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The Relationship between Emotion Regulation and Substance Use Treatment Attrition

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THE RELATIONSHIP BETWEEN EMOTION REGULATION AND SUBSTANCE USE TREATMENT ATTRITION

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Table of Contents

Abstract

Severe substance use disorders are characterized by chronic cycles of relapse; however, individuals who complete substance use treatment are less likely to experience relapse. Research has focused on trying to identify factors that predict treatment dropout to help improve treatment outcomes. Most of this research has focused on examining demographic and patient-specific factors, with little success in reliably predicting treatment attrition. There has been less focus on investigating transdiagnostic factors that span across discrete psychological diagnoses and demographics. The present study sought to determine if self-report and behavioral measures related to emotion regulation predicted inpatient substance use treatment dropout above and beyond demographic variables, and to determine if variables related to emotion regulation improved during substance use treatment**.** The present study included 69 male participants, 68 of whom completed the full baseline assessment. Nine participants dropped out of treatment prematurely. Of the 59 participants who remained in treatment, 49 completed follow-up data collection. No demographic or substance use-related factors emerged as predictors of treatment dropout, except for number of past substance use treatments. Self-report measures of emotion regulation, distress tolerance, urgency, and negative emotionality were also not significantly predictive of treatment dropout. Additionally, behavioral measures of distress tolerance and risky-decision making were not predictive of treatment attrition. Prior to accounting for multiple comparisons, self-reported emotion regulation and negative urgency improved between the baseline and follow-up sessions. This study was significantly underpowered due to factors related to COVID-19 impacting dropout rate. Measures to contain the spread of COVID-19 also likely compromised other aspects of data collection. While findings were not significant, most

findings were in the expected direction and warrant further consideration with a larger sample size and data collection after the impact of COVID-19 has subsided.

Introduction

Alcohol/Substance Use Disorders

In 2017, 19.7 million Americans aged 12 and older met criteria for a substance use disorder (SUD; 38%) or an alcohol use disorder (AUD; 74%), with approximately 2.5 million meeting criteria for both a SUD and an AUD (Substance Abuse and Mental Health Services Administration [SAMHSA], 2018). Of those individuals, roughly 8.5 million also met criteria for a co-occurring mental health disorder (SAMHSA, 2018). Reports of overdose deaths in 2017 totaled more than 70,200 in the United States, representing a two-fold increase in overdose deaths over the past decade, and a 12.9 time increase in overdose deaths related to opioids (Center for Disease Control [CDC], 2018; Scholl, Seth, Kariisa, Wilson, Baldwin, 2019). Not only has the cost in terms of human lives increased over the past decade, but the financial burden on society has also increased. The annual cost associated with drug addiction (including tobacco) is estimated at $740 billion due to loss of workplace productivity, healthcare-related expenses, and costs associated with crime and the legal system (National Institute on Drug Abuse [NIDA], 2017).

There are a variety of terms that have been used to define substance/alcohol-related problems. Most researchers utilize a three-stage conceptualization of drug-using behavior which includes use, abuse, and dependence (Institute of Medicine, 1996). Many adolescents and adults experiment with alcohol and illicit substances for non-medicinal purposes, and experience short-term mood or behavioral alterations due to intoxication (Institute of Medicine, 1996). However, the majority will never transition to problematic use (Institute of Medicine, 1996; Koob & Volkow, 2010). For a small percentage of individuals, drug/alcohol use becomes associated with patterns of binge/heavier-use and mild problems related to health and/or role functioning. This

pattern of use was defined as substance *abuse* in the previous iteration of the *Diagnostic and Statistical Manual of Mental Disorders*, (4th ed, text revision; *DSM-IV-TR*) (American Psychiatric Association [APA], 2000). The *DSM-IV-TR* distinguished abuse from dependence, to indicate that dependence is a more severe progression of substance use. The criteria for dependence in the *DSM-IV-TR* was distinct in containing criteria related to withdrawal and/or tolerance indicating psychological and/or physical dependence (APA, 2000). It should be noted that physical tolerance alone is not sufficient for substance dependency, as individuals who take prescription drugs for medicinal purposes may become physically dependent (APA, 2013; Institute of Medicine, 1996). The *DSM-5* uses a dimensional model of substance/alcohol-related problem classification, using the terms alcohol use disorder and substance use disorder, but with the addition of severity ratings. The current paper focuses on those on the more severe end of this dimensional spectrum. These are individuals for whom substance dependence has become more chronic and distinguishable from abuse, in terms of genetic predisposition, brain neurocircuitry, and behavior (Fowler, Volkow, Kassed, & Chang, 2007; Kreek & Koob, 1998; Koob & Volkow, 2010). Outside of the verbiage used in the *DSM-5*, the term addiction is often used interchangeably to represent more severe substance/alcohol dependence (APA, 2013; Institute of Medicine, 1996; Koob & Volkow, 2010). For some researchers, addiction is the preferable term because they argue that it more clearly represents the distinction between abuse and dependence as being characterized by compulsive drug-seeking, loss of control over drug use, and use primarily motivated by negative reinforcement of managing psychological and physical withdrawal symptoms (Institute of Medicine, 1996; Koob & Volkow, 2010). It also avoids confusion with those who are merely physically dependent (Institute of Medicine, 1996). The *DSM-5* states that descriptors such as substance dependence and use disorder are preferred due to

the term addiction potentially having more of a negative societal connotation (APA, 2013). The current paper will use the terms substance use disorder (severe), substance dependence, and addiction interchangeably to refer to both alcohol and illicit substance dependence without the inclusion of nicotine dependence.

The Addiction Cycle

Drug dependence follows a progression of neuroadaptations that starts with an initial impulsive action of substance use, which over time leads to compulsive chronic use (Koob & Volkow, 2010). The transition from abuse to dependence is described in a review article by Koob & Volkow (2010) as being comprised of changes in brain-circuitry, which lead to further addictive behaviors. These changes include alteration to reward and motivation systems, changes in conditioning and habituation, impairment of executive functioning and inhibitory control, reduction in self-regulation, and changes in stress reactivity. However, the cycle does not appear exactly the same across all individuals with substance dependence. This is due to interactions with genetic predisposition, developmental stage at which heavy use is initiated, and other environmental factors (Koob & Le Moal, 1997 & Koob & Volkow, 2010).

Changes in Reward and Motivation Systems. For many individuals who go on to develop substance dependence, the initial drug use period is comprised of impulsive administration of drugs/alcohol due to positive reinforcement expectancies of euphoria or other pleasurable attributes (Koob & Bloom, 1988; Koob & Le Moal, 1997; Koob & Volkow, 2010). The positive reinforcing effects of drugs have been tied to increased dopamine production in the meso-corticolimbic dopamine system and its connections to the basal forebrain (Wise & Rompre, 1989). For drugs that directly target the dopaminergic system, such as cocaine and amphetamine, this system is central to the acute reinforcing effects of these drugs (Wise &

Rompre, 1989). While other drugs such as opioids and alcohol have some dopamine-dependent action, they also have dopamine-independent action through other neurotransmitters and receptors such as mu opioid receptors and gamma-aminobutyric acid (GABA) (Koob & Bloom, 1988; Wise & Rompre, 1989). However, all of these neurotransmitters and receptors are associated with the meso-corticolimbic dopamine system and/or its connections to the nucleus accumbens and amygdala (Nestler, 2005).

Individuals with pre-existing brain abnormalities (i.e. neurotransmitter imbalances) related to genetics or environment that contribute to mental health problems such as depression, anxiety, etc., may initiate drug use due to self-medication (negative reinforcement motive) rather than initiation due to positive reinforcement (Blume, Schmaling, & Marlatt, 2000; Khantzian, 1985; Markou, Kosten, Koob, 1998;).

Regardless of initial reinforcement motive, with repeated drug administration, neurochemical changes occur within the nucleus accumbens such as decreases in dopamine and serotonin during drug withdrawal that lead to the next stage of addiction (Weiss & Koob, 2001). The stage following the initial pattern of binge/intoxication involves the transition to use to avoid physical and psychological withdrawal symptoms (Koob & Volkow, 2010). The timing of the shift to this stage interacts with the drug of abuse. For example, opiates cause rapid development of tolerance and withdrawal symptoms that are not only unpleasant, but can be fatal (Koob & Volkow, 2010). The transition to the avoidance of withdrawal symptoms marks a shift from impulsive to more compulsive drug use maintained by negative reinforcement. This is especially the case for psychological withdrawal symptoms which may include dysphoria, anxiety, irritability, etc. (Koob & Volkow, 2010). The motivation to avoid negative withdrawal states induces further drug seeking in an attempt at maintaining homeostasis (Koob & Le Moal, 1997).

All drugs acutely decrease brain stimulation reward thresholds, which serve to increase rewards. However, chronic administration increases reward thresholds, so that more of the drug is needed to achieve similar effects (tolerance) (Kornetsky & Esposito, 1979).

Habituation and Cue Conditioning. There are two main theories that are important in the discussion of the homeostatic struggle during the habituation portion of the addiction cycle: counteradaptation and sensitization (Deroche, Marinelli, Maccari, Le Moal, Simo, & Piazza, 1995; Solomon & Corbit, 1974;). Counteradaptation can be described in terms of Solomon and Corbit's (1974) opponent process theory. According to this theory initial drug use produces an intense affective peak shortly following use and a less intense affective reaction after-effect (psychological withdrawal). As use escalates, there is a change in the hedonic set-point (homeostatic system that regulates affect) so that the brain tries to maintain this set-point by lowering the initial affective reaction (Solomon & Corbit, 1974). There is also an increase in the affective after-reaction, which prompts continued use to avoid withdrawal. This is in contrast to the initial use, with the motive of seeking pleasure (Solomon & Corbit, 1974). Therefore, the opponent process theory essentially describes the transition from positive reinforcement motives to negative reinforcement maintenance of drug addiction. Related to this process, Baker (1998) proposed a negative reinforcement model of drug addiction, which was recently reformulated to include the relationship between cognitive processing and negative affect in drug addiction during this habituation phase (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). According to this theory, individuals develop interoceptive cues that create low level negative affect which alerts them to decreasing drug levels that may not be accessible to conscious awareness (Baker et al., 2004). While an individual may be aware of wanting a drug and administering a drug, they may be unaware of the motivation behind the craving. If drug use is interrupted or there are

significant environmental or internal stressors, negative affect may increase (Baker et al., 2004). Once negative affect enters conscious awareness, the individual experiences conflict in which he or she must decide on a response such as escape/avoidance through drug use versus avoiding drug use. As negative affect becomes heightened with prolonged delay of drug administration, individuals are less likely to be able to access higher level control resources and may resume drug use in order to relieve the negative affective state (Baker, 2004). Unfortunately, because negative affect has become associated with cuing impending drug withdrawal, there is generalization in learning in which other forms of negative affect also begin to serve as a cue motivating drug use. This effect persists even with longer periods of drug abstinence (Baker, 2004). In addition, with a period of abstinence there is a shift in the hedonic set-point and the opponent process theory then predicts that the system will swing back to sensitization of the initial drug effects, but maintain strong affective after-effects, thus leading to a cycle of craving and relapse (Solomon & Corbit, 1974). Thus, we enter the next stage of addiction, which involves craving and preoccupation with use (Koob & Volkow, 2010).

With sensitization to drug use, there is a shift from "liking" to "wanting" that is associated with cravings (Solomon & Corbit, 1974). This shift is due to a change in the mesolimbic dopamine system, which results in addicted individuals not only receiving reinforcement from drugs themselves, but also to cues associated with drug-use (including emotional states) (Koob & Le Moal, 1997; Koob & Volkow, 2010). Besides individuals becoming sensitized to cues associated with drug use, they also experience a narrowing of focus to drug-related cues, due to other formerly reinforcing stimuli no longer being associated with the same level of reinforcement (anhedonia) (Baker, 2004; Koob & Volkow, 2010; Wise, 2008). Baker and colleagues (2004) also described this process as deprivation resulting in heightened

incentive valuation. For example, when individuals are exposed to prolonged periods of starvation, after they have free access to food, they often eat more than is metabolically required. They also often show obsessive thoughts related to food and/or compulsive behavior such as hoarding food. (Crow & Eckert, 2000; Polivy, Zeitlin, Herman, & Beal, 1994). A similar process occurs for drugs, in which deprivation increases the salience associated with cues that indicate availability of drugs and other non-deprivation related cues lose salience (Baker et al., 2004) This effect is found across almost all drugs of abuse, including alcohol (Volkow et al., 1996), cocaine (Volkow et al., 1990), opioids (Zijlstra, Veltman, Booij, Van den Brink, & Franken, 2009), and methamphetamine (Newton, Kalechstein, Duran, Vansluis, & Ling, 2004). All of these substances have been associated with reduction in the level of dopamine receptors in the brain, which decreases dopamine related pleasure for ordinary activities, and leads to strong cravings for the massive dopamine release from drug use (Fowler et al., 2007).

Changes in Executive Functioning and Inhibitory Control. As a shift occurs for sensitization of drug-related cues, changes in executive functioning (mental processes necessary for planning, attention, inhibition of behavior, etc.) contribute to the addiction cycle (Fowler et al., 2007; Goldstein & Volkow, 2002). For example, while many individuals who develop drug addictions are more likely to engage in impulsive behaviors, drug use itself decreases inhibitory control; therefore, resulting in further drug use despite increasing consequences (Goldstein & Volkow, 2002; Koob & Volkow, 2010). Imaging research has also shown addictive drugs reduce volume and cause tissue composition changes in the frontal cortex, which is the part of the brain responsible for executive functions (Fowler et al., 2007). Unfortunately, these brain changes often persist for many months into substance abstinence, and some may reflect permanent changes in brain neurocircuitry (Kreek & Koob, 1998). These changes lead to increased

likelihood of returning to substance use even after periods of prolonged abstinence due to impaired decision-making and inhibitory control processes (Fowler et al., 2007; Kreek & Koob, 1998).

Changes in Self-Regulation. In association with impaired decision making and failure of inhibitory control processes, self-regulation becomes more difficult in later stages of addiction and often leads to common drug-seeking behaviors. Koob and Le Moal (1997) termed this loss of self-control, "spiraling distress." During the process of spiraling distress, the failure to self-regulate substance-seeking behavior leads to emotional distress, which then leads to a cycle of continued self-regulation failure, with additional negative affect occurring with each failure of self-regulation (Koob & Le Moal, 1997). This loss of self-regulation represents an outward manifestation of the dysregulation experienced by the brain reward system and executive functioning system (Koob & Le Moal, 1997).

Changes in Stress Response. As mentioned previously, drug addiction creates a homeostatic crisis in which normal regulatory mechanisms used to try to maintain balance, are no longer able to maintain regulatory control (Koob, 2009). Therefore, the hedonic set-point is altered in an attempt to maintain homeostasis, known as allostasis (Sterling & Eyer, 1988). Unfortunately, unlike homeostasis, which is maintained by a negative feedback mechanism, (eventually returning the system to its original set-point) allostasis uses a feed-forward mechanism to continually shift the set-point in order to achieve balance. For individuals with substance dependence the most severe consequence of this is long-term neuroadaptations that lead to heighted negative emotional experiences (Heilig & Koob, 2007; Koob, 2009). The key mechanism that results in the change in hedonic-set point involves corticotropin-releasing factor (CRF). CRF is an amino acid, which has the highest densities in the paraventricular nucleus

(PVN) of the hypothalamus (Heilig & Koob, 2007; Vale et al., 1981). CRF is also found in extrahypothalamic areas such as in the central nucleus of the amygdala (CeA) and the bed nucleus of the stria terminalis (BNST) (Vale, Spiess, Rivier, & Rivier, 1981). CRF has been found to mediate behavioral stress and anxiety responses through the latter extrahypothalamic areas with CRF_1 receptors (Vale et al., 1981). In addition, CRF interacts with norepinephrine in the brainstem and basal forebrain, which leads to symptoms of chronic negative emotions among individuals in prolonged withdrawal (Koob & Le Mal, 2001). This experience of long-term negative emotionality and hypersensitivity to stress has been associated with all types of drugs of abuse and is a motivating factor in drug-seeking and relapse even in individuals with significant periods of sobriety (Koob, 2009). There are two main types of stress associated with drug-seeking and drug reinstatement. These include stress due to cue-exposure of either the drug itself or associated cues, and behavioral stressors not associated with drug use (Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Shaham, Shalev, Lu, De Wit, & Stewart, 2003). While drugs such as naltrexone (an opioid receptor antagonist) have been found to block cue-related stressors in animal studies, these types of drugs have not proven effective for other types of stressors (Liu & Weiss, 2002). Of note, while animal studies have found that upregulation in the stress system is associated with alcohol and drug use outside of genetic predisposition, it is unclear what role genetics play in humans who are prone to higher alcohol, drug use, or negative emotionality (Heilig & Koob, 2007). Nevertheless, the change in stress-related neurocircuitry is another major factor related to high rates of relapse among individuals with substance dependence.

Addiction as a Disease Characterized by Chronic Relapse

Due to the multiple ways in which brain structure and function is altered during addiction (and before addiction for those genetically predisposed), many researchers have argued that

addiction is best characterized as a chronic, relapsing disease (Leshner, 1997; McLellan, Lewis, O'Brien, Kleber, 2000). This is in contrast to the viewpoint that drug dependence is more of a social problem that should be dealt with through the criminal justice system and not through the health care system (Leshner, 1997; McLellan et al., 2000). The reason why many struggle with the idea of addiction as a disease is because of high relapse rates, even after substance use treatment. However, this implies that drug addiction is an acute condition that is curable with the correct mental health treatment (McLellan et al., 2000).

In their article comparing drug addiction to a medical illness, McLellan and colleagues (2000) compare outcomes for drug addiction to three chronic medical illnesses that also have accepted treatments, but no cures. These included type 2 diabetes, hypertension, and asthma. In terms of heritability McLellan and colleagues put forth the argument that all three medical illnesses and substance dependence have high rates of heritability in monozygotic twin studies (type 2 diabetes .80, hypertension .25-.50, asthma .36-.70, and substance dependence .34-.55). They also discuss how genetics and culture interact with all of these diseases. For example, they discuss some men having a genetically transmitted risk factor for salt sensitivity. While this increases their risk of hypertension, those who come from families who may use less salt may not be as at risk for the development of hypertension (McLellan et al., 2000). Similarly, individuals who inherit a predisposition for substance dependence may be more at risk in an environment where drugs are more easily accessible. McLellan and colleagues also challenge the argument that drug use cannot be a disease because it starts out as a voluntary choice. The element of voluntary choice is also present in individuals with type 2 diabetes and hypertension. In addition, like salt-sensitivity, some individuals may experience vastly different interactions with drugs due to genetic factors. For example, some individuals may be repelled by certain

drugs, while others may experience heightened feelings of euphoria (McLellan, 2000). Lastly, McLellan and colleagues compare the relapse rates found in individuals with these various medical illnesses to individuals with substance dependence. They report that around 40-60% of individuals one-year post-treatment remain abstinent. Similar numbers of medication non-compliance and symptom relapse occur in individuals with diabetes, hypertension, and asthma, and there are even worse outcomes for behavioral and diet-related changes (McLellan, 2000).

With the conceptualization of addiction as a chronic disease, relapse is a frequent occurrence. However, this is no different than other attempts at changing problematic behaviors. Research has found that when individuals try to change a wide array of behaviors from weight loss, to reducing hypertension, to quitting smoking, that these attempts are often characterized by periods of behavioral relapse (Polivy & Herman, 2002; Witkiewitz & Marlatt, 2004). In addition to the neurobiological contributions to relapse reviewed previously, there are also behavioral models of relapse that have been hypothesized. For example, Marlatt (1985) proposed the cognitive-behavioral model of relapse. In this model an individual is presented with a high-risk situation and successful navigation of the situation is dependent upon the person's ability to use effective coping mechanisms and their confidence in their ability to use these coping mechanisms, known as self-efficacy (Marlatt, 1985). This relationship is mediated by expectations individuals have about whether drug use will serve as an effective coping mechanism in the high-risk situation. Marlatt (1996) also proposed different types of situations that are associated with relapse, including intrapersonal (ex. negative emotional states, negative physiological states, positive emotional states, urges/cravings, etc.) and interpersonal situations (interpersonal conflict, social pressure, positive social experiences, etc.). In one sample with substance dependence, he found that the largest factor that explained relapse was the

intrapersonal factor of negative emotional states (Marlatt, 1996). A study by Ramo and Brown (2008) examined similar relapse-related factors and found that in their sample 2/3 of participants reported relapsing due to urges and temptations to drink/use while 1/3 relapsed due to trying to cope with negative emotions. Self-efficacy plays a large role in how individuals respond to various stressors and relapse (Marlatt, Baer, & Quigley, 1995; DiClemente, Fairhurst, & Piotrowski, 1995). Individuals who are more confident in their abilities to use coping strategies in these situations, or who are more confident in the ability to maintain abstinence even after a lapse, are more likely to have better outcomes (Marlatt et al., 1995; DiClemente et al., 1995).

Among individuals with substance dependence, both those receiving treatment and those not receiving treatment, studies report a wide range of relapse rates both in short-term and long-term follow-up studies (Bradizza, Stasiewicz, & Paas, 2006; Moos & Moos, 2006; Scott, Foss, Dennis, 2005; Xie, McHugo, Fox, & Drake, 2005). In a longitudinal study conducted by Scott and colleagues (2005), they explored relapse rates by examining individuals moving through different stages of the addiction cycle over a three-year follow-up period. Their sample included both treated and non-treated participants. This method of examining movement within the addiction cycle is particularly helpful because while abstinence rates may appear stable at a group level across certain periods of follow-up, there may be individual differences in terms of who is cycling in and out of abstinence. Scott and colleagues found that between the intake and 6-month follow-up period that 49.9% of participants moved from one point in the addiction cycle to another. Between 6 to 24 months 53% transitioned to different parts of the cycle, and between 24 to 36 months, 44.9% transitioned. At the 3-year follow-up individuals in the community actively using dropped from 80% to 39.6%. Rates of incarceration increased from 3.6 to 8.9%. Participation in treatment decreased from 15.5% to 10.3%. Participants in the community not

using increased from 8.3% to 41.2% (reflecting many individuals who received treatment re-entering the community and staying abstinent) (Scott et al., 2005). These results clearly indicate that substance dependence involves various cycles over time between active addiction, relapse, and sobriety (Scott et al., 2005). In a study examining long-term follow-up of participants diagnosed with alcohol use disorders (received treatment vs. no treatment), at the 3-year follow-up 62.4% of individuals in the treated group were abstinent versus 43.4% in the no-treatment group (Moos & Moos, 2006). At the 16-year follow-up 60.5% of the individuals who were abstinent at the 3-year follow-up in the no-treatment group had relapsed verses 42.9% in the treatment group. Of note, this study included individuals who had less severe alcohol use disorders, and those in the treatment group were participating in their first alcohol use treatment (Moos & Moos, 2006). In other studies, short-term remission for alcohol use disorder has ranged from 20-50% for treated samples verses 5-45% for non-treated samples (Armor & Meshkoff, 1983; Miller, Walters, & Bennett, 2001). Long-term remission estimates for individuals with alcohol use disorders have ranged from 20-80% relapsing (treated and non-treated samples) (Finney, Moos, Timko, 1999; Jin, Rourke, Patterson, Taylor, Grant, 1998). Another factor to consider in assessing relapse rates is co-occurring mental health disorders. A study by Xie and colleagues (2005) found that for individuals diagnosed with a comorbid severe mental illness, 1/3 had relapsed within the first year following treatment, 1/2 had relapsed within 3 years, and more than 2/3 had relapsed 9 years post-treatment (Xie et al., 2005).

Outcomes Related to Treatment Length

One of the best predictors for sustained sobriety is length of time in treatment. Many studies have found that those who spend at least three months in inpatient residential treatment or one year in methadone maintenance treatment have the best outcomes in terms of substance

reduction or cessation and improved psychosocial functioning (Hubbard, Gail Craddock, Rynn, Anderson, & Etheridge, 1989; Simpson & Joe, 2004; Simpson, Joe, Broome, Killer, Knight, & Rowan-Szal, 1997; Simpson & Sells, 1983). Several studies have used the three-month cut-point as a rigid boundary, indicating that there is little improvement prior to this point, potentially due to lingering withdrawal symptoms (Katz et al., 2004; Simpson & Joe, 2004). However, a study by Zhang and colleagues (2003) found evidence that supports even initial treatment benefits, despite seeing larger benefits with a longer period in treatment (Zhang, Friedman, & Gerstein, 2003). Zhang and colleagues sample consisted of 4,005 clients from four types of treatment facilities: outpatient methadone maintenance, outpatient non-methadone maintenance, short-term residential treatment, and long-term residential treatment. Clients in methadone maintenance treatment spent an average of 8.8 months in treatment compared to clients in non-methadone maintenance outpatient treatment who spent an average of 4.4 months in treatment. Participants in short-term residential spent an average of .7 months in treatment compared with long-term residential in which participants spent an average of 4.3 months in treatment (Zhang et al., 2003). Zhang and colleagues found that no matter the treatment modality or length of treatment duration, there were statistically significant improvements in primary and overall drug use. This indicates that even those who only briefly admit to substance use treatment experience some benefits (Zhang et al., 2003). However, clients in long-term residential treatment showed greater overall improvements in terms of substance use compared to short-term residential treatment participants and methadone maintenance treatment participants. All of these groups showed greater improvements overall compared to outpatient non-methadone maintenance treatment (Zhang et al., 2003). In long-term residential treatment and methadone-maintenance there was an inverted U relationship between treatment duration and substance use improvements. This

indicates that there are limited benefits for short-treatment durations, but also reduction in benefits with long-term treatment stays extending around a year or more (Zhang et al., 2003). Zhang and colleagues concluded that while the three-month treatment marker may not be a hard and fast cut-point, those who stay for longer-term treatment, (up to a certain threshold) have better outcomes. However, those who stay relatively longer than others, but do not meet the three-month mark, still do better in comparison to those who drop out at the beginning of treatment (Zhang et al., 2003).

A major problem plaguing substance use treatment is high attrition rates, especially during the first month of addiction treatment (Harris, 1998; Simpson et al., 1997). Several studies have found that dropouts in the first month of treatment (non-methadone maintenance) occur for about 30% of clients (Harris, 1998; Hubbard et al., 1989; Simpson, 1981). By the recommended average length of treatment (three months) more than 50% of clients will drop out (Hubbard et al., 1989; Simpson et al., 1997). Since time in treatment is such an important predictor of treatment outcomes, a large body of research has focused on predictors of treatment dropout, but with variable success.

Predictors of Treatment Dropout

Much of the focus in predicting treatment attrition has been on demographic variables. However, these variables have been inconsistent, or at best, represent a relatively small amount of variance in understanding treatment dropout (Brorson, Arnevik, Rand-Hendriksen, & Duckert, 2013; Harris, 1998; Wierzbicki & Pekarik, 1993). The main demographic variables that have been studied include gender, race, age, socioeconomic status, education level, and employment status. In regard to gender, the majority of findings examined in meta-analyses have found gender not to be a significant predictive factor of treatment dropout. However, those that did find

gender to be a significant predictor of treatment attrition, found that males are more likely than females to drop out of treatment prematurely (Brorson et al., 2013; McKay & Weiss, 2001; Wierzbicki & Pekarik, 1993). In regard to race, there have been similarly mixed results. In a study by Milligan and colleagues (2004) being African American was related to treatment dropout (Milligan, Nich, & Carroll, 2004). However, in another study by Ball and colleagues (2006) race was not a significant variable in this relationship (Ball, Carroll, Canning-Ball, & Rounsaville, 2006). In the most recent meta-analysis on substance dependence treatment dropout factors by Brorson and colleagues (2013), racial status was not a significant predictor. Among the demographic predictors, younger age is one of the better predictors of treatment dropout, although it is not without its inconsistencies (Brorson et al., 2013). Studies have either found younger age to be predictive of treatment dropout or they have found no relationship with age. There have not been any studies finding older age to be associated with treatment dropout (Ball et al., 2006; Brorson et al., 2013; McKay & Weiss, 2001; McKellar, Kelly, Harris, & Moos, 2006). In examining socioeconomic status (SES), two meta-analyses have found significant predictive ability of lower SES and treatment dropout (Stark, 1992; Wierzbicki & Pekarik, 1993). However, SES was not a significant factor in the meta-analysis conducted by Brorson and colleagues (2013). Related to SES, lower education has been a significant predictor of dropout in some studies, but other studies have found no relationship (Ball et al., 2006; Brorson et al., 2013; Wierzbicki & Pekarik, 1993). Finally, employment status has also been an unreliable predictor. Some studies have found that being unemployed is related to treatment dropout, while others have found no association (Ball et al., 2006; Mertens & Weisner, 2000; Veach, Remley, Kippers, & Sorg, 2000). The overall message that authors of meta-analyses have portrayed is that continuing to focus on demographic variables alone to predict treatment dropout is not useful.

Examination of these variables has not led to meaningful information to guide decisions about interventions or identification of high-risk clients (Brorson et al., 2013; Craig, 1985). Instead, authors of meta-analyses have suggested that researchers shift their focus to other variables such as differences in symptom presentation and emotional and cognitive differences between clients (Brorson et al., 2013; Craig, 1985)

Another main variable outside of demographics that has been studied in relationship to predicting treatment attrition is motivation (Brorson et al., 2013). Ways of examining motivation in the context of addiction typically fall into three main categories: motivation as stages of change, readiness to change, and readiness for treatment. While these variables are very similar, they are not entirely interchangeable and have different predictive utilities (DiClemente, Schlundt, & Gemmell, 2004). Prochaska and DiClemente (1986) outlined the Transtheoretical Model (TTM) of intentional behavior change that is comprised of five stages that individuals pass through during the behavior change process. These stages include precontemplation, contemplation, preparation, action, and maintenance (Prochaska & DiClemente, 1986). Regarding the variable of readiness, it is broader than the stages of change and refers more to a willingness, openness, or preparedness for making a behavior change. There are two types of readiness that are often measured including general readiness to make a change and specific readiness for treatment (DiClemente et al., 2004). While motivation and readiness to change are likely important factors in predicting treatment outcomes, unfortunately they have been inconsistent in helping to predict treatment attrition (Cahill, Adinoff, Hosig, Muller, & Pilliam, 2003; De Weert-Van Oene, Schippers, De Jong, & Schrijvers, 2001; Joe et al., 1999; Ryan et al., 1995; Simpson & Joe, 1993). In a recent meta-analysis motivation was found to have a significant relationship in predicting treatment dropout in five out of nine studies that examined

the variable (Brorson et al., 2013). Two studies found that lower motivation was related to higher dropout, two studies found that higher motivation was related to higher dropout, and one study found that higher extrinsic motivation (such as being on probation) was related to higher dropouts, but found that intrinsic motivation was unrelated (Brorson et al., 2013). There are several possible reasons why motivation has not provided consistent results, outside of motivation not serving as a good predictor of treatment dropout. One potential reason for the inconsistent findings is likely due to different scales being used to measure motivation and readiness to change (DiClemente et al., 2004). In addition, most measurements are taken at one time point, and motivation is not a stable construct, and may change at various points in the treatment process. Another reason may be that clients are often not forthcoming about their actual motivation levels or may underestimate the amount of work required to make such a large behavioral change (DiClemente et al., 2004). Finally, motivation may interact with other variables, such that looking at overall group levels of motivation yields inconsistent findings. For example, in a study by Ali (2017) and colleagues, they found that the effect of motivation and readiness to change on treatment retention interacted with distress tolerance (Ali, Green, Daughters, & Lejuez, 2017). Individuals high in ability to tolerate distress were more likely to stay in treatment if they had higher motivation and readiness to change, but were more likely to drop out of treatment with low motivation and readiness to change. For individuals with poor distress tolerance the reverse was true (Ali et al., 2017).

In examining more patient-related variables, another area of focus has been on severity of substance use and associated co-occurring mental health disorders. The findings on severity of drug use have not provided much clarity in predicting treatment dropout. While some studies have found that lower severity of alcohol/substance use problems and lower dependency are

associated with higher rates of treatment dropout (Joe, Simpson, & Broome, 1999; McKellar et al., 2002; Ryan, Plant, & O'Malley, 1995), other studies have found that more severe drug use is associated with treatment dropout (Fishman, Reynolds, & Riedel, 1999; Wickizer et al., 1994). Similarly, differences in co-occurring psychological disorders have also not yielded much predictive value. For example, some researchers have found that the presence of an Axis I disorder was predictive of increased treatment retention (Siqueland et al., 1998), while others have found that the presence of an Axis I disorder decreases treatment retention (Green, Polen, Dickinson, Lynch, & Bennett, 2002; Kokkevi, Stefanis, Anastasopoulou, & Kostogianni, 1998). Still others have found that there is no relationship between Axis I disorders and addiction treatment dropout (Miller, Ninonuevo, Hoffmann, & Astrachan, 1999). However, there have been some more reliable results when examining personality disorders. Borderline, Antisocial, and Histrionic Personality Disorders (Cluster B Personality Disorders) have been associated with early attrition from addiction treatment (Brorson et al., 2013; Martinez-Raga, Marshall, Keaney, Ball, & Strang 2002). Therefore, while focusing on specific diagnoses may not be as helpful in terms of predicting treatment attrition, it may be fruitful to instead focus on transdiagnostic symptoms of psychological disorders, especially if they are related to Cluster B Personality Disorders.

Emotion Regulation as Predictor of Treatment Dropout

An Overview of Emotion Regulation. As demonstrated above, much of the work in discerning attrition-related variables has fallen into the examination of demographic or diagnosis-specific factors. There has been less focus on looking at transdiagnostic factors that span across discrete psychological diagnoses and across demographics (Hopwood, Schade, Matusiewicz, Daughter, & Lejuez, 2015). The National Institute of Mental Health (NIMH)

proposed that there has been a divide in the way that clinical and neuroscience research has been conducted for various forms of psychopathology, including substance dependence (Sanislow et al., 2010). In order to better integrate these two fields, the Research Domain Criteria (RDoC) framework was created in an attempt to shift the focus from examining traditional diagnostic categories composed of diverse underlying mechanisms, to examining specific psychological and biological mechanisms that underly these disorders and span across various diagnoses (Sanislow et al., 2010). Emotion regulation is a transdiagnostic construct that represents many of the difficulties that patients have early in addiction treatment, and is often impacted directly by neurobiological changes, either due to substance use itself or due to co-occurring disorders associated with substance use (Grantz & Tull, 2010; Hopwood et al., 2015). There are discrepancies in how the term emotion regulation has been defined (Gratz & Tull, 2010). Some researchers define emotion regulation in terms of one's control over emotions and ability to reduce the frequency of negative emotions (Kopp, 1989; Zeman & Garber, 1996). The problem with this definition is that it implies that negative emotions themselves indicate emotion dysregulation and that the treatment for this dysregulation would be emotional suppression and control (Gratz & Tull, 2010.) However, a large body of research shows that attempts at emotional control are often unhealthy and produce paradoxical effects. For example, individuals who use suppression or avoidance as coping mechanisms often experience increased frequency and intrusiveness of these thoughts or emotions (Gratz & Tull, 2010; Hayes, Luoma, Bond, Masuda, & Lillis, 2006). An alternative to this approach to understanding emotion regulation, focuses on emotional regulation as the ability to control one's *behaviors*, as opposed to one's emotions (Linehan, 1993). From this approach, all emotions, regardless of valence are considered to be useful. Instead, it is the ability to inhibit emotional reactions, that are not in

service of long-term goals, that defines emotion regulation (Gratz & Tull, 2010; Linehan, 1993). Inherit in modulating behaviors associated with emotions is the ability to reduce emotional intensity and duration in order to reduce the urgency associated with the emotion to react in an impulsive manner (Thompson, 1994). This leads to the second area of contention in defining emotion regulation (Gratz & Tull, 2010). Some researchers have concluded that the mere presence of more negative emotional intensity and duration is equivalent to emotion dysregulation (Livesley, Jang, & Vernon, 1998). For example, researchers who take on this perspective view individuals who have higher trait experiences of emotional intensity/reactivity as being more emotionally dysregulated, basically equating emotion dysregulation with proclivity to experience negative affect (Livesley et al., 1998). While emotional intensity and reactivity may certainly be risk factors for emotion dysregulation, research has shown that not all individuals with increased emotional intensity and reactivity have negative psychological outcomes (Flett, Blankstein, & Obertynski, 1996; Gratz, 2006; Larsen & Diener, 1987). In contrast, most researchers separate emotion regulation from the intensity or duration of emotional response and instead conceptualize that emotion dysregulation can occur even in individuals lower in emotional arousal in general (Linehan, 1993; Mennin et al., 2005). Gratz and Roemer (2004) developed a definition of emotion regulation that focuses on adaptive ways of responding to emotions rather than on emotional control or general emotional arousal. Their definition includes the ability to be aware, understand, and accept emotions; the ability to engage in behaviors that reflect long-term goals in response to emotions; the ability to inhibit impulsive behaviors in response to emotions; the ability to use different coping mechanisms based on the particular situation to help modulate intensity and duration of emotional experiences; and the

willingness to experience a wide-range of emotions as part of living a meaningful life (Gratz & Roemer, 2004).

Emotion regulation difficulties underly many different areas of psychopathology including self-harm, substance use, binge eating, depression, generalized anxiety disorder, posttraumatic stress disorder, and borderline personality disorder (Gratz & Tull, 2010). Treatments that focus on acceptance and mindfulness have been shown to be particularly helpful in improving emotion regulation and in increasing flexibility in responding to emotions (Gratz, & Tull, 2010). Therapies that incorporate these types of strategies include Dialectical Behavioral Therapy (DBT; Linehan, 1993), Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams, & Teasdale, 2002), and Mindfulness-Based Stress Reduction (MBSR; Kabat- Zinn, 2005). Therefore, unlike demographic variables, age of first substance use, or addiction severity, emotion regulation is a factor that can be directly impacted by effective treatments if it is found to be a key factor in predicting addiction-related outcomes.

The Relationship between Emotion Regulation and Substance Dependence. As reviewed previously, many neurobiological changes associated with the development and maintenance of addiction are also related to emotion dysregulation. In a review article by Murphy and colleagues (2012), they detail how substance dependence is essentially a disorder characterized by emotion dysregulation due to changes in brain reward circuitry, which results in impulsivity, compulsivity, and impaired decision-making (Murphy, Taylor, & Elliott, 2012). Murphy and colleagues discuss the sensitization of drug-cues as a process of emotion dysregulation. For example, learning occurs during emotion-related processing through both classical and operant conditioning. In the context of classical conditioning, previously neutral

stimuli associated with drug-use become conditioned stimuli and produce their own conditioned response, thereby high-jacking emotion related processing when around drug-related cues (Murphy et al., 2012). In addition, as mentioned previously, both positive and negative reinforcement play a strong role in the addiction cycle and as substance use increases, neuroadaptations in the brain make it more difficult for individuals to control behavior when experiencing either positive or negative emotions (Murphy et al., 2012; Woicik, Stewart, Pihl, & Conrod, 2009). Finally, as also discussed previously, substance use impairs the brain's stress system, causing emotional hyperarousal and problems dealing with stress. Therefore, impulsivity, higher levels of negative affect, and problems with distress tolerance due to addictive processes may also underly difficulties with emotion regulation (Murphy et al., 2012), and this is without even considering the likely deficits in these areas prior to substance use in individuals who go on to develop substance dependence.

There are several self-report measures that examine emotion regulation, with the most popular being the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). The DERS provides a total score that measures overall difficulties in emotion regulation. It also contains six subscales that measure emotional nonacceptance, difficulties engaging in goal-directed behaviors when distressed, difficulties controlling impulsive behaviors when distressed, lack of emotional awareness, limited access to emotion regulation strategies perceived as effective, and lack of emotional clarity (Gratz & Roemer, 2004). Unfortunately, there are no frequently used behavioral measures of emotion regulation, perhaps because it is comprised of many different behavioral components.

There have been several recent studies examining the relationship between emotion regulation and substance dependence. In a study by Dingle and colleagues (2018), adults in

residential substance use treatment reported significantly more emotion regulation difficulties on the DERS than healthy controls (Dingle, Neves, Alhadad, & Hides, 2018). In addition, they also reported higher levels of negative self-evaluation and social expectancies not to feel negative emotions in comparison to healthy controls. During a paradigm in which participants viewed various facial expressions, the participants with substance dependence showed less flexibility in their emotional expressions in reaction to viewing the facial expressions in comparison to control participants (Dingle et al., 2018). Another study utilizing the DERS, found that individuals with alcohol dependence had greater difficulties with regulating their emotions due to deficits in emotional awareness and impulse control compared with social drinkers (Fox, Hong, Sinha, 2008). In a study utilizing the DERS with a cocaine dependent population early in sobriety, cocaine dependent individuals reported more difficulties with emotional clarity and awareness compared to healthy controls. They also reported more difficulties with use of emotional strategies and more problems with impulse control compared to controls (Fox, Axelrod, Paliwal, Sleeper, & Sinha, 2007). In a study utilizing the Emotion Dysregulation Scale, emotion dysregulation added incremental validity in predicting alcohol and substance abuse above and beyond the variability accounted for by negative affect, indicating that emotion dysregulation is not reducible to trait negative affect or neuroticism (Bradley et al., 2011).

Emotion Regulation and Treatment Attrition. Outside of studies linking emotion regulation to prediction of the presence of substance dependence or abstinence duration, there have also been several studies examining the role of emotion regulation on substance dependence treatment dropout rates. Emotion regulation appears to have a special role in treatment attrition, especially in residential inpatient treatment programs due to the unique requirements for these programs (Hopwood et al., 2015). For example, most substance use

treatment at least partially focuses on the ability to identify emotional triggers for relapse and emotion triggers that are tied to abuse (Marlatt & Gordon, 1985). In addition, treatment often consists of imparting new coping mechanisms for dealing with addiction, and effective use of these strategies may depend on the client's emotional awareness, ability to implement these strategies flexibly, and ability to inhibit impulsive behavior long enough to use more adaptive coping skills (Hopwood et al., 2015). Another factor related to residential treatment, is that most clients enter with at least some ambivalence about whether or not they have a substance use problem and need treatment. Other factors such as physical and psychological withdrawal symptoms, cravings, and general distress from being around other clients who may also be in a precarious emotional state, may lead to difficulty tolerating distress and impulsive behaviors such as dropping out of treatment early or engaging in behaviors that would lead to dismissal from the treatment program (Davidson, Putnam, Larson, 2000; Heilman, Crisan, Houser, Miclea, & Miu, 2010; Hopwood et al., 2015). In a study by Hopwood and colleagues (2015), emotion regulation was examined to determine if it predicted residential treatment dropout, above and beyond related factors of motivation and trait negative emotionality. On the DERS, clients with more problems with emotional clarity and less ability to engage in goal directed behavior despite emotional distress, were more like to drop out of treatment prematurely. Clients that dropped out of treatment early were also more likely to experience negative emotions, but emotion regulation difficulties still provided additional predictive validity. In addition, motivation was not related to treatment dropout (Hopwood et al., 2015).

Distress Tolerance as a Component of Emotion Regulation

An Overview of Distress Tolerance. Another transdiagnostic construct related to emotion regulation is distress tolerance. There are multiple definitions of distress tolerance, but

most converge on distress tolerance involving behavioral inhibition (not engaging in negative reinforcement opportunities, such as avoidance) during aversive states, especially in relationship to negative emotions (Leyro, Zvolensky, & Bernstein, 2010; Trafton & Gifford, 2010). Therefore, individuals with poor distress tolerance may choose immediate rewards as opposed to withstanding negative experiences to be able to gain access to delayed reinforcers that are more in line with long-term goals. According to Trafton and Gifford (2010), an individual's ability to tolerate distress is mediated by neurobiological mechanisms underlying reward learning and response inhibition, similar to emotion regulation. Distress tolerance is closely related to emotion regulation, as emotional regulation involves difficulties in emotional functioning and behavioral control, and problems with distress tolerance may represent a facet of difficulties regulating emotions (Leyro et al., 2010; Linehan, 1993). For example, individuals with lower emotion regulation abilities may be more likely to experience higher levels of emotional distress, which may result in reduced ability to cope with the distress except through escape and avoidance. Alternatively, use of more maladaptive distress coping mechanisms may leave individuals feeling in less control of their ability to regulate emotions, which may in turn lead to further emotion regulation failures (Van Eck, Warren, Flory, 2017). In a study by Jeffries and colleagues (2016) they examined which types of emotion regulation strategies individuals with high versus low distress tolerance were more likely to engage (Jeffries, McLeish, Kraemer, Avallone, Fleming, 2016). Individuals with low distress tolerance were more likely to engage in suppression, avoidance, and rumination compared to those high in distress tolerance. However, those higher in distress tolerance were not more likely to engage in a more adaptive emotion regulation strategy of reappraisal (Jeffries et al., 2016). This may indicate that while problems with distress tolerance may include using poor emotion regulation strategies, that there is still a

distinction between the two constructs, since those higher in distress tolerance did not engage in the healthier emotion regulation strategy. A possible reason for this is that higher levels of negative affect may also be involved, in which individuals with lower levels of distress tolerance have to deal with more negative emotions and become more easily overwhelmed (Leyro et al., 2010), whereas individuals with higher distress tolerance may not have experienced as much taxing of the system with negative emotions (Jeffries et al., 2016). Individuals who use substances or alcohol to cope with negative affect are more prone to having trouble tolerating negative emotions and may experience more distress in response to negative emotions (Carey & Correia, 1997; Carpenter & Hasin, 1999).

Measures of Distress Tolerance. There are several ways to measure distress tolerance. Researchers have argued that self-report measures and behavioral measures do not necessarily measure the same construct. For example, while self-report measures assess an individual's beliefs about whether they *could* tolerate some future distress, behavioral measures measure an individual's *actual* ability to sustain behavior on the task despite the opportunity for negative reinforcement of quitting and reducing stress associated with the task (Leyro et al., 2010). The most popular self-report measure of distress tolerance is the Distress Tolerance Scale (DTS; Simons & Gaher, 2005). This scale measures five areas related to distress tolerance, specifically related to withstanding negative emotions. These areas include the individual's anticipation of experiencing negative emotions, assessment of whether or not the emotional situation is acceptable, ability to tolerate negative emotions in a situation, attention focused on the negative emotion, and emotion regulation strategies. There are several behavioral measures of distress tolerance that utilize difficult cognitive tests to induce stress and frustration. Some examples of these include the Paced Auditory Serial Addition Task (PASAT; Lejuez, Kahler, & Brown,

2003) and the Mirror-Tracing Persistence Task (MTPT; Strong, Lejuez, Daughters, Marinello, Kahler, & Brown, 2003). There are also behavioral measures of physical distress tolerance including breath holding and the cold pressor task (Glassman et al., 2016). There is some early evidence that the ability to engage in cognitive tasks of distress tolerance despite high degree of psychological frustration, is related to the ability to maintain abstinence from substance use despite distress and availability of negative reinforcement opportunities (Brandon, Herzog, Juliano, Irvin, Lazev, & Simmons et al., 2003).

Distress Tolerance and Substance Dependence. In a study by Daughters and colleagues (2015a), they examined two psychologically stressful cognitive measures, the PASAT (visual computerized version, Lejuez et al., 2003) and the computerized MTPT (Strong, et al., 2003). For the PASAT numbers were flashed sequentially on a computer and participants had to add the presented number to the previously presented number, while inhibiting the answer that they had just given. The PASAT was administered in three levels with decreasing latencies between numbers. Participants were told that once they started the final level they could end the task at any time; however, the amount of money they would make at the end of the session would depend on their performance on the task. The researchers measured psychological distress tolerance by examining latency in seconds to task termination (Daughters et al., 2005a). For the MTPT, participants traced a red dot along a star on the computer which moved in the reverse direction. If the red dot was moved outside of the star or if there was a pause for more than two seconds, a loud buzzer would sound and the participant would return to the starting position. Participants could end this task at any time, but were also told on this task that how well they did would affect how much money they would make. Psychological distress tolerance was again measured in terms of latency in seconds to task termination (Daughters et al., 2005a). Physical

distress was also measured through two behavioral measures including breath holding and a cold presser task. Participants completed these measures during the first week of residential treatment after detox. Both measures of psychological distress were predictive of earlier treatment dropout above and beyond demographic variables. Additionally, accuracy of task completion was not related to latency for quitting the task, reducing the possibility that tasks were confounded by higher intelligence or better task performance. Physical distress tolerance was not related to treatment dropout (Daughters et al., 2005a). In a second study by Daughters and colleagues (2005b) using the PASAT, they found that abstinence duration was related to persistence on the PASAT, above and beyond the influence of demographics, substance use level, and trait negative affect (Daughters, Lejuez, Bornovalova, Kahler, Strong, & Brown, 2005b).

Impulsivity as a Component of Emotion Regulation

An Overview of Impulsivity. Impulsivity is another transdiagnostic term, that is broadly defined as a tendency to act without appropriate forethought (Evenden, 1999). However, there are many different types of impulsivity that have been researched. These typically fall into areas of reflexive impulsivity, impulsive action, risky decision-making, attentional impulsivity, emotional impulsivity, and sensation seeking (Murphy et al., 2012). Reflexive impulsivity involves action without appropriate evaluation of the situation and its consequences, and has sometimes been called lack of premeditation (Dalley, Everitt, & Robbins, 2011; Whiteside & Lynam, 2001). Impulsive action involves problems with motor inhibition. Risky decision-making involves problems examining risks versus benefits, especially for delayed benefits (Dalley et al., 2011). Attentional impulsivity has also been called lack of perseverance and is related to problems focusing on tasks or goals (Whiteside & Lynam, 2001). Emotional impulsivity has been split into two concepts: positive and negative urgency. Positive urgency

refers to rash action due to experiencing positive affect, while negative urgency involves rash action in response to experiencing negative affect (Cyders & Smith, 2008). Finally, sensation seeking is related to seeking out novel, varied, and often risky experiences to increase positive affect (Zuckerman, 2007).

Measures of Impulsivity. There are several self-report measures of impulsivity. Three of the most popular measures include the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995) Eysenck's Impulsiveness Scale (Eysenck & Eysenck, 1978), and the UPPS-P Impulsive Behavior Scale (Lynam, Smith, Whiteside, & Cyders, 2006). There are also several behavioral paradigms that measure different types of impulsivity including delayed discounting, behavioral response inhibition, attention and memory, and risky decision making (Loree et al., 2014).

Impulsivity and Substance Dependence. Despite impulsivity being a multifaceted construct, multiple studies have found that substance use disorders are related to various types of impulsivity and are predictive of treatment outcome and risk of relapse (Charney, Zikos, & Gill, 2009; Moeller, Dougherty, Barratt, Schmitz, Swann, & Grabowski, 2001; Verdejo-Garcia, Lawrence, & Clark, 2008). This is likely due to impulsivity not only being a pre-existing trait that influences the development of substance use, but also a consequence of executive functioning deficits due to substance dependence (Loree, Lundahl, & Ledgerwood, 2014). For example, the prefrontal cortex (PFC) is the area that controls many executive functions such as attention, working memory, delay discounting, and self-control (Goldstein & Volkow, 2012). The orbitofrontal cortex (OFC) is associated with planning and reward valuation. In addition, it works with subcortical emotion systems such as the amygdala to include emotion-based feedback. These systems are all affected by long-term drug use (Elliott, Newman, Longe, &

Deakin, 2003; Goldstein & Volkow, 2012). The dorsal anterior cingulate cortex (dACC) is another area involved in attention and decision making. The dACC is connected to both the PFC and the amygdala (Goldstein & Volkow, 2012). In several studies involving inhibitory control in individuals with substance dependence, the dACC was found to be hypoactive, which may explain some impairment in task performance (Goldstein & Volkow, 2012).

Higher levels of impulsivity have been found for individuals across different types of substances (Verdejo-Garcia et al., 2008). In addition, abuse of more than one substance has been associated with higher levels of impulsivity (Patkar et al., 2004). In relationship specifically to treatment dropout, in a sample of clients with alcohol dependence, scores on the BIS-11 were associated with higher rates of relapse within the first 28 days (Charney et al., 2010). Another study found that higher sensation seeking was associated with earlier treatment dropout for individuals with alcohol dependence (Kravitz, Fawcett, McGuire, Kravitz, & Whitney, 1999). Similarly, for individuals with cocaine dependence, higher BIS-11 scores predicted treatment dropout (Moeller et al., 2001). Deficits in emotional impulsivity (negative and positive urgency) have also been an area of much research consideration in relationship to substance dependence. Both negative and positive urgency may explain part of the difficulty in controlling behavior when experiencing positive or negative emotions during addiction (Woicik et al., 2009). In fact, negative and positive urgency have been more strongly related with risky behaviors than other dimensions of impulsivity (Cyders, Flory, Rainer, & Smith, 2009; Cyders & Smith, 2008; Cyders, Smith, Spillane, Fischer, Annus, & Peterson, 2007) and these dimensions are found to be higher in polysubstance users (Verdejo-Garcia et al., 2010).

In terms of the relationship between impulsivity and emotion regulation, researchers have speculated that emotion dysregulation and altered reward sensitivity due to chronic drug use may

result in increased impulsive behavior and poor decision-making due to seeking out negative reinforcement (Cheetham, Allen, Yucel, & Lubman, 2010; Murphy et al., 2012). In a study by Weiss and colleagues (2015) the relationship between emotion dysregulation and impulsivity was examined in a college population (Weiss, Tull, Davis, Searcy, Williams, & Gratz, 2015). Students received one session treatments consisting of either emotion modulation or impulsivity reduction. They completed measures of emotion dysregulation, impulsivity, and past-week risky behaviors prior to the treatments and one week after the treatments (Weiss et al., 2015). Participants who received the emotion modulation treatment reported not only significant improvement with overall emotion dysregulation, but also reported improvements in negative and positive urgency. Participants who received the impulsivity reduction treatment only experienced a decrease in lack of premeditation. Changes in emotion dysregulation pre to post treatment accounted for reduction in risky behaviors from pre to post treatment, above and beyond changes in impulsivity dimensions (Weiss et al., 2015). This suggests that individuals who make riskier decisions, may be more impulsive in response to problems with emotion dysregulation because they may not consider the long-term consequences of the behavior if it serves to immediately reduce negative emotions (Heatherton & Baumeister, 1991). On the other hand, risky behaviors may also increase negative emotions, such as guilt and shame, which may lead to further emotion dysregulation (Weiss et al., 2015). In a study by Weiss and colleagues (2012) using a sample of substance dependent patients with posttraumatic stress disorder (PTSD), emotion dysregulation mediated the relationship between PTSD symptoms and impulsivity. This suggests that emotion dysregulation may be an underlying mechanism for impulsive behavior (Weiss, Tull, Viana, Anestis, & Gratz, 2012).

Trait Negative Affect as a Component of Emotion Regulation

An Overview of Trait Negative Affect. Trait negative affect is an underlying factor across many different psychological disorders. Affect can be described both in the context of trait (more stable patterns of affective responding) versus state (more transient emotional responses) (Cheetham et al., 2010). Trait negative affect describes an individual's propensity towards experiencing more negative affective states such as sadness, anger, anxiety, guilt, etc. (Watson & Clark, 1999). As mentioned previously, some definitions of emotion dysregulation are based off of the experience of higher levels of trait negative affect; however, it is more likely that higher trait negative affect is a risk factor for having problems with emotion regulation (Gratz & Tull, 2010). For example, experiencing more negative emotions utilizes a lot of regulatory capacity, which may not be as available for individuals early in sobriety. Therefore, continual negative affect may deplete limited self-regulatory systems resulting in more impulsive responses to high emotion (urgency) (Cheetham et al., 2010). Besides the effects of long-term drug use depleting self-regulatory systems, individuals with high levels of trait negative affect may be more likely to use drugs or alcohol as a coping mechanism for dealing with these negative mood states, and experiencing negative affect during abstinence may serve as a strong cue for drug craving (Cheetham et al., 2010).

Many studies measuring the relationship between emotion regulation and substance dependence, also have examined trait negative affect, often to prove that a relationship extends beyond negative affect for emotion dysregulation (Bradley et al., 2015; Hopwood et al., 2015). However, trait negative affect might play an important role in emotion dysregulation, especially in terms of impulsive behaviors. Several studies have utilized a behavioral measure of impulsive risk-taking, the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) with a stress induction.

On the BART, participants pump balloons in an attempt to maximize money earned. While some balloons can be pumped more to earn more money, balloons can pop at any time, which results in all money from that balloon being lost. If participants choose to keep the money they have earned for a particular balloon before it pops, this money contributes towards their overall total. Each pump increases the probability of the balloon popping, so more pumps on this task are considered to reflect riskier decision making (Lejuez et al., 2002). Studies using the BART have found increased impulsive responding with a negative mood induction for males, although women show a different pattern and are more likely to become more risk averse (Daughters, Gorka, Matusiewicz, & Anderson, 2013; Lighthall, Mather, & Gorlick, 2009).

Because high levels of negative affect likely contribute to poor decision making in individuals with addiction, such as relapse, researchers have examined the role of negative affect inductions on impulsivity in populations with substance dependence. For example, in a study by Zhang and colleagues (2011), a stress induction reduced performance on the Iowa Gambling Task for heroin users in early and longer-term abstinence, but did not impair performance for control participants.

The Present Study

For individuals with severe substance dependence, addiction processes are akin to chronic diseases, and as such, are often characterized by multiple relapses (McLellan et al., 2000). Rates of relapse among individuals with substance dependence range from 40-60% and remain high even among individuals receiving substance use treatment (McLellan et al., 2000). A key factor related to substance use treatment efficacy is the length of time individuals remain in treatment (Hubbard et al., 1989; Simpson et al., 1997; Simpson & Joe, 2004). Treatment outcomes have been shown to be the most favorable for those staying in treatment for at least

three months (Simpson et al., 1997). However, there is a high rate of treatment dropout, with only about 60-70% of clients completing detox and less than half of individuals completing more long-term inpatient treatment (Harris, 1998; Hubbard et al., 1989; Loveland & Driscoll, 2014; Simpson, 1981). There have been multiple studies examining demographics and diagnostic-specific factors in an attempt to predict treatment dropout, but for the most part these findings have been inconsistent (Brorson et al., 2013).

There current study focused on transdiagnostic factors that span across discrete psychological diagnoses and across demographics (Hopwood et al., 2015). Emotion regulation is a transdiagnostic construct that represents many of the difficulties that patients have early in treatment, either due to substance use itself or due to co-occurring disorders associated with substance use (Grantz & Tull, 2010; Hopwood et al., 2015). There are several components of emotion regulation that are particularly relevant for dealing with the emotional experiences that go along with factors present during inpatient substance use treatment such as post-acute withdrawal symptoms, having to live with other people who may be difficult to get along with, and having to discuss and process emotional issues (Hopwood et al., 2015). Components involved in regulating emotions include ability to tolerate distress, ability to react in a non-impulsive manner in response to emotions (positive and negative urgency), and level of trait negative affect (Hopwood et al., 2015). Individuals who have a more difficult time tolerating distress are more likely to impulsively leave treatment when exposed to a stressor. Also, those with higher experiences of negative affect may be more prone to finding the experience of treatment particularly stressful (Daughters et al., 2005; Hopwood et al., 2015).

Specifically, the current study explored whether individuals who have higher levels of emotion regulation and associated factors (distress tolerance, impulsivity, and trait negative

affect) are more likely to drop out of inpatient substance use treatment prematurely, and to determine if these problems explain variance in dropout above and beyond demographic and patient-related factors. The current study also utilized both self-report and behavioral measures of these traits in order to capture differences between client perceptions of these traits and actual measures of them. The current study also examined if deficits in emotion regulation and related constructs improved during the course of inpatient residential treatment.

Aims and Hypotheses of the Present Study

Specific Aim 1. To determine whether emotion regulation and associated constructs of distress tolerance, impulsivity, and trait negative affect predicted treatment dropout during inpatient substance use treatment (typical stay between 28-30 days) above and beyond demographic variables, substance use-related variables, and/or readiness for change.

*Hypothesis 1.1***.** It was hypothesized that demographic variables, readiness for change, and substance use-related variables would not be predictive of treatment dropout.

Hypothesis 1.2. It was hypothesized that participants with higher scores on self-report measures of emotion dysregulation, distress tolerance, positive and negative urgency, and trait negative affect during the beginning of treatment would be more likely to drop out of treatment prematurely. It was also hypothesized that if there were significant demographic, motivational, or substance use-related variables that predicted treatment dropout, self-report variables related to emotion dysregulation would continue to serve as significant predictors of treatment dropout after accounting for these covariates.

Hypothesis 1.3. It was hypothesized that behavioral measure outcomes taken during the beginning of treatment associated with poorer distress tolerance skills and risky decision-making in the context of experiencing negative affect would predict treatment dropout. It was also

hypothesized that if there were significant demographic, motivational, or substance use-related variables that predicted treatment dropout, behavioral outcome variables would continue to serve as significant predictors of treatment dropout after accounting for these covariates.

Hypothesis 1.4. It was also hypothesized that there would be small to moderate correlations between self-report measures that correspond to behavioral measure outcomes.

Specific Aim 2. To determine if problems related to emotion dysregulation improved over the course of inpatient substance use treatment.

Hypothesis 2. It was hypothesized that participants would report an improvement in emotion regulation, improvement in distress tolerance, reduction in impulsivity, and a decrease in trait negative affectivity from the baseline session to follow-up session.

Methods

Participants

Participants were recruited from an all-male detox/inpatient program at St. Christopher's Addiction Wellness Center in Baton Rouge, LA. St. Christopher's is a multi-modality substance use treatment center that also treats co-occurring mental health problems. The primary framework for the program is a 12-step model, but various evidence-based treatments including Cognitive Behavioral Therapy, Dialectical Behavior Therapy, mindfulness-based approaches, and other therapies are incorporated, depending on a client's specific treatment plan. Clients also learn life skills and have access to wellness/exercise activities, as well as have the opportunity to participate in family therapy. Clients attend groups throughout the week on various topics related to substance use/co-occurring mental health treatment, and also meet with at least one individual therapist. St. Christopher's has different program tracks and encourages clients to stay for at least 90 days of treatment. (Please see COVID-19 Related Changes below for alterations to St. Christopher's usual treatment programming.) After clients completed detox they were offered the opportunity to voluntarily participate in the current study. If a client was interested in participating, he was given information about the study and its purpose by reviewing the consent form with a graduate researcher. The client signed a HIPPA release form for the primary researcher to have access to diagnostic information (See Appendix A for Consent Form and Appendix B for HIPPA release form).

COVID-19 Related Changes. Data collection for the current study started on March 19, 2020, which also coincided with the beginning of the United States' response to the novel coronavirus (COVID-19) pandemic. On March 22, 2020 Governor John Bel Edwards of Louisiana issued a state-wide stay-at-home order. Between March 22-May 15, 2020, Louisiana

State University mandated that graduate students work from home in compliance with the stay-at-home order. Therefore, graduate students were unable to engage in in-person data collection during this timeframe. In order to continue the study, the primary researcher trained two clinicians at St. Christopher's to administer the study. The primary researcher was available by phone during and after the study administration for debriefing of any questions or problems that arouse. Due to clinicians running the study while also completing their normal job duties, baseline and follow-up timelines were extended to be able to include more people in the study. Additionally, once the stay-at-home order was lifted, only the primary researcher was able to resume data collection between May 15-July 18, 2020, as non-employees were not permitted into the facility. The originally proposed baseline timeline was for participants to be recruited between day 4-7 after being admitted to the program. This timeline was widened to day 4-10. The originally proposed follow-up timeline was between days 22-30, this was widened to days 20-31.

There were also several COVID-19 related changes to the structure of the inpatient substance use treatment program which may have impacted study results. Due to new capacity rules, admission was capped at 10 clients. Previously, inpatient admission ranged from 10-18 clients. Patients no longer had family visits once per week due to restrictions on who could enter the facility. They also were not able to leave the facility for typical activities such as going to the gym, going to AA/NA meetings, or going to recreational outings on the weekend. In June 2020 no new patients were admitted to the facility for a two-week period following a positive COVID-19 test of a client in the facility.

Criteria for Eligibility. In order for a participant to be eligible for the current study they had to 1) be admitted to St. Christopher's inpatient program, 2) be ≥ 18 years of age at the initial

study visit, and 3) have basic health-literacy (seventh grade level) as measured by the Rapid Estimate of Adult Literacy in Medicine- Short Form (REALM-SF; Arozullah et al., 2007)

Criteria for exclusion: Individuals were excluded from the study if they: 1) were discharged from St. Christopher's 2) were < 18 years of age, 3) were court mandated for treatment or 4) did not have the appropriate level of health-literacy. Individuals experiencing current severe mental health symptoms were excluded from behavioral measures to avoid exposure to the negative affect induction.

Recruitment Plan. The study aimed to recruit at least 80 participants in an effort to have a large enough sample size to use several predictive variables in a logistic regression analysis. There is limited research on how emotion regulation and related variables impact treatment dropout, or what the mean and standard deviation for these variables are in a substance dependent population. Therefore, it was difficult to determine either potential odds ratios or regression relationships between the various independent variables for such an analysis to calculate the power required. Of the few studies that have used similar methodology, sample sizes ranged from 60-133, with higher sample sizes being used for more predictors (Ali et al., 2017; Daughters et al., 2005a, Daughters et al., 2005b; Fox et al., 2007; Hopwood et al., 2015). According to Tabachnick & Fidell (2013) logistic regression analyses should not contain less than five participants per specific predictor variable for more than 20% of cells. Prior studies have found at least 30% treatment dropout during the first 30 days (Ali et al., 2017; Harris, 1998; Hubbard et al., 1989; Simpson, 1981). With 80 participants, it was estimated that this would provide approximately 24 participants in the treatment dropout group, which would allow for at least four or five predictor variables to be examined.

Self-Report Measures

Rapid Estimate of Adult Literacy in Medicine- Short Form (REALM-SF; Arozullah et al., 2007; See Appendix C). The REALM-SF is a seven-item test of word reading designed to briefly assess health literacy. The REALM-SF is highly correlated with the longer version of the REALM (r = .95) and is also correlated with Wide Range Achievement Test (WRAT) scores (r = .83). A score of four out of seven indicates at least a seventh-grade reading level (Arozullah et al., 2007).

Demographic Questionnaire (See Appendix D). This questionnaire was administered to eligible participants to collect basic demographic information.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004; see Appendix E). The DERS is a 36-item questionnaire assessing difficulties with regulating emotions and contains the following factors: nonacceptance (nonacceptance of emotions), goals (difficulties engaging in goal-directed behavior when experiencing negative emotions), impulse (problems with impulse control), awareness (lack of awareness of emotions), strategies (lack of access to emotion regulation strategies), and clarity (lack of emotional clarity). Participants were asked to rate how often items applied to them on 5-point Likert scale ranging from 1 (almost never, 0-10% of the time) to 5 (almost always, 91-100% of the time). Higher scores on subscales and for the total measure are indicative of greater problems with emotion regulation. The total scale has demonstrated high internal consistency ($\alpha = .93$) and subscale measures have good internal consistency (all $\alpha > .80$) (Gratz & Roemer, 2004). The current sample also demonstrated excellent internal consistency for the total scale ($\alpha = .96$) and subscale measures yielded good internal consistency (all $\alpha > .83$)

Distress Tolerance Scale (DTS; Simons & Gaher, 2005; See Appendix F). The DTS is a 15-item self-report measure assessing four areas related to an individual's perceived ability to tolerate emotional distress, subjective appraisal of distress, attention focused on negative emotions, and emotion regulation strategies used to reduce distress. Items are rated on a 5-point Likert scale ranging from 1- strongly agree to 5- strongly disagree. Higher scores are associated with higher levels of distress intolerance. The DTS has demonstrated good internal consistency (α = .82) (Simons & Gaher, 2005). In the current sample, the DTS had excellent internal consistency (α = .92)

Short Version UPPS-P Impulsive Behavior Scale (SUPPS-P; Lynam, 2013; See Appendix G). The SUPPS-P Impulsive Behavior Scale is a 20-item scale that is a shortened version of the UPPS-P, which measures different types of impulsive behaviors. The SUPPS-P contains five facets of impulsivity: sensation seeking, lack of premeditation, lack of perseverance, negative urgency, and positive urgency. Responses range from 1-agree strongly to 4- disagree strongly, with higher scores indicating higher levels of impulsivity (Lynam, 2013). The SUPPS-P retained adequate reliability, comparable intercorrelations, minimal loss of shared variance, and consistent factor structure in comparison to the full UPPS-P (Cyders, Littlefield, Coffey, & Karyadi, 2014). The SUPPS-P scales' internal consistencies ranged from acceptable to good (α = .73- .83) (Zsila, Bothe, Demetrovics, Billieux, & Orosz, 2017). The current sample yielded internal consistencies on SUPPS-P scales ranging from questionable to good (α = .62-.88).

The 30-Item Negative Emotionality Scale (NEM-30; Waller, Tellegen, McDonald, & Lykken, 1996; see Appendix H). The NEM-30 is a 30-item self-report measure that was created by taking items that measure negative emotionality from the Multidimensional Personality

Questionnaire (MPQ; Tellegen, 1982), with the goal of measuring trait negative emotionality facets including stress reaction, alienation, aggression, absorption, and problems with social closeness (Waller et al., 1996). Items are rated as true/false, and higher scores are indicative or more difficulties with negative emotionality. Studies using the NEM-30 have found good internal consistency (α = .89) (Ray, Weir, Polythress, & Rickelm, 2011) and this sample also demonstrated good internal consistency (α = .89).

The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES; Miller & Tonigan, 1996; See Appendix I). The SOCRATES is a 19-item questionnaire that was adapted from the University of Rhode Island Change Assessment (URICA) scale. It was developed to specifically assess the stages of change for individuals with alcohol use disorders, but has been found to better measure factors including problem recognition, taking steps, and ambivalence. This scale can also be changed to have drug-specific wording (DiClemente et al., 2004). Response options for the scale are on a 5-point Likert scale ranging from 1-strongly disagree to 5- strongly agree. Internal consistency for the scale ranges from good to excellent (α = .88-.95) (Miller & Tonigan, 1996). In the current sample the internal consistency across scales ranged from questionable to good (α = .60-.90).

Behavioral Measures

The Paced Auditory Serial Addition Test-Modified Computer Version (PASAT-C; Lejuez et al., 2003). The PASAT is a serial addition task that was originally developed by Gronwall and Sampson (1974). The PASAT-C involves visual presentation of a series of numbers sequentially flashed on a computer screen and participants add the currently presented number to the number presented previously. The PASAT has been used primarily as a measure of sustained attention and concentration; however, administration of the PASAT was noted to

elicit stress, negative affect, and a tendency for task termination (Tombaugh, 2006). Therefore, the PASAT has been used as a tool for stress-inductions and to test distress tolerance (Holdwick & Wingenfeld, 1999; Lejuez et al., 2003). The PASAT-C can use a range of numbers, but studies examining its relationship to distress tolerance have capped the sum of numbers at 20 so that mathematical skill plays less of a role in task persistence (Daughters et al., 2005b). Participants use the mouse to click on the correct answer on the screen. They gain one point for each correct answer, whereas incorrect answers or omissions will not affect their total score. A short sound blast plays for 100ms when a correct answer is not provided. The PASAT-C is comprised of three levels: Level 1-low difficulty (3-second latency between numbers; 3 minutes), Level 2-medium difficulty (2-second latency; 5 minutes), and Level 3-high difficulty (1-second latency; 7 minutes). A practice level can be added with a user-determined amount of practice items. There is a two-minute rest between the second and third level. During the third level participants are given access to a button that will terminate the task, if they choose to click on it. Distress tolerance is measured in terms of latency in seconds to task termination. Studies using the PASAT-C for purposes of measuring distress tolerance have utilized a measure of dysphoria prior to level 1 administration and after level 2 administration (Brown et al., 2002; Daughters et al., 2005b). Brown and colleagues' (2002) dysphoria measure is a four-item scale in which anxiety, difficulty concentrating, irritability, and frustration levels are rated on a 100-point Likert scale (See Appendix J). This scale has acceptable internal consistency ($\alpha = .77$). Studies using this scale have administered it at the end of the second level as opposed to at task termination to prevent potential confounds (Brown et al., 2002; Daughters et al., 2005b; Lejuez et al., 2003). In the current sample the dysphoria scale demonstrated good internal consistency ($\alpha = .85$).

The Balloon Analogue Risk Task (BART; Lejuez et al., 2002). The BART is a computer-based risk-taking task that is correlated with measures of impulsivity and problems with behavioral constraint (Bornovalova et al., 2009). Participants inflate virtual balloons by pressing a button for each pump in order to try to optimize monetary rewards. Each balloon has a certain unknown explosion point, and points are only gained if the participant stops pumping the balloon and cashes out before reaching its explosion point (Lejuez et al., 2002). The original version of the BART contained three different color balloons with different probabilities of explosion assigned to each balloon color. However, the restricted range of pumps on two of the balloon colors produced limited variability across participants (Lejuez et al., 2002). Therefore, current use of the BART only examined one color balloon with the probability of explosion ranging between 1-128 pumps, with the average break point of 64 pumps. Participants pump a series of 30 virtual balloons, one at a time, with the opportunity to cash out at any time. Participants earn one point per unexploded pump and only get to keep their points if the balloon does not explode. Money acquired from unexploded balloons is retained in a total earnings account and is not lost by subsequent explosions (Lejuez et al., 2002). A newer version of the BART, the automatic BART was used for the current study. In the automatic BART participants typed the total number of pumps they would like instead of pressing the button for each pump (DeMartini et al., 2014). They were also informed at the outset, that 64 pumps would provide optimal performance if there were an infinite number of balloons, but may not provide the most optimal performance for any one balloon (DeMartini et al., 2014). These changes to the BART have been found to increase risk taking, whereas in the original version of the BART participants often displayed risk aversion (DeMartini et al., 20014; Pleskac et al., 2008). There are several outcome measures that can be examined for the BART. A common method is to take the average

of the number of pumps for unexploded balloons (Lejuez, Aklin, Zvolensky, & Pedulla, 2003). However, by analyzing only unexploded balloons, scores are often biased toward lower scores because the more times respondents choose a risky option and the balloon explodes, the less balloons they have to calculate their score from. Also, the balloons that are left are likely going to represent less risky decisions or balloons that had higher pump thresholds (Pleskac, Wallsten, Wang, & Lejuez, 2008). The automatic BART allows for analysis of the number of pumps for all balloons to get a better index of risky behavior. Other outcomes for the BART are measures of performance which include money earned and number of total explosions (DeMartini et al., 2014).

Materials

Self-Report Measures. The consent form, HIPPA release form, REALM-SF, and Brown and colleagues' (2012) dysphoria measure (pre and post) were presented to participants via paper copies. The remaining self-report measures were administered online through SurveyMonkey, which is an online cloud-based survey software platform.

Behavioral Measures. The PASAT-C and automatic BART were administered on a Dell Inspiron 14 5,000 series laptop with touchscreen capabilities through the Inquisit 5 Lab. Participants were instructed to use the touchscreen to complete the PASAT-C to decrease time spent moving the mouse between numbers.

Compensation. Participants were compensated based on their performance on the PASAT and BART. On the PASAT participants could earn one piece of candy for every 20 correct answers. On the BART participants could earn one piece of candy for every $5 earned.

Procedure

Recruitment. Clients were approached by a researcher to determine interest in the study between days 4-10 in treatment (after completion of detox). One client was errantly recruited for the study on his first day in treatment; however, this data was retained in analyses because this participant did not require medical detox. If clients were interested in learning more about the study, a researcher would review the consent form, study requirements, and potential risks of participation with them.

Baseline Session. After reviewing the consent form and HIPPA release form, if a patient was eligible and expressed interest in participating, they were assigned a participant ID. They then completed the REALM-SF to determine if they met the reading level requirement. All participants scored at least a four on the REALM-SF, which indicated a sufficient reading level to complete the survey measures. They then completed the baseline assessment self-report measures. The baseline assessment was administered on the Dell laptop through SurveyMonkey and included a demographic questionnaire, the DERS, the DTS, the SUPPS-P Impulsive Behavior Scale, the NEM-30, and the SOCRATES. Participants then completed the four-item dysphoria scale and began the PASAT-C. Instructions for PASAT-C administration can be found in Appendix K. PASAT-C instructions were presented on the screen but were also reviewed with the participant by the research assistant. In these instructions participants were informed of the possibilities for receiving compensation (1 piece of candy for every 20 correct answers) in order to provide a mild incentive to continue with the task (Daughters et al., 2005a; Daughters et al., 2005b). Participants started with a five-item practice trial. If no items were answered correctly, the researcher repeated the instructions, and the practice items were repeated. After level two of the PASAT-C participants were re-administered the dysphoria scale. Participants then completed

the final level of the PASAT-C, during which they could discontinue at any time. The PASAT-C was not only used as a measure of distress tolerance, but also served as a negative affect induction for the BART. Studies using the BART have found increased impulsive responding in male participants by using a negative mood induction (Daughters et al., 2013; Lighthall et al., 2009). Instructions for BART administration can be found in Appendix L. Instructions were presented onscreen before the task and were also reviewed verbally with the participant by the researcher. Participants were instructed that they would receive one piece of candy for every five dollars they banked. Once participants completed the BART they received compensation for both the PASAT and BART. They were then asked if they would like to complete a short mindfulness activity to reduce any lasting negative effects of the PASAT negative affect induction. This mindfulness activity is included in Appendix M. None of the participants elected to participate in this optional mindfulness exercise. Participants were then be debriefed (see Appendix N) and thanked for their participation. After baseline assessments were completed, the primary researcher accessed the participants' charts at St. Christopher's and retrieved information pertaining to participants' substance use history including drug(s) of choice, substance use disorder diagnosis(es) and any mental health diagnoses (see Appendix O). Results of urine analyses throughout inpatient treatment were also examined to determine if there were any clients who relapsed. No clients who participated in the current study relapsed while in treatment. Only the primary researcher had access to patient charts.

Follow-up. Follow-up was conducted between days 20-31 in the program, with 92% of participants who completed follow-up completing it between days 24-30. Participants completed the DERS, the DTS, the SUPPS-P, the NEM-30, and the SOCRATES at follow-up and were given four pieces of candy as a mild incentive to complete the follow-up measures.

Determining Dropout. The primary researcher monitored online medical records to determine which participants dropped out of treatment before completion of the inpatient residential program. Participants were considered to have dropped out if they left treatment prior to program completion. Participants would also be considered as dropping out if they were discharged due to behavioral problems or relapse; however, no participants dropped out due to these reasons.

Confidentiality of Materials. The consent form, HIPPA release form, REALM-SF score sheet, dysphoria questionnaire, and diagnostic information taken from participants' charts were stored in a locked filing cabinet in the Smoking and Substance Use Research Laboratory at Louisiana State University (LSU). All excel or SPSS files with participant information was deidentified.

Institutional Review Board (IRB). The current study was reviewed and approved by the LSU IRB and the IRB at St. Christopher's Addiction Wellness Center. A Certificate of Confidentiality from the National Institute of Drug Abuse (NIDA) was applied for and granted to protect participant information. A Certificate of Confidentiality provides additional protection to participants by allowing the researchers the right, "to refuse to disclose identifying information on research participants in any civil, criminal, administrative, legislative, or other proceeding, whether at the federal, state, or local level" (NIDA, 2015). This helps to ensure that data collected is not used in a way that could potentially be harmful to participants.

Data Analytic Strategy

Hypothesis 1.1. Differences in demographic data were examined for the variables of age, race, education level, socioeconomic status (SES), insurance type, and distance of residence from treatment center. The SOCRATES was also assessed for motivation-related variables.

Differences in substance use-related variables were also examined including drug of choice, number of substance use disorder diagnoses, age of first substance use, number of prior substance use treatments, and number of substances used in the month prior to substance use treatment. Differences were also analyzed between participants diagnosed with mental health disorders versus those not diagnosed with additional mental health disorders outside of their substance use disorder(s). Differences in categorical variables were calculated utilizing chi-square analyses and Welch's t-tests (for unequal group sizes) were used for continuous variables.

Hypothesis 1.2. In order to determine if there was a significant relationship between each of the self-report variables (emotion dysregulation, distress tolerance, positive urgency, negative urgency, and trait negative affect) and treatment dropout, Welch's t-tests were conducted. A logistic regression analysis was conducted with treatment completion vs. non-completion as the dependent variable. Covariates including demographic variables, substance use-related variables, and readiness for change variables were added in step 1. Covariates were added through forward stepwise logistic regression with Wald criteria set to .25 to determine if variables that might not be significant in and of themselves made an important contribution to another variable (Bursac, Gauss, Williams, Hosmer, 2008). Stepwise logistic regression was used because it was hypothesized that no covariates would be significant, and no specific hypotheses were made about greater predictability of some covariates over others. Given the number of demographic-related variables examined in this study, they could not all be included in the logistic regression. Step 2 included self-report variables of emotion dysregulation, distress tolerance, negative and positive urgency, and negative trait affectivity. The Holm-Bonferroni Method was used to control for multiple comparisons.

Hypothesis 1.3. For behavioral measures there were several validity checks conducted to determine the effectiveness of the behavioral tasks. For the PASAT-C, the four-item dysphoria scale was compared pre-PASAT and post level 2 of the PASAT via paired t-test to ensure that the task produced significant distress and to determine that it resulted in a negative mood induction for the BART. Next several variables were examined that could serve as potential confounds in interpretating the PASAT latency as a measure of distress tolerance. Accuracy on the PASAT was examined to determine whether or not there was a relationship between performance and task persistence. This relationship was examined by conducting a correlation analysis between the number of correct answers on levels one and two of the PASAT and PASAT latency. Relationships between reading level and level of education and PASAT latency were also examined. The relationship between PASAT latency and REALM score was examined through a correlation analysis. The relationship between PASAT latency and education level was examined via an ANOVA.

A chi square analysis was utilized to determine any differences between treatment completers and non-completers in completion or non-completion of the PASAT. A Welch's t-test was used to examine differences in termination latencies between treatment completers and treatment non-completers. For the BART, average number of pumps, total number of explosions, and total money earned were examined for treatment completers versus non-completers using Welch's t-tests.

The PASAT and BART outcome measures of PASAT latency, BART mean total pumps, BART total explosions, and BART total money earned were included as predictors in a logistic regression analysis with treatment completion versus treatment non-completion used as the

dependent variable. The same covariate strategy used in hypothesis 1.2 was used for this regression analysis. The Holm-Bonferroni Method was used to control for multiple comparisons.

Hypothesis 1.4. Analyses were conducted to examine relationships between self-report measures and behavioral measures. Welch's t-tests were utilized to examine differences between PASAT completers versus non-completers for self-report measures including the DERS, DTS, SUPPS Negative and Positive Urgency Scales, and NEM-30. The Holm-Bonferroni correction was used to control for multiple comparisons. Correlation analyses were used to examine the relationship between the SUPPS Negative and Positive Urgency Scales and BART average total pumps, total money earned, and total number of explosions.

Hypothesis 2. Paired t-tests were used to determine whether self-report variables (emotion regulation, distress tolerance, positive urgency, negative urgency, and trait negative affect) changed from the baseline study session to the follow-up study session for treatment completers. The Holm-Bonferroni method was used to control for multiple comparisons.

Results

Participant Recruitment and Follow-up

A total of 106 patients were approached for participation in the current study. A total of 69 participants were eligible and agreed to participate. One participant discontinued while completing survey measures at the baseline study session due to experiencing severe psychotic symptoms. Therefore, 68 participants completed the entire baseline study session. Nine participants dropped out of treatment due to leaving the facility before completion of the inpatient program. No participants relapsed or were asked to leave the inpatient facility due to behavioral problems. Of the 59 participants who remained in treatment, follow-up data was collected for 49 participants. Follow-up data was not able to be obtained for 10 participants. Two of these participants had made a deal prior to coming to the treatment facility, (unbeknownst to the primary researcher) that they would only stay for two weeks and then transition to an Intensive Outpatient Program (IOP) at another substance use treatment facility closer to their homes. Three participants refused to complete follow-up. Four participants graduated from the treatment program without a researcher being available for data collection, two of which occurred during the stay-at-home order. One participant's data was lost due to internet connection problems resulting in the SurveyMonkey data not saving.

Participant Characteristics

Participants (N= 69) were adult males currently enrolled in substance use treatment at St. Christopher's Addiction Wellness Center. The sample was 89.9% white, 5.6% black, 2.8% Asian, and 1.4% Hispanic/Latino. In terms of education, 4.2% had not completed high school, 22.5% had a high school diploma or GED as their highest level of educational obtainment, 46.5% had completed 1-2 years of college, 20.3% had completed a bachelor's degree, and 4.3%

had obtained a graduate degree. SES was examined based on household income in the past year. If participants had lost their job(s) due to their substance use or COVID-19 in the past six months of completing the survey they were asked to calculate their income for the year prior to losing their job(s). This sample consisted of 14.1% reporting household income as less than $15,000 per year, 11.3% between $15,000-$29,999, 14.1% between $30,000-$49,999, 19.7% between 50,000-74,999, 9.9% between $75,000-$99,999, 15.5% between $100,000-$150,000, and 9% above $150,000. To pay for inpatient substance use treatment, 38% of the sample used Medicare/Medicaid, 47.9% used private health insurance, and 8% paid out-of-pocket. In terms of substance use-related demographics, 37.68% of the sample reported that alcohol was their substance of choice. See Table 1 for a break-down of substance of choice. On average participants were diagnosed with two substance use disorders (*SD* = 1.16), engaged in first substance use at age 14.74 on average (*SD* = 2.82), participated in an average of 1.62 treatments prior to their current substance use treatment (*SD* = 1.48), and used an average of 2.85 substances in the month prior to being admitted to treatment (*SD*= 1.98). In the current sample, 79.71% of participants were also diagnosed with a mental health condition in addition to a substance use disorder. See Table 2 for breakdown of demographic and substance use-related variables.

Table 1. Substances of Choice

Alcohol	$N = 26$
Opiates	$N = 25$
Stimulants	$N = 15$
Cannabis	$N = 6$
Sedative, Hypnotics, or Anxiolytics	$N = 6$
Hallucinogens	$N = 1$

Note. Total greater than 69 due to participants being able to choose more than one substance of choice.

Hypothesis 1.1.

Variables of race, age, education level, SES, treatment payment type, and residence were examined for differences between participants who remained in treatment versus those who dropped out prematurely. For chi square analyses categorical variables were collapsed into dichotomous variables due to a lack of participants per cell when using multiple levels. No significant differences emerged between these two groups for any of the demographic variables. See Table 2 for a comparison of these demographic variables between treatment completers and treatment non-completers.

Differences in scores on the three SOCRATES scales measuring variables related to motivation for treatment were also tested for between group differences. There were no significant differences at baseline for individuals who remained in treatment versus those who dropped out on any of these scales. See Table 2.

Table 2. Comparison of Demographic Variables between Treatment Completers and Treatment Non-Completers

	Overall	Treatment Completers	Treatment Non-Completers	*P*-value
	(*N* = 69)	(*n* = 60)	(*n* = 9)	
Race, N (%)				
Caucasian	62 (89.9%)	54 (90%)	8 (88.89%)	.918
Other	7 (10.1%)	6 (10%)	1 (11.11%)	
Age				
Mean *(SD)*	32.54 *(10.46)*	32.43 *(10.7)*	33.22 *(9.14)*	.818
Education, N (%)				
High School or less	19 (27.54)	16 (26.67)	3 (33.33)	.676
Some college	50 (72.46)	44 (73.33)	6 (66.67)	
SES, N (%)				
≤$49,999	28 (40.58%)	23 (38.33%)	5 (55.56%)	.327
≥$50,000	41 (59.42%)	37 (61.67%)	4 (44.44%)	
Payment type, N (%)				
Medicare/Medicaid	27 (39.13%)	23 (38.33%)	4 (44.44%)	.726
Private Ins/Self-pay	42 (60.87%)	37 (61.67%)	5 (55.56%)	
Residence, N (%)				
Louisiana	54 (78.26%)	45 (75%)	9 (100%)	.090
Outside of Louisiana	15 (21.74%)	15 (25%)	0 (0%)	
Taking Steps Scale				
Mean *(SD)*	35.39 *(4.77)*	35.3 *(4.92)*	36 *(3.74)*	.626
Recognition Scale				
Mean *(SD)*	30.66 *(5.99)*	30.38 *(6.22)*	32.44 *(4.07)*	.212
Ambivalence Scale				
Mean *(SD)*	12.8 *(4.11)*	12.97 *(3.99)*	11.67 *(4.97)*	.472

Note. SD = standard deviation; Taking Steps Scale, Recognition Scale, and Ambivalence Scale from the SOCRATES.

Substance use-related variables were also examined to determine any differences between treatment completers and those who dropped out of treatment. No significant differences were found between the two groups for drug of choice (alcohol versus other drugs), number of substance use diagnoses, age of first substance use, number of prior substance use treatments, or number of substances used in the month prior to entering substance use treatment. Additionally, there were no significant differences found for individuals diagnosed with mental health disorders in terms of treatment dropout. See table 3 for comparisons between treatment completers and treatment non-completers for substance use-related variables.

Table 3. Comparison of Substance Use-Related Variables between Treatment Completers and Treatment Non-Completers

	Overall	Treatment Completers	Treatment Non-Completers	*P*-value
	(*N* = 69)	(*n* = 60)	(*n* = 9)	
Drug of Choice, N (%)				
Alcohol	26 (37.68%)	23 (38.33%)	3 (33.33%)	.773
Other than Alcohol	43 (62.32%)	37 (61.67%)	6 (66.67%)	
Number of SUDs				
Mean *(SD)*	2 *(1.16)*	2.02 *(1.17)*	1.89 *(1.17)*	.765
Age of First Use				
Mean *(SD)*	14.74 *(2.82)*	14.9 *(2.68)*	13.67 *(3.64)*	.353
# of Prior Treatments				
Mean *(SD)*	1.62 *(1.48)*	1.47 *(1.35)*	2.67 *(1.62)*	.106
# of Substances Used the Month Prior to Treatment				
Mean *(SD)*	2.85 *(1.98)*	2.9 *(2.01)*	2.56 *(1.81)*	.610
Participants Diagnosed with Mental Health Disorder, N (%)				
Yes	55 (79.71%)	49 (81.67%)	6 (66.67%)	.297
No	14 (20.29%)	11 (18.33%)	3 (33.33%)	

Note. SD= standard deviation; SUDs= substance use disorders.

Hypothesis 1.2.

It was hypothesized that treatment completers would have significantly lower scores on self-report measures of emotion regulation, distress tolerance, urgency, and negative emotionality compared to treatment non-completers. While scores on these measures were lower for treatment completers in the current sample, these differences were not statistically significant. On the DERS, treatment completers scored an average of 83.32 (*SD* = 27.11) and treatment non-completers scored an average of 89.67 (*SD* = 23.99), but as mentioned this difference was not significant, t (11.30) = .529, p = .482. On the DTS, treatment completers had an average score of 3.17 (*SD* = .95) and non-completers had an average score of 3.35 (*SD* = .82), but again this was not a significant difference, t (11.55) = .344, p = .569. Two scales on the SUPPS were examined, the Negative and Positive Urgency scales. Treatment completers scored an average of 10.47 (*SD* = 3.1) on the Negative Urgency Scale compared to an average of 11.33 (*SD* = 3.28) for treatment non-completers, t (10.26) = .55, p = .473. On the Positive Urgency Scale treatment completers scored an average of 7.77 (*SD* = 2.47) and treatment non-completers scores an average of 9.11 (*SD* = 2.8), t (9.96) = 1.85, p = .203. Neither of these impulsivity scales were significantly different between the two groups. On the NEM-30 treatment completers scored an average of 11.52 (*SD* = 7.03) and treatment non-completers scored an average of 12.89 (SD = 5.37), which was also a non-significant difference, t (12.53) = .467, p = .507. See Table 4 for comparisons between self-report measures for treatment completers versus treatment non-completers.

Table 4. Comparisons of Self-Report Measures between Treatment Completers and Treatment Non-Completers

	Overall	Treatment Completers	Treatment Non-Completers	*P*-value
	(*N* = 69)	(*n* =60)	(*n* = 9)	
DERS				
Mean *(SD)*	84.14 *(26.65)*	83.32 *(27.11)*	89.67 *(23.99)*	.482
DTS				
Mean *(SD)*	3.2 *(.93)*	3.17 *(.95)*	3.35 *(.82)*	.569
SUPPS Neg. Urgency				
Mean *(SD)*	10.58 *(3.11)*	10.47 *(3.1)*	11.33 *(3.28)*	.473
SUPPS Pos. Urgency				
Mean *(SD)*	7.94 *(2.54)*	7.77 *(2.47)*	9.11 *(2.8)*	.203
NEM-30				
Mean *(SD)*	11.7 *(6.82)*	11.52 *(7.03)*	12.89 *(5.37)*	.507

Note. SD = standard deviation; DERS = Difficulties with Emotion Regulation Scale; DTS = Distress Tolerance Scale; NEM-30 = The Negative Emotionality Scale.

Demographic variables, substance use-related variables, and readiness to change variables were included as covariates in a logistic regression analysis with treatment completion versus non-completion as the predictor variable. Through stepwise regression only number of prior substance use treatments was retained as a significant predictor in Step 1 and Step 1 was significant in the logistic regression model, $X^2(1) = 4.81$, $p = .028$. Of note, location of residence prior to entering treatment was excluded from the covariate analysis because groups were perfectly separated by this variable, which was likely the result of the small sample size. Including this predictor created overfitting and so this variable was removed (Tabachnick & Fidell, 2013). Self-report variables were then included in Step 2 of the logistic regression analysis. As anticipated by the lack of significant results from Welch's t-tests between self-report measures, Step 2 was not significant, $X^2(5) = 8.11$, $p = .150$ with none of the self-report measures predicting treatment dropout. The overall model for the logistic regression retained significance $X^2(6) = 12.91$, $p = .044$. See table 5 for standardized Beta coefficients from the logistic regression analysis.

Table 5. Self-Report Measures as Predictors of Treatment Dropout

	Step 1 β coefficient	Step 2 β coefficient
# of Prior SUD Treatments	1.66*	2.32*
DERS		1.03
DTS		4.60
SUPPS Negative Urgency		.896
SUPPS Positive Urgency		1.37
NEM-30 Total		.98

Note. *$p < .05$; SUD = substance use disorder; DERS = Difficulties with Emotion Regulation Scale; DTS = Distress Tolerance Scale; NEM-30 = The Negative Emotionality Scale. Holm-Bonferroni Method used for multiple comparisons.

Hypothesis 1.3.

Behavioral Measure Validity Checks In order to determine if the PASAT served as a distressing task, scores on the dysphoria scale taken pre-PASAT and post level 2 of the PASAT were compared. The average pre-PASAT dysphoria score was 86.34 (*SD* = 88.87) and the average dysphoria score post level 2 of the PASAT was 134.01 (*SD* = 102.91). This mean difference of 47.68 was statistically significant t (67) = 5.67, $p < .001$. In order to determine if individuals were more likely to persist on the PASAT due to variables outside of distress tolerance, relationships between REALM score, education level, and performance on the PASAT were examined. There was no significant relationship between REALM score (reading level) and PASAT latency (r = -.038, p = .760). There was also no significant relationship between

education level and PASAT latency $F(4, 63) = .775$, $p = .546$. There was a small significant correlation between performance (number correct) on levels 1 and 2 of the PASAT and PASAT latency ($r = .248$, $p = .041$). This indicates that task continuation was not solely based on distress tolerance, but also on performance. To determine if individuals who had lower performance on the PASAT quit earlier due to increased distress from poor performance the relationship between PASAT performance and dysphoria score post level 2 of the PASAT was examined. There was no correlation between these two variables ($r = .086$, $p = .483$). Finally, there was no correlation between level of distress pre-PASAT ($r = .205$, $p = .094$) or post level 2 of the PASAT ($r = .166$, $p = .177$) and PASAT latency.

Comparison of Behavioral Measures. Of the 68 participants who completed baseline, 20 participants (29.41%) terminated the PASAT prior to completion. Treatment non-completers trended towards being more likely to terminate the PASAT (55.56%) compared to treatment completers (29.41%); however, this difference was not statistically significant $X^2(1) = 3.415$, $p = .065$. In terms of how long participants persisted on the PASAT, the overall average PASAT latency was 811.52 seconds (13.53 minutes) (SD = 153.73 seconds; 2.56 minutes). For those who remained in treatment, average PASAT latency was 820.64 seconds (13.68 minutes) (SD = 148.93 seconds; 2.5 minutes) and for treatment non-completers average PASAT latency was 751.74 seconds (12.53 minutes) (SD = 180.26; 3 minutes). This difference was also not significant, t (9.74) = 1.19, $p = .301$. Due to the truncated range for PASAT latency (average latency 13.53 minutes out of 15 minutes) further analyses utilized PASAT as a dichotomous variable of PASAT completion vs non-completion. See Table 6 for PASAT outcomes for treatment completers vs. non-completers.

Table 6. Comparison of PASAT Outcome Measures between Treatment Completers and Treatment Non-Completers

	Overall	Treatment Completers	Treatment Non-Completers	*P*-value
	(N = 68)	(*n* = 59)	(*n* = 9)	
Quit PASAT, *N* (%)				
Yes	20 (29.41%)	15 (25.42%)	5 (55.56%)	.065
No	48 (70.69%)	44 (74.58%)	4 (44.44%)	
PASAT latency				
Mean (*SD*)	811.52 *(153.73)*	820.64 *(148.93)*	751.74 *(180.26)*	.301

Note. SD = standard deviation; PASAT = Paced Auditory Serial Addition Test

On the BART, the primary measure of risk taking was mean total pumps. Mean total pumps was greater in the treatment non-completion group (M= 63.58, *SD* = 8.69) compared to the treatment completers group (M = 57.9, *SD* = 12.48); however, this difference was not significant t (13.64) = 2.92, p = .110. Other outcome measures for the BART, which measure success, include average number of explosions and amount of money earned. Treatment non-completers were less successful in terms of number of explosions (M = 15.44, *SD* = 2.35) compared to treatment completers (M = 14.34, *SD* = 3.2), t (13.03) = 1.56, p = .235, but were more successful in terms of money earned (M = $39.04, *SD* = 6.36) compared to treatment completers ($37.49, *SD* = 6.96), t (11.15) = .45, p = .514, but again these differences were not statistically significant. See Table 7 for BART outcomes for treatment completers vs. treatment non-completers.

Table 7. Comparison of BART Outcomes between Treatment Completers and Treatment Non-Completers

	Overall	Treatment Completers	Treatment Non-Completers	*P*-value
BART Risk Taking				
Mean Total Pumps *(SD)*	58.66 *(12.15)*	57.9 *(12.48)*	63.58 *(8.69)*	.110
BART Success				
Explosions Mean *(SD)*	14.49 *(3.11)*	14.34 *(3.2)*	15.44 *(2.35)*	.235
Money Earned Mean				
(SD)	37.99 *(6.86)*	37.49 *(6.96)*	39.04 *(6.36)*	.514

Note. *SD* = standard deviation; BART = Balloon Analogue Risk Task

Demographic variables, substance use-related variables, and readiness to change variables were included as covariates in a logistic regression analysis with treatment completion versus non-completion as the predictor variable. Through stepwise regression, only number of prior substance use treatments was retained as a significant predictor in Step 1 and Step 1 was significant in the logistic regression model, $X^2(1) = 4.81$, $p = .028$. As expected, based on examination of preliminary statistical analyses, Step 2 utilizing PASAT latency and measures of BART risk and success was not significant, $X^2(4) = 4.83$, $p = .305$, and no individual predictors emerged as significant. The overall model also did not retain significance $X^2(5) = 9.63$, $p = .086$. See Table 8 for standardized Beta coefficients from the logistic regression.

Table 8. Behavioral Measures as Predictors of Treatment Dropout

	Step 1 β coefficient	Step 2 β coefficient
# of Prior SUD Treatments	1.65*	1.83*
PASAT latency		1.00
BART mean total pumps		1.15
BART total explosions		.68
BART total money earned		1.02

Note. *$p < .05$; SUD = substance use disorder; PASAT = Paced Serial Addition Test; BART = Balloon Analogue Risk Task. Holm-Bonferroni Method used for multiple comparisons.

Hypothesis 1.4.

Mean differences between PASAT completion vs. non-completion for self-report scores were also examined. There were no significant differences across the DERS, DTS, SUPPS Negative Urgency Scale, Positive Urgency Scale, or NEM for PASAT completers vs. non-completers after using the Holm-Bonferroni method to account for multiple comparisons. Prior to accounting for multiple comparisons, the DERS total score was significantly higher for PASAT completers (M = 88.19, SD = 27.29) compared to PASAT non-completers (M = 72.8, SD = 21.57), t (44.76) = 6.105, p = .017). Prior to accounting for multiple comparisons there was also a trend towards the DTS total score being significantly different for PASAT completers (M = 3.08, SD = .93) and PASAT non-completers (M = 3.54, SD = .86) t (38.48) = 3.97, p = .053. See Table 9 for comparison of self-report scores between PASAT completers versus non-completers.

Table 9. Comparison of Self-Report Measures between PASAT Completers and PASAT Non-Completers

	Overall	PASAT Completers	PASAT Non-Completers	P-value
	(*N* = 68)	(*n* = 48)	(*n* = 20)	
DERS				
Mean *(SD)*	83.66 *(26.54)*	88.19 *(27.29)*	72.8 *(21.57)*	.017
DTS				
Mean *(SD)*	3.2 *(.93)*	3.08 *(.93)*	3.54 *(.86)*	.053
SUPPS Neg. Urgency				
Mean *(SD)*	10.5 *(3.06)*	10.81 *(2.86)*	9.75 *(3.48)*	.237
SUPPS Pos. Urgency				
Mean *(SD)*	7.93 *(2.55)*	8.04 *(2.43)*	7.65 *(2.87)*	.596
NEM				
Mean *(SD)*	11.64 *(6.86)*	11.98 *(7.11)*	10.85 *(6.34)*	.522

Note. DERS = Difficulties with Emotion Regulation Scale; DTS = Distress Tolerance Scale; NEM-30 = The Negative Emotionality Scale; *SD* = standard deviation. Holm-Bonferroni Method used to control for multiple comparisons, resulting in no significant findings after this correction.

The relationship between BART outcome measures and measures of impulsivity were also examined. BART mean total pumps was correlated with the SUPPS Negative (r = .294, p = .015) and Positive Urgency Scales (r = .239, p = .049). BART total explosions was also correlated with the Negative Urgency Scale (r = .326, p = .007) and Positive Urgency Scale (r = .247, p = .042). See Table 10 for correlations between BART outcome measures and measures of impulsivity.

Table 10. Correlations between BART Outcome Measures and Impulsivity

	BART mean total pumps	BART total money earned	BART total explosions	SUPPS Negative Urgency Scale	SUPPS Positive Urgency Scale
BART mean total pumps	-	-	-	-	-
BART total money earned	.235	-	-	-	-
BART total explosions	.898**	.073	-	-	
SUPPS Negative Urgency Scale	.294*	.063	.326**	-	-
SUPPS Positive Urgency Scale	.239*	.028	.247**	.371**	-

Note. *$p < .05$; ** p .01. BART = Balloon Analogue Risk Task.

Hypothesis 2.

Self-report measures including the DERS, DTS, SUPPS scales of Negative and Positive Urgency, and NEM-30 were compared from baseline to follow-up to determine if there were areas of improvement over the course of inpatient substance use treatment. After using the Holm-Bonferroni method to control for multiple comparisons, none of the variables retained significance. Prior to this correction the DERS score decreased from baseline (M= 84.53, SD = 26.72) to follow-up (M = 78.55, SD = 26.72), t (48) = 2.25, p = .029. Also, prior to this correction the Negative Urgency Scale decreased from baseline (M = 10.61, SD = 3.06) to follow-up (M = 9.88, SD = 3.46), t (48) = 2.20, p = .032. See Table 11 for comparisons between self-report scores at baseline versus follow-up.

Table 11. Comparison of Self-Report Scores between Baseline and Follow-up for Treatment Completers

	Beginning of Treatment	End of Treatment	P-value
	(*n* = 49)	(*n* = 49)	
DERS			
Mean *(SD)*	84.53 *(26.72)*	78.55 *(26.72)*	.029
DTS			
Mean *(SD)*	3.15 *(.95)*	3.23 *(.99)*	.469
SUPPS Negative Urgency			
Mean *(SD)*	10.61 *(3.06)*	9.88 *(3.46)*	.032
SUPPS Positive Urgency			
Mean *(SD)*	7.86 *(2.49)*	7.88 *(2.64)*	.957
NEM-30			
Mean *(SD)*	11.67 *(7.53)*	10.55 *(6.99)*	.080

Note. DERS = Difficulties with Emotion Regulation Scale; DTS = Distress Tolerance Scale; NEM-30 = The Negative Emotionality Scale; *SD* = standard deviation. Holm-Bonferroni Method used to control or multiple comparisons, with no significant findings following this correction.

Discussion

The purpose of the current study was to examine whether transdiagnostic variables related to emotion regulation severed as more robust predictors of inpatient substance use treatment dropout than traditionally examined variables related to demographics and motivation for substance use treatment. Secondarily, for participants remaining in treatment, the study also examined if these areas improved over the course of their approximately month-long treatment stay. To examine these aims it was hypothesized that participants with higher scores on self-report measures of emotion regulation, distress tolerance, positive and negative urgency, and trait negative affect during the first week of treatment would be more likely to drop out of treatment prematurely. In addition, it was hypothesized that behavioral measure outcomes on the PASAT and BART taken during the first week of treatment (associated with poorer distress tolerance skills and risky decision-making in the context of experiencing negative affect) would also predict treatment dropout. It was also hypothesized that demographic variables, substance use-related variables, and motivation-related variables would not be predictive of treatment dropout due to the lack of predictive utility of these variables in the research literature (Brorson et al., 2013). If any demographic variables were significant, it was hypothesized that self-report and behavioral measures of emotion regulation and related constructs would continue to serve as predictors even with demographic variables accounted for as covariates. Finally, it was hypothesized that participants remaining in treatment would show a reduction in their self-reported emotion dysregulation, distress intolerance, impulsivity related to urgency, and trait negative affect from the baseline to follow-up session.

Impact of COVID-19

Data collection for this study occurred during the months in which the United States was hit hardest by the COVID-19 pandemic. This resulted in multiple impacts on data collection, changes to regulations and activities involved in the inpatient substance use treatment setting, and wider societal issues that all likely impacted treatment dropout; and therefore, may also have impacted study findings.

Related to data collection, widening of the timeframes for baseline and follow-up data collection may have decreased potential differences between these two timepoints as participants had fewer days between the two timepoints than originally planned. Additionally, during the stay-at-home order, counseling staff at St. Christopher's were trained to administer the study for eight of the participants. Staff completed thorough training with the primary researcher, had detailed materials to guide them through the study process, and were able to contact the primary researcher to troubleshoot any problems that arouse during study administration. However, there is the potential that because the staff members did not have prior experience with delivering research protocols, that they may have not maintained as strict of adherence to the study protocol as trained researchers.

There were also significant changes to programming at St. Christopher's due to COVID-19. Prior to the pandemic, clients typically engaged in a variety of activities outside of the treatment facility including attending AA/NA meetings, having weekly family visits, going to the gym or having time for outdoor exercise at least five days per week, and participating in a fun activity during the weekend like going to the movies or a park. All of these activities were discontinued due to lockdown orders and concerns of exposing clients and staff to the virus. Clients in inpatient treatment also previously had opportunities to interact with longer-term

clients in group therapy and during social events. Due to COVID-19 inpatient clients had to remain in one building isolated from other clients. During the stay-at-home order only core inpatient counselors/staff continued to see clients in-person. The rest of the staff conducted individual, group, and medication management sessions via telehealth. These various programmatic changes likely influenced several aspects of the study. During administration of the study, many of the participants discussed that they were excited to have something to do because they were bored due to a lack of activities. Many even reported finding the PASAT enjoyable, despite finding it distressing, because they found it be to a relief from boredom. One study participant asked if the PASAT could be left for clients "to play with" in their free time. Additionally, changes to programming may have impacted self-report variables as the treatment experience may have been more aversive overall due to these lockdown measures.

Perhaps the largest way the study was impacted was in the change in dropout rates in the inpatient treatment center. Based on data from prior years, it was anticipated that there would be a 20-30% dropout rate. However, the dropout rate for the current study was about 13%. There are several potential reasons for this change in dropout rate. For several months of the study the stay-at-home order and lockdown measures were in effect. This made it harder for individuals to travel, especially if they lived out of state. Additionally, clients may have found it harder to find a place to stay if they left treatment prematurely. Another potential reason for the lower dropout rate may have been that people seeking treatment during the pandemic may have been more motivated to complete treatment. There were more stringent requirements prior to entering treatment due to the pandemic, including a COVID-19 test, quarantine period, and a longer wait to enter treatment due to admissions being capped at ten clients. Therefore, once individuals made it into treatment, they may have been more committed to staying. The admission cap also

made the data collection process longer, and the number of participants originally proposed could not be achieved.

From a broader societal level there is research indicating that more individuals were seeking out substance use treatment during the pandemic due to a decrease in accessibility to substances, decreased accessibility to substance use treatment, and due to an increase in overall distress related to the pandemic (Chiappini, Guirguis, John, Corkery, & Schifano, 2020), which may have increased commitment to staying in treatment due to limited alternative treatment opportunities. Due to the global and domestic lockdown measures drug trafficking was significantly impacted. Lack of movement between borders and plummeting airline traffic resulted in drug shortages, increased prices, and decreased purity of drugs that were available which may have left many substance dependent individuals in a state of withdrawal (Chiappini et al., 2020). Additionally, some methods of substance use treatment were no longer available to individuals at the beginning of the pandemic. For example, many opioid-maintenance clinics and inpatient residential programs closed due to the high risk of spreading the virus (Chiappini et al., 2020). Initial research related to substance use and COVID-19 also indicates that while the pandemic has increased mental health concerns globally, it has been especially detrimental to individuals with pre-existing mental health and substance use problems (Dubey et al., 2020; Taylor, Landry, Paluszek, & Asmunson, 2020). The lockdown led to increased feelings of loneliness and economic struggles for many Americans (Dubey et al., 20020) and for individuals with pre-existing mental health concerns, significantly increased feelings of uncertainty, worry, and difficulty tolerating distress (Liu, Zhang, Tin Fifi Wong, Hyun, & Hahm, 2020; Taylor et al., 2020). The decrease in access to drugs, decreased access to substance use treatment, and increase in distress may have impacted that current study by potentially increasing the likelihood that

individuals would stay in treatment. These factors may also have increased reports of emotion dysregulation and related variables at both timepoints of the study.

Hypothesis 1.1.

As predicted, demographic variables including age, race, years of education, socioeconomic status, health insurance type, and location of hometown from treatment facility were not predictive of treatment dropout. This is in line with previous research indicating that demographic variables are inconsistent or insignificant predictors of treatment dropout (Brorson et al., 2013; Craig, 1985; Harris, 1998, & Wierzbicki & Pekarik, 1993).

Readiness for change was also examined through the use of the SOCRATES. Like demographic variables, motivation-related variables have been frequently examined, though inconsistent predictors of treatment dropout. None of the scales on the SOCRATES were predictive of treatment dropout, which is in line with prior research (Brorson et al., 2013).

In addition, substance use-related variables including drug of choice (alcohol versus other drugs), number of substance use diagnoses, age of first substance use, number of substances used in the month prior to entering substance use treatment, and diagnoses of other mental health conditions beyond substance use disorders were examined to determine if any of these variables were predictive of treatment dropout. Consistent with prior research, none of these variables were predictive of treatment dropout either (Brorson et al., 2013; Miller et al., 1999).

Number of prior substance use treatments was not significantly different between treatment completers and non-completers when examined via a Welch's t-test; however, this variable did emerge as a significant covariate in the logistic regression analyses with higher numbers of prior substance use treatment being predictive of treatment dropout. This finding is inconsistent with research that prior substance use treatment is either not a significant predictor

of treatment dropout versus completion or is predictive of treatment retention (Andersson, Steinsbekk, Walderhaug, Otterholt, & Nodfjaern, 2018; Stark, 1992). Potential reasons for this discrepancy include that prior substance use treatment may be confounded by its association with other variables including age, severity of substance use history, and ability to access substance use treatment (Stark, 1992). In the current sample average age was approximately 32 which was younger than most populations examined in inpatient substance use treatment dropout studies (Ali et al., 2007; McKellar et al., 2006). Additionally, in the current population prior substance use treatment had a moderate negative correlation with age, indicating that younger clients were more likely to have attended a greater number of prior substance use treatments; whereas other treatment studies have found that older age is correlated with number of prior substance use treatments (Stark, 1992). Therefore, the client population being treated at St. Christopher's may differ from the average treatment setting. St. Christopher's markets to a younger population with complex co-occurring disorders. Many clients who attend St. Christopher's were refused treatment at other settings due to their co-occuring conditions or were discharged from previous treatments due to behavioral problems.

Lack of significant findings related to demographic variables should be interpreted with caution due to the small sample in the treatment dropout group. It is possible that there was not sufficient statistical power to detect any differences in these variables between the two groups.

Hypothesis 1.2.

It was hypothesized that treatment completers would have significantly lower scores on self-report measures of emotion regulation, distress tolerance, negative and positive urgency, and negative emotionality at baseline compared to treatment non-completers. While scores were lower across the measures in the treatment completion group, none of these differences were

statistically significant. In addition to the lack of significant findings when examining individual variables related to emotion regulation between treatment completers and non-completers, there were also no significant predictors when these variables were included in a logistic regression analysis to predict treatment completion vs. non-completion. Only the covariate of number of prior substance use treatments was significant. While the total logistic regression model retained significance, this was only due to this covariate, rather than significant emotion regulation variables predicting treatment dropout. It is likely that the small sample size in the treatment non-completion group contributed to the lack of significant findings. Additionally, the study being conducted during COVID-19 may have increased reporting of difficulties across the domains measured.

Early research on COVID-19 has revealed a negative psychological impact on the general population globally due to the virus itself and measures to contain the spread of the virus. Research on prior epidemics and the current pandemic indicate that measures taken to decrease the spread of viruses, including home confinement and restrictions on activities, contribute to increases in psychological distress and increased difficulties with emotions (Brooks et al., 2020). With increasing stressors across various domains including financial, occupational, childrearing, social, health, etc. emotion regulation and distress tolerance have become more difficult for many people (Liu et al., 2020). This impact has been found to be even greater for individuals with pre-existing mental health disorders (Vindegaard & Benrod, 2020). Comparisons of general distress from April 2018 to April 2020 quantitatively support the notion that distress has been significantly higher during the pandemic (McGinty, Presskreischer, Han, & Barry, 2020). In a study conducted by Park and colleagues (2021) they conceptualized this distress from the framework of the transactional stress or coping model (Lazarus & Folkman, 1984). This model

states that an individual's psychosocial resources and coping responses influence how much of an impact stress exposure will have on them. Park and colleagues (2021) examined how much general distress, and stress specific to COVID-19, Americans reported in April 2020. They found that individuals with limited financial resources were at the greatest risk for peritraumatic distress, and that in general, greater psychosocial resources were associated with lower levels of distress. In terms of coping skills, emotion regulation skills were strongly associated with lower distress levels (Park et al., 2021). Decreased psychosocial resources and increased stress were associated with a decrease in reported ability to tolerate distress, and distress intolerance was found to be predictive of higher levels of depression, anxiety, and PTSD during the pandemic (Park et al., 2021). Participants entering inpatient substance use treatment are more likely than the general population to have a deficit of psychosocial resources and to experience emotion dysregulation, which during the pandemic have been predictors of heightened distress and difficulties in coping with this distress (Chiappini et al., 2020; Park et al., 2021).

Along with increasing emotion dysregulation and distress intolerance due to the pandemic there has also been an increase in the rate of addictive behaviors (Albertella et al., 2021). A study by Albertella and colleagues (2021) found that increases in impulsivity and compulsivity from pre-COVID to during COVID-19, were associated with increased engagement in various types of addictive behaviors and were theorized to be the mechanisms linking distress and increased addictive behaviors during the pandemic (Albertella et al., 2021). Given these impacts across the examined study variables of emotion regulation, distress tolerance, impulsivity, and negative emotionality, it is likely that COVID-19 may have had an influence on reporting of these variables across the study duration.

Hypothesis 1.3.

Several validity checks were completed for the PASAT prior to running the main analyses. The PASAT was found to be distressing based on statistically significant increases in the dysphoria scale from pre-PASAT to post level 2 PASAT administration. This is consistent with a body of research that has utilized the PASAT as a tool for stress-induction and for measuring distress tolerance (Holdwick & Wingenfeld, 1999; Lejuez et al., 2003; Tombaugh, 2006). It should be noted that PASAT latency was not correlated with level of dysphoria at the post level 2 administration. This lack of association between how long individuals persisted on the PASAT and level of distress does not mean that the task was not distressing, but is further demonstration that despite distress some participants choose to continue on the task while others quit.

In order to verify the utility of the PASAT as a measure of distress tolerance, potential confounding variables related to task termination were examined including relationship between reading level, education level, and performance. There were no relationships found between PASAT latency and reading level or level of education. However, there was a small correlation between performance (number of items correct) on levels 1 and 2 of the PASAT and PASAT latency. This is inconsistent with prior findings that PASAT performance is not predictive of PASAT latency (Brown et al., 2002, Daughters et al., 2005a; Daughters et al., 2005b). A potential reason for this discrepancy may be that only about 30% of participants in the current study terminated the PASAT prematurely, whereas other studies using a substance dependent population have found that around 70% quit the PASAT prematurely (Brown et al., 2002, Daughters et al., 2005a; Daughters et al., 2005b). These differences are likely explainable due to the impact of the pandemic. As mentioned previously, many participants reported that despite

being distressed by the PASAT they also enjoyed it because it decreased boredom. Therefore, individuals who were performing more poorly on the PASAT may have been biased towards quitting prematurely. Level of distress was not higher for individuals who had poorer performances; therefore, they may have quit earlier due to realizing that the amount of effort was not worth the limited rewards they were earning from getting few answers correct.

Treatment non-completers had a higher rate of PASAT termination than treatment completers, but this difference was not significant. This is not in line with previous findings which have found PASAT termination to be associated with premature substance use treatment dropout (Daughter et al., 2015a). This was likely a result of small sample size as the difference were quite large (about 25% of treatment completers quit the PASAT prematurely vs. about 55% of treatment non-completers) and trended towards significance. However, due to the small sample size in the treatment non-completion group the analysis was likely underpowered. Another potential reason for the lack of difference in PASAT completion in treatment completers versus non-completers could be due to boredom being more distressing than the PASAT, which impacted rate of completion. A study by Yan and colleagues explored the relationship between boredom, stress, and distress during the COVID-19 outbreak (Yan, Gan, Ding, Wu, Duan, 2021). They found that boredom proneness served as a partial mediator in the relationship between perceived stress and increased emotional distress during the pandemic. They theorized that this is because individuals with higher boredom proneness are more likely to focus on themselves or their internal states which leads to more rumination on psychological symptoms, and a decreased ability to regulate emotions when experiencing high levels of stress (Yan et al., 2021). There is a well-researched relationship between boredom proneness and substance dependence tied to increased cognitive and affective dysregulation (Iso-Ahola & Crowley, 1991; Orcutt, 1984). For

example, individuals with high levels of boredom proneness and substance use disorders report feeling in less control, which may relate to difficulties in tolerating the distress of internal (i.e. emotions, negative thoughts) and external factors (i.e. uncontrollability of environment associated with boredom and in the current study, the pandemic) (Isacescu, Struk, & Danckert, 2017; Eastwood, Frischen, Fenske, & Smilek, 2012). Therefore, individuals in substance use treatment who were experiencing heightened distress due to boredom may have found the alleviation of boredom to be more reinforcing than the PASAT was distressing.

The outcome measure on the BART related to risk taking (mean total pumps) was greater for participants in the non-treatment completion group reflecting a riskier strategy use in this group; however, this was not statistically significant. Relatedly, the treatment non-completion group had more explosions due to choosing higher pump counts but also made more money on average due to this riskier strategy; however, again these differences were not significant, potentially due to the sample size. Another reason for the lack of significant differences may be that the number of average total pumps for treatment completers and treatment non-completers was 57.9 and 63.58 respectively, which both are near the suggested target. Participants were told that if they had an infinite number of balloons that the best guess would be 64 for each balloon. This suggests that on average participants did not have high levels of risk-taking on the BART despite the negative mood induction of the PASAT. The instructions for giving participants the number of ideal pumps and using a negative mood induction were included as the traditional BART has research indicating that the majority of participants were risk averse and that these modifications help to increase risk-taking (DeMartini et al., 2014; Pleskac et al., 2008). A potential reason for the overall less risky approach in this sample may have been that the PASAT did not function as a strong enough negative mood induction. As mentioned previously, while

the dysphoria scores statistically increased following the first two levels, dysphoria was not measured right after PASAT completion to prevent confounds with ending the task. There may have been significant relief experienced with ending the task and so the distress may not have carried over to the BART. Additionally, since many participants reported finding the PASAT enjoyable due to it decreasing boredom, despite raising frustration levels, it may also have served as less of a negative mood induction due to negative reinforcement of reduced boredom. Another possible reason for lack of overall risk taking may have been due to the form of compensation. A study by Ferrey & Mishra (2014) found that the means and timing of compensation greatly impacted the level of risk taking on the BART. They found that immediate cash payments led to the riskiest decision making. While participants were immediately compensated, they were given candy, as cash could not be given to participants while in the substance use treatment program. Therefore, this may not have been a strong enough form of compensation to lead to riskier decision making.

As expected, based on the lack of differences in preliminary statistical analyses on PASAT and BART outcome measures and treatment completion vs. non-completion, the logistic regression model with PASAT latency, BART mean total pumps, total explosions, and total money earned was not significant and no individual predictors emerged as significantly predicting treatment dropout. Only the covariate of number of previous treatments served as a predictor for treatment dropout.

Hypothesis 1.4.

There were also no significant differences on self-report measures of emotion dysregulation, distress tolerance, impulsivity, or negative emotionality and PASAT completion vs. non-completion once accounting for multiple comparisons. Prior to accounting for multiple

comparisons, PASAT non-completers had significantly higher scores of emotion dysregulation and distress intolerance. With a larger sample size this finding may have remained significant. Research examining the relationship between behavioral and self-report measures of distress tolerance is sparse, but for the most part has found them to not be significantly correlated with one another (McHugh et al., 2010). Potential reasons for this may include that behavioral measures have more ecological validity and are less susceptible to social desirability. Another potential factor is that distress may be domain specific and so it may be related to the type of distress caused by the task such as pain, sadness, or frustration (McHugh et al., 2010).

BART outcome measures including mean total pumps and total explosions were significantly correlated with both negative and positive urgency. This is in line with research that has found small to moderate correlations between the BART and measures of impulsivity and risk-taking (Lejuez et al., 2002). A potential reason that the BART was correlated with measures of impulsivity but that neither these self-report or behavioral measures were related to treatment dropout is that there were more barriers in place to individuals leaving treatment prematurely. For example, during the pandemic a plan would have to be set in place ahead of time of either how to get back home if living out of the state, or where to stay if family members/friends refused to break lockdown measures. Therefore, for some clients this may have reduced the ability to leave based on urgency in the moment. Additionally, much of the research on the BART and self-reported impulsivity has focused on predicting level of substance use or relapse, not on treatment dropout (Cyders et al., 2010; Loree et al., 2014).

Hypothesis 2.

It was hypothesized that variables of emotion dysregulation, distress intolerance, impulsivity related to negative and positive urgency, and negative emotionality would improve

over the course of inpatient substance use treatment for treatment completers. Prior to controlling for multiple comparisons, emotion dysregulation and negative urgency significantly decreased from the baseline to follow-up study sessions. However, after accounting for multiple comparisons these findings were no longer significant. A potential reason for a lack of significant findings was the widening of the timeframes for collecting data. The baseline assessment was collected between days 4-10 and follow-up between days 22-30. Therefore, for some participants data may have been collected too close in time to capture differences in self-report measures. Another potential reason for the lack of significant change in these measures may have been that programming significantly changed due to the pandemic. For example, some groups were held over telehealth and other portions of the program were discontinued. The primary researcher ran a group over telehealth and observed decreased level of engagement in these groups compared to in-person groups and frequent technological problems. Additionally, being confined to one building without any visits from family or interaction with people outside of the treatment environment, plus stressors related to COVID-19 may have also influenced the lack of improvement in the measured self-report domains. In a study by DeJong and colleagues (2020) they found that participants in substance use treatment rated the influence of COVID-19 management as negatively influencing their treatment experiences due to sudden changes in how their treatment was being conducted and perceiving that their mental health care providers were more focused on figuring out how to adapt to COVID-19 measures rather than focusing on their treatment (DeJong, Dejong Verhagen, Pols, Verbrugge, & Baldacchino, 2020). Another reason for the lack of significantly findings was likely due to problems with the sample size. With a larger sample it would be interesting to see if emotion regulation and negative urgency maintained significance as these two areas are closely linked. Researchers have found that

substance use increases emotion dysregulation and alters reward sensitivity which results in increased impulsive behavior related to urgency due to seeking out negative reinforcement (Cheetham, et al., 2010; Murphy et al., 2012). Emotion regulation and impulsivity tied to substance use may start to decrease over time with sustained abstinence. Additionally, many substance dependent individuals have emotion regulation and impulse control problems that predate and lead to substance use, that components of treatments such as DBT and CBT would help to target (Blume et al., 2000; Cyders & Smith, 2008; Linehan, 1993). A study by Weiss and colleagues (2015) found that in a college population, participants who received an emotion regulation treatment reported not only significant improvement with overall emotion dysregulation, but also reported improvements in negative and positive urgency. A frequent target of interventions in substance use treatment focuses on emotion regulation and may help individuals to consider the long-term consequences of the behavior rather than acting out of urgency on emotions.

Limitations

There were several limitations to the current study, which likely impacted study findings. Limitations related to the COVID-19 pandemic and measures taken to decrease the spread of the pandemic were discussed in detail in the results and discussion sections. The main limitations related to COVID-19 included a decreased sample size in the treatment dropout group which likely resulted in an underpowered study. Additionally, increased levels of distress and emotion dysregulation related to the unique problems that the pandemic presented also likely had a large impact on the variables being measured in the current study. The lack of normal activities during treatment was also verbally reported to have increased boredom, which likely impacted participants' willingness to continue on the PASAT despite experiencing distress. Study

variables were trending in the predicted direction across most of the analyses; and therefore, it is important to continue researching the relationships between these variables of emotion regulation related to treatment dropout, potentially once the impact of COVID-19 has decreased, and with a larger sample.

Another limitation was the treatment setting utilized. This setting included only male substance users who were mostly younger in age and white. This is not representative of demographics of those with substance use disorders in the United States. Additionally, treatment at St. Christopher's is not standardized across clients and may also look very different from treatment at other substance use centers. Therefore, even if significant results had been achieved there would be difficulty in generalizing them.

Finally, some of the self-report measures used had questionable internal consistency in the current sample.

Implications and Future Directions

Rates of relapse among individuals with substance dependence are high, even for individuals receiving treatment (McLellan et al., 2000). An important factor related to substance use treatment efficacy is the length of time individuals remain in treatment (Hubbard et al., 1989; Simpson et al., 1997; Simpson & Joe, 2004). While many researchers have focused on demographic variables in predicting treatment attrition, these variables have yielded inconsistent findings. The current study focused on examination of transdiagnostic variables related to emotion regulation. Emotion regulation difficulties underly many areas of difficulty related to substance dependence and co-occurring mental health disorders (Gratz & Tull, 2010). Therefore, unlike demographic variables, age of first substance use, or addiction severity, emotion regulation is a factor that can be directly impacted by effective treatments. The current study had multiple limitations due to the COVID-19 pandemic which impacted the sample size and measures involved in the study, which resulted in mostly insignificant findings. However, there were several encouraging trends and variables that were significant prior to controlling for multiple comparisons that indicate that further exploration with a large sample is needed. Future research is necessary to continue to study these variables and to determine if clients with deficits in these areas would benefit from targeted interventions earlier in treatment, with the hopes of mitigating some of the risk that problems with emotion regulation might confer, not only for treatment dropout, but also for relapse.

Appendix A. Consent Form

Consent Form

Study Title: *The Relationship between Emotion Regulation and Substance Use Treatment Attrition*

Performance Sites: St. Christopher's Addiction Wellness Center

Contact: Amy L. Copeland, Ph.D., M.P., the Principal Investigator, can be reached at copelan@lsu.edu. The Co-Investigator, Melanie Roys, M.S., can be reached at mroys1@lsu.edu

Study Purpose: The purpose of this research project is to determine the relationship between emotion regulation and related factors and inpatient substance use treatment dropout.

Participants:

Inclusion: In order to participate in the study, participants must 1) be currently admitted at St. Christopher's inpatient residential level of treatment, 2) be ≥ 18 years of age at the initial study visit, 3) not court mandated for treatment, 4) demonstrate a 7th grade reading level or higher.

Exclusion: Participants will be excluded if any of the above criteria are not met.

Number of Participants: The maximum number of participants we plan to enroll is 200.

Study Procedures: The study requires that you complete several surveys at two time points, including questionnaires regarding your ability to regulate emotions, deal with distress, level of impulsivity, emotional state, and motivation for treatment. The baseline surveys will be completed during the first week of inpatient treatment, and the follow-up surveys will be completed in the last week of inpatient treatment. In the baseline assessment you will also participate in a task measuring your attention and concentration abilities and a task measuring decision making. Additionally, information from your online medical record from St. Christopher's will be used to gather diagnostic information regarding your current and past psychological and substance use history.

Benefits: You will be contributing to our knowledge regarding factors that predict premature treatment dropout, which is highly related to poor treatment outcomes.

Risks/Discomforts: Participation in the study is not known to cause any physical discomfort, but you may experience some psychological discomfort due to the difficult nature of the attention task. You can end your participation at any time if you are experiencing too much discomfort. An optional mindfulness

exercise will be provided at the end of the study for those who feel discomfort from the attention task.

Confidentiality is protected through use of a secured office and locked filing cabinet where all completed study materials will be stored. While every effort is being made to preserve confidentiality, there is always a remote possibility that thieves could obtain your data. Again, this is very unlikely given the multiple steps taken to assure that completed study measures are kept protected.

Right to Refuse: Participation in this study is voluntary, and you may withdraw from the study at any time without prejudicing your future relations with St. Christopher's Addiction Wellness Center.

Privacy: Results of this study may be published, but no names or identifying information will be included in the publication. All personal information obtained in this study will be kept confidential. Your responses will be labeled only with a study identification number within an electronic database.

Financial Information: Participants have the opportunity to earn candy based on performance on two tasks. On a measure of attention, participants can earn one piece of candy per 20 points earned, for a total of up to 12 pieces of candy. On a measure of decision-making, participants can earn one piece of candy per $5 dollars collected in the test, for a total of up to 10 pieces of candy.

Withdrawal: Participants may withdraw from the study at any time.

Removal: Obvious disruption, harm or threat of harm to other study participants, or members of the research team will conclude in participant removal from the study. Additionally, if a participant leaves treatment at St. Christopher's follow-up data will not be collected.

Alternatives: There are not alternatives for discontinuing participation.

Unforeseeable Risks: Due to the potentially stressful nature of the attention task there is a risk for psychological distress. This is not expected to persist longer than the baseline study session, and a mindfulness exercise will be provided for those who are experiencing ongoing distress.

As with any study, confidentiality is a concern, however, confidentiality risk is unlikely given the steps we have taken to ensure that participant identifying information is kept confidential. Confidentiality is protected using locked filing cabinets in secured rooms at Louisiana State University. Additionally, we have obtained a Certificate of Confidentiality through the National Institutes of Health.

Certificate of Confidentiality: To help us protect your privacy, we have obtained a Certificate of Confidentiality from the National Institutes of Health. With this Certificate, the researchers cannot be forced to disclose information that may identify you, even by a court subpoena, in any federal, state, or local civil, criminal, administrative, legislative, or other proceedings. The researchers will use the Certificate to resist any demands for information that would identify you, except as explained below.

The Certificate cannot be used to resist a demand for information from personnel of the United States Government that is used for auditing or evaluation of federally funded projects or for information that must be disclosed in order to meet the requirements of the federal Food and Drug Administration (FDA).

You should understand that a Certificate of Confidentiality does not prevent you or a member of your family from voluntarily releasing information about yourself or your involvement in this research. If an insurer, employer, or other person obtains your written consent to receive research information, then the researchers may not use the Certificate to withhold that information.

The Certificate of Confidentiality does not prevent the researchers from disclosing voluntarily, without your consent, information that would identify you as a participant in the research project under the following circumstances: reporting of child abuse and intent to hurt self or others.

Study-related illness or injury: Participants are instructed to seek necessary medical care from their physician and contact the Principal Investigator, Dr. Amy Copeland (copelan@lsu.edu) in the event of a study-related illness or injury.

New Findings: Any significant new findings developed from the study data or independent sources during the course of research which may influence your willingness to continue in the study will be explained to you.

Signatures: ***This study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. For injury or illness, call your physician, or the Student Health Center if you are an LSU student. If I have questions about subjects' rights or other concerns, I can contact Dennis Landin, Institutional Review Board (225) 578-8692, irb@lsu.edu, or www.lsu.edu/research. I agree to participate in the study described above***

and acknowledge the investigator's obligation to provide me with a signed copy of the consent form.

Subject Signature: _____ Date: _____

The study subject has indicated to me that he/she is unable to read. I certify that I have read this consent form to the subject and explained that by completing the signature line above, the subject has agreed to participate.

Signature of Reader: _____ Date: _____

Identifiers might be removed from the identifiable private information or identifiable biospecimens. After removal, the information or biospecimens may be used for future research studies or distributed to another investigator for future research studies without additional informed consent.

Yes, I give permission_____

Signature

No, I do not give permission_____

Signature

Appendix B. HIPAA Agreement Form

HIPAA Agreement Form

Authorization to Use or Disclose (Release) Health Information that Identifies You for a Research Study

If you sign this document, you give permission to St. Christopher's Addiction Wellness Center (St. Christopher's) to use or disclose (release) your health information that identifies you for the research study described here:

The current study titled, *The Relationship Between Emotion Regulation and Substance Use Treatment Attrition* is being conducted at St. Christopher's. The study aims to determine the relationship between emotion regulation and related factors and inpatient substance use treatment dropout.

The health information that we may use or disclose (release) for this research includes:

The current study will use information pertaining to a participant's substance use and mental health history that will be collected from medical chart records through St. Christopher's online charting system.

The health information listed above may be used by and/or disclosed (released) to: The Copeland Smoking and Substance Use Clinical Research Lab.

St. Christopher's is required by law to protect your health information. By signing this document, you authorize St. Christopher's to use and/or disclose (release) your health information for this research. Those persons who receive your health information may not be required by Federal privacy laws (such as the Privacy Rule) to protect it and may share your information with others without your permission, if permitted by laws governing them.

Please note that St. Christopher's may not condition (withhold or refuse) treating you on whether you sign this Authorization.

Please note that you may change your mind and revoke (take back) this Authorization at any time, except to the extent that St. Christopher's has already acted based on this Authorization. To revoke this Authorization, you must write to:

St. Christopher's Addiction Wellness Center
150 Cora Drive
Baton Rouge, LA 70815
(225) 387-1611

This Authorization does not have an expiration date.

_____	_____
Signature of participant or participant's personal representative	Date
_____	_____
Printed name of participant or participant's personal representative	If applicable, a description of the personal representative's authority to sign for the participant

Appendix C. The Rapid Estimate of Adult Literacy in Medicine—Short Form

Participant ID #: _____ Date: _____

Behavior _____

Exercise _____

Menopause _____

Rectal _____

Antibiotics _____

Anemia _____

Jaundice _____

TOTAL SCORE _____

Appendix D. Demographic Questionnaire

1. Age: _____

2. Where were you living prior to coming to treatment?
    a. Baton Rouge, Louisiana
    b. Louisiana, but outside of Baton Rouge
    c. outside of Louisiana

2. With which ethnic/racial group do you most identify yourself? (choose one)
    a. Caucasian
    b. African-American
    c. Asian
    d. Hispanic
    e. Other

3. What is the highest level of education you have completed?
    a. less than high school
    b. high school diploma/GED
    c. some college
    d. 4-year college degree
    e. graduate degree

4. What is your approximate annual household income? (Include everyone you live with. If you have recently lost your job, include prior salary). _____

5. What is your parents' approximate household income? (Even if they do not reside together.) _____

6. Do you parents or other relatives provide you with regular financial support?
    a. Yes
    b. No

7. In the past 6 months, what has been your primary occupation? _____

8. In the past 6 months, how often did you work?
    a. full-time
    b. part-time
    c. unemployed

9. How are you currently paying for substance use treatment at St. Christopher's? (choose one)
    a. Medicaid/Medicare
    b. Private health insurance
    c. Out of pocket

Appendix E. Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item.

1----------2----------3----------4----------5

almost never	sometimes	about half the time	most of the time	almost always
(0-10%)	(11-35%)	(36-65%)	(66-90%)	(91-100%)

_____ 1) I am clear about my feelings.

_____ 2) I pay attention to how I feel.

_____ 3) I experience my emotions as overwhelming and out of control.

_____ 4) I have no idea how I am feeling.

_____ 5) I have difficulty making sense out of my feelings.

_____ 6) I am attentive to my feelings.

_____ 7) I know exactly how I am feeling.

_____ 8) I care about what I am feeling.

_____ 9) I am confused about how I feel.

_____ 10) When I'm upset, I acknowledge my emotions.

_____ 11) When I'm upset, I become angry with myself for feeling that way.

_____ 12) When I'm upset, I become embarrassed for feeling that way.

_____ 13) When I'm upset, I have difficulty getting work done.

_____ 14) When I'm upset, I become out of control.

_____ 15) When I'm upset, I believe that I will remain that way for a long time.

_____ 16) When I'm upset, I believe that I will end up feeling very depressed.

_____ 17) When I'm upset, I believe that my feelings are valid and important.

_____ 18) When I'm upset, I have difficulty focusing on other things.

_____ 19) When I'm upset, I feel out of control.

_____ 20) When I'm upset, I can still get things done.

_____ 21) When I'm upset, I feel ashamed at myself for feeling that way.

_____ 22) When I'm upset, I know that I can find a way to eventually feel better.

_____ 23) When I'm upset, I feel like I am weak.

_____ 24) When I'm upset, I feel like I can remain in control of my behaviors.

_____ 25) When I'm upset, I feel guilty for feeling that way.

_____ 26) When I'm upset, I have difficulty concentrating.

_____ 27) When I'm upset, I have difficulty controlling my behaviors.

_____ 28) When I'm upset, I believe there is nothing I can do to make myself feel better.

_____ 29) When I'm upset, I become irritated at myself for feeling that way.

_____ 30) When I'm upset, I start to feel very bad about myself.

_____ 31) When I'm upset, I believe that wallowing in it is all I can do.

_____ 32) When I'm upset, I lose control over my behavior.

_____ 33) When I'm upset, I have difficulty thinking about anything else.

_____ 34) When I'm upset, I take time to figure out what I'm really feeling.

_____ 35) When I'm upset, it takes me a long time to feel better.

_____ 36) When I'm upset, my emotions feel overwhelming.

Appendix F. Distress Tolerance Scale

Directions: Think of times that you feel distressed or upset. Select the number that best describes your beliefs about feeling distressed or upset.

1----------2----------3----------4----------5

strongly agree mildly agree agree and disagree equally mildly disagree strongly disagree

_____ 1. Feeling distressed or upset is unbearable to me.

_____ 2. When I feel distressed or upset, all I can think about is how bad I feel.

_____ 3. I can't handle feeling distressed or upset.

_____ 4. My feelings of distress are so intense that they completely take over.

_____ 5. There's nothing worse than feeling distressed or upset.

_____ 6. I can tolerate being distressed or upset as well as most people.

_____ 7. My feelings of distress or being upset are not acceptable.

_____ 8. I'll do anything to avoid feeling distressed or upset. Regulation

_____ 9. Other people seem to be able to tolerate feeling distressed or upset better than I can.

_____ 10. Being distressed or upset is always a major ordeal for me.

_____ 11. I am ashamed of myself when I feel distressed or upset.

_____ 12. My feelings of distress or being upset scare me. Appraisal

_____ 13. I'll do anything to stop feeling distressed or upset.

_____ 14. When I feel distressed or upset, I must do something about it immediately.

_____ 15. When I feel distressed or upset, I cannot help but concentrate on how bad the distress actually feels.

Appendix G. Short UPPS-P

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree** somewhat circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below.

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
1. I generally like to see things through to the end.	1	2	3	4
2. My thinking is usually careful and purposeful.	1	2	3	4
3. When I am in great mood, I tend to get into situations that could cause me problems.	1	2	3	4
4. Unfinished tasks really bother me.	1	2	3	4
5. I like to stop and think things over before I do them.	1	2	3	4
6. When I feel bad, I will often do things I later regret in order to make myself feel better now.	1	2	3	4
7. Once I get going on something I hate to stop.	1	2	3	4
8. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.	1	2	3	4
9. I quite enjoy taking risks.	1	2	3	4
10. I tend to lose control when I am in a great mood.	1	2	3	4
11. I finish what I start.	1	2	3	4
12. I tend to value and follow a rational, "sensible" approach to things.	1	2	3	4
13. When I am upset I often act without thinking.	1	2	3	4
14. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	1	2	3	4
15. When I feel rejected, I will often say things that I later regret.	1	2	3	4
16. I would like to learn to fly an airplane.	1	2	3	4
17. Others are shocked or worried about the things I do when I am feeling very excited.	1	2	3	4
18. I would enjoy the sensation of skiing very fast down a high mountain slope.	1	2	3	4
19. I usually think carefully before doing anything.	1	2	3	4
20. I tend to act without thinking when I am really excited.	1	2	3	4

Appendix H. The 30-item Negative Emotionality (NEM-30) Scale

Please circle T for True or F for False for each statement.

1. I often find myself worrying about something. T/F

2. Some people go out of their way to keep me from getting ahead. T/F

3. My feelings are rather easily hurt. T/F

4. I am easily "rattled" at critical moments. T/F

5. Many people try to push me around. T/F

6. Often I get irritated at little annoyances. T/F

7. I suffer from nervousness. T/F

8. I am usually happier when I am alone. T/F

9. When I get angry I am often ready to hit someone. T/F

10. I often find it difficult to sleep at night. T/F

11. My mood often goes up and down. T/F

12. I am more of a "loner" than most people. T/F

13. I have personal enemies who would like to harm me. T/F

14. Often I have feelings of unworthiness. T/F

15. Occasionally I experience strong emotions—anxiety, anger—without really knowing what causes them. T/F

16. People often say mean things about me. T/F

17. I am often nervous for no reason. T/F

18. I am able to wander off into my own thoughts while doing a routine task and actually forget that I am doing the task, and then find a few minutes later that I have completed it. T/F

19. I feel that life has handed me a raw deal. T/F

20.1 often feel fed-up. T/F

21. People rarely try to take advantage of me. T/F

22. Minor setbacks sometimes irritate me too much. T/F

23. My "friends" have often betrayed me. T/F

24. I worry about terrible things that might happen. T/F

25.1 have often been lied to. T/F

26. When people insult me, I try to get even. T/F

27. There are days when I'm "on edge" all the time. T/F

28. At times I somehow feel the presence of someone who is not physically there. T/F

29. Sometimes I just like to hit someone. T/F

30. Some people oppose me for no good reason. T/F

Appendix I. SOCRATES

Instructions: Please read the following statements carefully. Each one describes a way that you might (or might not) feel about your drug use. For each statement, circle one number from 1 to 5, to indicate how much you agree or disagree with it right now. Please circle one and only one number for every statement. Alcohol is considered a type of drug use for the purposes of this questionnaire.

	Strongly Disagree	Disagree	Undecided or Unsure	Agree	Strongly Agree
1. I really want to make changes in my use of drugs.	1	2	3	4	5
2. Sometimes I wonder if I am an addict.	1	2	3	4	5
3. If I don't change my drug use soon, my problems are going to get worse.	1	2	3	4	5
4. I have already started making some changes in my use of drugs.	1	2	3	4	5
5. I was using drugs too much at one time, but I've managed to change that.	1	2	3	4	5
6. The only reason I'm here is that somebody made me come.	1	2	3	4	5
7. Sometimes I wonder if my drug use is hurting other people.	1	2	3	4	5
8. I have a drug problem.	1	2	3	4	5
9. I'm not just thinking about changing my drug use, I'm already doing something about it.	1	2	3	4	5
10. I have already changed my drug use, and I am looking for ways to keep from slipping back to my old pattern.	1	2	3	4	5
11. I have serious problems with drugs.	1	2	3	4	5
12. Sometimes I wonder if I am in control of my drug use.	1	2	3	4	5

	Strongly Disagree	Disagree	Undecided or Unsure	Agree	Strongly Agree
13. My drug use is causing a lot of harm.	1	2	3	4	5
14. I am actively doing things now to cut down or stop my use of drugs.	1	2	3	4	5
15. I want help to keep from going back to the drug problems that I had before.	1	2	3	4	5
16. I know that I have a drug problem.	1	2	3	4	5
17. There are times when I wonder if I use drugs too much.	1	2	3	4	5
18. I am a drug addict.	1	2	3	4	5
19. I am working hard to change my drug use.	1	2	3	4	5
20. I have made some changes in my drug use, and I want some help to keep going.	1	2	3	4	5

Appendix J. Dysphoria Scale

Please rate how you are **currently** feeling on a scale of 0-100.

0----------100

Not at all Extremely

Anxiety _____

Irritability _____

Difficulty concentrating _____

Frustration _____

Appendix K. PASAT-C Instructions

(These instructions will be presented on the computer, but will also be reviewed with the participant by the researcher.)

Page 1. Welcome. On this task you will see a series of single digit numbers presented once every 3 seconds. Look for the first two numbers, add them up, and indicate your answer. When you see the next number, add it to the one presented right before it. Continue to add the next number to each preceding one.

Remember, you are not being asked to keep a running total, but rather the sum of the last two numbers that were presented.

You will receive a point for each correct response and the goal is to get as many points as you can.

Page 2. For example, if the first two number were 5 and 7, you would press or click 12. If the next number were 3, you would press or click 10. Then if the next number were 2, you would press or click 5.

On each trial, you will see a circle with number buttons on the screen. Respond by pressing the number on the screen or clicking with the mouse on the number that corresponds to the sum.

Page 3. You will receive 1 point for each trial that you get correct. You will receive 0 points for each incorrect trial or trials you do not answer.

You will receive 1 piece of candy for every 20 points you earn.

Note: Do not respond to the first trial because there is no preceding number to add it to.

Page 4. This is a challenging task. If you lose your place, just jump right back in- look for two numbers in a row and add them up and keep going.

Next, you will do some practice items.

Start the practice when you are ready.

Participants complete practice level. If zero correct answers, repeat instructions and practice trial.

Page 5. Practice is now complete. The real task will now begin.

On the following trials, the digits will be presented slightly faster than before.

Click start when you are ready.

Participants complete Levels 1 & 2.

Page 6. On the following trials, the digits will be presented faster than before and will be the most challenging.

This last part of the task will take approximately 7 minutes.

To end earlier, a button labeled ‘Quit’ will appear at the bottom of the screen.

Pressing this button will terminate the Math Task immediately.

The next task starts in: 2:00 minutes.

During 2:00 minutes rest period participants fill out dysphoria scale then complete Level 3.

Appendix L. BART Instructions

(These instructions will be presented on the computer screen, but will also be reviewed with the participant by the researcher.

Page 1. You are going to see 30 balloons, one after another, on the screen.

Each balloon will be pumped up and will eventually pop when it reaches its explosion point. Some of these balloons might pop after just one pump. Others might not pop until they fill up the whole screen.

For each balloon, you will be asked how many times you want to pump up the balloon.

Each pump earns $0.05. However, if a balloon pops before it can be pumped as many times as you indicated, you lose the money you earned on the balloon.

After each time you collect money or pop a balloon, a new balloon will appear.

At the end of the experiment, you will receive a piece of candy for every $5 you earn in the game.

Page 2. The explosion point varies across balloons, ranging from the first pump to the 128th pump.

The ideal number of pumps is 64. What that means is that if you were to make the same number of pumps on every balloon, you best strategy would be to make 64 pumps for every balloon.

This would give you the most money over a long period of time.

However, the actual number of pumps for any particular balloon will vary, so the best overall strategy may not be the best strategy for one balloon.

Page 3. Summary

Your write the number of times you want to pump up each balloon in a provided textbox.

Remember: each balloon can be pumped up to 128 times (but if it had not popped after 127 times, it will surely pop after 128)

Each balloon is then pumped up until a) that number is reached or b) it pops. Whatever occurs first.

If it does not explode, you make $0.05 for each pump.

The ideal number of pumps is 64. However, the best overall strategy may not be the best strategy for any one balloon.

There are just 30 balloons.

At the end you will receive a piece of candy for every $5 dollars you earned in the game.

Now, do you have any questions?

Continue if you are ready to start.

Participant starts task.

Instructions on task screen. Enter how many times you want to pump up this balloon.

Remember anything higher than 127 and the balloon SURELY pops.

Number of wanted pumps:

Potential earnings:

Balloon number:

Total winnings:

Appendix M. Mindfulness Instructions

Mindfulness Instructions

Adapted from Delinsky and Wilson (2006), Kabat-Zinn (1994, 2002), Baer et al. (2006), and Lau et al. (2006).

"While sitting down in your chair, place your feet flat on the floor. Sit up straight. Relax your shoulders, relax your neck, and place your hands in your lap or on your knees. As you settle into a comfortable position, commit yourself to simply being fully awake, fully present for these next few moments. If you feel comfortable with it, gently close your eyes. Otherwise, just look toward the floor.

Focus on tuning into the feeling of the breath moving in and out of your body. Focus on the sensation of the breath moving through your nose on each inbreath and each outbreath. Allow yourself to just be here in this moment, following the breath as it comes in and as it goes out. Just breathe and let go. Breathe and let be.

Naturally your mind may wander off into thoughts of one kind or another. Take note of any thoughts as they come up. Note what's on your mind and how your body is feeling. Acknowledge these thoughts, whatever they are, without judging or evaluating them. And then just gently let them go. Bring your attention back to the breath, focusing on the feeling of the breath coming in and out of your nostrils.

And each time you notice that your mind has gone off somewhere else, wherever that may be, just bring your attention back to the feeling of the breath. And if the mind wanders off a thousand times, you simply bring it back a thousand times, intentionally cultivating an attitude of patience and gentleness towards yourself. This means choosing as best you can not to react to or judge any of your thoughts or feelings, impulses or perceptions, reminding yourself instead that absolutely anything that comes into the field of awareness is ok. We simply sit with it and breathe with it and observe it, staying open and awake in the present moment, right here, right now, a continual process of seeing and letting be, seeing and letting go, rejecting nothing, pursuing nothing, dwelling in stillness and in calmness as the breath moves in and out.

If you'd like, commit yourself to bringing this attitude of attention and acceptance with you throughout your day, being fully aware in the present moment, noticing any thoughts or feelings that may arise, without judging them – just being right here and right now, accepting the present moment, and accepting yourself, no matter what happens. Remember that you can always bring your focus back to your breath, back to the sensations of the present moment, to cultivate this sense of attention and acceptance."

Appendix N. Debriefing

The measure that you were told was for attention, was actually a measure examining ability to tolerate distress. The decision-making task was also looking at how risky decision making is influenced by a negative emotional state. Please do not discuss the purpose of the study with other clients in order to avoid participants knowing the purpose of these measures ahead of time.

Appendix O. Substance Use and Mental Health Diagnostic Form

Information will be gathered from the participants' psychosocial assessment and from their initial psychiatric intake.

1. According to psychiatric intake, does client currently have severe mental health symptoms such as psychosis or mania? ____ If yes, discontinue study after self-report measures.

2.How many days in treatment prior to baseline assessment? _____

3. What is substance(s) of choice? _____

4. Age of first use and substance used: _____

5. Number of treatment centers attended: _____

6. Substances used during month prior to admission to substance use treatment (circle below):

a. Alcohol	f. Amphetamines	j. Hallucinogens
b. Cannabis	g. Opiates	k. Ecstasy
c. Cocaine (crack)	h. Benzodiazepines	l. Bath salts
d. Cocaine (powder)	i. Inhalants	
e. Methamphetamine	k. Steroids	

7. Substance use disorders:

Substance use disorder: _____ Severity: _____

Substance use disorder: _____ Severity: _____

Substance use disorder: _____ Severity: _____

Substance use disorder: _____ Severity: _____

8. Other psychological disorders:

Disorder: _____

Disorder: _____

Disorder: _____

Disorder: _____

APPENDIX P. IRB Approval Form

ACTION ON PROTOCOL APPROVAL REQUEST

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu
lsu.edu/research

TO: Amy Copeland
Psychology

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: January 23, 2020

RE: IRB# 4302

TITLE: The Relationship Between Emotion Regulation and Substance Use Treatment Attrition

New Protocol/Modification/Continuation: New Protocol

Review type: Full X Expedited ____ **Review date:** 12/13/2019

Risk Factor: Minimal ____X____ Uncertain _____ Greater Than Minimal_____

Approved _____X_____ **Disapproved** _____

Approval Date: 12/13/2019 **Approval Expiration Date:** 12/12/2020

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 200

LSU Proposal Number (if applicable):

By: Dennis Landin, Chairman DLandin

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE: **Make sure you use bcc when emailing more than one recipient.**

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

Appendix Q. Certificate of Confidentiality

CERTIFICATE OF CONFIDENTIALITY

Number:
CC-OD-20-214

Issued to

Louisiana State University

conducting research known as

The Relationship Between Emotion Regulation and Substance Use Treatment Attrition

In accordance with the provisions of section 301(d) of the Public Health Service Act, 42 U.S.C. 241(d), this Certificate is issued to the Principal Investigator, *Dr. Amy Copeland* and *Louisiana State University* to protect the privacy of subjects in the above named *single-site/single-protocol* research study, which is collecting or using identifiable, sensitive information. If there is a discrepancy between the terms used in this Certificate and section 301(d), the statutory language will control.

Research data containing identifiable, sensitive information collected during this study initiated on 02/24/2020 (and concluding on 02/28/2021) is covered by the Certificate. Identifiable, sensitive information protected by the Certificate and all copies thereof are protected for perpetuity.

The recipient of this Certificate shall comply with all requirements of subsection 301(d) of the Public Health Service Act.

This Certificate does not represent an endorsement of the research project by the Department of Health and Human Services. Information collected during the term of the Certificate is protected in perpetuity. However, this Certificate does not protect information collected from participants enrolled after the term of the Certificate.

2/20/2020
Date

NIH Certificates of Confidentiality Coordinator
Office of Extramural Research
National Institutes of Health

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VITA

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