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Abstract

Gaining a better understanding of the change process holds promise to improve alcohol treatment. Ecological momentary assessment (EMA) coupled with intensive longitudinal data (ILD) approaches have been proposed as promising methods that can advance change process research but have been used infrequently in AUD treatment research. The current study used these approaches to examine the within-person associations of motivation and self-efficacy and drinking among treatment seeking problem drinkers. Participants (N=96) received daily EMA surveys before, during, and after treatment for seven weeks spread over a nine month period. Multi-level modeling was used to test the within-person relationships between the change processes and drinking, controlling for between-person associations and prior drinking. Results indicated that daily fluctuations in motivation and self-efficacy significantly predicted drinking over the next 24 hours; however, several theory-driven hypotheses regarding factors that might moderate that relationship were not supported. Overall, results support the advantages of EMA and ILD as methods that can advance AUD treatment research.

Keywords

drinking; motivation; self-efficacy; ecological momentary assessment; intensive longitudinal data

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Introduction

Several effective treatments exist to treat problem drinkers (Morgenstern, Kuerbis, Chen, et al., 2012; Walitzer & Connors, 1999); however, these treatments are modestly effective. One promising approach to improving the potency of behavioral interventions is to gain a better understanding of the change process. Research on change process in alcohol use disorders (AUD) is often subsumed under the label of Mechanisms of Behavior Change (MOBC) research (Tonigan & Huebner, 2007). While MOBC research has a strong intuitive appeal, it is generally understood that substantial improvement in research methods, including better conceptualization, measurement, and data analytic strategies are required to better understand the change process (Collins, 2006). The broad aim of this study was to use ecological momentary assessment (EMA) and an intensive longitudinal data (ILD) approach, (Bolger & Laurenceau, 2013; Walls & Schafer, 2006) to probe the intraindividual relationships between motivation and self-efficacy to reduce drinking and drinking outcomes among treatment seeking problem drinkers.

Advantages of EMA in Examining Change Processes in AUD Treatment

EMA involves repeated sampling of individuals' behaviors and experiences in real-time, in the individuals' natural environment. EMA has significant advantages in probing change processes relative to global self-report and fixed-time assessment measures, especially when combined with ILD approaches (Bolger & Laurenceau, 2013). Studies comparing EMA with standard global self-report have found that daily EMA provides a more accurate representation of drinking relative the retrospective recall derived from the timeline follow-back interview (TLFB; Kranzler, Abu-Hasaballah, Tennen, Feinn, & Young, 2004). In addition, EMA has substantial advantages relative to standard methods in efforts to examine time-varying cognitive and motivational processes that may mediate or moderate AUD treatments (Morgenstern, Kuerbis, & Muench, 2014). EMA measures of process variables have been shown to be more accurate than retrospective recall of the same constructs (Shiffman, 2009).

Moreover, EMA methods coupled with ILD enable the exploration of within-person association between change processes and outcome; whereas in more standard methods, between-person associations are often used to infer within-person relationships (Molenaar, 2004). For example, studies have generally found a robust and significant relationship between drinking motives and alcohol consumption (L. Cooper, Kuntsche, Levitt, Barber, & Wolf, in press; M. L. Cooper, Russell, Skinner, & Windle, 1992; Crutzen, Kuntsche, & SchellemanOffermans, 2013). Recent studies have examined this relationship using EMA and ILD strategies that enable exploration of the within-person relationship between drinking motives and alcohol consumption (Piasecki et al., 2014; Todd et al., 2005). Results from these studies found a much weaker and more complicated relationship among dispositional motives, negative mood, and drinking. Overall, these findings, as well as others, illustrate the advantages of EMA and ILD approaches when examining the hypothesized relationship among change processes, interventions, and drinking outcomes in AUD treatment (Morgenstern et al., 2014; Shiffman, 2009).

Motivation and Self-Efficacy to Reduce Drinking

Motivation to change and self-efficacy are thought to be important mediators of AUD treatment and have been explored extensively in abstinence-oriented treatments (Longabaugh, Magill, Morgenstern, & Huebner, 2013). Motivation to reduce drinking is a multifaceted construct and has been defined and operationalized in several ways, including via global selfreport measures of readiness to change (DiClemente, Schlundt, & Gemmell, 2004) as well as via the coding of within-session client speech to assess desire, reason, need, intention, and commitment to change (Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003). Self-efficacy refers to one's belief in the ability or confidence to change (Bandura, 1982). In the AUD treatment literature, self-efficacy is generally measured via global self-report measures that assess a participant's confidence to achieve a treatment-related drinking goal (abstinence or moderation) across a number of context specific drinking situations (Annis & Graham, 1988). Self-efficacy measures such as the Situational Confidence Questionnaire have shown strong psychometric properties including predictive validity. By contrast, the predictive validity of measures of motivation to reduce drinking have yielded mixed support (Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003; Magill et al., 2014).

In a prior study, we developed and administered daily EMA measures of motivation and self-efficacy to reduce heavy drinking among individuals seeking brief moderation goal treatment and then compared these measures to global self-report measures of similar constructs (Kuerbis, Armeli, Muench, & Morgenstern, 2013). Results supported study hypotheses that EMA measures would prove superior to global self-report measures of similar cognitive processes. Notably, daily EMA measures administered in the week prior to treatment were significant predictors of drinking outcomes, whereas the self-report measures were not; however, because the goal of that study was to compare EMA and global self-report measures, only between, but not within-person, associations with drinking were tested. Specifically, daily EMA measures for the week prior to treatment were aggregated into a single score for each participant and then regressed onto end treatment aggregate measures of drinking drawn from the TLFB.

The Current Study

The goal of the current study was to strengthen causal inferences about the association between motivation and self-efficacy to reduce drinking and drinking outcomes among problem drinkers in moderation goal treatment. Specifically, we examined whether daily fluctuations in motivation and self-efficacy would significantly predict next day's drinking, even after controlling for between-person or average effects of these variables on drinking. In addition, the temporal ordering of the independent (process) and dependent (outcome) measures were clearly demarcated, such that timeframes for each construct did not overlap. Finally, as an additional stringent test, we controlled for prior drinking in the analyses to determine whether the process variables contained significant information about next day's drinking over and above prior drinking behavior. The primary study hypothesis was that motivation and self-efficacy would be significantly and positively associated with reduced drinking at a within-person level.

The study also tested several secondary hypotheses regarding factors that might moderate the relationship between the change processes and drinking. Motivation and self-efficacy are components of higher-order cognitive processes associated with selection and implementation of goal-directed behaviors (Naqvi & Morgenstern, 2015). Dual process theories postulate that a number of factors can disrupt goal-directed cognitive control processes. Alcohol dependence is a consistent predictor of poor treatment outcome and is thought to operate by directly impairing cognitive control processes, as well as strengthening cue conditioned urges to drink (Morgenstern, Naqvi, DeBellis, & Breiter, 2013). Negative affect and fatigue are also thought to weaken top-down control of behavior by reducing the energy available to implement goaldirected behavior. This process has been labeled “ego depletion” (Baumeister, 2003). While alcohol dependence is a stable disease entity and has a persistent influence on drinking, the intensity of negative affect and fatigue vary considerably, even over short periods of time.

Accordingly, we hypothesized that greater baseline alcohol dependence would significantly weaken the association of daily motivation and self-efficacy with next day’s drinking (drinking in the next 24 hours); whereas daily measures of negative affect and fatigue would have a similar moderating effect.

Method

This study used EMA data from the first 96 men and women enrolled in a randomized controlled trial of Motivational Interviewing (MI) for problem drinkers. There were three treatment conditions to which participants could be assigned: MI, Spirit Only MI (SOMI), and Self Change (SC).

Participants

Participants seeking treatment to reduce but not stop drinking were recruited using general advertising online and in local media. Advertisements emphasized participant choice and a moderation approach. Prospective participants were screened on the phone and, if eligible, were scheduled for an in-person screening assessment. Participants were considered eligible if they were: (1) between the ages of 18 and 65; (2) consumed an estimated weekly average of greater than 15 or 24 standard drinks per week for women and men, respectively, during the prior eight weeks, and (3) had a current AUD. Participants were excluded if they had: (1) a substance use disorder (for any substance other than alcohol, marijuana, or nicotine) or were regular (greater than weekly) drug users; (2) a serious psychiatric disorder or suicide or violence risk; (3) physical withdrawal symptoms or a history of serious withdrawal symptoms; (4) a legal mandate to substance abuse treatment; (5) social instability (e.g., homeless); (6) a desire to achieve abstinence at baseline; or (7) a desire or intent to pursue additional substance abuse treatment during the eight-week treatment period. Demographics and baseline sample characteristics are presented in Table 1.

Procedures

One week after an in-person screening assessment, eligible participants completed an in person baseline assessment and were randomized to one of the three treatment conditions.

All participants were provided with normative feedback about their drinking from study staff prior to randomization. Feedback included an estimated average weekly consumption of alcohol based on screening reports and their score from the Alcohol Use Disorder Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) with a description of AUDIT risk categories. Participants assigned to either MI or SOMI received four sessions of psychotherapy over the next seven weeks (at weeks 1, 2, 5, and 8). Those randomized to the SC condition were encouraged to change on their own, and, if still drinking at problematic levels at the end of the seven-week period, were offered four sessions of MI. Participants in all conditions completed 3-, 6-, and 9-month post-baseline, follow-up assessments.

In addition to standard assessments, participants were prompted via text message two times daily to complete a morning and evening survey for a total of seven weeks across the treatment and post-treatment period as described below.

Study Interventions

The MI protocol was adapted from the motivational enhancement therapy used in Project MATCH (Miller, Zweben, DiClemente, & Rychtarik, 1992; Project MATCH Research Group, 1993) and included structured personalized feedback. The SOMI protocol consisted of the relational elements of MI, specifically including therapist stance (warmth, genuineness), extensive use of reflective listening skills, and avoidance of MI-inconsistent behaviors (advise, confront). Technical or directive elements (e.g., amplified or double-sided reflections, decisional balance, etc.) were proscribed to avoid the selective reinforcement of change talk. The SC protocol emphasized personal responsibility for change by asking participants to change on their own. Participants were also told that research demonstrated that some individuals could reduce their drinking without professional help (cf., Morgenstern, Kuerbis, Amrhein, et al., 2012) for a detailed description of the interventions).

Measures

Daily assessments.—Focal predictors and drinking outcomes were assessed at the daily level. Starting the morning after the in-person screening assessment, eligible participants received two prompts via text message per day, one in the morning and one in the evening, asking that they complete an online survey using the web browser on their mobile phone. Participants received these prompts twice per day for the first two weeks of the study (i.e. one week prior to and one week following baseline assessment/randomization). In addition, participants received daily morning and evening surveys in the week prior to each subsequent assessment (e.g. week 4, week 7, week 11, week 23, week 35) for a total of 49 days of morning and evening surveys throughout the study period. At the screening appointment, participants watched two training videos on the EMA surveys, and research assistants provided ongoing support and clarification of any questions that participants had about the surveys or the process. Participants were given a choice regarding the timing of the morning and evening prompts in order to align with their schedules. Morning prompts could be sent between 6 a.m. and 12 p.m. and evening prompts could be sent between 4 p.m. and 9 p.m. Efforts were made to ensure that evening prompts were sent more than 9 hours after morning prompts (i.e., if a participant chose 12 p.m. for the morning prompt, the first

available option for the evening prompt was 9 p.m.). Each daily survey took about 2 to 6 minutes to complete.

Compliance with the survey at the 3-month follow-up was 77% for the morning survey and 62% for the evening survey. At the 9-month follow-up, compliance rates were 71% for the morning survey and 56% for the evening survey. Since the present study assessed EMA reports from all 49 days of surveys over the 9-month study, data from the morning survey was used due to better response rates relative to the evening survey. Although participants were assessed for 49 days, due to the alternating nature of the assessment weeks and lagged nature of the computation of drinks to align with motivation and self-efficacy ratings, only 4,128 observations were expected (96 participants x 43 days of available data). Of the expected observations, 1,685 observations were not included in the analyses for motivation to change and 1,684 observations were not included in the analyses for self-efficacy due to missing data. Missing drinking outcomes accounted for 1,282 of the missing observations. These observations were missing due to survey noncompliance (i.e. question skipped or survey not responded to). The additional 403 observations missing for motivation and 402 observations missing for self-efficacy were due to noncompliance with those particular questions, respectively (i.e. question skipped).

Drinking outcomes.—Drinking was assessed in the daily morning survey by asking, “Did you drink yesterday since your morning survey?” When participants responded “yes” to this question, they were asked to report the number of standard drinks of beer, wine, and liquor respectively that they had consumed in the last 24 hours. Participants were reminded in the survey question about standard drink sizes for each category. Participants who responded “no” to the question of whether they drank yesterday were coded as drinking 0 drinks in the prior day. Totals were then lagged to align morning report of commitment and self-efficacy with drinking that occurred in the following 24 hours (next day’s drinking).

Motivation to change and self-efficacy to resist heavy drinking.—We selected items from our prior validated EMA measure to assess motivation and self-efficacy to reduce heavy drinking (Kuerbis et al., 2013). In his study on client’s natural language around motivation to reduce drinking, Amrhein identified five types of language: desire, ability, reasons, need, and commitment. Strength of commitment was a significant predictor of drinking outcome (Amrhein et al., 2003). Following Amrhein, we operationalized motivation to reduce drinking by assessing the strength of commitment not to drink heavily using a single item. The item asked, “How committed are you to not drink heavily (that is, drink 4 or more drinks for women, 5 or more drinks for men) in the next 24 hours?” This question was followed by one item assessing selfefficacy that asked, “How confident are you that you can resist the temptation to drink heavily over the next 24 hours?” The response set for these items ranged from 0 “not at all” to 8 “extremely.”

Mood, negative affect, and sleep quality.—Eight items in the morning survey measured mood, negative affect, and sleep quality. Three bimodal items assessed mood over the last hour using a response set anchored on extremes. For instance, participants were asked “Please click on the item below which comes closest to your mood over the last hour” and presented with responses ranging from, for instance, 1 “extremely sad” to 8 “extremely

happy." In these response sets, 4 represented "slightly sad" and 5 represented "slightly happy." Participants were asked to rate their mood in the last hour in the way for sad to happy (sad-happy), anxious to calm (anxious-calm), and tired to energetic (tired-energetic). Four items on the questionnaire measured negative affect including anger/frustration, boredom, loneliness, and stress by asking, for example, "How angry/frustrated do you feel?" The response set on these items ranged from 0 "not at all" to 8 "extremely." Finally, one item asked participants to "rate your sleep quality last night overall." The response set for this item ranged from 1 "very good" to 4 "very bad."

Person-level assessments.—Sociodemographic and drinking covariates were assessed at baseline. In addition, person-averages of focal predictors were created to partition variance related to daily fluctuations in focal predictors and overall levels of these variables.

Sociodemographics.—A self-report, demographic questionnaire collected data on age, gender, educational and occupational information, race and ethnicity, medical history, family psychiatric and substance abuse history, and the participant's substance abuse treatment history.

Screening and substance use diagnosis.—The Alcohol Use Disorders Identification TestC (AUDIT-C,Bush, Kivlahan, & McDonell, 1998) was used to determine preliminary eligibility for the study in regards to quantity and frequency of drinking, and it has demonstrated adequate psychometric properties. The Composite International Diagnostic Instrument, Substance Abuse Module (Cottler, Robins, & Helzer, 1989) was used to evaluate substance dependence exclusion criteria and the number of AUD criteria a participant satisfied. It is a well-established diagnostic interview with excellent reliability and validity (Wittchen et al., 1991).

Alcohol use.—To derive a measure of baseline drinking, alcohol use patterns were measured using the Timeline Followback interview (TLFB; Sobell et al., 1980). It assessed frequency and quantity of alcohol use during the eight weeks prior to baseline/randomization. The TLFB has demonstrated good test-retest reliability (Carey, Carey, Maisto, & Henson, 2004), agreement with collateral reports of alcohol (Dillon, Turner, Robbins, & Szapocznik, 2005), convergent validity, and reliability across mode of administration (i.e., in person or over the phone) (Vinson, Reidinger, & Wilcosky, 2003). Baseline TLFB data was aggregated into a summary variable for the entire pre-baseline period that was then divided by the number of days assessed. Thus, the control variable for baseline drinking used in this analysis represented average drinks per day in the eight weeks prior to randomization.

In addition, an aggregate of the sum of standard drinks (SSD) per week was calculated for the eight weeks prior to baseline, the four weeks following end of treatment (i.e. 3-months post-baseline), and the twelve weeks prior to the 9-month follow-up assessment. These data were not used in the analyses, but are presented in Table 1 in order to characterize drinking patterns of the sample during and after treatment.

Severity of alcohol problems.—The Alcohol Dependence Scale (ADS, Skinner & Allen, 1982) is a 25-item self-report measure used to assess severity of alcohol dependence. Items are summed, providing a raw score for interpretation. The ADS has demonstrated high reliability and validity across substance using populations (Kahler, Strong, Hayaki, Ramsey, & Brown, 2003).

Average motivation to change and average self-efficacy to resist heavy drinking.—Daily commitment and confidence ratings were averaged to create estimates of person-average motivation to change and person-average self-efficacy to resist heavy drinking, respectively.

Analytic Plan for Modeling Within-person Change Processes

Although EMA/ILD studies can provide a more fine-grained perspective on with in person change processes, commonly-used modeling techniques do not capitalize on the full potential of these methods. For example, EMA measures are often aggregated into a single score for each participant, as we have done in our prior daily EMA study with composite scores of motivation and self-efficacy. This approach provides a better point estimate for labile, statedependent processes, but the full advantages of the ILD are not fully realized. Putative processes of change can be expected to vary within each person over time (within-persons), but also on average from person to person (between-persons). These sources of variation can have dissimilar influences on the outcome of interest, and conflating the two can confound interpretation. Through creating separate within- and between- versions of our focal variables, we are able to isolate the within-person processes underlying changes in alcohol consumption (Bolger & Laurenceau, 2013).

Data were analyzed with multilevel models (MLMs) specifying within-person processes of variability in daily commitment and confidence that were hypothesized to be related to drinking the next day. MLMs account for the non-independence of observations due to nesting of daily ratings (level 1) within persons (level 2), are robust to missing data, and can include random terms to model individual variability (Gibbons, Hedeker, & DuToit, 2010; Raudenbush & Bryk, 2002; Singer & Willett, 2003). Analyses were implemented with SAS 9.3 software (SAS Institute Inc. 2012), using the GLIMMIX procedure. Preliminary descriptive analyses explored the distribution of daily reports of the number of drinks consumed, which showed significant right skew. Thus, drinks were modeled within a generalized MLM framework with a negative binomial distribution and log link function. Degrees of freedom were calculated using the between-within method, an unstructured variance-covariance matrix was specified, and all analyses utilized maximum likelihood (ML) estimation with Laplace approximation. All models included random intercept terms to allow for individual variability in drinking levels. Daily predictors were centered at the person mean, and average predictors were centered at the grand mean, thus allowing the intercept (i.e., when all other terms in the model are equal to zero) to be interpreted as the level of the outcome at the mean of these predictors.

The approach to testing the influences of daily fluctuations in commitment and confidence were identical. For simplicity, we describe our analytic plan for commitment here. To isolate

the within-person process of today's commitment predicting next day's drinking from the overall relation of commitment to drinking, we created separate within- and between-person versions of the commitment predictor. Specifically, we included a daily measure of commitment that was centered at each person's mean (the within-person part) and a person-average measure of commitment that was centered at the grand mean (the between-person part). Including both of these terms in the MLM decoupled the within-person process of change from between-person, individual differences in commitment. Treatment condition was initially controlled for in all MLMs but was found to have no significant effects. Because the study aims did not include a test of treatment condition's impact on motivation nor self-efficacy, treatment condition was not included in further analyses. Finally, time was excluded to avoid focusing on any one particular segment of the treatment study.

Preliminary, descriptive analyses included exploration of within-person daily fluctuations in drinks consumed through visual inspection of panel plots for each participant and average trends. In addition, bivariate correlations explored the relations of daily fluctuations in drinking to motivation and affect variables. Finally, intraclass correlation coefficients (ICCs) were calculated from unconditional means models to quantify the relative variability in drinks consumed and focal process variables accounted for at the daily (level 1) and person levels (level 2).

Primary analyses included between- and within- versions of morning ratings of commitment and confidence in separate models predicting next day's drinking. Potential moderators of significant relationships were explored, including alcohol dependence severity, affective influences, and poor sleep quality. As a final step, baseline and person-average drinking variables were included as covariates to test whether significant main and/or interactive effects remained influential over and above what could be explained by typical drinking patterns.

Results

Sample Description

On average, participants were middle-aged, well-educated (69% college graduates), employed (82%), Caucasian (59%) women (57%) (See Table 1). Participants drank heavily at baseline, consuming on average about 31 standard drinks per week. Almost all participants (92%) met criteria for current DSM-IV alcohol dependence. Table 2 presents the means, standard deviations and intercorrelations among the drinking outcome variable (next day's drinks), focal daily process variables, between-person averages of process variables, and putative moderators. Next day's drinking was significantly and moderately correlated with the commitment and confidence measures. Within- (daily) and between-person variables for commitment and confidence were both significantly associated with decreased drinking, but the degree of association was stronger at the daily process level. Dependence severity was significantly associated with commitment and confidence as well as several other putative moderators. Specifically, participants with more severe dependence reported more overall commitment and confidence to reduce drinking and also greater daily levels of these change variables. Dependence was also related to reduced feelings of calmness and energy, but greater negative affect, and poor sleep quality. Interclass correlation coefficients

(ICC) indicated that 81.6% of the variance in next day's drinking was accounted for by within-person effects; whereas 18.4% of the variance was accounted for by between-person effects. For commitment, 54.8% of the variance was accounted for by within-person effects, and for confidence, 58.6% of the variance was accounted for by within-person effects.

Relationship of Commitment and Confidence to Next Day's Drinking

Table 3 presents separate models examining the relationship between daily fluctuations in commitment and confidence to next day's drinking, controlling for average effects of each predictor variable and treatment condition. The intercept rate ratios (RR) for commitment and confidence models provide the estimated count of next day drinks at average daily- and personlevels of these predictor variables. Thus, intercept RRs estimate that participants are consuming approximately 2.8 drinks each day, on average. Both daily predictors were significant. For confidence, the effects on drinking appeared to be shared about equally across average and daily variability, with the number of drinks consumed decreasing by 13% for every 1-unit increase in overall confidence, $RR = .87$, $p < .0001$, and by 22% for every 1-unit increase in daily confidence, $RR = .78$, $p < .0001$. By contrast, average commitment was not a significant predictor, suggesting that only daily or within-person fluctuation in commitment accounts for the significant association with drinking. The predicted number of drinks decreased by 19% for every 1-unit increase in daily commitment, $RR = .81$, $p < .001$, but did not change based on overall (person-average) commitment, $p = .053$.

Put differently the results for daily commitment and confidence suggest that for every one-unit increase in daily levels of these process variables, the number of drinks consumed the next day decreases by a factor of .78 to .81, so approximately .80. Thus, if the average number of daily drinks is estimated around 2.8 drinks, a person whose commitment/confidence this morning is increased by one unit from their typical level can be expected to drink a little over half a drink less the next day ($0.80 \times 2.8 = 2.24$ drinks). As an additional stringent test, we explored the influence of commitment and confidence on drinking over and above typical drinking levels. Specifically, baseline drinking (i.e., drinks per drinking day from TLFB at baseline, centered at the grand mean) and overall drinking level throughout the study (i.e., drinks per drinking day averaged across the study period, centered at the grand mean) were included as covariates.

Results remained consistent and significant when controlling for baseline typical drinking. Controlling for typical drinking patterns did not change the significance levels nor substantively reduce the size of the parameter estimates for the focal commitment or confidence predictors (Daily Confidence: $RR = 0.78$, 95% CI [0.76, 0.80], $p < .001$; Daily Commitment: $RR = 0.81$, 95% CI [0.79, 0.83], $p < .001$).

Moderation Hypotheses

Next we examined whether alcohol dependence severity, daily affective states, or daily sleep quality would significantly moderate the relationship between daily commitment and confidence and next day's drinking. Applying a correction for multiple tests yielded a significance criterion of $p < .008$ (i.e., $.05 \div 6$ putative moderators = .0083). No moderators were significant at this level.

Discussion

Findings support the main hypothesis that motivation and self-efficacy to reduce heavy drinking are significant within-person predictors of next day's drinking, even after controlling for other confounding variables. By contrast, secondary hypotheses about moderators of the link between motivation and self-efficacy and drinking received no support. Neither alcohol dependence nor any of the mood, negative affect, or sleep quality variables were significant moderators of the link between self-efficacy and drinking. The role mood plays in facilitating heavy drinking is complicated (Mohr, Arpin, & McCabe, 2015), and few studies have probed this particular hypothesis. One possibility is that our design was insufficient to capture within day fluctuation of affect, as we tested only morning reports. It may be that affective states more proximal to the initiation of heavy drinking do weaken the effects of motivation and self-efficacy on drinking. It is more surprising that alcohol dependence severity did not moderate motivation and self-efficacy, as drinking severity is a consistent predictor of poor treatment outcome. Future research is needed to explore other plausible pathways.

Findings in Context

Only two prior studies have examined the momentary influence of self-efficacy on AUD treatment outcome (Cooney et al., 2007; Holt, Litt, & Cooney, 2011). Both studies were conducted in the context of abstinence-oriented treatment in combination with smoking cessation. Findings in those studies were mixed. One study (Cooney et al., 2007) found that momentary self-efficacy predicted first drink in a small sample (n=13) of individuals who lapsed, but the Holt et al. (2011) study failed to replicate those findings. To the best of our knowledge, no study has examined the momentary influence of motivation in AUD treatment. Study findings that self-efficacy predicted next day's drinking at both the between and within-person levels are consistent with similar findings in the smoking literature (Shiffman, 2014). It seems likely that feelings of competence to succeed in changing behavior may have stable as well as momentary features, perhaps similar to self-esteem. This explanation would be consistent with findings that global self-report measures of self-efficacy are typically good predictors of AUD outcome.

Implications and Future Research

Study findings provide strong support for the use of EMA and ILD strategies as methods that can strengthen MOBC research in AUD treatment (Shiffman, 2005, 2009). Specifically, study findings regarding motivation illustrate that point. While it may seem self-evident that motivation is a critical factor in efforts to reduce drinking, prior research attempting to demonstrate that relationship has met with limited success (Magill et al., 2014). Motivation to reduce drinking is likely a multi-faceted construct. If replicated, the finding that daily higher motivation predicts reduced drinking provides an important anchor point for further empirical research on motivation. For example, it would be interesting to examine the relationship of daily commitment measured by EMA and other measures of AUD treatment motivation such as within-session client change talk.

While study findings strengthen causal inference, experimental tests are required to fully establish motivation and self-efficacy as mechanisms of change and not simply correlated factors in the change process. Pursuing this issue is not solely of academic interest. In a review of selfefficacy and AUD treatment, Cooney et al. (2007) noted that while research often examines selfefficacy as a mediator of existing AUD treatments, few studies have attempted to directly strengthen self-efficacy as a strategy to improve treatment outcomes. We agree that efforts to directly target important change processes using experimental designs offers a promising alternative approach to MOBC research that examines change process in the context of existing treatments. Study findings demonstrate that it is feasible to collect EMA data on problem drinkers and suggest relatively simple EMA measures are reliable and sensitive measures intraindividual changes in motivation and self-efficacy (Kadden & Litt, 2011).

Study Limitations

Study findings are limited by missing data due to survey non-compliance. While the EMA completion rate of 77% is similar to that of other daily studies (Schuz, Walters, Frandsen, Bower, & Ferguson, 2014; Wray, Merrill, & Monti, 2014), higher compliance rates might have influenced results. Drinking outcomes are based on self-report of EMA data. While self-report of drinking outcomes is reliable (Babor, Steinberg, Anton, & Del Boca, 2000), biological verification of self-report, when feasible, adds an additional level of confidence to study findings. Study findings may not generalize to individuals in abstinence-oriented treatment or those with more severe AUD. The study examined one aspect of motivation to change, the level of commitment to a drinking goal. Motivation is likely a multifaceted constructs and findings may not generalize to other aspects of motivation. In addition, the study examined one time-lagged association between confidence, self-efficacy and drinking: whether morning report predicts drinking in the next 24 hours. Assessment of constructs in closer temporal proximity to the drinking might yield different findings. Finally, this study did not examine a full treatment mediation model. Rather, we examined one pathway: the association between the mediator and the outcome (Longabaugh et al., 2013). Future studies are needed to test whether MI or other effective AUD treatment outcomes are mediated by EMA measures of motivation or self-efficacy.

Conclusions

This study examined the within-person relationships of daily ratings of motivation and self-efficacy and next day’s drinking in a sample of problem drinkers seeking moderation goal treatment. Among the study strengths were a relatively representative sample of problem drinkers (Moss, Chen, & Yi, 2007), an EMA assessment period that sampled across 36 weeks, and a set of methods designed to strengthen causal inference. Daily fluctuations in motivation and self-efficacy significantly predicted next day’s drinking, as hypothesized; however, moderation hypotheses were not supported. Overall, the study provides support for the use EMA and ILD as methods to improve our understanding of MOBC in AUD treatment.

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References

Amrhein PC, Miller WR, Yahne CE, Palmer M, & Fulcher L (2003). Client commitment language during motivational interviewing predicts drug use outcomes. Journal of Consulting and Clinical Psychology, 71(5), 862–878. [PubMed: 14516235]

Annis HM, & Graham JM (1988). A Situational Confidence Questionnaire (SCQ 39) users guide. Toronto: Addiction Research Foundation.

Babor T, Higgins-Biddle JC, Saunders JB, & Monteiro MG (2001). The Alcohol Use Disorders Identification Test (AUDIT): Guidelines for use in primary care (2nd ed.). Geneva, Switzerland: Department of Mental Health and Substance Dependence, World Health Organization.

Babor T, Steinberg K, Anton R, & Del Boca FK (2000). Talk is cheap: Measuring drinking outcomes in clinical trials. Journal of Studies on Alcohol, 61, 55–63. [PubMed: 10627097]

Bandura A (1982). Self-efficacy mechanism in human agency. American Psychologist, 37(2), 122–147.

Baumeister RF (2003). Ego depletion and self-regulation failure: A resource model of self control. Alcoholism: Clinical and Experimental Research, 27(2), 281–284.

Blanchard KA, Morgenstern J, Morgan TJ, Labouvie E, & Bux DA (2003). Motivational subtypes and continuous measures of readiness for change: Concurrent and predictive validity. Psychology of Addictive Behaviors, 17(1), 56–65. doi:10.1037/0893-164X.17.1.56 [PubMed: 12665082]

Bolger N, & Laurenceau JP (2013). Intensive longitudinal methods: An introduction to diary and experience sampling research. New York: The Guilford Press.

Bush K, Kivlahan DR, & McDonell MB (1998). The AUDIT Alcohol Consumption Questions (AUDIT-C): An effective brief screening test for problem drinking. Archives of Internal Medicine, 3, 1789–1795.

Carey KB, Carey MP, Maisto SA, & Henson JM (2004). Temporal stability of the Timeline Followback Interview for alcohol and drug use with psychiatric outpatients. Journal of Studies on Alcohol, 65, 774–781. [PubMed: 15700516]

Collins LM (2006). Analysis of longitudinal data: The integration of theoretical model, temporal design, and statistical model. Annual Review of Psychology, 57, 505–528.

Cooney NL, Litt MD, Cooney JL, Pilkey DL, Steinberg HR, & Oncken C (2007). Alcohol and tobacco cessation in alcohol-dependent smokers: Analysis of real-time reports. Psychology of Addictive Behaviors, 21(3), 277–286. [PubMed: 17874878]

Cooper L, Kuntsche E, Levitt A, Barber LL, & Wolf S (in press). Motivational models of substance abuse: A review of theory and research on motives for alcohol, marijuana, and tobacco In Sher KJ (Ed.), The Oxford handbook of substance use disorders (Vol. 1). New York: Oxford University Press.

Cooper ML, Russell M, Skinner JB, & Windle M (1992). Development and validation of a three-dimensional measure of drinking motives. Psychological Assessment, 4, 123–132.

Cottler LB, Robins LN, & Helzer JE (1989). The reliability of the Composite International Diagnostic Interview Substance Abuse Module-(CIDI-SAM): A comprehensive substance abuse interview. British Journal of Addiction, 84, 801–814. [PubMed: 2758153]

Crutzen R, Kuntsche E, & Schelleman-Offermans K (2013). Drinking motives and drinking behavior over time: A full cross-lagged panel study among adults. Psychology of Addictive Behaviors, 27(1), 197–201. doi:10.1037/a0029824 [PubMed: 22925011]

DiClemente CC, Schlundt D, & Gemmell L (2004). Readiness and stages of change in addiction treatment. American Journal on Addictions, 13(2), 103–119. [PubMed: 15204662]

Dillon FR, Turner CW, Robbins MS, & Szapocznik J (2005). Concordance among biological, interview, and self-report measures of drug use among African American and Hispanic adolescents

referred for drug abuse treatment. Psychology of Addictive Behaviors, 19(4), 404–413. [PubMed: 16366812]

Gibbons RD, Hedeker D, & DuToit S (2010). Advances in analysis of longitudinal data. Annu Rev Clin Psychol, 6, 79–107. doi:10.1146/annurev.clinpsy.032408.153550 [PubMed: 20192796]

Holt LJ, Litt MD, & Cooney NL (2011). Prospective analysis of early lapse to drinking and smoking among individuals in concurrent alcohol and tobacco treatment. Psychology of Addictive Behaviors, Advance online publication. doi:10.1037/a0026039

Kadden R, & Litt MD (2011). The role of self-efficacy in the treatment of substance use disorders. Addictive Behaviors, 36(12), 1120–1126. [PubMed: 21849232]

Kahler CW, Strong DR, Hayaki J, Ramsey SE, & Brown RA (2003). An item response analysis of the Alcohol Dependence Scale in treatment-seeking alcoholics. Journal of Studies on Alcohol, 64, 127–136. [PubMed: 12608493]

Kranzler HR, Abu-Hasaballah K, Tennen H, Feinn R, & Young K (2004). Using daily interactive voice response technology to measure drinking and related behaviors in a pharmacotherapy study. Alcoholism: Clinical & Experimental Research, 28(7), 10601064.

Kuerbis A, Armeli S, Muench F, & Morgenstern J (2013). Motivation and self-efficacy in the context of moderated drinking: Global self-report and ecological momentary assessment. Psychology of Addictive Behaviors, 27(4), 934–943. [PubMed: 23276318]

Longabaugh R, Magill M, Morgenstern J, & Huebner R (2013). Mechanisms of behavior change in treatment for alcohol and other drug use disorders In McCrady BS & Epstein EE (Eds.), Addictions: A Comprehensive Guidebook (2nd ed.). USA: Oxford University Press.

Magill M, Gaume J, Apodaca TR, Walthers J, Mastroleo NR, Borsari B, & Longabaugh R (2014). The technical hypothesis of motivational interviewing: A metaanalysis of MI's key causal model. Journal of Consulting and Clinical Psychology, 82(6), 973–983. doi:10.1037/a0036833 [PubMed: 24841862]

Mohr CD, Arpin S, & McCabe CT (2015). Daily affect variability and context-specific alcohol consumption. Drug Alcohol Rev, 34(6), 581–587. doi:10.1111/dar.12253 [PubMed: 25735819]

Molenaar PCM (2004). A manifesto on psychology as idiographic science: Bringing the person back into scientific psychology, this time forever. Measurement, 2(4), 201–218.

Morgenstern J, Kuerbis A, Amrhein PC, Hail LA, Lynch KG, & McKay JR (2012). Motivational interviewing: A pilot test of active ingredients and mechanisms of change. Psychology of Addictive Behaviors, 26(4), 859–869. doi:10.1037/a0029674 [PubMed: 22905896]

Morgenstern J, Kuerbis A, Chen A, Kahler CW, Bux DA, & Kranzler H (2012). A randomized clinical trial of naltrexone and behavioral therapy for problem drinking menwho-have-sex-with-men. Journal of Consulting and Clinical Psychology, 80(5), 863–875. [PubMed: 22612306]

Morgenstern J, Kuerbis A, & Muench F (2014). Ecological momentary assessment and alcohol use disorder treatment. Alcohol Research: Current Reviews, 36(1), 101–109. [PubMed: 26259004]

Morgenstern J, Naqvi N, DeBellis R, & Breiter H (2013). The contributions of cognitive neuroscience and neuroimaging to understanding mechanisms of behavior change in addiction. Psychology of Addictive Behaviors, 27(2), 336–350. [PubMed: 23586452]

Moss HB, Chen CM, & Yi HY (2007). Subtypes of alcohol dependence in a nationally representative sample. Drug and Alcohol Dependence, 91(2–3), 149–158. [PubMed: 17597309]

Naqvi NH, & Morgenstern J (2015). Cognitive neuroscience approaches to understanding behavior change in alcohol use disorder treatments. Alcohol Research: Current Reviews, 37(1), 29–38. [PubMed: 26259087]

Piasecki TM, Cooper ML, Wood PK, Sher KJ, Shiffman S, & Heath AC (2014). Dispositional drinking motives: Associations with appraised alcohol effects and alcohol consumption in an ecological momentary assessment investigation. Psychological Assessment, 26(2), 363–369. doi:10.1037/a0035153 [PubMed: 24274049]

Raudenbush SW, & Bryk AS (2002). Hierarchical linear models: Applications and data analysis methods. Thousand Oaks, CA: Sage Publications.

Schuz N, Walters JA, Frandsen M, Bower J, & Ferguson SG (2014). Compliance with an EMA monitoring protocol and its relationship with participant and smoking characteristics. Nicotine Tob Res, 16 Suppl 2, S88–92. doi:10.1093/ntr/ntt142 [PubMed: 24052500]

Shiffman S (2005). Dynamic influences on smoking relapse process. Journal of Personality, 73(6), 1715–1748. doi:10.1111/j.0022-3506.2005.00364.x [PubMed: 16274451]

Shiffman S (2009). Ecological momentary assessment (EMA) in studies of substance use. Psychological Assessment, 21(4), 486–497. [PubMed: 19947783]

Shiffman S (2014). Conceptualizing analyses of ecological momentary assessment data. Nicotine & Tobacco Research, 16(Suppl 2), S76–S87. [PubMed: 24323571]

Singer JD, & Willett JB (2003). Applied longitudinal data analysis: Modeling change and event occurrence. New York: Oxford University Press.

Sobell MB, Maisto SA, Sobell LC, Cooper AM, Cooper T, & Saunders B (1980). Developing a prototype for evaluating alcohol treatment effectiveness In Sobell LC & Ward E (Eds.), Evaluating alcohol and drug abuse treatment effectiveness: Recent advances (pp. 129–150). New York: Pergamon.

Todd M, Armeli S, Tennen H, Carney MA, Ball SA, Kranzler H, & Affleck G (2005). Drinking to cope: A comparison of questionnaire and electronic dairy reports. Journal of Studies on Alcohol, 66, 121–129. [PubMed: 15830912]

Tonigan JS, & Huebner R (2007). The search for mechanisms of behavior change in evidence-based behavioral treatments for alcohol use disorders: Overview. Alcoholism: Clinical & Experimental Research, 31(S3), 1S–3S.

Vinson DC, Reidinger C, & Wilcosky T (2003). Factors affecting the validity of a Timeline Followback Interview. Journal of Studies on Alcohol, 64, 733–740. [PubMed: 14572197]

Walitzer KS, & Connors GJ (1999). Treating problem drinking. Alcohol Research & Health, 23(2), 138–143. [PubMed: 10890808]

Walls TA, & Schafer JL (2006). Models for Intensive Longitudinal Data. New York: Oxford University Press.

Wittchen HU, Robins LN, Cottler LB, Sartorius N, Burke JD, Regier D, & trials P. i. t. m. W. A. f. (1991). Cross-cultural feasibility, reliability and sources of variance of the Composite International Diagnostic Interview (CIDI). British Journal of Psychiatry, 159, 645–653. [PubMed: 1756340]

Wray TB, Merrill JE, & Monti PM (2014). Using ecological momentary assessment (EMA) to assess situation-level predictors of alcohol use and alcohol-related consequences. Alcohol Research: Current Reviews, 36(1), 19–27. [PubMed: 26258997]

Table 1

Characteristics of Study Sample

Variable	*M* or %	*SD*
Demographics		
Age	38.4	11.1
Male	42.8	
Race, Ethnicity		
Hispanic Latino, any race	22.9	
White/Caucasian	59.4	
Black African American	14.6	
Asian	1.0	
More than one race	3.1	
Not reported	21.9	
Education		
Bachelor's degree or higher	69.7	
Employment		
Employed part- or full-time	82.3	
Baseline Drinking Severity		
Sum of Standard Drinks per week (SSD)[a]	30.9	15.5
Alcohol Dependence Scale (ADS)	14.6	5.9
Met DSM-IV alcohol dependence criteria	91.7	
Alcohol Consumption at Follow-up		
3-month SSD[b]	19.8	14.6
9-month SSD[C]	20.5	22.8

[a]Baseline SSD was assessed via Timeline Followback (TLFB) method for the period of 56 days prior to the baseline visit. Total drinks for 56 days were summed and divided by 8 weeks for a SSD per week variable.

[b]3-month SSD was calculated using data from the 3-month post-baseline assessment. Sum of total drinks consumed since the 2-month (end of treatment) visit were divided by number of weeks in the assessment period (usually about 4).

[c]9-month SSD was calculated using date from the 9-month post-baseline visit. Sum of total drinks consumed since the 6-month visit were divided by number of weeks in the assessment period (usually about 12).

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Table 2.

Bivariate Associations of Next Day Drinking with Today's Commitment, Today's Confidence, and Today's Affective States

	M (SD)	Ranee	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
						Within-person (daily) variabes							
1. Next day drinks[a]	3.40(3.77)	0–31											
2. Commitment	5.40 (2.65)	0–8	- .32**										
3. Confidence	5.11 (2.54)	0–8	- .42**	.83**									
4. Sadness—Happiness	5.03 (1.34)	1–8	.01	.07**	.07**								
5. Anxiousness—Calm	4.99 (1.49)	1–8	-.01	.07**	.07**	.51**							
6. Tired—Energized	4.35 (1.59)	1–8	-.01	.05*	.04*	.53**	.28**						
7. Negative affect[b]	1.32 (1.33)	0–7	-.01	- .12**	-.12**	- .49**	- 42**	- .25**					
8. Poor sleep quality	2.19 (0.75)	1–4	.00	.00	.01	-.31**	-.25**	- .43**	.22**				
						Betwen-person variables							
9. Average commitment	5.47 (1.79)	0.09–8	-.10**	.69**	.60**	.12**	.08**	.07**	-.15**	-.02			
10. Average confidence	5.16(1.65)	0.13–7.9	- .20**	.62**	.66**	.09**	.07**	.05*	-.15**	.00	.90**		
11. Dependence Severity	14.6 (5.86)	3–33	.04	.10**	.07**	-.02	-.11**	-.10**	.20**	.12**	.18**	.13**	
12. Baseline drinking	4.42 (2.20)	1.1–11.3	.22**	- .12**	-.18**	-.01	.01	.04	.02	.00	- .20**	- .28**	.03*

Note. Tabled values are based on the full daily data in its raw form. The *n* and thus significance values for tests of within- and between-person correlations is inflated due to repetition of averages on each row for each person.

*$p < .01$

**$p < .001$.

[a]Total drinks reported in morning survey, lagged to align with prior day's ratings.

[b]Composite of stressed, lonely, bored, and angry.

Table 3.

Rate ratios (and 95% confidence intervals) from multilevel negative binomial models of next day's drinks

	B	*RR*	95% CI	*p*
Commitment				
Intercept	0.97	2.86	(2.56, 3.20)	< .001
Person-average	− 0.06	0.94	(0.88, 1.00)	.053
Daily	− 0.21	0.81	(0.79, 0.83)	< .001
Confidence				
Intercept	0.95	2.79	(2.51, 3.10)	< .001
Person-average	− 0.14	0.87	(0.81, 0.92)	< .001
Daily	− 0.24	0.78	(0.76, 0.80)	< .001

Note. RR = rate ratio; 95% CI = 95% confidence interval. Daily-level variables were centered at the person mean. Average variables were centered at the grand mean. Both models accounted for treatment condition, and removing this predictor did not influence results.