Published in final edited form as:

Alcohol Treat Q. 2015 ; 33(2): 161–184. doi:10.1080/07347324.2015.1018778.

Trajectories of Drinking Urges During Individual- and Couple-based Cognitive-Behavioral Treatment for Alcohol Use Disorders

Kevin A. Hallgren, PhD

University of Washington, Center for the Study of Health and Risk Behaviors, Seattle, WA USA

Mandy D. Owens, MS and Julie M. Brovko, MS

University of New Mexico, Center on Alcoholism, Substance Abuse, and Addictions, Albuquerque, NM USA

Benjamin O. Ladd, PhD

Reed College, Adolescent Health Research Program, Portland, OR USA

Barbara S. McCrady, PhD

University of New Mexico, Center on Alcoholism, Substance Abuse, and Addictions, Albuquerque, NM USA

Elizabeth E. Epstein, PhD

Rutgers University, Center of Alcohol Studies, Piscataway, NJ USA

Abstract

Individuals receiving treatment for alcohol use disorders (AUDs) often experience urges to drink, and reductions in drinking urges during cognitive-behavioral therapy (CBT) predict better treatment outcomes. However, little previous work has examined patterns of daily drinking urges during treatment. The present study examined patterns of change in daily drinking urges among participants in two randomized clinical trials of males ($N = 80$ with 4401 daily recordings) and females ($N = 101$ with 8011 daily recordings) receiving individual- or couples-based CBT. Drinking urges were common during treatment, occurring on 45.1% percent of days for men and 44.8% for women. Drinking urges and alcohol use for both genders decreased substantially during the course of treatment. Both genders had increases in drinking urges as more time elapsed since attending a treatment session. For men, this increase was most pronounced at the beginning of treatment, but for women it was most pronounced near the end of treatment. Alcohol use and drinking urges were both more likely to occur on weekends. The results suggest that these times may lead to higher risk for drinking, and clients may benefit from high-risk planning that is focused on these times.

Keywords

cognitive-behavioral therapy; craving; daily drinking logs; drinking urges

Introduction

Cognitive behavioral therapy (CBT) has strong empirical support as an efficacious treatment for alcohol use disorders (AUDs; Epstein & McCrady, 2009; Magill & Ray, 2009; Martin & Rehm, 2012; Project MATCH Research Group, 1997, 1998). One marker of success in CBT is a reduction in drinking urges, which predicts reduced alcohol consumption during treatment and up to three years following treatment (Subbaraman, Lendle, van der Laan, Kaskutas, & Ahern, 2013; Witkiewitz, 2012). The association between drinking urges and subsequent heavy alcohol consumption among adults receiving AUD treatment has been supported in several studies (Flannery, Volpicelli, & Pettinati, 1999; Flannery, Poole, Gallop, & Volpicelli, 2003; Witkiewitz, 2011; Witkiewitz & Marlatt, 2004; Yoon, Won Kim, Thuras, & Grant, 2006).

In CBT particular attention is devoted to identifying antecedents to urges to consume alcohol (O'Brien, 2005). Once these antecedents are identified, CBT aims to change clients' experiences with drinking urges, for example by increasing the ability to reduce exposure to stimuli that precipitate urges, conditioning new cognitive and behavioral responses to these stimuli to prevent urges or drinking from occurring, and improving skills to cope with urges once they occur (Kadden & Cooney, 2005; Marinchak & Morgan, 2012). One technique commonly employed in CBT for AUDs involves identifying potential high-risk situations that may occur in the near future (e.g., within one week; Epstein & McCrady, 2009; Kadden & Cooney, 2005; McCrady and Epstein, 2009; O'Leary & Monti, 2002). Through this technique, treatment providers help clients identify upcoming situations that are likely to elicit drinking urges or alcohol consumption and develop strategies to avoid the situation or change the coping response to reduce the likelihood of drinking urges and prevent alcohol consumption. In addition to helping clients cope with high-risk situations and reducing the likelihood of relapse, this high-risk planning can provide clinically useful information to clients and therapists about the particular situations that commonly lead to drinking urges for a given client.

Individuals with AUDs may have an especially difficult time resisting alcohol use when faced with drinking urges early in treatment, as supported by studies with humans (Papachristou, Nederkoorn, Giesen, & Jansen, 2014; Subarraman et al., 2013) and in animal models (Breese et al., 2005). Cognitive-behavioral theories posit that this difficulty is due in part to clients' limited experience generating non-drinking coping responses when faced with high-risk situations and drinking urges (Rotgers, 2012).

Despite calls for additional study of drinking urges measured at the daily level and in the natural environments of individuals in AUD treatment (Kavanagh et al., 2013; Litt & Cooney, 1999), little research has examined the manner by which drinking urges change on a daily basis during the course of AUD treatment. Instead, previous research often has focused on environmental and affective antecedents that trigger drinking urges, for example, showing in laboratory settings (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Litt & Cooney, 1999) and in naturalistic settings (Litt, Cooney, & Morse, 2000) that drinking urges can be induced by exposure to alcohol or alcohol images, induction of negative mood states, and alcohol-related environments. For individuals in AUD treatment, previous research has also

shown the tendency for drinking urges to decrease over time (Flannery et al., 1999; Witkiewitz, 2011), although drinking urges in these studies have typically been measured in aggregate over a period of weeks or months rather than on a daily basis. More recent research using daily assessments of craving has demonstrated that drinking urges predict increased likelihood of relapse on the same day or the next day among individuals in AUD treatment (Fazzino, Harder, Rose, & Helzer, 2013; Moore, Seavey, Ritter, McNulty, Gordon, & Stuart, 2014). However, little research has examined the manner in which drinking urges themselves change over time during AUD treatment when measured on a daily level.

Understanding the typical course of daily drinking urges during treatment can provide useful information for clients and clinicians. For example, clinicians could help clients understand how drinking urges typically change over time in treatment, which could help instill hope that their drinking urges are likely to decrease over time. In addition, clinicians could use normative information about the times when drinking urges are most likely to occur to help clients predict and plan for these high-risk times and develop coping strategies for such high-risk situations.

The aim of the present study was to examine the trajectories of daily drinking urges and alcohol consumption during the course of CBT for AUDs to help understand how they change over time during treatment. Specifically, we aimed to quantify the degree of change in drinking urges and alcohol consumption over the course of treatment and identify whether drinking urges were associated with other time-based variables, including the number of sessions attended, weekends, and the number of days that elapsed since last attending a treatment session.

Method

Participants

The present study is a secondary analysis of data from two randomized controlled trials examining Alcohol Behavioral Couple Therapy (ABCT) and Alcohol Behavioral Individual Therapy (ABIT). The “men’s study” included 90 males with AUDs who provided 6834 total daily urge recordings, with 4401 retained for analysis (criteria for retention are described below); the “women’s study” included 102 females with AUDs who provided 11,487 total daily urge recordings, with 8011 retained for analysis. Only participants who completed at least two sessions and provided daily urge recordings for at least one week were included in the analyses (men’s $N = 80$, women’s $N = 101$). Table 1 provides sample characteristics by study.

All participants had current alcohol abuse or dependence per the Diagnostic and Statistical Manual of Mental Disorders (DSM)-III-R or DSM-IV (American Psychiatric Association 1987, 1994) and were married or in a committed heterosexual relationship with a partner who was willing to participate in treatment. Exclusion criteria included psychotic symptoms in the past 6 months, severe cognitive impairment, or current drug dependence with physiological dependence. Additional information on the participant flow, eligibility criteria, and study procedures can be found in the original publications (McCrary, Epstein, & Hirsch, 1999; McCrary, Epstein, Cook, Jensen, & Hildebrandt, 2009).

Measures

Clients were asked to make recordings of drinking urges and alcohol consumption in real time, each time an urge or drinking episode took place during treatment. Clients were instructed to report all urges and drinking at the time of occurrence, on a “daily monitoring card” each day and returned the completed cards to the next session to review with the therapist. Urges were defined as any desire for or thought about consuming alcohol and were rated on a 7-point Likert scale with higher values indicating greater urge intensity. Similar single-item measures of drinking urges have been shown to correlate highly with more extensive multiple-item instruments (Rosenberg, 2009) and have been described as more practical for obtaining repeated measures of craving than multi-item questionnaires (Drobes & Thomas, 1999). Clients who failed to complete self-recording cards for the week completed them retrospectively with their therapists at the beginning of the next session. Daily drinking urges and daily alcohol consumption were dichotomized into yes/no values indicating whether participants did or did not experience drinking urges or consume alcohol for a particular day due to strong violations of normality in the number of urges, urge intensities, and number of drinks reported per day. Dichotomization facilitated the use of generalized (logistic) linear mixed models using dichotomous dependent variables (described in more detail below), which do not rely on assumptions of normality.

Only self-recordings within the seven-day period after attending a treatment session were retained for analysis. The majority of daily recordings fell within seven days of a treatment session (men’s study: 64.3%, women’s study: 69.7%) and the biggest drop in the frequency of recordings occurred on the first day after this seven-day period. We expected that using data only for from this seven-day period would reduce the likelihood of bias in parameter estimates due to having a small number of observations with extreme values for the number of days elapsed since attending a treatment session (similar to reducing the presence of extreme values or outliers in predictor variables; Choi, 2009). We also anticipated that the seven-day period after a treatment session would best represent the period of time following each session that CBT therapists are likely to discuss and help with planning ways to handle upcoming potential drinking urges. Different cutoff points for excluding daily recordings (e.g., 14-day window) were tested and typically provided a similar pattern of urge and alcohol consumption trajectories as reported in the results.

Procedures

Men’s study—In the men’s study, couples (males with AUDs and their female partners) were randomized to one of three modified ABCT conditions: standard ABCT, ABCT + Relapse Prevention (RP), or ABCT + Alcoholics Anonymous (AA) involvement. All three treatments were manual-guided, included up to seventeen 90-minute sessions intended to be provided once per week, and required the presence of both partners at every session. All three treatment conditions taught a core set of skills, including individual CBT elements (e.g., functional analysis, coping skill training, cognitive restructuring), CBT elements adapted for the supportive partner (e.g., eliciting partner support for abstinence, partner skill training), and couple therapy techniques (e.g., reciprocity enhancement, communication skill training). In addition, the ABCT+RP included RP training and planning for high-risk situations at the end of each treatment session as well as optional booster sessions; the

ABCT+AA condition encouraged participants and partners to become active in AA and Al-Anon Family Groups, respectively. Previous findings showed that all three conditions significantly reduced the frequency of drinking and heavy drinking and that the conditions did not differ with respect to within-treatment drinking, within-treatment heavy drinking, treatment session attendance, length of time in treatment, or length of time between treatment sessions (McCrary et al., 1999).

Women's study—In the women's study, participants were randomly assigned to either ABCT or ABIT. Both treatments were manual-guided and included up to 20 sessions that were intended to be provided once per week. ABCT sessions were 90 minutes and ABIT sessions were 60 minutes. The ABCT condition included male partners' attendance in treatment sessions, had similar treatment components as the men's ABCT+RP condition (but with no booster sessions offered), and also incorporated additional motivational enhancement components such as assessment feedback and decisional balance exercises. The ABIT condition contained all of the motivational, skill-training, and RP components included in the women's ABCT protocol, but in the absence of the partner and without any partner- or couple-focused interventions. For more information on the specific treatment conditions, see McCrary et al. (2009).

Analytic Plan

Generalized linear mixed models (GLMMs) were used to analyze patterns of drinking urges and alcohol consumption during the treatment periods of the two studies. GLMMs combine multilevel models to account for multiple correlated observations that are nested within individuals (Snijders & Bosker, 2012) and generalized linear models (e.g., logistic regression; Nelder & Wedderburn, 1972) to account for non-normal distributions associated with dichotomous variables (Muthén, 1997; Stroup, 2014). These models are considered to be appropriate for the structure of the data in the present study with daily observations nested within participants and daily urges and drinking measured as dichotomous variables (e.g., urge vs. no urge). GLMMs also can include random effects, which allow trajectories and regression effects to vary across individuals rather than assuming that they are fixed across all individuals in the sample. In addition, multiple simulation studies suggest that these models are robust for unequal numbers of treatment weeks or daily observations that were nested within participants compared to more traditional models such as linear regression or ANOVA (Stroup, 2014). All models were analyzed in Mplus 6.12 (Muthén & Muthén, 2011) using full information maximum likelihood (FIML), which provides less biased results in the presence of missing data compared to other methods such as case-wise deletion or mean imputation (Hallgren & Witkiewitz, 2013).

GLMMs were examined separately for the men's and women's studies to account for differences due to study design (e.g., treatment content, maximum number of sessions) and gender. A path diagram for the daily drinking urge GLMM is depicted in Figure 1 and was tested for both the men's and the women's studies. Identical path models were tested for both studies using daily measures of alcohol consumption. Daily recordings were specified to load onto intercept and slope terms that represented the trajectories of daily drinking urges and alcohol consumption within the seven days that elapsed since last attending a treatment

session. Intercept and slope growth parameters were divided into within-subject and between-subject terms. Specifically, the within-subjects term accounted for the variability in growth curves that was within subjects but between session weeks, and the between-subjects term accounted for the variability in growth curves that was strictly between subjects. Random effects were included for the within- and between-subjects portions of the model to account for variability in intercept and slope terms between session weeks and between subjects. To examine how growth curves changed as participants progressed through treatment, within-subject random intercepts and slopes were regressed onto session number. A dummy variable representing weekend days (Friday, Saturday, and Sunday coded as 1) vs. weekdays (coded as 0) was included as a predictor of each daily drinking urge and alcohol consumption variable to account for the possibility of urges and consumption being higher on weekends compared to weekdays. The session number variable was coded with the first session as 0, the second session as 1, and so on. Residual variances of the daily drinking urge and alcohol consumption variables and effect estimates of weekend days predicting daily measurements were constrained to equality in each model to improve model estimation and convergence (parameter estimates constrained to equality are represented by letters on the paths in Figure 1).

Results

Daily Drinking Urges

On average, participants reported drinking urges on 45.1% percent of days ($SD = 32.7$) for the men's study and 44.8% ($SD = 27.5$) days for the women's study. Seventy-six men (95.0%) and 99 (98.0%) women reported at least one drinking urge for the daily recording data that was available during the treatment period. There were no differences in participants' overall mean proportion of urges between conditions in the men's study, $F(2,77) = 0.992, p = 0.38$, or in the women's study $t(99) = 0.83, p = 0.41$.

Men's study drinking urges—Estimates of fixed and random effects for the GLMMs of drinking urges for the men's study are presented in the left half of Table 2. The between-subjects section of the results indicates that mean growth-curve slopes were positive and significant, meaning that, across subjects, participants in the men's study tended to have an increase in urges as more days elapsed since attending a treatment session. Also in the between-subject portion of the model, men had significant intercept variance and non-significant slope variance, indicating that the proportion of days with drinking urges varied between subjects but the degree to which urges were related to time since attending a treatment session did not vary between subjects. The non-significant intercept-slope covariance indicates that differences between participants' urges at the beginning of treatment were unrelated to the degree in which their urges changed as time elapsed since attending a treatment session.

In the within-subject portion of the model, effect estimates for urge intercepts and slopes predicted by session number were significant and negative, indicating that as participants completed more treatment sessions they had fewer drinking urges and the degree to which drinking urges increased as time elapsed since attending a treatment session also decreased.

The regression effect of daily urges predicted by weekends was significant and positive, indicating that urges were more common on weekends. Within-subject residual intercept variance was significant and positive, indicating that the frequency of drinking urges varied within individuals (i.e., between weeks) after accounting for other parameters in the model. The non-significant residual slope variance indicates that the increase in drinking urges that was observed as more time elapsed since attending a treatment session did not significantly vary within individuals (between weeks) after accounting for the regression effect of slopes predicted by session number. Within-subject intercept and slope means were necessarily fixed to zero (Muthén & Muthén, 2011) and are therefore not shown in Table 2.

As with all multiple regression techniques, the interpretation of the “whole picture” of drinking urges in the presence of multiple parameter estimates can be difficult. To facilitate easier interpretation, these results are plotted in the first panel of Figure 2, which shows the simple probability of participants experiencing a drinking urge (y -axis, expressed as the model-predicted probability of drinking) based on the number of days since attending a treatment session (x -axis). Urge trajectories are presented for a subset of session weeks (separate segments of the x -axis), and show that the probability of having drinking urges decreased substantially over the course of treatment. The model-predicted probabilities of experiencing a drinking urge are represented by black circles connected by lines (center line in each segment of the x -axis) and represent the predicted probability of daily drinking urges for an average participant. The trajectories of these lines show that the probability of experiencing a drinking urge increased as more time elapsed since attending a treatment session during the first several treatment weeks, but this effect was attenuated as more treatment sessions were completed. The plus and minus signs above and below the circles incorporate the observed between-subject intercept variance, representing the model-predicted probabilities of experiencing a drinking urge for participants who were plus and minus one standard deviation from average in terms of their overall proportion of drinking urges. These random effects demonstrate that the overall amount of drinking urges varied substantially between participants across the treatment period.

Women’s study drinking urges—Effect estimates for GLMM drinking urge parameters for the women’s study are presented in the right half of Table 2. The parameter estimates can be interpreted similarly to the parameter estimates in the men’s study. The results from the between-subject part of the model indicate that women had a non-significant slope mean estimate, meaning that during the first week of treatment, women’s urges were unrelated to the number of days that elapsed since attending a treatment session. The women’s urge model also yielded significant intercept and slope variances but non-significant intercept-slope covariance, indicating that the number of urges and the relationship between urges and time since attending a treatment session varied between subjects, but these random effects were unrelated to each other.

In the within-subject portion of the model, regression estimates for urge intercepts predicted by session number were significant and negative, indicating that participants experienced a decrease in drinking urges as more treatment was completed. In contrast to the men, women’s within-subject slopes predicted by session number were significant and positive, indicating that there was an increase in urges as more time elapsed since attending a

treatment session during later treatment weeks. As with men, women had more urges on weekends and significant residual variability in within-subjects (i.e., between week) intercepts.

Model-predicted urge trajectories for the women's study treatment period are plotted in the second panel of Figure 2, which shows that daily drinking urges decreased over the course of treatment, were unrelated to the number of days that elapsed since attending treatment in early treatment weeks, and were increasingly related to the number of days that elapsed since attending a treatment session in later treatment weeks. The figure also demonstrates that drinking urges varied substantially between subjects, as indicated by the plus and minus signs that represent drinking urges for participants who were plus and minus one standard deviation from average in terms of their overall proportion of drinking urges.

Daily Alcohol Consumption

On average, participants reported alcohol consumption on 17.9% ($SD = 24.5$) of all days during the treatment period for the men's study and on 18.0% ($SD = 23.5$) days for the women's study. Twenty-eight men (35.0%) and 27 women (26.7%) reported total abstinence on all of the daily drinking measures that were available during the treatment period. There were no differences in the overall number of drinking days during treatment between conditions in the men's study, $F(2,77) = 1.53$, $p = 0.22$, or in the women's study $t(99) = 0.74$, $p = 0.46$.

Men's study alcohol consumption—Effect estimates for GLMM alcohol consumption parameters for the men's study are presented in the left half of Table 3. The results from the between-subject part of the model indicate that men had a non-significant slope mean estimate, indicating that alcohol consumption was unrelated to the number of days elapsed since attending a treatment session. The men's drinking model yielded significant intercept variance but non-significant slope variance and intercept-slope covariance, indicating that the number of days with any alcohol consumption varied between subjects, but the degree of change in alcohol consumption as more time elapsed since attending a treatment session did not vary between subjects and was unrelated to between-subject differences in alcohol consumption.

In the within-subject portion of the model, regression estimates for intercepts predicted by session number were significant and negative, indicating that overall, men experienced a decrease in alcohol consumption as more treatment was completed. Men's within-subject slopes were not significantly predicted by session number, indicating that across the course of treatment, the probability of drinking did not change systematically in relation to the number of days that elapsed since attending treatment. Men were more likely to drink on weekends and had significant residual within-subjects intercept variance.

Model-predicted probabilities of daily drinking throughout the men's study treatment period are plotted in the first panel of Figure 3, which presents the model-predicted results in an identical format as Figure 2 and shows that daily alcohol consumption decreased over the course of treatment and was unrelated to the number of days that elapsed since attending a treatment session. The variability between participants, depicted using plus and minus signs

to display participants who were plus and minus one standard deviation from the mean in terms of their drinking levels, indicated that there was substantial variability in daily drinking during the beginning of treatment, but that this variability tended to be lower toward the end of treatment when overall drinking was low for most participants.

Women's study alcohol consumption—Effect estimates for alcohol consumption parameters for the women's study are presented in the right half of Table 3. Women had a non-significant between-subjects slope mean estimate, indicating that alcohol consumption was unrelated to the number of days elapsed since attending a treatment session for treatment weeks coded as 0 (i.e., at the beginning of treatment). As with men, women had significant intercept variance but non-significant slope variance and intercept-slope covariance.

In the within-subject portion of the model, regression estimates for intercepts predicted by session number were significant and negative, indicating that women experienced a decrease in alcohol consumption as more treatment was completed. Women's within-subject slopes predicted by session number were significant and positive, indicating that in later treatment weeks, the probability of drinking increased as more days elapsed since attending treatment in a similar manner that women's drinking urges increased. Women were more likely to drink on weekends and had significant residual within-subjects intercept variance.

Model-predicted probabilities of daily alcohol consumption throughout the women's study treatment period are plotted in the second panel of Figure 3, which shows that daily alcohol consumption decreased over the course of treatment. Figure 3 also shows that as women completed more treatment, daily alcohol consumption was increasingly related to the number of days that elapsed since attending a treatment session, particularly for women who were reported an above-average amount of alcohol consumption (e.g., women who were one standard deviation above the mean in terms of their daily alcohol consumption as represented by plus signs).

Discussion

CBT aims to help clients recognize and cope with drinking urges in response to triggers and high risk situations. Despite previous findings that within-treatment drinking urges predict post-treatment outcomes (Flannery et al., 1999, 2003; Witkiewitz, 2011; Witkiewitz and Marlatt, 2004; Yoon et al., 2006), little previous research has examined drinking urges longitudinally when measured on a daily basis throughout the course of behavioral treatments for AUDs. The current study examined the trajectories of drinking urges and alcohol consumption during CBT for men and women with AUDs to help understand how these variables change over time during treatment. In both studies, drinking urges and alcohol consumption decreased over time as participants completed more treatment. Additionally, drinking urges and alcohol consumption were higher on weekends than weekdays.

In the men's study, drinking urges increased significantly as more days elapsed since attending a treatment session during the first several weeks of treatment. However, as

participants completed more treatment, drinking urges increased less in relation to the number of days that elapsed since attending a treatment session. For example, based on the model-predicted probabilities in the results above, men's drinking urges were quite common, with a 68.5% chance of occurring for the average participant on the first day of the first treatment week, and the probability of experiencing an urge increased significantly within the first week to 83.0% when six days had elapsed since attending a treatment session. Men's drinking urges decreased throughout the course of treatment, for example having a 13.4% chance of occurring for the average participant during the first day of the ninth treatment week, and were effectively unchanged over the course of the week, increasing only slightly to 13.8% six days after the ninth treatment session.

In the women's study, drinking urges also increased significantly as more time elapsed since attending a treatment session; this effect was not present at the beginning of treatment but became increasingly present as more treatment was completed. For example, in the women's study, drinking urges were consistently high during the first treatment week, with a 76.2% chance of occurring on any day for the average participant and did not change as more time elapsed since attending a session. By the ninth treatment session, even though drinking urges were considerably lower with a 16.5% probability of occurring on the first day after the ninth treatment session, women's drinking urges increased to 25% six days after attending the ninth session.

Men's daily drinking likewise decreased as more treatment was completed, however their daily drinking was unrelated to the number of days that elapsed since attending a treatment session. Women's daily drinking also decreased as they completed more treatment, and increased as more time elapsed since attending a treatment session during later treatment weeks in a similar manner to women's drinking urges.

Theoretical Implications

Although previous research suggests that drinking urges and alcohol consumption decrease during the course of treatment and are likely to be higher in relation to environmental triggers (Litt et al., 2000), the finding that drinking urges were related to the amount of time that elapsed since attending a treatment session has not been reported previously. The reduced frequency of urges over the course of treatment and immediately after attending treatment sessions (relative to several days after attending sessions) could in part be related to increases in skills for understanding, identifying, and coping with drinking urges, which are core components of the CBT treatments in the two studies examined here. For example, if CBT provided participants with skills for coping with drinking urges over the course of therapy, it is possible that clients were more likely to recall and utilize these skills shortly after attending treatment sessions compared to when several days had elapsed since attending a session. However, this hypothesis is difficult to test directly in the present study because skill acquisition was a major focus throughout the treatment period for all treatment conditions and skill acquisition was not measured in the present study, limiting our ability to statistically test this hypothesis directly. In addition, other variables also could be related to time since attending treatment sessions, such as motivation for change, which could account for this finding. Therefore, the hypothesis that coping skills contribute to decreases in

drinking urges could be examined more directly in future research by testing whether client skills for coping with drinking urges are mediators of change or whether skills-based treatment reduces drinking urges more than other treatment modalities. Future research also could focus on the manner by which clients with AUDs use the skills they learn in CBT during the days following treatment sessions. Despite the limitations in understanding why drinking urges were related to the time elapsed since attending a treatment session, the results of the present study provide a starting point for understanding that these patterns may be present for many clients and should be studied further in future research.

Most research suggests that the nature of AUDs is more similar than different between men and women (Kuhn, 2011; Schuckit, Daepfen, Tipp, Hesselbrock, & Bucholz, 1998). Likewise, the patterns of urges found in the present study were also more similar than they were different between men and women, with both genders demonstrating substantial decreases in urges over the course of treatment, more urges on weekends, and a tendency for urges to increase as more days elapsed since attending a treatment session. However, the increase in urges as more days elapsed since attending a treatment session was more prominent for men at the beginning of treatment but more prominent for women at the end of treatment. Research on gender differences suggests that women are more likely to experience milder withdrawal (Kuhn, 2011), develop alcohol dependence slightly faster (Schuckit et al., 1998), have more severe psychiatric comorbidity (Mann, Hintz, & Jung, 2004), and are more likely to drink in response to negative emotions and interpersonal conflict (Annis & Graham, 1995). However, none of these established gender differences would clearly predict the difference in the pattern of urges that was found in the present study. Future work may further examine how these factors (e.g., withdrawal symptoms, psychiatric distress, negative emotions) interact with drinking urges for men and women to better understand the reasons for gender differences in drinking urges during AUD treatment.

Clinical Implications

The observed patterns of drinking urges found in the present study suggest several implications for clinical practice. Earlier in outpatient treatment, clients experience a greater number of drinking urges and consume more alcohol, possibly because they have less experience being abstinent from alcohol and likewise have less developed skills for coping with high-risk situations without drinking. CBT models posit that clients are likely to benefit from concrete ways of anticipating and dealing with drinking urges, and the current study provides empirical support for monitoring daily drinking urges and daily alcohol consumption to help clients better understand their patterns of drinking urges and alcohol consumption, which are likely to be influenced by treatment- and environment-related events and vary substantially between individuals (Epstein & McCrady, 2009). Many treatment components in CBT related to monitoring drinking and urges and planning for high-risk situations may help with these goals. For example, if clinicians employ self-recording strategies with clients, they can plot this information at a daily or weekly level to help clients understand how their drinking urges and alcohol consumption change over time. Based on the results of the present study, clinicians may reassure clients early during treatment to anticipate that their drinking urges are likely to change in relation to specific events, for

example, being higher on weekends or potentially higher as more time elapses since attending a treatment session, and decreasing as more treatment is completed. Likewise, the technique of identifying possible high-risk situations for the upcoming week during therapy sessions and planning for ways to cope with those situations, as used in CBT, could be particularly helpful for reducing drinking despite experiencing drinking urges and may facilitate client practice of new coping skills. Based on the results of the present study, it may be especially useful for clinicians to work with clients to anticipate and plan for high-risk situations at those times when drinking urges and alcohol consumption are both more likely to occur, such as early during treatment, weekends, and as more time elapses since attending a treatment session.

Outpatient CBT typically is scheduled on a weekly basis, and clients in abstinence-oriented treatment are often expected to achieve abstinence early in treatment so that they have opportunities to practice new coping skills instead of consuming alcohol. If drinking urges and/or alcohol consumption are more likely to occur several days after attending treatment sessions, as was found in the present study, it may be possible that clients would have better success in reducing their drinking if they attended treatment sessions more frequently early in treatment. Further, clients may be more successful with their drinking goals if the clinician then gradually reduces the frequency of their sessions over time (e.g., McKay, 2005) or utilizes brief telephone or email contacts between sessions early during treatment.

Last, the current study provides empirical support for gradual reduction of cravings throughout the treatment period; thus, clinicians can help instill hope for their clients by informing them that even though drinking urges may be distressing, they are quite common for most individuals, especially at the beginning of treatment, and they tend to decrease for most people as they complete more treatment. Clients in AUD treatment often find drinking urges to be distressful and confusing when they also have a strong desire to reduce their drinking. Reassurance from clinicians that drinking urges are common in treatment and are likely to decrease throughout treatment may help reduce the distress associated with experiencing drinking urges.

Limitations and Strengths

The present study has several limitations. First, although the present study found significant changes in drinking urges and alcohol consumption as a function of attending CBT sessions, the specific components of treatment covered in each session were not examined and determining which aspects of CBT may have contributed to these changes was beyond the scope of the present study. Second, it is possible that the simple act of monitoring and recording one's drinking urges and alcohol consumption may change the occurrence of these behaviors. This may be viewed as a form of assessment reactivity, where exposure to alcohol-related assessment impacts alcohol consumption outcomes (Clifford, Maisto, & Davis, 2007; Epstein et al., 2005; Walters, Vader, Harris, & Jouriles, 2009). Although this effect may be desirable in therapeutic contexts, it limits the external validity of self-reports of drinking urges and alcohol consumption in situations where drinking urges are not explicitly monitored as they were in the present study. Nonetheless, previous research using daily telephone-based self-recording of alcohol consumption has found that daily self-

reporting of alcohol consumption does not always reduce drinking urges (Simpson, Kivlahan, Bush, & McFall, 2005). Third, because daily drinking urges and alcohol consumption were recorded using paper-and-pencil self-recording cards, we were unable to determine which self-recording cards were completed in real-time vs. retrospectively alone or with therapists.

The present study also has several strengths. Drinking urges and alcohol consumption were examined during treatment, which represents an important period of time in which people often experience substantial changes in these measures. The data source included two large samples of several thousand observations of daily drinking urges and alcohol consumption measured among individuals in treatment for AUDs, offering substantial statistical power. Several patterns in the results were replicated across two independent samples of men and women, where the latter are often underrepresented in the AUD literature. This research also extends previous findings on drinking urges, which have tended to focus on drinking urges measured in aggregate over longer periods of time (e.g., measured weekly or monthly) or in non-treatment contexts.

Conclusion

The present study found that drinking urges were associated with CBT session attendance, and specifically indicated that individuals were more likely to experience drinking urges early during treatment, on weekends, and in some cases, after more time has elapsed since attending a treatment session. Because drinking urges are associated with increased probability of drinking, future research may identify ways to reduce the probability of experiencing drinking urges during these high-risk times. For example, multiple factors could plausibly mediate the increase in drinking urges during these times, such as difficulty in using new cognitive-behavioral coping skills, fluctuations in motivation and ambivalence, or variability in exposure to high-risk environments. With more knowledge of these mediating factors, subsequent research may focus on reducing drinking urges and alcohol consumption during these times of highest risk, for example, by increasing treatment contact through adjunct technology, increasing access to social support, or focusing more explicitly on coping skills that are specifically tailored to the high-risk situations that occur during these times.

Acknowledgments

This research was funded by NIAAA grants R37AA07070 and F31AA021031. Any opinions, findings and conclusions, or recommendations expressed in this material are those of the authors, and do not necessarily reflect the views of the National Institutes of Health or the National Institute on Alcoholism and Alcohol Abuse.

References

- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 3rd. author; Washington, DC: 1987.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th. author; Washington, DC: 1994.
- Annis HM, Graham JM. Profile types on the Inventory of Drinking Situations: Implications for Relapse Prevention counseling. *Psychology of Addictive Behaviors*. 1995; 9(3):176–182.

- Breese GR, Chu K, Dayas CV, Funk D, Knapp DJ, Koob GF, Weiss F. Stress enhancement of craving during sobriety: A risk for relapse. *Alcoholism: Clinical and Experimental Research*. 2005; 29(2): 185–195.
- Choi S. The effect of outliers on regression analysis: Regime type and foreign direct investment. *Quarterly Journal of Political Science*. 2009; 4:153–165.
- Clifford PR, Maisto SA, Davis CM. Alcohol treatment research assessment exposure subject reactivity effects: Part I. Alcohol use and related consequences. *Journal of Studies on Alcohol and Drugs*. 2007; 68(4):519–528. [PubMed: 17568955]
- Cooney NL, Litt MD, Morse PA, Bauer LO, Gaupp L. Alcohol cue reactivity, negative-mood reactivity, and relapse in treated alcoholic men. *Journal of Abnormal Psychology*. 1997; 106(2): 243–250. [PubMed: 9131844]
- Drobes DJ, Thomas SE. Assessing craving for alcohol. *Alcohol Research & Health*. 1999; 23(3):179–186. [PubMed: 10890813]
- Epstein EE, Drapkin ML, Yusko DA, Cook SM, McCrady BS, Jensen NK. Is Alcohol assessment “therapeutic?” Pretreatment change in drinking among alcohol dependent women. *Journal of Studies on Alcohol*. 2005; 66(3):369–378. [PubMed: 16047526]
- Epstein, EE.; McCrady, BS. *Treatments that work: Individual cognitive behavioral therapy for alcohol use problems*. Therapist Manual. New York; Oxford University Press: 2009.
- Fazzino TL, Harder VS, Rose GL, Helzer JE. A daily process examination of the bidirectional relationship between craving and alcohol consumption measured via interactive voice response. *Alcoholism: Clinical and Experimental Research*. 37(12):2161–2167.
- Flannery BA, Poole SA, Gallop RJ, Volpicelli JR. Alcohol craving predicts drinking during treatment: An analysis of three assessment instruments. *Journal of Studies on Alcohol*. 2003; 64:120–126. [PubMed: 12608492]
- Flannery BA, Volpicelli JR, Pettinati HM. Psychometric properties of the Penn Alcohol Craving Scale. *Alcoholism: Clinical and Experimental Research*. 1999; 23(8):1289–1295.
- Kadden, RM.; Cooney, NL. *Treating alcohol problems*. In: Marlatt, GA.; Donovan, DM., editors. *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors*. Guilford; New York: 2005.
- Kavanagh DJ, Statham DJ, Feeney GFX, Young RM, May J, Andrade J, Connor JP. Measurement of alcohol craving. *Addictive Behaviors*. 2013; 38(2):1572–1584. [PubMed: 23142210]
- Kuhn CM. Alcohol and women: What is the role of biologic factors? *Alcoholism Treatment Quarterly*. 2011; 29(4):479–504.
- Litt MD, Cooney NL. Inducing craving for alcohol in the laboratory. *Alcohol Research & Health*. 1999; 23(3):174–178. [PubMed: 10890812]
- Litt MD, Cooney NL, Morse P. Reactivity to alcohol-related stimuli in the laboratory and in the field: Predictors of craving in treated alcoholics. *Addiction*. 2000; 95(6):889–900. [PubMed: 10946438]
- Magill M, Ray LA. Cognitive-behavioral treatment with adult alcohol and illicit drug users: A meta-analysis of randomized controlled trials. *Journal of Studies on Alcohol and Drugs*. 2009; 70(4): 516–527. [PubMed: 19515291]
- Mann K, Hintz T, Jung M. Does psychiatric comorbidity in alcohol-dependent patients affect treatment outcome? *European Archives of Psychiatry & Clinical Neuroscience*. 2004; 254(3):172–181. [PubMed: 15205971]
- Martin GW, Rehm J. The effectiveness of psychosocial modalities in the treatment of alcohol problems in adults: A review of the evidence. *Canadian Journal of Psychiatry*. 2012; 57(6):350–358. [PubMed: 22682572]
- Marinchak, JS.; Morgan, TJ. *Behavioral treatment techniques for psychoactive substance use disorders*. In: Walters, ST.; Rotgers, F., editors. *Treating substance abuse: Theory and technique*. 3rd. Guilford; New York: 2012.
- McCrady, BS.; Epstein, EE. *Overcoming alcohol problems: A couples-focused program*. Oxford University Press; New York: 2009.
- McCrady BS, Epstein EE, Cook S, Jensen NK, Hildebrandt T. A randomized trial of individual and couple behavioral alcohol treatment for women. *Journal of Consulting and Clinical Psychology*. 2009; 77:243–256. [PubMed: 19309184]

- McCrady BS, Epstein EE, Hirsch LS. Maintaining change after conjoint behavioral alcohol treatment for men: outcomes at 6 months. *Addiction*. 1999; 94:1381–1396. [PubMed: 10615723]
- McKay JR. Is there a case for extended interventions for alcohol and drug use disorders? *Addiction*. 2005; 100(11):1594–1610. [PubMed: 16277622]
- Moore TM, Seavey A, Ritter K, McNulty JK, Gordon KC, Stuart GL. Ecological momentary assessment of the effects of craving and affect on risk for relapse during substance abuse treatment. *Psychology of Addictive Behaviors*. 2014; 28(2):619–624. [PubMed: 24128286]
- Muthén, B. Latent variable growth modeling with multilevel data. In: Berkane, M., editor. *Latent variable modeling and applications to causality*. Springer; New York: 1997. p. 149–161.
- Muthén, LK.; Muthén, BO. *Mplus: Statistical Analysis with Latent Variables (Version 6.12)* [Software]. 2011. Available at www.statmodel.com
- Nelder JA, Wedderburn RWM. Generalized linear models. *Journal of the Royal Statistical Society. Series A*. 1972; 135(2):370–384.
- O'Brien CP. Anticraving medications for relapse prevention: a possible new class of psychoactive medications. *American Journal of Psychiatry*. 2005; 162(8):1423–1431. [PubMed: 16055763]
- O'Leary, TA.; Monti, PM. Cognitive-behavioral therapy for alcohol addiction. In: Hoffman, SG.; Tompson, MD., editors. *Treating chronic and severe mental disorders*. Guilford; New York: 2002. p. 234–257.
- Papachristou H, Nederkoorn C, Giesen JCAH, Jansen A. Cue reactivity during treatment, and not impulsivity, predicts an initial lapse after treatment in alcohol use disorders. *Addictive Behaviors*. 2014; 39(3):737–739. doi:10.1016/j.addbeh.2013.11.027. [PubMed: 24368002]
- Project MATCH Research Group. Matching alcoholism treatments to client heterogeneity: Project MATCH Posttreatment drinking outcomes. *Journal of Studies on Alcohol*. 1997; 58(1):7–29. [PubMed: 8979210]
- Project MATCH Research Group. Matching alcoholism treatments to client heterogeneity: Project MATCH three-year drinking outcomes. *Alcoholism: Clinical and Experimental Research*. 1998; 22(6):1300–1311. doi:10.1097/00000374-199809000.00016.
- Rosenberg H. Clinical and laboratory assessment of the subjective experience of drug craving. *Clinical Psychology Review*. 2009; 29(6):519–534. [PubMed: 19577831]
- Rotgers, F. Cognitive-behavioral theories of substance abuse. In: Walters, ST.; Rotgers, F., editors. *Treating substance abuse: Theory and technique*. 3rd. Guilford Press; New York, NY: 2012. p. 113–137.
- Schuckit MA, Daepfen JB, Tipp JE, Hesselbrock M, Bucholz KK. The clinical course of alcohol-related problems in alcohol dependent and nonalcohol dependent drinking women and men. *Journal of Studies on Alcohol*. 1998; 59(5):581–590. [PubMed: 9718111]
- Simpson TL, Kivlahan DR, Bush KR, McFall ME. Telephone self-monitoring among alcohol use disorder patients in early recovery: A randomized study of feasibility and measurement reactivity. *Drug and Alcohol Dependence*. 2005; 79(2):241–250. [PubMed: 16002033]
- Snijders, TAB.; Bosker, RJ. *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. 2nd. Sage; London: 2012.
- Stroup WW. Rethinking the analysis of non-normal data in plant and soil science. *Agronomy Journal*. 2014; 106:1–17.
- Subbaraman MS, Lendle S, van der Laan M, Kaskutas LA, Ahern J. Cravings as a mediator and moderator of drinking outcomes in the COMBINE study. *Addiction*. 2013; 108(10):1737–1744. [PubMed: 23668624]
- Walters ST, Vader AM, Harris TR, Jouriles EN. Reactivity to alcohol assessment measures: An experimental test. *Addiction*. 2009; 104(8):1305–1310. [PubMed: 19624323]
- Witkiewitz K. Predictors of heavy drinking during and following treatment. *Psychology of Addictive Behaviors*. 2011; 25:426–438. doi: 10.1037/a0022889. [PubMed: 21480681]
- Witkiewitz K. Temptation to drink as a predictor of drinking outcomes following psychosocial treatment for alcohol dependence. *Alcoholism, Clinical and Experimental Research*. 2012; 37(3): 529–537. doi:10.1111/j.1530-0277.2012.01950.x.
- Witkiewitz K, Marlatt GA. Relapse prevention for alcohol and drug problems: That was Zen, this is Tao. *American Psychologist*. 2004; 59:224–235. [PubMed: 15149263]

Yoon G, Won Kim S, Thuras P, Grant JE. Alcohol craving in outpatients with alcohol dependence: Rate and clinical correlates. *Journal of Studies on Alcohol*. 2006; 67:770–777. [PubMed: 16847547]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Figure 1.

Path diagram for multilevel logistic growth-curve model of daily drinking urges. Paths with identical letters are constrained to equality.

Figure 2.

Model-predicted daily drinking urges based on days since attending treatment, session number, and treatment condition. Lines with black circles represent the model-predicted average probability of daily drinking urges. Plus and minus signs above and below the circles represent the model-predicted probability of daily drinking urges for participants who deviated by plus and minus one standard deviation from average in terms of their between-subject drinking urge intercepts.

Figure 3.

Model-predicted daily alcohol consumption based on days since attending treatment, session number, and treatment condition. Lines with black circles represent the model-predicted average probability of daily alcohol consumption. Plus and minus signs above and below the circles represent the model-predicted probability of daily alcohol consumption for participants who deviated by plus and minus one standard deviation from average in terms of their between-subject alcohol consumption intercepts.

Table 1

Sample Demographics

Variable	Men's (<i>n</i> = 80)		Women's (<i>n</i> = 101)	
	<i>M</i> (<i>SD</i>)	% (<i>n</i>)	<i>M</i> (<i>SD</i>)	% (<i>n</i>)
Age	40.2 (10.8)		45.0 (9.2)	**
Education (years)	13.4 (2.3)		14.6 (2.6)	**
% Caucasian		90.0 (72)		94.1 (95)
% married		78.8 (63)		89.1 (90)
Baseline PDA	40.9 (32.8)		33.5 (28.6)	
Treatment sessions	11.9 (5.1)		13.8 (6.4)	***

Notes. PDA = percent days abstinent, Treatment Sessions indicates the total number of session attended. Significance testing indicates significant differences in variables between groups.

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 2

Predictors of Daily Drinking Urges

	Men's Study				Women's Study			
	Estimate	SE	t	p	Estimate	SE	t	p
Between-Subject Model								
<i>Growth Parameters</i>								
Intercept Mean	0 ^a				0 ^a			
Slope Mean	0.150	0.06	2.55	.01	−0.070	0.39	−1.78	.08
Intercept Variance	6.235	1.58	3.95	< .001	4.603	1.14	4.06	< .001
Slope Variance	0.026	0.02	1.29	.20	0.014	0.01	2.06	.04
<i>Covariance of</i>								
Intercept, Slope	0.093	0.14	0.68	.49	−0.052	0.09	−0.59	.56
<i>Threshold</i>								
Daily Urge	−0.426	0.40	−1.05	.29	−1.198	0.25	−4.89	< .001
Within-Subject Model								
<i>Regressions</i>								
Slope predicted by session no.	−0.015	0.01	−2.14	.03	0.012	0.01	2.42	.02
Intercept predicted by session no.	−0.211	0.05	−3.91	< .001	−0.291	0.02	−12.38	< .001
Daily urges predicted by weekend	0.278	0.12	2.38	.02	0.749	0.13	5.58	< .001
<i>Residual Variances</i>								
Intercept	1.930	0.73	2.65	.01	0.975	0.34	2.84	.01
Slope	0.036	0.03	1.42	.16	0.025	0.02	1.54	.12
<i>Covariance of</i>								
cov(Intercept, Slope)	0.062	0.09	0.73	.47	−0.034	0.06	−0.61	.54

Note. Significant effects are in bold.

Table 3

Predictors of Daily Alcohol Consumption

	Men's Study				Women's Study			
	Estimate	SE	<i>t</i>	<i>p</i>	Estimate	SE	<i>t</i>	<i>p</i>
Between-Subject Model								
<i>Growth Parameters</i>								
Intercept Mean	0 ^a				0 ^a			
Slope Mean	−0.072	0.09	−0.80	.42	0.008	0.06	0.12	.90
Intercept Variance	7.955	2.62	3.03	.002	10.288	3.16	3.26	.001
Slope Variance	0.059	0.05	1.27	.21	0.012	0.01	0.80	.43
<i>Covariance of</i>								
Intercept, Slope	0.494	0.24	2.02	.04	−0.276	0.23	−1.21	.23
<i>Threshold</i>								
Daily drinking	2.882	0.53	5.45	< .001	2.490	0.46	5.42	< .001
Within-Subject Model								
<i>Regressions</i>								
Slope predicted by session no.	−0.008	0.01	−0.84	.40	0.020	0.01	3.37	.001
Intercept predicted by session no.	−0.266	0.08	−3.17	.002	−0.284	0.04	−6.77	< .001
Daily drinking predicted by weekend	0.607	0.16	3.79	< .001	0.972	0.17	5.71	< .001
<i>Residual Variances</i>								
Intercept	2.681	1.09	2.46	.01	1.888	0.62	3.04	.002
Slope	0.014	0.02	0.85	.40	< 0.000	< 0.00	0.13	.89
<i>Covariance of</i>								
cov(Intercept, Slope)	0.158	0.10	1.56	.12	−0.009	0.05	−0.19	.85

Note. Significant effects are in bold.