO-FFI which had response options ranging from *strongly disagree* (0) to *strongly agree* (4). We recoded reverse-scored items and then computed composite scores by summing responses across all items. Cronbach's α for this scale was .85 in this sample.

Electronic interviews—For 21 consecutive days, participants recorded their mood, interpersonal problems and alcohol consumption on a hand-held computer (PSION Organizer Model LZ; PSION, Concord, MA) programmed as an electronic diary (ED). Data on negative and positive moods and interpersonal problems were collected three times daily using an interval contingent recording schedule, while drinking occasions were recorded using an event-contingent schedule as detailed below.

Negative and positive moods: At random times during each of three intervals (between 10:00 and 11:30 a.m.—Morning; between 3:00 and 4:30 p.m.—Afternoon; and between 8:00 and 9:30 p.m.—Evening) the ED signaled participants to complete a mood interview. Participants rated their mood during the interval since the previous mood interview. Negative mood adjectives were *bored, sad, nervous, angry, lonely*, and *disappointed*; positive moods adjectives were *peppy, happy,* and *relaxed*. The mood adjectives were in part derived from Larsen and Deiner's (1992) circumplex model of moods, in which moods are located in a two-dimensional space defined by orthogonal dimensions of activation (high intensity versus low intensity) and valence (positive versus negative). Response options ranged from 0 (*not at all*) to 4 (*extremely*).

Across 2,037 person-days of data collection, participants were prompted to complete 6,111 (97 persons × 21 days × 3 interviews) signal-contingent assessments of moods and interpersonal problems, and they completed 5,891 (96.4%) of these mood interviews. Here we use reports from the morning mood interviews only. In addition to discrete negative moods, we used a negative mood composite score based on all of the negative moods. Instead of using discrete positive moods as covariates, we used a composite of the 3 positive mood ratings. Cronbach's αs for morning negative mood on study days 2, 14, and 20 (chosen to represent days at the beginning, middle, and end of the daily recording period) were .75, .81, and .82, respectively. Cronbach's αs for morning positive mood on study days 2, 14, and 20 were .65, .69, and .65, respectively.

Interpersonal problems: Following the mood section of each mood interview, the ED instructed participants to rate how important 5 interpersonal problems had been since the previous interview. Items were as follows: *demand/criticism*; *disagreement*; *rejected/ignored*; *goal blocked*; and *other conflicts*. Response options ranged from 0 (*not at all*) to 4 (*extremely*) along with a "*didn't happen*" option (scored as missing). We computed a summary score using the sum of individual item responses. Cronbach's αs from morning mood interviews for study days 2, 14, and 20 were .65, .57, and .71, respectively for this composite.

Daily alcohol consumption: Participants in the current sample completed a total of 4,948 event-contingent (i.e., real time) drinking interviews in which they recorded their drinking as it occurred. Participants recorded drinks in two ways. First, participants could record each drink as it was consumed. Second, if they anticipated drinking for an extended period of time (e.g., having several drinks throughout the course of an evening), they initiated a "start drink" command and the ED would prompt them once an hour to record what they had consumed since the last prompt. Participants reported the number of drinks, size in ounces, and proof in four categories: beer, wine, liquor, and other (e.g., brandy, cordials) as they were consumed. For each category, standard sizes and proofs were listed (e.g., beer sizes were 8 oz, 10 oz, 12 oz, 16 oz, with proofs of regular, light, ale/imported, and low alcohol). The ED recorded the exact time when participants completed the drinking questions.

Analytic approach

To examine the association between early day moods and interpersonal problems, and time to drinking during each day, we estimated hazard models with frailty using SAS PROC GLIMMIX (v 9.1; SAS Institute, 2002) employing a multilevel hazard modeling approach described by Feng and colleagues (Feng, Nie, & Wolfe, under review; Feng, Wolfe, & Port, 2005). Frailty models are essentially hazard models that incorporate random effect components to account for otherwise unmodeled between-person heterogeneity in the hazard function. The form of this model closely parallels that of multilevel regression models with random intercept components. To conduct our analyses we first created a multilevel person-period dataset with observations nested within the 21 study days nested within 97 persons. For each study day, we created observations corresponding to one-hour intervals, with the first interval beginning at the end of the Morning mood interview period, i.e., 11:30 a.m.[2] A dichotomous indicator of within-day drinking initiation was then created. For every interval up until the interval containing the first drinking episode of the day, the drinking initiation variable was coded as 0. For the interval containing the day's initial drinking episode, the drinking initiation variable was coded as 1. Examination of the data revealed that the latest interval during which more than one person initiated drinking was the 16th hourly interval (2:30 a.m-3:29 a.m.), as such, estimation of models using data beyond this interval was not possible. As such, a maximum of 16 intervals per person-day were retained for the analyses reported here. Each day in the person-period dataset had one record for each interval up to and including the interval during which the day's first drink was consumed. For example, if on a given day, a participant consumed his first drink at 5:45 p.m. his data for that day would contain 7 observation periods corresponding to the 6 hour-long intervals at the beginning of the day (i.e., 11:30 a.m. – 5:29 p.m.) during which no drinking occurred and the 1 hour-long interval containing that day's first drinking episode (i.e., 5:30 p.m.-6:29 p.m.). Thus, in this example, the drinking initiation variable would take on values of 0 for the first 6 observation periods and a value of 1 for the final observation period. On days during which no drinking occurred, this participant's data would contain 16 observation periods corresponding to the 16 hour-long intervals during which drinking did not occur. On non-drinking days, the initiation variable took on values of 0 for all 16 possible recording intervals. Each observation in the resulting person-period dataset contained values for the person's gender, neuroticism and DTC scores, as well as mood and interpersonal problem scores from the corresponding day's morning ED interview and the dichotomous indicator of initiation.

The initial step in our analyses was to derive the approximate shape of the observed baseline hazard function, which guided the selection of polynomial time vectors used in the final multilevel regression models. To derive this shape we used a discrete-time hazard modeling approach whereby we estimated a conventional logistic regression model (ignoring nesting of days within participants) with no intercept predicting the dichotomous drinking initiation indicator from 16 dummy variables each corresponding to one of the 16 hour-long observation periods. Based on the results of this model (see details in Results), polynomial time vectors were created and used as predictors in the multilevel hazard models drinking initiation. To address our hypotheses, late morning mood and interpersonal problems, DTC motives, and mood/problems × DTC interactions were included as additional model predictors. Our base multilevel regression model was a multilevel hazard model with time indexed in hours since the end of the day's morning mood interview period. This model is illustrated in Equation 1.

[2]Preliminary examination of the data revealed that drinking prior to the morning mood interview occurred on 26 (1.3%) of the 2,037 person-days in the sample. These person-days were not included in the analyses reported here.

At the level of study day (Level 1), the log hazard of drinking for interval t during day i for person j is modeled as a function of a random intercept α_{j0} and a set of polynomial time variables (Vk_{tij}) with values corresponding to the hour-long observation intervals (where hour 1 = 11:30 a.m.-12:29 p.m.; hour 16 = 2:30 a.m.-3:29 a.m.). B_{jk} represents a vector of fixed slope coefficients corresponding to these time predictors.

$$\begin{aligned} \text{Level} \quad 1: \quad & \eta_{tij}=\alpha_j+\sum_{k=1}^{l} \mathrm{B}_{jk}\left(Vk_{tij}\right) \\ \text{Level} \quad 2: \quad & \alpha_j=\gamma_{00}+u_{0j} \\ & \mathrm{B}_{jk}=\Gamma_{k0} \end{aligned} \tag{1}$$

At the person level (Level 2), γ_{00} represents the sample-level "average" of the person-specific intercepts, and u_{0j} is the between-person random component of the person-specific intercept. The vector of Γ_{k0} coefficients contains the average values (across persons) of the polynomial time vectors.

Results

Descriptive statistics

Participants consumed at least one alcoholic beverage on 1,606 (78.8%) of the 2,037 person-days. Table 1 shows correlations, means, and standard deviations for individual difference variables as well as for person-level aggregate (i.e., average) values of interpersonal problems, negative moods, and positive mood, and drinking.

Deriving the baseline hazard function

The plot of the observed hazard values from the preliminary logistic regression analysis are presented in the top panel of Figure 1. The plot in this panel shows the risk of initiating drinking versus time. That is, it reflects the probability of initiating drinking during a particular interval, given that one has not yet taken a drink that day. The hazard plot shows a generally increasing risk of initiating drinking up to the interval beginning at 8:30 p.m., and a generally decreasing risk of initiating drinking subsequent to that point. The observed pattern suggests that the relationship of the probability of initiating drinking to time elapsed since the end of the day's morning interview has linear, quadratic, and cubic components. As such, linear, quadratic, and cubic polynomial functions of time were included as predictors in the final multilevel hazard models. Across all days, approximately 50% of individuals initiated drinking by the 6:30 pm interval, and approximately 30% did not engage in drinking by the end of the day (middle panel of Figure 1).[3]

Multilevel hazard models

We next estimated our base multilevel hazard model (outlined above), which used linear, quadratic, and cubic functions of time since the morning mood interview interval as predictors, which were selected based on the preliminary logistic regression analysis. To this base hazard model we then added level 1 terms for person-mean-centered negative mood (or interpersonal

[3]The middle panel of Figure 1 is a graph of the survival function. In this graph, the proportion of person-days on which drinking had not yet occurred by a particular time is plotted against time. As such, this graph shows the rate of abstention from initiation at each hourly interval. For example, in these data, on 97.6% of the total person-days, drinking did *not* occur before the end of the 11:30am-12:29 pm interval. In contrast, by the end of the 9:30pm – 10:29pm interval drinking had been initiated on but a quarter of the person-days. The bottom panel of the figure is a graph of the cumulative hazard of drinking initiation l plotted against time. This graph provides a useful index of the change in the hazard over time. Plateaus in the cumulative hazard function (e.g., late morning-early afternoon, late evening) correspond to times periods of little change in the risk for initiating drinking, whereas the steeper section of the function (late afternoon-early evening) corresponds to a period of rapid change in the risk for initiating drinking.

problems) and positive mood and six dummy vectors coding for day of the week (coefficients not shown below).[4] Level 2 terms included grand mean-centered neuroticism, participant age and gender, the person-level mean of negative affect/problems and positive mood variables, average drinking level and DTC motives. We also included a cross-level DTC × affect/problem interaction term. We estimated a separate model for each mood variable and for interpersonal problems. The results of models predicting time to drinking from morning negative mood and interpersonal problems are presented in Table 2. The results from these models indicate that DTC motives, positive mood, angry mood, and nervous mood, drinking level, as well as participant age, are all associated with elevated hazards for drinking (i.e., high levels of these variables are associated with earlier initiation of daily drinking). Other negative moods and interpersonal problems were not associated with time to drinking. Only bored mood interacted with DTC in predicting time to drinking.

To examine the possibility that associations of mood, interpersonal problems, and DTC motives with drinking initiation differed over the course of the day, we estimated a set of models specifying interactions between each negative mood/interpersonal problem variable and the linear, quadratic, and cubic time variables and between DTC and time variables. Each model thus contained a total of 6 interaction terms (mood × linear time, mood × quadratic time, mood × cubic time, DTC × linear time, DTC × quadratic time, and DTC × cubic time). We then trimmed non-significant time interaction terms in a hierarchical fashion. First, we trimmed non-significant cubic time interactions from the full model and re-tested remaining model terms. We then trimmed non-significant quadratic time interactions and re-tested remaining terms. Finally, non-significant linear time interactions were trimmed.

Significant mood × linear time and DTC × linear time interactions emerged. Angry mood and nervous mood interacted with linear time in predicting drinking initiation (hazard ratios = 1.0450 and 1.0423, respectively; *p*s < .05). To illustrate these interactions, we chose to plot observed hazard rates at points representing what would, on average, be days where negative mood scores would be at or very near zero (0.5 scale points below person-specific average level of negative mood) or slightly above the person's average level of negative mood (0.5 scale points above person-specific average level of negative mood). These plots revealed that negative moods were essentially unrelated to drinking initiation during the early part of the day, but then positively related to drinking during the later part of the day (see top panel of Figure 2 for plot based on nervous mood). For example, in the early evening hours (5:30p.m.-9:29p.m.), the difference between high- and low-nervous mood days was pronounced (mean difference in observed hazards across the 4 intervals = .21, compared to .01 and .05 in the preceding and subsequent 4-hour blocks, respectively). Across all models, DTC interacted with linear time (hazard ratios ranging from 0.9850 to 0.9853, all *p*s < .001). A plot of observed hazard rates for high-DTC individuals (1.5 scale points above sample mean—the approximate boundary between the middle and upper tertiles of the sample) vs. low-DTC individuals (1.5 scale points below the sample mean—the approximate boundary between the middle and lower tertiles of the sample) revealed that DTC was more strongly related to drinking initiation during the early part of the day than during the later part of the day (see bottom panel of Figure 2).[5]

[4]Coefficients revealed significant day of week effects with initiation of drinking occurring significantly later on weekdays than on Saturdays. Time to initiation of drinking on Sundays was not significantly slower than on Saturdays. The weekday-vs.-Saturday effect was most pronounced for Monday through Wednesday. Complete findings are available from the first author.

[5]Dividing the dataset to examining patterns of hazard values on high- and low-negative mood days and in high- and low-DTC individuals resulted in sparseness drinking initiation data at later time points. As such, only the first 14 hourly intervals could be used in models used to obtain these hazard values.

Supplemental analyses: Weekdays only vs. all days

Because we expect social norms for drinking initiation to be different across weekdays and weekends (i.e., less restrictive on the weekends), we estimated supplemental models examining whether our findings differed across these time periods. To that end, we estimated models using a dataset comprising observations from weekdays only and compared them to the full-sample results reported above.[6] Examination of the coefficients from the two sets of analyses revealed differences of substantive interest. Unlike in the full sample, early-day anger did not predict time to drinking in the weekday-only sample (hazard ratio = 1.0624, *ns*). In the weekday-only analyses, lonely mood and sad mood emerged as significant predictors of time to drinking, with more intense morning lonely and sad moods being associated with *less* rapid initiation of drinking (hazard ratios = 0.8613 and 0.8791, respectively, ps $< .05$). Significant DTC × negative mood interactions not observed in the analyses using data from the full sample emerged in the weekday-only analyses. Specifically, bored mood, disappointed mood, and composite negative mood all interacted with DTC (hazard ratios = 1.0526, 1.0465, 1.0980, respectively; all ps $< .01$) such that stronger negative mood was associated with more rapid initiation of drinking among those reporting stronger DTC motives as compared to those reporting weaker DTC motives.

Discussion

In the current study, we examined how negative affect and interpersonal stress related to the immediacy of drinking over the course of each day and whether this process varied across individual differences in DTC motives. In addition, we explored whether the associations among early day negative mood, DTC motives and time to drinking might be specific to certain times of the week. Whereas prior analyses of these data revealed no evidence for covariation between intensity of prior negative mood and amount of alcohol consumed over various fixed time intervals, findings from the current study do indicate an association between intensity of early day negative mood and the immediacy of alcohol consumption within the same day. In addition, we found support for the idea the associations between early day negative moods and immediacy of drinking are moderated by DTC motives such that those with stronger DTC motives are more likely respond to negative mood by initiating drinking earlier in the day than are those with relatively weaker DTC motives. Though the results of the current study provide evidence for within-day relations between negative mood and drinking, they were somewhat mixed. Not all of the negative moods examined were related to increased immediacy of drinking, some moods appeared to be related to immediacy of drinking only on weekdays, and the impact of some moods depended on the strength of the DTC motives reported.

In analyses using reports from all available study days, we found that both early day anger and nervousness were related to more rapid initiation of drinking. These findings are consistent with various models of negative mood reduction-related drinking. The associations between angry and nervous mood and initiation of drinking, however, were qualified by significant interactions with time, such that the impact of negative mood on the initiation of drinking was relatively more pronounced during the later part of each day. Negative moods tied to sadness (sad mood, lonely mood), however, were associated with *less* rapid initiation of drinking on weekdays. These results point not simply to the importance of early day negative mood as a predictor of time to drinking but also suggest that high-activation negative mood states, such as anger and nervousness may be more likely to prompt more rapid initiation of drinking than low-activation moods such as sadness and loneliness for all drinkers, regardless of the strength of their coping-related motives for drinking.

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[6]Analyses using only weekend data only did not converge, so a direct comparison of a weekday-only subsample to a weekend-only subsample was not possible.

Interactions involving negative moods, DTC, and time of day further highlight the complex nature of their associations with drinking. The main effects of negative mood indicate that drinking is likely to begin earlier on days when late morning anger and nervousness are more intense, regardless of the person's DTC motives. The interactions between mood and time since the morning interview, however, indicate that this difference between high anger (or nervousness) days and low anger (or nervousness) days is greater in the latter part of the day than in the earlier part. This differential impact across the course of the day might reflect moderating effects of constraints on alcohol consumption that are present during the early part of day (e.g., workplace prohibitions on drinking) but not during the late afternoon and evening hours. Similarly, the weekday-specific delays in initiation related to sad and lonely moods across all drinkers may reflect a synergistic effect of social role constraints that limit drinking during the workweek and suppression of drinking due to sadness-driven withdrawal from or avoidance of post-work social events (e.g., happy hours) where drinking might occur. Some low-activation moods (boredom and disappointment), however, actually predicted *more* rapid initiation of drinking, but only among those with higher levels of DTC motives. This pattern of results suggests that those with stronger coping-related motives for drinking, unlike those with weaker motives, might actually be motivated to drink sooner by the experience of these particular low- activation emotions rather than emotions that might arise from anticipation of successes or positive social interactions. The association between DTC and drinking initiation was stronger during times overlapping with typical work hours than during later times. Considered in the context of Stressor-Vulnerability Model, this finding is not surprising, as it suggests that the impact of DTC on drinking initiation is actually at its strongest when drinking is most likely to be non-normative and potentially problematic.

High levels of alcohol use carry obvious risks for serious negative health, social, and legal consequences. Early day drinking could present problems as well. One intuitively appealing notion is that earlier initiation could lead to more prolonged bouts of drinking, which could then in turn lead to higher levels of consumption; however, in previous analyses of these data, we found no within-day association between early-day negative mood and number of drinks consumed. There are drinking-related risks, though, that may be more specifically tied to earlier initiation of drinking, regardless of the amount consumed later in the day. In particular, earlier drinking could be associated with failure to perform in important social contexts, such as the workplace, parenting, or martial relationships. As seen here, both negative mood and DTC are related to the timing of drinking initiation. The findings regarding the role of anger and nervous mood suggest that successful management of negative moods may help prevent or reduce potentially maladaptive drinking behavior. In addition, understanding that individuals with stronger DTC motives, compared to others, demonstrate maladaptive drinking *initiation* patterns could inform intervention efforts to reduce such problematic drinking by allowing therapists and counselors to screen for and specifically target individuals who exhibit higher levels of DTC motives and/or potentially risky drinking patterns.

Although the study reported here uses an innovative analytic approach to assessing the impact of negative mood on time to drinking and the possible moderating effects of DTC motives, some caution is warranted in interpreting the results. The questionnaire measure of DTC used here was brief, and thus might not have assessed all facets of the DTC construct. Another concern is that because we did not assess other drinking motives (e.g., enhancement) we were unable to model their potential influences on time to drinking or on the association between negative affect and time to drinking. This allows for the possibility that variation that might have been accounted for by these other motives might have been reflected in artificially inflated (or diminished) associations between DTC and the outcome or person-level slope estimates and also precludes exploration of the potential moderating effects of these motives on the association between early day mood and time to drinking. Our protocol did not allow participants to record whether a day was a vacation day or not, so it is possible that some relatively earlier drinking occurred on weekdays when the usual social constraints on alcohol consumption were not in place. Though our current study uses within-day prospective prediction of drinking from negative mood and interpersonal problems, the recording schedule used did not allow for characterization a person's affective state at the start of each drinking episode.

Though the current study focused on drinkers wishing to reduce their alcohol use, those meeting criteria for current or lifetime alcohol dependence were excluded from the sample. Exclusion of drinkers meeting criteria for clinical diagnoses may have inadvertently introduced selection biases that could explain the lack of consistent associations between all the negative moods measured here and time to drinking. Conversely, because the sample comprised only participants who were concerned about their drinking, the current findings might not be generalizable to lighter drinkers or others who do not wish to reduce the drinking. Finally, given that our sample was overwhelmingly White, well-educated, and middle class, some caution in generalizing from the current findings to other populations is warranted. Nevertheless, future studies of alcohol use and related topics (e.g., smoking behavior) should draw on the obvious methodological strengths of the current study, i.e., repeated and frequent assessment of acute stress, mood and drinking. Also, future work should consider how theoretically important constructs such as avoidance coping, alcohol outcome expectancies, and other drinking motives as well as demographic variables such as ethnicity might circumscribe the effect of negative affect on time to drinking.

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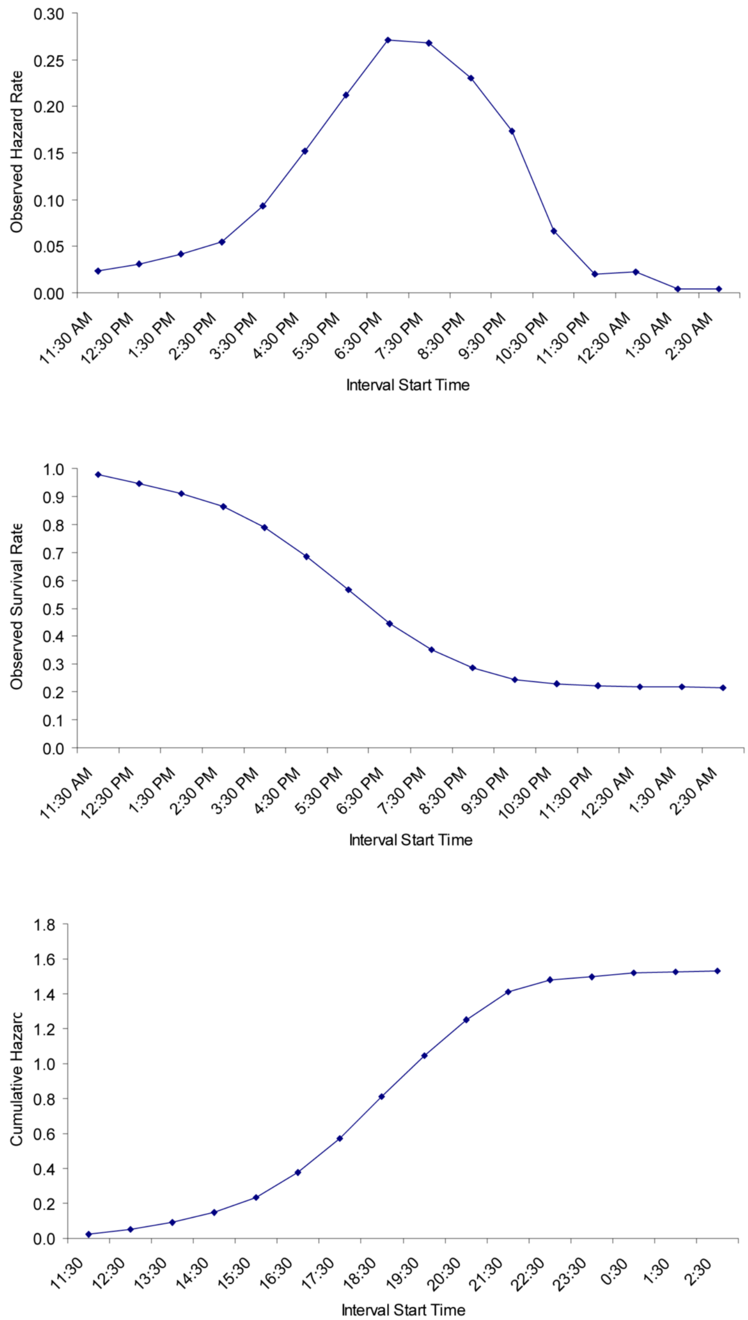
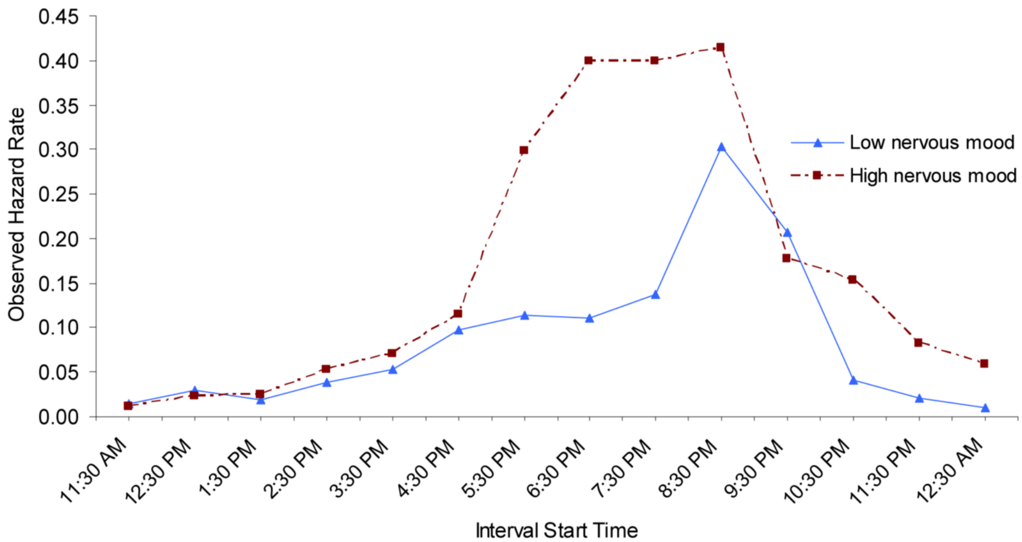


Figure 1.
Plots of the observed baseline hazard function, observed baseline survival function, and cumulative hazard function, ignoring nesting of days within persons.

a)



b)

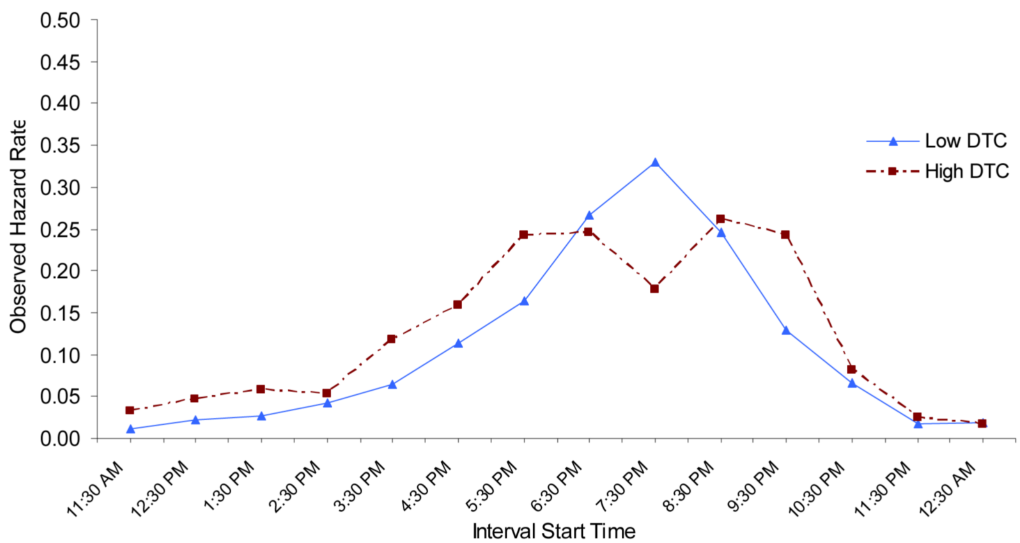


Figure 2.

Plots of observed hazard rates: a) comparing high nervous mood days to low nervous mood days; b) comparing individuals endorsing lower levels of DTC to individuals endorsing higher levels of DTC.

Table 1

Person-level Correlations, Means, and Standard Deviations

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Age	--	.08	−.12	.16	−.15	−.19	−.13	−.12	.03	−.12	−.13	−.09	.14	.21*
2.	Gender		--	.04	.08	.03	−.14	.10	.16	.25*	.20	.13	.14	−.11	−.30**
3.	Neuroticism			--	.37**	.25*	.19	.36**	.33**	.30**	.35**	.36**	.19	−.28**	.02
4.	DTC				--	.04	−.11	.15	.18	.23*	.17	.14	.03	−.16	.18
5.	Angry					--	.54**	.87**	.56**	.67**	.79**	.88**	.61**	−.33**	.02
6.	Bored						--	.56**	.50**	.34**	.55**	.69**	.59**	−.22*	.11
7.	Disappointed							--	.61**	.72**	.86**	.93**	.64**	−.36**	−.01
8.	Lonely								--	.54**	.75**	.78**	.49**	−.23*	.04
9.	Nervous									--	.69**	.80**	.55**	−.41**	−.02
10.	Sad										--	.93**	.56**	−.37**	.07
11.	Negative mood											--	.68**	−.39**	.04
12.	IP												--	−.20	−.07
13.	Positive mood													--	.08
14.	Drinks/day														--
	M	43.49	--	19.23	8.54	0.28	0.35	0.44	0.27	0.40	0.37	0.35	0.24	1.97	0.95
	SD	8.73	--	7.57	3.59	0.32	0.43	0.52	0.41	0.47	0.49	0.37	0.30	0.49	0.46

N =97. DTC = Drinking to cope; IP = Interpersonal problems; Gender coded so that low = male, high = female. Mood rating scales range from 0 to 4.

* *Note*. $p < .05$.

** $p < .01$.

Table 2

Hazard ratios and 95% confidence intervals for predictors in multilevel hazard models

	Stress/Negative Mood Model							
Model Term	**Angry**	**Bored**	**Disappointed**	**Lonely**	**Nervous**	**Sad**	**Negative Mood**	**Problems**
Intercept	0.13** *0.07-0.22*	0.12** *0.06-0.22*	0.12** *0.06-0.23*	0.13** *0.07-0.23*	0.14** *0.07-0.28*	0.12** *0.06-0.23*	0.13** *0.07-0.24*	0.12** *0.06-0.22*
Age	1.02** *1.01-1.04*	1.02** *1.01-1.04*	1.02** *1.01-1.04*	1.02** *1.01-1.04*	1.03** *1.01-1.04*	1.02** *1.01-1.04*	1.02** *1.01-1.04*	1.02** *1.01-1.04*
Gender	1.25 *0.96-1.62*	1.25 *0.96-1.62*	1.24 *0.96-1.61*	1.26 *0.97-1.63*	1.28 *0.98-1.67*	1.25 *0.96-1.63*	1.26 *0.97-1.63*	1.24 *0.95-1.61*
Neuroticism	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*	1.00 *0.98-1.02*
Average drinking level	1.48 *1.34-1.63*	1.47 *1.33-1.62*	1.48 *1.34-1.63*	1.48 *1.34-1.63*	1.48 *1.34-1.63*	1.47 *1.34-1.62*	1.48 *1.34-1.63*	1.47 *1.33-1.62*
Linear Time	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*	1.26** *1.22-1.31*
Quadratic Time	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*	0.93** *0.93-0.94*
Cubic Time	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*	0.99** *0.99-1.00*
Average positive mood	0.94 *0.72-1.24*	0.97 *0.74-1.26*	0.96 *0.73-1.26*	0.95 *0.73-1.23*	0.91 *0.69-1.20*	0.96 *0.73-1.26*	0.94 *0.72-1.24*	0.97 *0.74-1.26*
Average negative mood	0.89 *0.59-1.34*	1.03 *0.76-1.40*	0.99 *0.77-1.30*	0.90 *0.65-1.26*	0.85 *0.63-1.15*	0.99 *0.74-1.31*	0.93 *0.64-1.36*	1.00 *0.90-1.12*
Morning positive mood	1.26** *1.14-1.40*	1.22** *1.11-1.35*	1.25** *1.13-1.39*	1.23** *1.11-1.36*	1.26** *1.14-1.40*	1.22** *1.10-1.36*	1.28** *1.15-1.43*	1.24** *1.12-1.38*
Morning negative mood	1.13* *1.02-1.24*	1.03 *0.95-1.12*	1.06 *0.97-1.16*	1.04 *0.94-1.16*	1.18** *1.07-1.30*	1.01 *0.91-1.11*	1.17 *1.00-1.37*	1.02 *0.99-1.06*
DTC	0.99 *0.95-1.03*	0.999 *0.95-1.03*	0.999 *0.95-1.03*	0.999 *0.95-1.03*	0.999 *0.95-1.03*	0.99 *0.95-1.03*	0.99 *0.95-1.03*	0.99 *0.95-1.03*
DTC × Negative mood	1.01 *0.99-1.04*	1.03* *1.00-1.06*	1.01 *0.98-1.03*	0.98 *0.96-1.01*	0.99 *0.97-1.02*	1.00 *0.98-1.03*	1.02 *0.97-1.06*	1.00 *0.99-1.00*
Negative mood × Linear time	1.04* *1.01-1.0*				1.04* *1.01-1.08*			
DTC × Linear time	0.98** *0.98-0.99*	0.99** *0.98-0.99*	0.98** *0.98-0.99*	0.99** *0.98-0.99*	0.99** *0.98-0.99*	0.99** *0.98-0.99*	0.99** *0.98-0.99*	0.99** *0.98-0.99*

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Notes. DTC = Drinking to cope motive Degrees of freedom (*df*) for person-level predictors = 89; *df* for daily- and person × daily-level terms = 16800.

* $p \leq .05$

** $p \leq .01$.