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A Contextual Model of Self-Regulation Change Mechanisms among Individuals with Addictive Disorders

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Abstract

Numerous behavioral treatments for addictive disorders include components explicitly aimed at targeting self-regulation (i.e., coping and emotion regulation). We first provide a summary of key findings to date among studies that have examined self-regulation as a mechanism of behavior change (MOBC) in behavioral treatments for addictive disorders. Based on our review, we conclude that the role of self-regulation as a MOBC across behavioral treatments for addictive disorders is not well-characterized and findings are inconsistent across studies. For example, our review indicates that there is still inconsistent evidence that coping is a unique MOBC in cognitive-behavioral approaches for addictive behaviors. We propose that there has been slow progress in understanding self-regulation as a MOBC in addiction treatment because of a lack of attention to contextual factors. Accordingly, in the second half of this paper, we propose a *contextual model of self-regulation change mechanisms*, which emphasizes that the role of various facets of self-regulation as MOBC may depend on contextual factors in the immediate situational context (e.g., fluctuating internal and external cues) and in the broader context in which an individual is embedded (e.g., major life stressors, environmental conditions, dispositions). Additionally, we provide specific recommendations to guide future research for understanding both between-person and within-person self-regulation MOBC in addiction treatment. In particular, we provide key recommendations for how to capitalize on intensive longitudinal measurement methods (e.g., ecological momentary assessment) when bringing a contextual perspective to the study of self-regulation as MOBC in various addiction treatments.

Keywords

addictive disorders; self-regulation; addiction treatment; mechanisms of behavior change; coping

Research has demonstrated that self-regulation skills, such as coping and emotion regulation skills, play a key role in predicting the development and maintenance of and recovery from addictive problems, including tobacco, alcohol and drug use disorders, and pathological gambling (Berking et al., 2011; Chaney, O’Leary, & Marlatt, 1978; Cooper, Russell, & George, 1988; Gossop, Stewart, Browne, & Marsden, 2002; Morgenstern & Longabaugh, 2000; Moos & Moos, 2007; Petry, Litt, Kadden, & Ledgerwood, 2007; Shiffman, 1982;

Williams, Grisham, Erskine, & Cassedy, 2012). Numerous behavioral treatments for addictive disorders include components explicitly aimed at targeting self-regulation skills, such as coping and emotion regulation skills. There are several cognitive-behavioral treatment (CBT) packages for addictive disorders (Carroll, 1998; Marlatt & Gordon, 1985; Monti, Abrams, Kadden, and Cooney, 1989; Miller, 2004) that focus on teaching general skills for managing life stressors and negative affect (e.g., active communication skills, cognitive reappraisal) and urge-specific skills (e.g., drink refusal, stimulus control) for preventing addictive behavior. A growing number of behavioral treatments, such as acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 2011), mindfulness-based relapse prevention (MBRP; Bowen, Chawla, & Marlatt, 2011), dialectical behavior therapy (DBT; Linehan, 1993), affect regulation training (ART; Stasiewicz et al., 2013), and skills for improving distress intolerance (SIDI; Bornovalova, Gratz, Daughters, Hunt, & Lejuez, 2012), focus on teaching skills for tolerating distress and consciously regulating one's behavior when experiencing distress.

Given the common focus on self-regulation across behavioral treatments for addictive disorders, numerous studies over the past few decades have examined various facets of self-regulation as mechanisms of behavior change (MOBC) that are mobilized by various addiction treatments. MOBC are defined as mechanisms or processes that explain how and why changes in addictive behavior occur during and following treatment (Kazdin, 2007; Longabaugh & Magill, 2011). In this paper, we first provide a summary of key findings to date among studies that have examined self-regulation as a MOBC in behavioral treatments for addictive disorders. Based on our review, we conclude that the role of self-regulation as a MOBC across behavioral treatments for addictive disorders is not well-characterized and findings are inconsistent across studies. For example, it is unclear how different types of behavioral treatments and the specific methods employed in treatment (e.g., coping skills training) are actually impacting various facets of self-regulation among individuals with addictive disorders. It is also unclear whether certain treatments or treatment methods are particularly effective in mobilizing changes in self-regulation for some types of clients, but not others. Ultimately, current research provides limited guidance about *how* to most effectively target self-regulation in behavioral treatment addiction. Improving understanding of self-regulation as a MOBC in behavioral addiction treatment can facilitate the optimization of existing treatments, the tailoring of treatments to individual clients, the delivery of more efficient treatments, and the development of new strategies for targeting key self-regulatory mechanisms that predict long-term success following treatment.

Accordingly, in the second half of this paper, we propose a contextual model of self-regulation change mechanisms and provide directions for future research based on this model. In brief, this model emphasizes the dynamic interplay between self-regulatory behavior and contextual factors during the addictive disorder change process, rather than assuming that various facets of self-regulation are uniformly beneficial for all individuals and in all situational contexts.

Extant Research on Self-Regulation as a MOBC in Behavioral Addiction Treatment

Coping as a MOBC in CBT for Addiction

Given the explicit focus on coping skills training in CBT for addictive disorders, improvement in coping skills has been a widely studied MOBC in CBT. Morgenstern and Longabaugh's (2000) seminal review found very limited support for improvement in coping as a unique MOBC in CBT for alcohol use disorder. Since the Morgenstern and Longabaugh (2000) review paper, progress in understanding coping as a MOBC in CBT for various addictive disorders remains slow and collective findings are still mixed. Several studies in the past two decades have used retrospective self-report measures of coping skills; the majority of which have failed to show that coping is a mediator of CBT treatment effects (Litt, Kadden, Cooney, & Kabela, 2003; Litt, Kadden, Kabela-Cormier, Petry, 2008; Litt, Kadden, & Stephens, 2005; Monti et al., 2001). However, some studies using retrospective self-report measures have found coping to be a significant mediator of CBT effects. Petry, Litt, Kadden, and Ledgerwood (2008) found that self-reported coping, as measured by the Coping Strategies Scale (CSS; Litt et al., 2003) mediated the effects of CBT in decreasing gambling among pathological gamblers at the 2-month post-treatment follow-up, but not the 12-month post-treatment follow-up. Lévesque et al. (2017) evaluated coping skills as a MOBC for the Therapeutic Education System (TES), an internet-delivered version of the community reinforcement approach (CRA), a CBT-based approach for treating substance use disorders. They found that self-reported coping skills, as measured by the brief version of the CSS (Litt, Kadden, & Tennen, 2012), mediated the effects of TES on substance use outcomes during the last four weeks of treatment. However, they did not report whether coping skills mediated the effects of TES on longer-term outcomes. Finally, Roos, Maisto, and Witkiewitz (in press) conducted secondary analyses of the Project MATCH data to examine whether baseline alcohol dependence severity moderated the indirect effect of CBT on alcohol use outcomes via coping skills. Results indicated that end-of-treatment coping skills mediated the positive treatment effects of CBT on one-year drinking outcomes among outpatient clients with high dependence severity, but not those with low dependence severity.

Two recent MOBC studies have utilized methods other than retrospective self-report to measure coping. Litt et al. (2009) utilized ecological momentary assessment (EMA) in which participants were prompted to answer questions about their momentary coping responses several times per day for a 2-week period before and after treatment. They found that compared to a packaged version of CBT, an individualized version of CBT predicted increased momentary coping responses in high-risk drinking situations at post-treatment, which in turn was related to decreased drinking. However, mediational analyses to test whether coping was a statistical mediator of outcomes only approached statistical significance ($p < .07$). The most promising study on coping as a MOBC in CBT for substance use disorders is a study by Kiluk et al. (2010), which examined quality of coping responses on a role-play assessment as a statistical mediator of the effects of computerized CBT on substance use outcomes. The role-play assessment, called the Drug Risk Response Test (DRRT), presented eight high-risk scripts of substance-related scenarios and participants provided verbal responses of how they would cope, which were then evaluated

by trained raters. Results indicated that quality of coping responses following treatment mediated the effect of computerized CBT on duration of abstinence during the three months following treatment.

Overall, despite some studies with promising findings regarding coping as a mediator of CBT treatment effects (Kiluk et al., 2010; Lévesque et al., 2017; Litt et al., 2009; Petry et al., 2008; Roos et al., in press), the collective empirical evidence to date is still mixed with respect to whether changes in coping function as a unique MOBC in CBT for addictive disorders.

Other Self-Regulation Constructs as MOBC in Addiction Treatments

Emotion regulation skills.—Compared to research on coping as a MOBC in CBT, there are far fewer studies on emotion regulation skills as a MOBC in various behavioral addiction treatments. Axelrod, Pereplechikova, Holtzman, and Sinha (2011) examined improvement in emotion regulation skills, as measured by the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004), among women with substance use disorders and borderline personality disorder receiving dialectical behavior therapy. Results showed that improvement in emotion regulation skills during treatment was associated with decreased substance use frequency. Berking et al. (2011) examined how emotion regulation skills before and during treatment, as measured by the Emotion Regulation Skills Questionnaire (ERSQ; Berking et al., 2011), predicted outcomes among individuals receiving CBT for alcohol use disorder. They found that deficits in emotion regulation skills at both pre-treatment and end-of-treatment predicted poorer long-term drinking outcomes. Stasiewicz et al. (2013) recently developed a behavioral treatment for alcohol use disorder called affect regulation training (ART) that explicitly targets emotion regulation skills. Stasiewicz et al. (2013) evaluated the efficacy of ART as a supplement to CBT among individuals with alcohol use disorder who reported often drinking in negative affect situations. Counter to expectations, the CBT plus ART group did not exhibit differential changes on self-report measures of emotion regulation skills, including changes in DERS scores.

Flexibility.—There is a growing number of studies on flexibility as a MOBC in acceptance and commitment therapy (ACT) for smoking cessation. Specifically, these studies have utilized the Avoidance and Inflexibility Scale (AIS; Gifford et al., 2004), a self-report measure that assesses the degree to which individuals are able to flexibly respond to internal smoking triggers (e.g., smoking-related thoughts, emotions, and body sensations) without relying on avoidance-based strategies to prevent smoking. Three studies examining ACT for smoking cessation found that scores from the AIS significantly mediated the treatment effects of ACT on smoking outcomes (Bricker, Wyszynski, Comstock, & Heffner, 2013; Gifford et al., 2004; Gifford et al., 2012). However, there is limited evidence to date that flexibility is a MOBC in ACT for drug use disorders (Stotts et al., 2012).

Distress tolerance.—Distress tolerance has been defined as the ability to persist in goal directed activity when experiencing distress. Bornovalova et al. (2012) developed a distress tolerance treatment, called skill for improving distress intolerance (SIDI), aimed at enhancing distress tolerance among individuals receiving inpatient treatment for substance

use disorders. Using behavioral measures of distress tolerance, Bornovalova et al. (2012) found that participants who received the distress tolerance treatment evidenced significantly greater increases in distress tolerance, as compared to participants who received supportive counseling or treatment-as-usual. As noted above, Stasiewicz et al. (2013) tested the efficacy of affect regulation training (ART) as a supplement to CBT for alcohol use disorder. Participants who received ART did not exhibit differential changes in self-reported distress tolerance.

Mindfulness.—Several studies on mindfulness-based treatments for addictive disorders have examined trait mindfulness as a MOBC. Bowen et al. (2009) found that participants who received mindfulness-based relapse prevention (MBRP) showed greater increases in the acting with awareness facet of mindfulness than participants who received treatment as usual. However, changes in mindfulness did not statistically mediate the effects of MBRP on substance use outcomes. A follow-up analysis of the Bowen et al. (2009) study did find that changes in mindfulness, as measured by the acting with awareness and non-judgment facets of mindfulness as well as acceptance, significantly mediated the effects of MBRP on substance craving (Witkiewitz, Bowen, Douglas, & Hsu, 2013). Garland et al. (2016) compared mindfulness-oriented recovery enhancement (MORE) to CBT among previously homeless men with substance use disorders and co-occurring psychiatric disorders. Results indicated that increases in trait mindfulness significantly mediated the effect of MORE on reductions in craving and post-traumatic stress. Finally, Brewer et al. (2009) found no differences in changes in trait mindfulness between participants with substance use disorders who received mindfulness training and those who received CBT.

Moving Forward: The Need to Consider Context

Altogether, key findings from research to date on self-regulation as a MOBC in addiction treatment include the following: a) the collective evidence is still mixed as to whether coping is a unique MOBC in CBT for addictive disorders, b) the evidence is sparse and inconclusive as to whether constructs such as emotion regulation, distress tolerance, and mindfulness function as MOBC in mindfulness- and acceptance-based treatments, and, c) there is promising preliminary evidence that flexible regulation of internal triggers may be a key MOBC in acceptance and commitment therapy for tobacco use. Research on self-regulation as a MOBC in addiction treatment is clearly still in its early stages and more research is needed to elucidate the role of self-regulation as a MOBC across various addiction treatments.

We believe that *lack of attention to context* is a key limitation of the collective body of research to date on self-regulation as a MOBC in addiction treatment. In other words, most studies within this body of research have investigated self-regulation without adequately considering the contextual conditions in which individuals are embedded in over time as they are engaging in various self-regulatory behavior. Contextual conditions may include the immediate external environment, internal states, trait-level dispositions, and life circumstances. Numerous theoretical models of self-regulation in the field of psychology have emphasized the importance of context (Aldao, 2013; Aldao et al., 2015; Bonanno & Burton, 2013; Cheng, Lau, & Chen, 2014; Gross, 2015; Kashdan & Rottenberg, 2010;

Lazarus & Folkman, 1987; Sheppes et al., 2014). Specifically, researchers have consistently emphasized that the effectiveness or adaptability of self-regulatory behavior depends on the context. Importantly, empirical research (the majority conducted outside the addiction field) has demonstrated that various self-regulation strategies interact with contextual factors in the prediction of psychological health (see Kashdan & Rottenberg, 2010 and Bonanno & Burton, 2013 for reviews).

In the addiction field, several researchers have also emphasized the importance of considering the interaction of self-regulation and contextual factors in the prediction of addictive behavior (Moos & Holahan, 2003; Witkiewitz & Marlatt, 2004). Unfortunately, the vast majority of *empirical* research studies on self-regulation as a MOBC in addiction treatment still have not adequately considered the role of context. Rather, as our review has shown, most studies on self-regulation as a MOBC have analyzed changes in scores on global, retrospective self-report questionnaires of self-regulatory behavior, without regard to the contexts in which each individual is embedded in over time. The *contextual model of self-regulation change mechanisms* presented in this article is intended to build on prior conceptual models of addictive behavior that emphasize context (e.g., the dynamic model of relapse; Witkiewitz & Marlatt, 2004) in order to guide future research specifically aimed at better understanding self-regulation as a MOBC in behavioral addiction treatments.

Clinical Perspectives on the Interplay of Context and Self-Regulation in Addiction

The interplay between self-regulation and context among individuals with addictive disorders can also be considered from a clinical perspective. Here we outline several ways in which various contextual conditions may be important in the process of self-regulation among individuals with addictive disorders.

Situational Demands.—Situational demands may include both external cues (e.g., sight of drug paraphernalia) and internal cues (e.g., negative affect) that become linked to drug craving and substance use through both classical conditioning and operant conditioning processes (Skinner & Aubin, 2010). Based on an individual's learning history, a wide range of both external and internal cues can elicit substance craving and substance use and it is not uncommon for individuals with addictive disorders to be barraged with many different cues on several occasions in a day or with multiple cues simultaneously. Hence, the ability to accurately discriminate among various situational cues may be crucial in enabling an individual to select strategies that are most effective for the specific types of cues that are present. Indeed, there is preliminary evidence that the ability to discriminate emotional states is protective against problematic substance use (Emery, Simons, Clarke, & Gaher, 2014; Kashdan, Ferrisizidis, Collins, & Muraven, 2010; Sheets, Bujarski, Leventhal, & Ray, 2015).

For individuals with addictive disorders, it may be critical to remain sensitive to the fluctuation of situational demands (e.g., urge levels) or the arising of new demands (e.g., “slipping” and drinking after a period of sobriety), so that they can adjust their self-regulatory approach to meet the specific challenges of a given situation. Among individuals with addictive disorders, lapses are common following periods of abstinence or moderation. Thus, the ability to adjust after regulatory failures is of particular importance among

individuals with addictive disorders. Some studies lend support to the notion that strategy adjustment is important among substance use disorder populations, especially following lapses to substance use. Shiffman et al. (1996) found that smokers who reported using any coping strategies after a lapse to smoking were significantly less likely to progress to additional lapses in the same day. Witkiewitz & Masyn (2008) found that greater increases in alcohol-specific coping following treatment were related to decreased quantity of drinking over time following an initial drinking lapse.

Resources and Opportunities.—As Bonanno and Burton (2013) note, context may also be comprised of unique opportunities or resources that can facilitate self-regulation.

Environmental resources, such as family and friends, sponsors, mutual help group meetings, and exercise facilities, may facilitate effective self-regulation among individuals in recovery (Moos & Moos, 2007). Unique opportunities to engage in behaviors consistent with one's personal values and goals represent another type of situational opportunity. Heffner, Eifert, Parker, Hernandez, and Sperry (2003) point out that the process of recovery involves much more than simply "staying sober" and that being aware and committed to deeply held values (e.g., building close relationships with friends) is essential to the process of long-term recovery. Importantly, opportunities to pursue a particular valued goal may be afforded by some situations and not others. Individuals with addictive disorders may need to make careful judgments about the level of importance of pursuing a valued goal in a given situation relative to concerns about relapse. For example, an individual recovering from alcohol use disorder may need to weigh his concern of "slipping" against his desire to find a long-term romantic partner, an endeavor which may potentially involve exposing himself to other people drinking.

Changing Circumstances Over Time.—It may also be important for individuals with addictive disorders to adjust their overall repertoire of regulatory strategies over time.

Certain strategies may become more or less appropriate or effective over time. For example, according to the Transtheoretical Model of Change (Prochaska, DiClemente, & Norcross, 1992), various cognitive and behavioral change processes may be more or less effective depending on what stage an individual is in during the process of making changes (e.g., contemplation or preparation versus action or maintenance). As another example, it is plausible that stimulus control strategies (e.g., avoiding external cues) may be highly effective early on in treatment when an individual is actively changing their substance use and may be experiencing frequent craving and withdrawal symptoms. However, relying on avoidance of external cues in the long-run may not always be effective, especially when external cues may be unavoidable, and may prevent the occurrence for extinction of craving responses to external cues. In fact, O'Connell, Shiffman, and DeCarlo (2011) conducted secondary analyses on observational data among smokers and found that repeated exposure to cigarette cues without smoking predicted a decreased likelihood of lapse in subsequent temptation episodes.

Self-Regulation Repertoires.—For individuals with addictive disorders, the relative importance of utilizing certain self-regulation skills may depend on what skills they are already using, or their self-regulation repertoires. Hence, particular self-regulation skills can

also be viewed in the context of one's current overall repertoire. For example, for an individual who frequently avoids substance cues and exercises to reduce urges, but still eventually relapses to problematic substance use after periods of sobriety, it may be particularly important for him to implement new self-regulation skills, such as skills focused on tolerating urges, rather than only controlling the causes of urges or engaging in behaviors to reduce urges.

A Contextual Model of Self-Regulation Change Mechanisms

In the rest of this article, we present a framework to guide future research on facets of self-regulation as MOBC in addiction treatment. Figure 1 provides a conceptual depiction of the contextual model of self-regulation change mechanisms. Similar to how others have used the word context (Aldao, 2013), we use the term context to refer to the collection of contextual conditions that an individual experiences. As seen in Figure 1, we have organized these contextual conditions into components within the *immediate situational context*, as well as components within the *broader context* in which an individual is embedded. The immediate situational context includes the ever-changing set of momentary conditions that an individual experiences in the present moment. Specifically, we have organized the immediate situational context into the following key components: 1) *fluctuating internal states* (e.g., urge levels), 2) *fluctuating features of the immediate external environment* (e.g., other people who are present), 3) *momentary self-regulatory behaviors* carried out by the individual (e.g., coping responses), and 4) *momentary addictive behavior* (e.g., alcohol use). The broader context includes relatively more stable (but still changeable) conditions that are present over extended periods of time, as well as relatively infrequent major life events that are extremely salient and continue to affect an individual over time. We have organized the *broader context* into the following key components: 1) *major life events* (e.g., loss of a loved one), 2) *environmental conditions* (e.g., social support), and 3) *person-level characteristics or dispositions* (e.g., addictive disorder severity).

Figure 1 also depicts the complex interrelationships among these contextual conditions. Here, we elaborate on several key interrelationships within the model. First, *whether or not certain self-regulation skills are implemented* may depend on contextual factors (i.e., in Figure 1, all the arrows pointing to momentary self-regulation). For example, the ability to implement certain skills may depend on resources such as social support or socioeconomic status. Some skills, such as drink/drug refusal skills or active communication skills, may only be implemented among those individuals who experience particular challenging interpersonal situations. The preference for one skill over another may depend on individual difference factors such as gender, race/ethnicity, age, culture, and religiosity. Additionally, the degree to which self-regulation is warranted may depend on the overall frequency and intensity of situational demands. For example, experiencing frequent and high intensity urges in one's daily life may warrant the need to consistently use self-regulation skills each day.

Second, *whether or not self-regulation skills are effective* in preventing momentary addictive behavior may depend on contextual factors (i.e., in Figure 1, all the arrows pointing to the line connecting momentary self-regulation and momentary addictive behavior, which signify

that other factors can moderate the relationship between self-regulation and addictive behavior). For example, cognitive functioning or psychiatric symptoms may influence or interfere with one's ability to competently and appropriately execute self-regulation skills, which in turn may influence whether or not the skill is effective. As another example, it is plausible that the exclusive use of covert strategies (e.g., cognitive reappraisal) may not be effective in situational contexts in which highly salient external cues (e.g., direct social pressure, drugs are present in the immediate environment) may be triggering an urge to engage in an addictive behavior.

Third, conditions in the broader context will likely influence the frequency and intensity of immediate situational demands that individuals experience from day to day. For example, an individual with a severe substance use disorder, a co-occurring anxiety disorder, and several friends with addictive disorders is likely to experience more frequent and intense situational demands (e.g., urges, negative affect, external cues), as compared to an individual with a less severe substance use disorder, the absence of a co-occurring disorder, and no friends with addictive disorders. Hence, key factors in the broader context (which may be more feasible to empirically measure than situational demands in daily life) may be important markers of overall levels of daily situations demands.

Fourth, the model specifies that the relationship between self-regulation and addictive behavior can be bi-directional (hence the double arrows for the line connecting self-regulation and addictive behavior in Figure 1). Of note, Weiss et al. (2017) recently investigated the dynamic interplay between self-regulation and substance use by collecting daily-diary data from college student drinkers with no prior alcohol treatment experiences. They found that evening heavy drinking predicted lower odds of next-day problem-solving and higher odds of next-day avoidance (i.e., avoiding dealing with situation), and that evening marijuana use predicted lower odds of next-day problem-solving and higher odds of next-day cognitive reappraisal. This study suggests that addictive behavior can influence the subsequent utilization of strategies that tend to be maladaptive, as well as those that tend to be adaptive. Momentary addictive behavior can be conceptualized as another fluctuating feature of the immediate situational context, which in turn influences subsequent self-regulatory efforts. Of note, for individuals who experience a lapse following a period of successful behavior change, the occurrence of a lapse may signal the need to make adjustments to one's self-regulatory approach in order to sustain successful behavior change and avoid return to problematic patterns of addictive behavior. Hence, for some individuals, lapses may predict increases in self-regulation or the utilization of particular skills that are useful in recovering from a lapse.

What is Self-Regulation?

In addition to defining context, it is also important to define self-regulation. Self-regulation is a broad construct that has been operationalized in many ways (Carver & Scheier, 2001). Here we define the term self-regulation as the process by which individuals consciously engage in efforts to modify internal experiences (e.g., emotional states) and/or to modify their behavioral responses to internal, as well external experiences (e.g., argument with spouse). Hence, we consider both coping and emotion regulation responses as self-

regulation responses. Importantly, self-regulation can involve both efforts to *change one's emotional state* and efforts to change *behavioral responses to emotions*, which may or may not significantly change one's emotional state.

Here, we also focus on specific self-regulation skills that are targeted in addiction treatment. Table 1 provides an overview of key self-regulation skills, many of which are targeted by several different behavioral addiction treatments. We think it is important for empirical research to focus on measuring how individuals may use a broad range of different skills, and not just the skills targeted by the particular treatments under investigation, in order to understand how various treatments may impact individuals' overall self-regulatory repertoires. Additionally, we think it is important to measure how individuals use skills in both the context of high-risk situations involving urges to engage in addictive behaviors and in the context of general stress.

Table 2 specifies which self-regulation skills are the key targets of specific treatments and the treatment strategies employed to target these skills. Although there is certainly overlap among treatments in the skills that are targeted, there are also key differences. For example, relative to other treatments, motivational interviewing (MI; Miller & Rollnick, 2012) and twelve-step facilitation (TSF; Nowinski, Baker, Carroll, 1992) do not have a major focus on teaching self-regulation skills. Another key difference is that several "third-wave" treatments (e.g., MBRP, ACT, DBT) emphasize acceptance and emotional awareness, whereas CBT approaches for addictive disorders do not emphasize these skills to the same degree.

Studying Both Between- and Within-Person Relations

The study of self-regulation can involve the investigation of both average between-person relations among variables (e.g., on average, people with more active coping styles also tend to drink less) and average within-person relations among variables over time (e.g., on average, an individual will drink less during those high-risk episodes when he or she uses coping skills, as compared to high-risk episodes when he or she does not use coping skills). In regards to research on self-regulation as a MOBC in addiction treatment, we think it is important to examine both between- and within-person relations. Both approaches for measuring self-regulation are valuable and can answer different questions of interest, such as "How do different addiction treatments impact stable patterns of self-regulation over time? (between-person)" and "How do different treatments impact how individuals engage in the daily process of self-regulation within fluctuating situational contexts (within-person)?" Hence, we first present a contextual model of self-regulation treatment mechanisms that focuses on between-person relations (Figure 2). Subsequently, we present two additional models that focus on within-person relations (Figures 3 and 4).

Integrating Context into the Empirical Study of Between-Person Treatment Mechanisms

Figure 2 provides a model for studying self-regulation change mechanisms at the between-person level. First, Figure 2 is a moderated mediation model. The effect of treatment condition on addictive behavior outcomes is mediated by indicators of post-treatment self-regulation. Moreover, Figure 2 specifies several factors within the *broader context* that may moderate the mediational pathway. Specifically, these factors may moderate the effect of

treatment condition on post-treatment self-regulation and the effect of post-treatment self-regulation on addictive behavior outcomes. Of note, Figure 2 also includes pre-treatment self-regulation as a predictor of post-treatment self-regulation to account for pre-treatment individual differences in self-regulation. Figure 2 includes four types of between-person indicators of self-regulation, which are reviewed below.

Average frequency of using self-regulation skills.—Average frequency of using self-regulation skills, has been commonly examined as a mediator of treatment effects in studies of self-regulation as a MOBC in addiction treatment. Yet, very few of these studies have considered the role of contextual factors. The contextual model specifies that increases in the frequency of using self-regulation skills may serve as a MOBC for some clients and not others. Specifically, we propose that increases in the frequency of using self-regulation skills is more likely to serve as a MOBC for clients with more frequent and severe daily situational demands, as compared to clients with relatively less frequent and less severe demands. Essentially, more frequent and severe situational demands (e.g., craving) may warrant greater need to use self-regulation skills in daily life to avoid relapse. We have found preliminary support for this notion in our secondary analysis of Project MATCH. We demonstrated that the frequency of using coping skills at post-treatment significantly mediated the treatment effects of CBT for alcohol use disorder among outpatient clients with high dependence severity, but not those with low dependence severity (Roos, Maisto, & Witkiewitz, in press).

Quality of self-regulation.—Another indicator of self-regulation is the *quality* of self-regulation, or how competently one can execute self-regulatory skills. As noted in our review, Kiluk et al. (2010) used a role-play task to measure quality of coping responses and found that quality of coping mediated the treatment effects of computerized CBT for substance use disorders. We propose that quality of self-regulation, just like quantity/frequency of self-regulation, is also more likely to serve as a MOBC for clients with more frequent and severe daily situational demands, as compared to clients with relatively less frequent and less severe demands. Basically, executing high quality regulatory responses is likely important for preventing relapse among clients who face frequent and severe daily situational demands, but not necessarily as important for clients with relatively less frequent and severe demands. Cognitive functioning may also be important to consider when examining quality of self-regulation as a mediator because individuals with significantly impaired cognitive functioning may lack the cognitive skills necessary to execute high-quality self-regulatory responses (Kiluk, Nich, & Carroll, 2011).

Self-regulation profiles or repertoires.—Self-regulation profiles or repertoires are characterized by distinct *patterns* of using different self-regulation skills over a period of time. Examining an individual's overall pattern of using various self-regulation skills is a contextual approach in that different types of self-regulation skills are considered *together* or in the context of one another, rather than in isolation. Latent class analysis is a useful analytic method for identifying self-regulation profiles. We recently examined end-of-treatment coping profiles in two independent alcohol treatment trials and found that clients with the broadest coping repertoires (i.e., consistently using a diverse range of different

skills) had the best alcohol-related outcomes (Roos & Witkiewitz, 2016). Furthermore, we also recently utilized a novel methodological approach for assessing latent class mediation and found support for a broad coping repertoire as a significant mediator of the association between receiving a behavioral alcohol treatment (as opposed to only medication management) and alcohol-related outcomes (Witkiewitz, Roos, Tofighi, & Van Horn, under revision). Of note, the contextual model also specifies that self-regulation profiles may function differentially as a MOBC depending on contextual factors. For example, it is plausible that a broad self-regulatory repertoire may be most important during the change process for clients who regularly encounter many different types of daily situational demands (e.g., negative affect, social pressure, physical pain), as compared to clients who encounter a smaller range of different demands.

Regulatory flexibility.—Here we describe a specific way to obtain a between-person measure of regulatory flexibility from within-person data on daily or momentary situational demands and self-regulatory behavior (Tennen, Affleck, Armeli, & Carney, 2000). Specifically, we recommend collecting intensive longitudinal data (e.g., ecological momentary assessment or daily diary methods) and then conducting multilevel analyses to extract between-person situational demand—self-regulation slope scores. That is, each individual will have his or her own self-regulation slope score based on the within-person association between situational demands and self-regulation efforts over time. Hence, the slope scores represent how well individuals are able to *match* their regulatory effort to fluctuating situational demands over time, an ability that has been referred to as regulatory flexibility (Bonanno & Burton, 2013; Cheng et al., 2014). A slope score derived from intensive longitudinal data is thus a process indicator of regulatory flexibility. For example, positive slope scores indicate a positive association between situational demands and regulatory effort over time, which in turn suggests high regulatory flexibility. Individuals with high regulatory flexibility are likely to be more successful in self-regulation efforts in response to situational demands. On the other hand, negative slope scores indicate a negative association between situational demands and regulatory effort over time, which in turn suggests low regulatory flexibility. Individuals with low regulatory flexibility are likely to be less successful in self-regulation efforts.

We propose that subjective urge levels and perceived stress levels are two key types of situational demands that would be valuable to assess with intensive longitudinal measurement methods. We also propose that items like those in Table 1 can be used in EMA or daily diary designs to measure the momentary or daily use of different self-regulatory skills. In Table 3, we provide an illustrative example of an EMA design for measuring regulatory flexibility. As shown in Table 3, there are many issues to be considered when using EMA among addictive disorder populations, such as the temporal ordering of urges and self-regulatory behavior and the availability of engaging in an addictive behavior in a given situation.

Finally, the contextual model also specifies that regulatory flexibility may function differentially as a MOBC depending on broader contextual factors. For example, we propose that general stress-related regulatory flexibility (as measured by the perceived stress—self-regulation slope) is most likely to function as a MOBC for individuals with addictive

disorders who also have co-occurring mental health or physical disorders (e.g., anxiety disorders, chronic pain) or who report dealing with one or more ongoing major life stressors (e.g., divorce).

Integrating Context into the Empirical Study of Within-Person Change Mechanisms

As noted above, the study of self-regulation as a MOBC in addiction treatment can also involve the investigation of average within-person relations among variables over time. To date, there is dearth of studies examining self-regulation as a within-person MOBC in addiction treatment. We think the investigation of within-person mechanisms, especially with intensive longitudinal data, is crucial because this approach can shed light on the process by which momentary use of one or more self-regulation skills in specific situational contexts may play a role in helping individuals resist engaging in addictive behaviors. Accordingly, we next present contextual models to guide the empirical investigation of within-person MOBC when analyzing intensive longitudinal data from EMA or daily diary measurement designs.

Treatment as the independent variable in the within-person mediational pathway.—Figure 3 presents a multilevel contextual model with treatment condition as an independent variable. Similar to the Figure 2 model, this model in Figure 3 is also a moderated mediation model. Treatment condition (the independent variable), person-level factors (moderator variables), and pre-treatment self-regulation (baseline covariate) are Level 2 (between-person) variables. Momentary self-regulation (the mediator) and momentary addictive behavior (the dependent variable) are Level 1 (within-person) variables. This model examines whether the effect of treatment condition on momentary addictive behavior is mediated by momentary self-regulation, and whether person-level factors (e.g., addictive disorder severity) may moderate this mediational pathway. When actually conducting multilevel analyses, a researcher might choose to only include assessment prompts or diary entries in which at least some urge was reported. Finally, for this type of model, a researcher may also be interested in specific types of self-regulation skills that are differentially targeted by different treatments. For example, in a study comparing mindfulness-based relapse prevention (MBRP) and twelve-step facilitation (TSF) in the treatment of substance use disorders, a researcher might examine whether receiving MBRP predicts momentary use of acceptance as a self-regulation skill during an urge episode, and whether acceptance in turn predicts momentary substance use. This type of analysis might shed light on the MOBC in MBRP by assessing whether or not MBRP mobilizes the use of acceptance to a greater extent than TSF and whether or not the use of acceptance is in turn effective in preventing momentary substance use.

Treatment as a moderator of the within-person mediational pathway.—Figure 4 presents a multilevel contextual model with treatment condition as a moderator variable. This model also includes momentary situational demands (e.g., urges and perceived stress) as Level 1 variables at the within-person level. Treatment condition is specified as moderator of the momentary situational demand → momentary self-regulation association. Person-level factors are specified as a moderator of the treatment condition x momentary situational demand interaction effect predicting momentary self-regulation (i.e., a three-way

interaction). As an example, in a study comparing cognitive behavioral therapy (CBT) and motivational interviewing (MI) for tobacco use disorder, a researcher might examine whether receiving CBT moderates the within-person association between momentary urge level and momentary self-regulation (measured as total number of self-regulation skills used). Based on the hypothesized MOBC in CBT, it would be expected that individuals receiving CBT would exhibit a significant and moderate to high average within-person positive association between urge level and self-regulation (reflecting better abilities to match regulatory effort to situational demands), whereas those receiving MI would be less likely to exhibit a within-person association between urge and self-regulation skills. Additionally, the researcher could examine whether treatment moderates the within-person indirect effect of urges on tobacco use (momentary urge→momentary self-regulation→momentary tobacco use), and whether person-level factors (e.g., cognitive functioning) might moderate the moderated mediated effect (i.e., a double moderated mediation effect).

Improving the Measurement of Self-Regulation Constructs

In addition to paying greater attention to context, future research will also need to focus on improving methods for measuring self-regulation. The majority of MOBC research on self-regulation constructs (i.e., coping, emotion regulation, flexibility, distress tolerance, and mindfulness) has utilized retrospective self-report questionnaires to assess these constructs. As noted by others (Magill, Kiluk, McCrady, Tonigan, Longabaugh, 2015; Morgenstern & Longabaugh, 2000; Naqvi & Morgenstern, 2015), the inadequacy of retrospective self-report questionnaires may in part explain the inconsistent evidence of self-regulation as a MOBC in treatments for addictive disorders. In order to more adequately measure self-regulation constructs, we think it is critical for researchers to use diverse measurement methods (e.g., EMA, behavioral tasks, neuroimaging) and to capture multiple levels of analysis (e.g., cognitive, behavioral, neurobiological) when assessing self-regulation processes and related constructs (Naqvi & Morgenstern, 2015).

In this paper, we have specifically focused on the use of EMA in future research and have provided an example of using EMA to capture momentary fluctuations in both self-regulatory behavior and immediate contextual conditions over time (see Table 3). However, we acknowledge that EMA still shares many limitations with other self-report methods and that other methods that do not rely on self-report are needed. Specifically, greater application of cognitive neuroscience methods and biosensors/ambulatory assessment tools may shed new light on the role of self-regulation processes as a MOBC (Morgenstern, Naqvi, Debellis, & Breiter, 2013; Naqvi & Morgenstern, 2015; Trull & Ebner-Priemer, 2014). Cognitive neuroscience methods may have the unique potential to break down complex and multi-faceted self-regulation constructs (e.g., coping) into *specific* self-regulatory neurocognitive processes (e.g., cognitive control, response inhibition, cognitive flexibility). Moreover, neuroimaging methods and physiological data assessed via biosensors can potentially capture key self-regulatory processes that are out of conscious awareness and may not be adequately measured by self-report methods.

Considering the Temporal Relationship between Self-Regulation and Outcomes

To provide evidence of a self-regulation construct as a MOBC, temporal precedence must be established (Kazdin, 2007). Accordingly, researchers need to carefully consider the timing of assessments. Ideally, self-regulation should be measured during a time frame that comes *before* the outcome of interest. As an example, for longitudinal designs with relatively spaced out assessment periods (e.g., during treatment and 2 months following treatment), self-regulation could be measured at baseline and during treatment and the outcome could be measured during the course of treatment and through a 2-month follow-up. It may also be important to consider changes in self-regulation and the outcome that might occur before treatment or during the early stages of treatment (Stasiewicz, Schlauch, Bradizza, Bole, & Coffey, 2013). For intensive longitudinal designs (e.g., using EMA with multiple assessment prompts per day for a 2-week period), researchers can evaluate more fine-grained temporal relationships, such as whether momentary self-regulatory behavior predicts subsequent substance use behavior during the same day. Accordingly, when conducting multilevel analyses, researchers might consider examining lagged associations between self-regulation and the outcome of interest (e.g., self-regulation at time $t-1$ predicting substance use at time t).

Incorporating Multiple Contextual Factors

Table 4 provides an illustrative example of how to incorporate *multiple* contextual factors into analyses when evaluating self-regulation as a MOBC. In this example, components of the immediate situational context are incorporated in analyses: fluctuating internal states (urge levels), fluctuating features of the external environment (access to substances), momentary self-regulation (use of specific skills taught in treatment), and momentary substance use. Additionally, components of the broader context are included: environmental conditions (percentage of substance users in one's network) and person-level characteristics (psychiatric severity). The analyses conducted in this example are guided by the statistical model presented in Figure 3. Furthermore, we would like to note that finite mixture modeling methods (e.g., latent class analysis; Collins & Lanza, 2013) may be particularly useful for incorporating multiple contextual factors when evaluating self-regulation as a MOBC. For example, latent class analysis can be used to empirically identify latent classes of individuals based on similar patterns of responses across several variables. The latent class variable can then be used to test how class membership may moderate the effect of treatment condition on MOBC variables or outcomes (see Cooper & Lanza, 2014 and Roos, Mann, & Witkiewitz, in press, as examples). The incorporation of multiple contextual factors with higher-order interaction analyses or latent class analysis will often require relatively large sample sizes. If researchers are primarily interested in *how* treatments work (rather than only *whether* treatments works) and how context influences how treatments work, they might consider prioritizing the need to collect larger sample sizes when designing studies (at the potential sacrifice of other design components, such as long-term follow-ups).

Summary and Conclusions

We have shown that progress in understanding self-regulation as a MOBC in behavioral addiction treatments has been suboptimal. We believe that greater attention to context may

be a promising next step in this line of work. Hence, in this article, we have proposed a contextual model of self-regulation change mechanisms to guide future empirical work. In this model, we have attempted to elucidate key components of context and how to actually incorporate these contextual components into the empirical investigation of self-regulation among individuals receiving behavioral treatments for addictive disorders. In particular, we believe that further incorporation of intensive longitudinal measurement methods (e.g., daily diary designs and EMA) in clinical treatment trials will be essential in this line of work. These intensive measurement methods will be especially critical in capturing the situational contexts in which self-regulation skills are actually used over time. Ultimately, it is our hope that empirical studies based on the contextual model of self-regulation change mechanisms can significantly improve our understanding of self-regulation as a MOBC in behavioral addiction treatments, which in turn can facilitate the delivery of more effective and efficient treatments for addictive disorders.

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Figure 1.
Contextual Model of Self-Regulation Change Mechanisms.

Figure 2.
A Between-Person Statistical Model of Self-Regulation Change Mechanisms.

Figure 3.
A Multilevel Statistical Model of Self-Regulation Change Mechanisms with Treatment as the Independent Variable.

Figure 4.

A Multilevel Statistical Model of Self-Regulation Change Mechanisms with Treatment as a Moderating Variable.

Table 1.

Types of Self-Regulation Skills

	In the Context of Urges to Engage in Addictive Behavior	In the Context of General Stress
Self-Regulation Skill		
Acceptance	Allow urge to come and go, rather than fighting it	Give self permission to feel feelings
Behavioral Activation	Get involved in an alternative activity that does not involve substances (e.g., clean the house)	Get involved in a valued activity (spend time with family) or a soothing activity (warm bath)
Defusion	See thoughts about drug use as just thoughts and not commands	See thoughts as just thoughts and not facts
Active Communication	Refuse offer to use or communicate with person(s) regarding use levels (e.g., not drinking)	Actively communicate with person(s) to resolve a problem or disagreement
Emotional Awareness	Recognize or label body sensations and emotions related to urge	Recognize and label emotions
Exercise	Get involved in moderate-to-vigorous intensity physical activity/exercise to deal with urge (e.g., biking, jogging, weight lifting)	Get involved in moderate-to-vigorous intensity physical activity/exercise (e.g., biking, jogging, weight lifting)
Grounding	Focus on sensations of breathing to stay grounded when having urge	Focus on just one thing, such as breathing, to ground the self
Cognitive Reappraisal	Remind self about the negative aspects of substance use or the positive aspects of sobriety	Think about a situation or problem differently/take a new perspective
Problem Solving	Brainstorm different ways for dealing with urge	Brainstorm different ways for dealing with a problem or situation
Seeking Social Support	Reach out to others for support or guidance in dealing with urge	Reach out to other people for guidance or support
Self-Compassion	Tell self that it is okay to have urges	Say kind, supportive things to self
Spiritual/Religious Coping	Pray or think about faith to deal with urge	Pray or think about faith
Stimulus Control	Avoid or leave a situation that triggers urge	Remove self from a situation/change my environment
Values Clarification	Remind self of commitment to sobriety or change goal	Remind self of the bigger picture and important life goals

Table 2.**How Behavioral Addiction Treatments Target Self-Regulation**

Treatment	Key Self-Regulation Skills Targeted	Key Treatment Strategies Employed to Target Self-Regulation
Cognitive-Behavioral Therapy (CBT) Approaches: (Carroll, 1998; Marlatt & Gordon, 1985; Monti et al., 1989; McCrady & Epstein, 2009) Meyers & Smith, 1995; Miller, 2004; O'Farrell & Fals-Stewart, 2006)	Stimulus Control Behavioral Activation Reappraisal Problem Solving Drink/Drug Refusal Active Communication Seeking Social Support	<ul style="list-style-type: none"> - Role-play/behavioral rehearsal - Self-monitoring - Functional analysis - Socratic discussion - Homework assignments - Incorporate significant others into treatment
Twelve-Step Facilitation (TSF; Nowinski et al., 1992)	Seeking Social Support Spiritual/Religious Coping Stimulus Control	<ul style="list-style-type: none"> - Facilitate regular attendance to Twelve-step meetings - Discussion and reinforcement of 12-step principles
Mindfulness-meditation approaches (Mindfulness-based relapse prevention (MBRP; Bowen et al., 2010), Mindfulness-based Recovery Enhancement; MORE; Garland et al., 2013)	Acceptance Defusion Self-Compassion Emotional Awareness Grounding	<ul style="list-style-type: none"> - In-session mindfulness meditation practice - Facilitation of regular home mindfulness meditation practice - Discussion about direct experiences following mindfulness practice - Imaginal exposure exercises
Acceptance and Commitment Therapy (ACT; Hayes et al., 2011)	Acceptance Defusion Emotional Awareness Values Clarification Behavioral Activation	<ul style="list-style-type: none"> - Metaphors - Experiential exercises - Mindfulness exercises - Values clarification exercises - Imaginal exposure exercises
Dialectical Behavior Therapy (DBT; Linehan, 1993)	Active Communication Acceptance Emotional Awareness Grounding Behavioral Activation	<ul style="list-style-type: none"> - Role-play/behavioral rehearsal - Self-monitoring - Functional/behavioral chain analysis - Homework assignments - Phone coaching - Brief mindfulness exercises - Experiential exercises
Skills for Improving Distress Intolerance (SIDI, Bornovalova et al., 2012)	Acceptance Emotional Awareness Grounding Behavioral Activation Active Communication	<ul style="list-style-type: none"> - Self-monitoring - Functional analysis - Homework assignment - Imaginal exposure exercises
Affect Regulation Training (ART; Stasiewicz et al., 2013)	Acceptance Self-Compassion Emotional Awareness	<ul style="list-style-type: none"> - Imaginal exposure - Mindfulness exercises
Motivational Interviewing (MI; Miller & Rollnick, 2012)	Values Clarification	<ul style="list-style-type: none"> - Evoking and selectively reinforcing change talk

Table 3.

An Example of Using EMA to Assess Regulatory Flexibility as a MOBC in Behavioral Treatment for Substance Use Disorders

<p>Study Design</p> <ul style="list-style-type: none"> • Randomized controlled trial comparing cognitive-behavioral therapy and motivational interviewing in the treatment of substance use disorder • Participants complete EMA measures via smartphones for a 2-week period immediately before treatment and then again immediately after treatment • Participants are prompted to answer a set of questions on their smartphone on a quasi-random basis 5 times per day, with one randomly scheduled prompt in each of five 3-hour time periods from 8:00AM to 10:00PM. • Substance use will be measured at 3 months following the completion of treatment.
<p>EMA Items for each prompt:</p> <ul style="list-style-type: none"> • Urge → “Right now, how strong is your urge to drink/use?” (0 = none/minimal, 4 = very strong) • Stress → “Right now, how stressed are you?” (0 = not stressed at all, 4 = very stressed) • Substance Use Availability → Right now, are you in a situation where BOTH of the following are true: you can <u>get access</u> to alcohol/drugs and it would <u>be possible</u> to actually drink/use if you decided to? (0 = No, 1 = Yes) • Urge-Specific Self-Regulation → Please indicate whether you did any of the following since the last recording to STOP YOURSELF FROM USING DRUGS OR DRINKING HEAVILY WHEN YOU HAD AN URGE: (0 = No, 1 = Yes) Display all the urge-specific self-regulation items in Table 1 • General Stress Self-Regulation → Please indicate whether you did any of the following since the last recording to HANDLE OR MANAGE GENERAL STRESS: (0 = No, 1 = Yes) Display all the stress-specific self-regulation items in Table 1
<p>Analytic Strategy</p> <ul style="list-style-type: none"> • Use multilevel modeling where assessment prompts (Level 1) are nested within person (Level 2) • Extract urge—self-regulation slope scores for each participant in which urge level at time $t-1$ is a predictor of self-regulation at time t. (A lagged association is computed to establish temporal ordering, i.e., the regulatory behavior comes after the urge). Self-regulation is computed as the total number of urge-specific strategies used at time t. In extracting the slopes, only use data from prompts in which urge is 1 or greater and substances are available (i.e., answered yes to substance use availability question). • Extract general stress—self-regulation slope scores for each participant in which stress level at time $t-1$ is a predictor of self-regulation at time t. Self-regulation is computed as total number of general stress strategies used at time t. In extracting slopes, only use data from prompts in which stress is 1 or greater and urge is 0. • Use the self-regulation slopes as mediator variables in a single-level mediation analysis with treatment condition as the independent variable and substance use at the month 3 follow-up assessment as the outcome.

Table 4.**An Illustrative Example of Incorporating Multiple Contextual Factors**

Study Design <ul style="list-style-type: none"> Randomized controlled trial comparing mindfulness-based relapse prevention (MBRP) and twelve-step facilitation (TSF) in the treatment of substance use disorder Participants complete EMA measures via smartphones for a 2-week period immediately before treatment and then again immediately after treatment Participants are prompted to answer a set of questions on their smartphone on a quasi-random basis 5 times per day, with one randomly scheduled prompt in each of five 3-hour time periods from 8:00AM to 10:00PM. Substance use will be measured via smartphones during treatment and at 3 months following the completion of treatment.
EMA Items for each prompt: <ul style="list-style-type: none"> Urge → “Right now, how strong is your urge to drink/use?” (0 = none/minimal, 4 = very strong) Substance Use Availability → Right now, are you in a situation where BOTH of the following are true: you can <u>get access</u> to alcohol/drugs and it would <u>be possible</u> to actually drink/use if you decided to? (0 = No, 1 = Yes) Urge-Specific Self-Regulation → Please indicate whether you did any of the following since the last recording to STOP YOURSELF FROM USING DRUGS OR DRINKING HEAVILY WHEN YOU HAD AN URGE: (0 = No, 1 = Yes) Display items on self-regulation skills emphasized in TSF (seeking social support and stimulus control) and items on self-regulation skills emphasized in MBRP (emotional awareness and acceptance)
Analytic Strategy <ul style="list-style-type: none"> Use multilevel modeling where assessment prompts (Level 1) are nested within person (Level 2) Only use data from prompts in which urge is 1 or greater and substances are available (i.e., answered yes to substance use availability question). Moderator variable # 1: Percent substance users in social network (“percent users in network”) Moderator variable # 2: Psychiatric severity Conduct double moderated mediation analyses which test the following path: Treatment X percent users in network X psychiatric severity → momentary self-regulation → momentary substance use (i.e., the three-way interaction among treatment, percent user in network, and psychiatric severity predicts momentary self-regulation, which in turn predicts momentary substance use)
Hypotheses: <ul style="list-style-type: none"> Among individuals with high psychiatric severity and a low to moderate percentage of users in network, the use of self-regulation skills emphasized in MBRP (emotional awareness and acceptance) during urge episodes will mediate the effect of receiving MBRP on momentary substance use Among individuals with high percentage of users in network and low to moderate psychiatric severity, the use of the self-regulation skill emphasized in TSF (seeking social support and stimulus control) will mediate the effect of receiving TSF on momentary substance use