



Prevalence and Clinical Correlates of Co-Occurring Attention Deficit/Hyperactivity Disorder and Posttraumatic Stress Disorder in a Sample of Inpatients Being Treated for Substance Use Disorder

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Prevalence and Clinical Correlates of Co-occurring Attention Deficit/Hyperactivity Disorder and
Posttraumatic Stress Disorder in a Sample of Inpatients Being Treated for Substance Use Disorder

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for the Degree of Master of Liberal Arts in Extension Studies

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Abstract

Attention-deficit/hyperactivity disorder (ADHD) and posttraumatic stress disorder (PTSD) commonly co-occur, and both have been recognized as risk factors for substance use disorder (SUD). Previous research has shown lifetime prevalence of PTSD was greater in adults with ADHD compared to controls, and those with both ADHD and PTSD had increased risk for other psychiatric comorbidities, higher functional impairment, and lower quality of life. However, no studies to date have examined the prevalence of these two disorders together in an inpatient population seeking treatment for SUD. The present study aims to examine the prevalence and clinical correlates of these two disorders in a sample of adults being treated for SUD.

A sample of 293 participants being treated for SUD completed the Adult ADHD Self-Report Scale Symptom Checklist (ASRS-v1.1) and the PTSD Checklist 5 (PCL-5). SUD symptom severity was measured by the Brief Addiction Monitor (BAM) and the Brief Substance Craving Scale (BSCS). A linear regression analysis was run to characterize the association between ADHD and PTSD symptom severity and SUD symptom severity, controlling for clinical and demographic factors.

Results indicated that ADHD and PTSD were highly prevalent in this setting, (39% and 35%, respectively). Diagnosis of one disorder was strongly associated with the likelihood of the other disorder ($\chi^2 = 17.49$, $p = .001$), and symptom severity for the two disorders was highly correlated ($r = 0.50$, $p < .001$). In multivariable models controlling for sociodemographic variables and primary substance of abuse, greater PTSD severity

was associated with higher overall SUD severity, and greater ADHD symptom severity was associated with craving at a trend level.

The prevalence of co-occurring ADHD and PTSD in this sample was at the high end of what has been previously cited in other settings, with significant associations between ADHD and PTSD symptoms and diagnosis likelihood. Even in this sample of adults with severe SUD, PTSD and ADHD symptoms were associated with greater SUD severity. Although integrated therapeutic modalities currently exist, additional study is needed to devise appropriate and efficacious behavioral interventions for this constellation of disorders.

Dedication

This thesis is dedicated to my mother, Dr. Arlene B. McCoy, who showed me how to do middle age right.

Acknowledgments

I would like to acknowledge the unwavering guidance of my thesis director, Dr. R. Kathryn McHugh, the most excellent preparation and encouragement from Dr. Dante Spetter, and the love and support of my five fabulous sisters, my five precious children, my posse of amazing college pals, and my beautiful and brilliant life partner, Susan RA Correa.

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Chapter I.

Introduction

Substance use disorder (SUD) has been defined as a chronic, relapsing brain disease, characterized by compulsive drug seeking behavior, despite harmful consequences (American Psychiatric Association, 2013). An extensive literature suggests that SUD frequently co-occurs with other disorders; recent estimates indicate that of the 20.2 million adults who were diagnosed with a substance use disorder, nearly 40% (7.9 million) had a co-occurring mental disorder (SAMHSA, 2014). Among these co-morbidities, both attention-deficit/hyperactivity disorder (ADHD) and posttraumatic stress disorder (PTSD) figure prominently, with ADHD co-occurring in an estimated range of 10-46% of people with SUD (van Emmerik-van Oortmerssen et al., 2012), and PTSD co-occurring in estimated 40% of people with SUD (Pietrzak, 2011, Blanco, 2013). It is well established that ADHD and PTSD are independent risk factors for SUD; however, the co-occurrence of ADHD and PTSD among those with SUD is less well understood. There have been studies that examine that co-occurrence in a military veteran population (Harrington 2012) which showed that challenges modulating arousal level (hypo- and hyper-arousal) were factors common to both disorders. In another study, a meta-analysis of prevalence of co-occurring ADHD and PTSD, no studies were identified that included samples from a SUD inpatient treatment setting (Spencer, 2016). Although this co-occurrence has been studied in the general and veteran populations, the lack of studies in people with severe SUDs that received inpatient treatment is a gap in the literature pertaining to the co-occurrence of PTSD and ADHD in people being treated for

SUD. This is important given the high likelihood that ADHD and PTSD will present in an inpatient setting and may interfere with treatment effectiveness; understanding this co-occurrence with SUD could provide insights regarding targeted treatment for this special population.

ADHD

Attention deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that commences in childhood and can continue into adulthood, manifesting in symptoms of inattention, hyperactivity or impulsivity (American Psychiatric Association, 2013). Symptoms can differ between genders, with girls presenting with inattentive symptoms more frequently, which may contribute to underdiagnosis in females and higher documented prevalence in males (Biederman, 2002). To meet diagnostic criteria for ADHD, symptoms must present in two or more settings (home, school, work) and there must be clear evidence that these symptoms interfere with functioning. It is worth noting that exclusion criteria for ADHD stipulates that these symptoms do not occur solely with a co-morbid disorder such as schizophrenia, or mood, anxiety, or dissociative disorders. Additionally, presentation of these symptoms in either substance intoxication or withdrawal does not constitute definitive diagnosis (American Psychiatric Association, 2013). Childhood prevalence of ADHD has been estimated at 5% and adult ADHD prevalence has been estimated at 4.4% (Kessler, 2006), with males are more likely to be diagnosed than females (Wilcott, 2012).

ADHD and SUD

In those seeking treatment for SUD, the prevalence of co-occurring adult ADHD ranges from 10% to 46% (van Emmerik-van Oortmerssen et al., 2012; Wilens, 2004). In

a meta-analysis that examined twelve studies in adult, treatment-seeking SUD patients, the pooled ADHD prevalence rate was 23.3%, ranging from 10.0 to 54.1% in individual studies. In a cross-sectional study statistically powered to determine the prevalence of ADHD in SUD populations, 40% of subjects screened positive for ADHD (van de Glind, 2013). This broad spectrum of prevalence could be attributed to multiple factors, including differing diagnostic criteria for ADHD, variability in use of instruments and assessors, and heterogeneity between study settings and sample selection strategies (van Emmerik van Oortmerssen et al., 2013).

There are several theories that explain this co-occurrence. The high-risk theory, posits that impulsivity, a hallmark symptom of ADHD, has been shown to correspond with engagement in high risk behaviors, among them frequent substance use, which can result in SUD (Chilcoat & Breslau, 1998). Additionally, risk for SUD is higher among those who use substances to “self-medicate” psychiatric symptoms (Khantzian, 1985, 1990, 1997). It has also been shown that there is a genetic component to both ADHD and SUD; whether inherited ADHD increases SUD risk or the comorbidity of SUD in and of itself is inherited remains unclear (Kessler, 2006).

PTSD

Posttraumatic stress disorder is classified as a Trauma-and Stress Related Disorder that occurs after experiencing or witnessing a traumatic event (American Psychiatric Association, 2013). The diagnostic criteria are comprised of 8 categories (criteria A-H), each having a set of circumstances and symptoms that are characteristic of PTSD. According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), criterion A exposure must be one or more of the following event types:

1) a direct experience of the event, 2) firsthand witnessing of the event, 3) learning of a sudden, violent, or accidental death of a close family member or close friend, or 4) a result of repeated exposure occupational exposure, such as that experienced by first responders, military, or mortuary workers (American Psychiatric Association, 2013).

Behavioral symptoms present in four distinct clusters: 1) persistent re-experiencing of the traumatic event; (2) avoidance of stimuli related to trauma experienced; 3) feelings of isolation, negative affect, and inability to recall trauma; and 4) arousal and reactivity, such as irritability, risky behavior, hypervigilance, heightened startle reaction, difficulty concentrating and sleeping (American Psychiatric Association, 2013).

PTSD diagnostic criteria stipulate that the trauma can be measured either in terms of a composite trauma (exposure to different trauma types), or same event trauma (repeated exposure to the same event). In a study that assessed exposure to traumatic events, PTSD symptoms and functional impairment using an online survey, prevalence in the general population of composite event PTSD was measured at 9.4%, and 8.3% for composite and same-event PTSD, respectively (Kilpatrick, 2013). Women are approximately twice as likely than men to have composite event PTSD (12.8 %/5.7%, respectively) as well as same-event PTSD (11.0%/5.4%, respectively). Additionally, 53.1% of PTSD cases are attributable to direct interpersonal violence victimization (58.6% of women and 47.1% of men). This includes physical abuse in childhood, physical assault, and sexual assault, including rape. Sexual assault victimization prevalence is 29.7% overall (42.4% among women and 15.8% among men) and physical assault victimization was 43.7% overall (44.9% of women and 42.4% of men) (Kilpatrick, 2013).

PTSD AND SUD

SUD and PTSD are strongly correlated, with epidemiological data showing practically a third of the general US population will experience SUD, and roughly 8 % will experience PTSD during their lifetime (Kessler, 2012). Comorbid PTSD occurs with SUD approximately 40 % of the time in both military and civilian populations (Pietrzak, 2011, Blanco, 2013). The predominant explanation for this co-occurrence is the self-medication theory, which hypothesizes that individuals with PTSD develop increased risk for substance use due to their tendency to drink alcohol or use drugs to deal with the symptoms and sequelae of PTSD (Khantzian, 1985; Reed, Anthony, & Breslau, 2007, Stewart, 2003).

In a study that investigated clinical correlates of co-occurring SUD and PTSD in women, it was found that hyperarousal and avoidance symptoms were more prominent with comorbid PTSD/SUD, as compared to those with SUD alone (Saladin, Brady, Dansky, & Kilpatrick, 1995). In this study, the use of depressants, such as alcohol, was more strongly associated than use of stimulants, such as cocaine use to mitigate hyperarousal symptoms. Other research focused on comorbid PTSD and SUD found that intense substance craving follows exposure to trauma-related cues (Coffey et al., 1998), and increases in craving following cue exposure are predicted by PTSD symptom severity (Saladin et al., 2003). Additionally, substance use withdrawal symptoms (e.g., sleep disturbance, difficulty concentrating, feelings of detachment, irritability) may mirror some symptoms of PTSD. This may contribute to a reinforcing cycle of self-medication that precipitates the development of a SUD (McCauley, 2012). In a prospective study that followed 35 outpatients with comorbid PTSD and SUDs, tracking

weekly fluctuations in symptoms over a 26 week period, it was found that increases in PTSD symptoms were associated with increases in symptoms of substance dependence (Ouimette, Read, Wade, and Tirone, 2010).

There are also theories that posit that SUDs precede PTSD. The high-risk hypothesis (Acierno, Resnick, Kilpatrick, Saunders, & Best, 1999; Chilcoat & Breslau, 1998) hypothesizes that the context of illicit substance acquisition and use (i.e., dangerous environments to purchase /use drugs) may increase the likelihood of experiencing a traumatic event and subsequently developing PTSD. The susceptibility hypothesis proposes that chronic substance abuse, coupled with poor coping skills, and increased anxiety and arousal may increase biological vulnerability to developing PTSD subsequent to trauma exposure (Jacobsen et al., 2001; Sharkansky, Brief, Peirce, Meehan, & Mannix, 1999; Stewart et al., 2000). Finally, there is evidence that certain common factors play a role in the development of comorbid PTSD and SUD, including genetics, neurophysiologic systems, and prior exposure to traumatic events (McCauley, 2012, Stewart & Conrod, 2003). It is widely held that the co-occurring presentation of PTSD and SUDs is associated with a more severe clinical presentation and poorer treatment prognosis. This seemingly synergistic effect can result in chronic health problems, diminished social functioning, higher suicidality, legal problems, low treatment adherence, and negative treatment outcomes, including frequent relapse (Back, 2009, Driessen, 2008, Norman, 2007, Ouimette, 1998, 2006, Tate 2007).

ADHD and PTSD

There is a growing literature that examines the relationship between ADHD and PTSD. ADHD has been seen to be a risk factor for PTSD, as it is associated with high levels of risk-taking behavior which can lead to exposure to traumatic events (Adler, 2004, Harrington, 2012).

In a study that compared ADHD patients with and without PTSD, it was found that lifetime prevalence of PTSD was greater in adults with ADHD compared to controls (10.0% vs 1.6%; $p = .004$). Additionally, in a sample of military veterans, it was found that although type of trauma exposure accounted for 5% of variance in PTSD symptom severity, having ADHD increased PTSD symptom severity by additional 7% (Harrington, 2012). In other research, it was found that those with ADHD and PTSD had higher rates of psychiatric comorbidity, worse quality of life ratings, and shared elevated risk for these disorders in family members (Antshel, 2014). In this study, the ADHD + PTSD group experienced increased rates of major depressive disorder, oppositional defiant disorder, and anxiety disorders, including social phobia, agoraphobia, and generalized anxiety disorder. Higher functional impairment and lower quality of life ratings were reported by the ADHD + PTSD group as compared to participants with ADHD alone. Relatives of the ADHD + PTSD group had significantly higher rates of this co-occurrence than those of controls (Antshel, 2014).

In an analysis of the findings of the National Comorbidity Survey Replication (NCS-R) study, Kessler et al (2004) found that 13% of the respondents diagnosed with PTSD had co-occurring ADHD. In a meta-analysis of studies that examined the

relationship between ADHD and PTSD, it was found that the greatest relative risk was for the development of PTSD in individuals with ADHD compared to normal controls, with ADHD increasing the risk of PTSD four-fold. Although statistical inference does not constitute causality, age of onset of ADHD prior to PTSD clearly indicated individuals with ADHD have an increased likelihood for later development of PTSD (Spencer, 2016).

There are several possible explanations for the association between ADHD and PTSD. First, there may be both genetic and neurologic factors that predispose vulnerability to PTSD in individuals with ADHD. Both disorders can be inherited (Kremen, 2012; Faraone, 2010), and share similar genetic variation in the 3' untranslated region of the dopamine transporter gene (Drury, 2013, Spencer, 2013). Moreover, and in both ADHD and PTSD, abnormalities in neural circuits implicated in dopaminergic transmission and prefrontal cortex dysfunction have been observed. (Kremen, 2012; Gamo, 2011).

Perhaps the most compelling and relevant aspect of co-occurring ADHD and PTSD is a consistent, positive correlation between symptom severity for each disorder. This synergistic relationship between symptoms suggests that ADHD symptoms may exacerbate PTSD symptoms and vice versa (Spencer, 2016). The authors of a meta-analysis of ADHD/PTSD comorbidity postulate that PTSD may cause an acquired, ADHD-like syndrome; this hypothesis is supported by preclinical research demonstrating that chronic, untreated stress impairs working memory and prefrontal cortical function (Arnsten, 2007).

Extensive data has been published co-occurrence of ADHD and SUD, PTSD and SUD, and a growing literature exists looking at ADHD and PTSD; however, there are no studies to date that examine adult, comorbid ADHD and PTSD in an inpatient population being treated for SUD. Better understanding the prevalence of this co-occurrence and its clinical correlates could lead to early screening, diagnosis, and targeted treatment, improving outcomes in this hard to treat population. The proposed study will investigate the prevalence of PTSD and/or ADHD in an inpatient population being treated for SUD. Additionally, this study will identify the clinical correlates that are common to both disorders, and how gender may be associated with symptom severity in this population.

Chapter II.

Research Methods

Participants

Adults being treated for SUD on the inpatient service of an academically-affiliated psychiatric hospital were recruited for a study of clinical characteristics of individuals with SUDs. Participants (N=293) were recruited via brief presentations or invitation to participate by study staff. Eligibility was determined by age (at least 18 years old) and ability to complete study procedures (i.e., read and provide informed consent). Individuals were excluded from participation if they presented with an unstable psychiatric or medical illness, or cognitive impairment that would preclude completion of study procedures. Informed consent was completed prior to the study.

Procedures

All participants completed informed consent and all study procedures were approved by the local Institutional Review Board. Individuals answered questions on a battery of self-report measures, which took approximately 15–30 min to complete.

Measures

Demographic data was self-reported by participants. Diagnoses of SUD were obtained from their medical record. The primary SUD diagnosis was determined by the type of substance for which the individual was admitted for treatment.

Participants were administered the Adult ADHD Self-Report Scale Symptom Checklist (ASRS-v1.1), which includes 18 questions that constitute DSM-IV-TR diagnostic criteria for ADHD. The first six questions are seen to be the most predictive of the accompanying symptoms of ADHD (Kessler, 2004). The questions assess frequency of symptoms across several domains, including inattention (e.g., “How often do you have problems remembering appointments or obligations?”), hyperactivity (e.g., “How often do you fidget or squirm with your hands or your feet when you have to sit down for a long time?”), and impulsivity (e.g., “How often do you interrupt others when they are busy?”). The measure is scored by responses of ‘never’, ‘rarely’, ‘sometimes’, ‘often’ and ‘very often’, and symptom frequency is associated with symptom severity. If the individual marks ‘sometimes’, ‘often’ or ‘very often’ in four of the six questions on Part A of the instrument, the individual is seen to have symptoms highly associated with ADHD in adults.

Participants were administered the PTSD Checklist 5 (PCL-5) (Blevins, 2015), a self-report screening tool used to assess symptom severity of PTSD. The measure consists of one question that asks about a stressful experience or event, followed by twenty multiple choice questions that categorize symptom severity (‘not at all’, ‘a little bit’, ‘moderately’, ‘quite a bit’ and ‘extremely’). Questions assess severity across four symptom clusters (intrusion, avoidance, negative alterations in cognitions and mood, and alterations in arousal and reactivity) with questions that map to diagnostic criteria B-E, such as, B: “In the past month how much were you bothered by repeated disturbing unwanted memories of the stressful experience?” C: avoidance of trauma related thoughts/reminders – e.g., “In the past month how much were you bothered by memories,

thoughts or feelings related to the stressful experience?”, D: negative alternations in mood/cognitions (e.g., “In the past month how much were you bothered by blaming yourself or someone else for the stressful experience or what happened after it?”).

Data analysis

The prevalence of ADHD and PTSD was characterized using descriptive statistics. Then, we characterized whether PTSD was more prevalent among those with, relative to those without ADHD using a χ^2 test. The association between the severity of ADHD and PTSD and other clinical characteristics were first characterized using Pearson’s correlations (bivariate analysis). A regression was then run to characterize the association between clinical severity markers (dependent variables) and PTSD and ADHD symptoms, controlled for key clinical and demographic covariates.

Chapter III.

Results

The participants in this sample (N=288) reported a mean age of 39.3 years (SD = 13.89, range 18-79). About 67.9% had a primary diagnosis of alcohol use disorder (AUD) and 29.3% had a primary diagnosis of opioid use disorder (OUD). The sample was predominantly male (65.9% M, 33.4% F), and White (91.5%), with the remaining 9% Asian, Black, American Indian, Biracial/Multiracial, and 2.4% preferring not to report their race. Almost half (48.5%) of the sample was never married, with varying levels of education (24.2% completed college, 35.2 % with some college or trade school education, and 19% completed high school). Employment also varied, with 39.6% employed full time, 30.4% unemployed; part-time, students, retirees, disabled or homemakers made up the remaining 25% of the sample.

Prevalence and Co-occurrence of ADHD and PTSD

ADHD was highly prevalent in this sample. Of the 288 patients completing the ADHD self-report scale, 113, or 39.2% met criteria for a probable diagnosis of ADHD. PTSD was also highly prevalent in the sample; for those reporting a criterion A event, (143/288, or 49.7% of the total sample), 100 of the 143 (69%) met criteria for PTSD, or 34.7% of the total sample.

There was a large, significant correlation between ADHD and PTSD symptoms ($r = 0.50$, $p < .001$, $n = 143$). Results suggest PTSD and ADHD diagnoses are related; the likelihood of having an ADHD/PTSD diagnosis if the other diagnosis is present is significant ($\chi^2 = 17.49$, $p = .001$, $n = 143$).

Clinical Correlates

Primary measures of severity included risk factors score from the BAM (physical health, sleep, mood, craving, placement in risky social situations, family and social problems), and polysubstance use (number of substances used in the past month). For these factors, only PTSD symptom severity was significantly associated with BAM risk factors in adjusted models ($b = .38, p = .001$). Higher ADHD symptom severity was not significantly associated with BAM risk factors ($b = .66, p = .18$). There was no significant association between either ADHD symptoms ($b = -.08, p = .25$) or PTSD symptoms ($b = .01, p = .55$), and number of substances used in the past 30 days.

Results were mixed for secondary outcomes. Neither ADHD symptoms ($b = .10, p = .804$) nor PTSD symptoms ($b = -.06, p = .48$) were associated with BAM protective factors. However, ADHD symptoms were associated with craving at a trend level ($b = .10, p = .056$). Conversely, PTSD symptoms were not significantly associated with craving severity ($b = .02, p = .09$). Given the large correlation between ADHD and PTSD symptoms, we conducted collinearity diagnostics on all models. These statistics indicated that collinearity was not an issue in our models (e.g., tolerance = .774).

Exploratory Aims

We conducted exploratory analyses to determine whether any of these associations differed by gender (i.e., whether gender moderated these associations). After splitting the sample by gender, there was no substantive differences in the

associations between ADHD and PTSD or these diagnoses and the clinical variables of interest. Accordingly, we did not conduct formal analyses of moderation.

Table 1

Variables by diagnosis

	-PTSD/-ADHD (n=36)	+PTSD/-ADHD (n=46)	-PTSD/+ADHD (n=7)	+PTSD/+ADHD (n=54)
gender	F 42.9%, M 44.7%	F 42.6% M 53.3%	F 6.2% M 22.2%	F 57.4%, M 50.9%
age	47.1, 4.5SD	41.1, 14.0 SD	37.0, 12.2 SD	35.8, 13.7 SD
craving	2.9, 2.3 SD	4.3, 2.8 SD	5.6, 2.5 SD	5.6, 2.2 SD
BAM risk	41.1, 24.8 SD	53.3, 24.8 SD	46.6, 24.0 SD	64.7, 21.5 SD
% AUD	28.9%	35.1%	4.1%	32.0%
Polysubstance use	83.7 %	46.0%	16.3 %	54.0%
BAM protective	25.2%	32.2 %	4.9%	37.8 %

Table 1 and Table 2: PTSD = posttraumatic stress disorder, ADHD = attention deficit/hyperactivity disorder, BAM = Brief Addiction Monitor, AUD = alcohol use disorder, OUD = opioid use disorder, PCL 5= PTSD for DSM-5, ASRS = Adult ADHD Self-Report Scale. Craving = Brief Substance Craving Scale.

Table 2

Covariates by Gender

	B	SE	t	P value
Polysubstance use				
age	.01	.02	-.35	.726
male	-.06	.48	-.13	.898
PCL prorated sum score	-.00	.01	-.14	.890
ASRS prorated sum score	-.08	.06	-1.35	.180
AUD vs OUD	2.70	.58	4.73	.000
BAM risk				
age	-.51	.15	-3.31	.001
male	1.43	3.78	-.38	.707
PCL prorated sum score	.38	.11	3.50	.001
ASRS prorated sum score	.66	.49	1.36	.179
AUD vs OUD	.11	4.60	.02	.981
BAM protective				
age	-.01	.13	-.11	.911
male	7.10	3.18	2.23	.027
PCL prorated sum score	-.06	.09	-.70	.483
ASRS prorated sum score	.10	.41	.25	.804
AUD vs OUD	-.12	3.87	-.03	.975
Craving				
age	-.05	.02	-3.05	.003
male	.13	.40	.32	.751
PCL prorated sum score	.02	.01	1.74	.085
ASRS prorated sum score	.01	.05	1.93	.056
AUD vs OUD	-.78	.48	-1.62	.109

Chapter IV.

Discussion

This study examined the prevalence and clinical correlates of ADHD and PTSD in an inpatient substance use disorder (SUD) treatment setting. Previous studies in other contexts (outpatient treatment, veteran populations) have that found these disorders commonly co-occur; this study replicated these findings in a sample of people enrolled in SUD inpatient treatment. The prevalence of this co-occurrence is at the higher end of what has been previously cited in other settings, with significant associations between ADHD and PTSD symptoms and diagnosis likelihood. It was hypothesized that this comorbidity would be associated with higher SUD symptom severity; we found that high PTSD symptom severity was significantly associated with BAM risk, and higher ADHD symptom severity was positively associated with increased craving (with a trend toward significance).

It is well understood that the co-occurring presentation of both ADHD and PTSD in combination with SUD is associated with a more severe clinical presentation and subsequently, poorer treatment prognosis. Theories such as the Dynamic Model of Relapse (DMR) posit that cognitive process, coping behavior, and affective state illuminate pathways to both the quantity and frequency of the substance use behavior (Marlatt and Witkiewitz, 2004). In both ADHD and PTSD, these states of behavior can be impaired, altered or amplified, further reinforcing the negative feedback loop that results in return to substance use after abstinence. Koob and Volkow (2010) conceptualized addiction as a process of 'binge/intoxication', 'withdrawal/negative

affect', and 'preoccupation/anticipation' (craving). Higher measures of craving intensity coupled with impulsivity (BAM risk measures) as evidenced in this study could indicate heightened risk for relapse among those with higher PTSD and ADHD symptom severity. Difficulties regulating emotions, an affective consequence of both PTSD and ADHD (Weiss, 2012, Hirsch, 2018) adds additional liability with treatment adherence. The DMR also emphasizes the significance of timing and sequencing of events; for example, changes in motivation or craving intensity can consequently dysregulate affective states. For people with co-occurring ADHD and PTSD, it could be that this comorbidity hinders coping behavior and increases the probability of relapse. Avoidance coping, as evidenced in PTSD by using substances to cope with trauma-related symptoms (Mills, 2006) and in ADHD to mitigate the effects of insomnia and hyperactivity (Wilens, 2004) is consistent with research that demonstrates hampered coping in people with these disorders (Ouimette, 1999, Kronenberg, 2015, Harrington, 2012).

With the exception of the positive associations between craving and ADHD (at a trend level) and increased BAM risk and PTSD symptoms, these disorders were not associated with clinical severity markers. There was no significant association between number of substances used in the past 30 days and either PTSD or ADHD symptoms. These null findings may reflect a ceiling effect in the data. Specifically, this was a sample with severe SUDs and high levels of psychiatric comorbidity, and thus PTSD and ADHD may not have predicted additional variance on top of the contribution of other variables. Additionally, neither ADHD symptoms nor PTSD symptoms were significantly associated with BAM protective factors (self-efficacy, self-help, religion, spirituality, work, school, social supports, and income). This finding is surprising, given some of the

circumstantial challenges common to this population, specifically in relation to social supports. ADHD core symptoms of inattentiveness, forgetfulness, and impulse control can result in socially inappropriate behaviors and foster the perception of negative personality attributes. This can contribute to feelings of low self-esteem and social rejection, resulting in isolation from peers (Wilens, 2007). In PTSD, lack of social support contributes to the susceptibility to PTSD when exposed to a traumatic event; the literature suggests positive social support can promote resilience to stress and help protect against the development of trauma-related psychopathology (Southwick, 2005). Future longitudinal research is warranted to better determine how lack of social support is implicated in predicted outcomes this population.

Finally, contrary to what was hypothesized, gender did not moderate the co-occurrence of ADHD and PTSD or the clinical variables of interest. This suggests that these associations may operate similarly for women and men. Nonetheless, larger sample sizes may be needed to adequately power for subgroup analysis, and thus replication of this null result in larger samples is needed.

These findings could have several implications. It is likely that someone presenting for inpatient treatment for SUD will have at least one co-occurring disorder (Kessler, Chiu, Demler, & Walters, 2005). Co-occurrence of multiple disorders can complexify treatment of each disorder and, in many cases, may lead to worse outcomes as compared to when the disorders occur in isolation (Kessler, 2006). In the case of co-occurring ADHD/PTSD/SUD, pharmacologic interventions, such as stimulant medications, that are effective in reducing ADHD symptoms are not necessarily well-suited to address either PTSD symptoms or SUD, because of their abuse liability,

particularly if the person has a history of stimulant misuse. More research is warranted to better understand how to effectively treat this combination of disorders in an inpatient setting.

There are several limitations with this study. Given the cross-sectional study design, the data collected, and subsequent observations represent a snapshot in time; only a longitudinal study could attribute negative outcomes to the presence of these co-occurring disorders. Additionally, one could argue that observed symptoms attributed to ADHD/PTSD are common in the withdrawal and medical detoxification process, and consequently, experienced by many people with SUDs receiving inpatient treatment, regardless of comorbidity. Finally, although the self-report measures used in this study were validated for the identification of ADHD and PTSD, confirmation of diagnoses with clinical interviews and /or neuropsychological testing is needed for a definitive diagnosis of these disorders.

The present findings are consistent with previous research on prevalence of co-occurring ADHD and PTSD and highlight the importance of better understanding comorbidities associated with SUD. Research suggests that this co-occurrence is associated with worse outcomes. Although some integrated therapeutic modalities currently exist, additional study is needed to optimize appropriate and efficacious behavioral interventions for this constellation of disorders.

Appendix A.
Demographic Questionnaire

Demographic and Smoking Questionnaire

Directions: Please answer each question using the answer that best describes you.

1. Age:

2. Gender:

0. Female

1. Male

2. Other

Please specify your gender:

3. What is the highest level of education you have completed?

0. 8th Grade or less

1. Some high school

2. Completed high school or equivalent (for example, GED)

3. Some college/associate degree/trade school

4. Completed college degree (4 year)

5. Completed post-college education

4. What is your current employment status?

- 0. Unemployed
- 1. Employed Full-Time
- 2. Employed Part-Time
- 3. Student
- 4. Retired
- 5. Disabled
- 6. Homemaker

5. What is your current marital status?

- 0. Never married
- 1. Married
- 2. Divorced
- 3. Separated
- 4. Widow/Widower
- 5. Partner

6. What race do you identify with?

- 0. Black
- 1. White
- 2. Asian
- 3. American Indian or Alaskan Native
- 4. Native Hawaiian or Pacific Islander
- 5. Biracial/Multiracial
- 6. Other

Please specify your race: _____

7. Do you identify as Hispanic or Latino/a?

- 0. No
- 1. Yes

8. Do you smoke cigarettes?

0. No

1. Yes

If Yes,

8a. How many cigarettes do you smoke on average each day? _____

8b. Do you smoke electronic cigarettes? Yes No

8c. How many years have you smoked cigarettes? _____

Appendix B.

ADHD Questionnaire

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist

Instructions

The questions on the back page are designed to stimulate dialogue between you and your patients and to help confirm if they may be suffering from the symptoms of attention-deficit/hyperactivity disorder (ADHD).

Description: The Symptom Checklist is an instrument consisting of the eighteen DSM-IV-TR criteria. Six of the eighteen questions were found to be the most predictive of symptoms consistent with ADHD. These six questions are the basis for the ASRS v1.1 Screener and are also Part A of the Symptom Checklist. Part B of the Symptom Checklist contains the remaining twelve questions.

Instructions:

Symptoms

1. Ask the patient to complete both Part A and Part B of the Symptom Checklist by marking an X in the box that most closely represents the frequency of occurrence of each of the symptoms.
2. Score Part A. If four or more marks appear in the darkly shaded boxes within Part A then the patient has symptoms highly consistent with ADHD in adults and further investigation is warranted.
3. The frequency scores on Part B provide additional cues and can serve as further probes into the patient's symptoms. Pay particular attention to marks appearing in the dark shaded boxes. The frequency-based response is more sensitive with certain questions. No total score or diagnostic likelihood is utilized for the twelve questions. It has been found that the six questions in Part A are the most predictive of the disorder and are best for use as a screening instrument.

Impairments

1. Review the entire Symptom Checklist with your patients and evaluate the level of impairment associated with the symptom.
2. Consider work/school, social and family settings.
3. Symptom frequency is often associated with symptom severity, therefore the Symptom Checklist may also aid in the assessment of impairments. If your patients have frequent symptoms, you may want to ask them to describe how these problems have affected the ability to work, take care of things at home, or get along with other people such as their spouse/significant other.

History

1. Assess the presence of these symptoms or similar symptoms in childhood. Adults who have ADHD need not have been formally diagnosed in childhood. In evaluating a patient's history, look for evidence of early-appearing and long-standing problems with attention or self-control. Some significant symptoms should have been present in childhood, but full symptomology is not necessary.

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist

Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that best describes how you have felt and conducted yourself over the past 6 months. Please give this completed checklist to your healthcare professional to discuss during today's appointment.

Patient Name _____

Today's Date _____

Choose one: never, rarely, sometimes, often, very often

1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?
2. How often do you have difficulty getting things in order when you have to do a task that requires organization?
3. How often do you have problems remembering appointments or obligations?
4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?
5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?
6. How often do you feel overly active and compelled to do things, like you were driven by a motor?
7. How often do you make careless mistakes when you have to work on a boring or difficult project?
8. How often do you have difficulty keeping your attention when you are doing boring or repetitive work?
9. How often do you have difficulty concentrating on what people say to you, even when they are speaking to you directly?
10. How often do you misplace or have difficulty finding things at home or at work?
11. How often are you distracted by activity or noise around you?
12. How often do you leave your seat in meetings or other situations in which you are expected to remain seated?
13. How often do you feel restless or fidgety?

14. How often do you have difficulty unwinding and relaxing when you have time to yourself?
15. How often do you find yourself talking too much when you are in social situations?
16. When you're in a conversation, how often do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves?
17. How often do you have difficulty waiting your turn in situations when turn taking is required?
18. How often do you interrupt others when they are busy?

Appendix C.

PCL-5 Questionnaire

PCL-5 with Criterion A

Instructions: This questionnaire asks about problems you may have had after a very stressful experience involving actual or threatened death, serious injury, or sexual violence. It could be something that happened to you directly, something you witnessed, or something you learned happened to a close family member or close friend. Some examples are a serious accident; fire; disaster such as a hurricane, tornado, or earthquake; physical or sexual attack or abuse; war; homicide; or suicide.

First, please answer a few questions about your worst event, which for this questionnaire means the event that currently bothers you the most. This could be one of the examples above or some other very stressful experience. Also, it could be a single event (for example, a car crash) or multiple similar events (for example, multiple stressful events in a war-zone or repeated sexual abuse).

Briefly identify the worst event (if you feel comfortable doing so):

How long ago did it happen? _____ (please estimate if you are not sure)

Did it involve actual or threatened death, serious injury, or sexual violence?

No _____ Yes _____

PCL-5 with Criterion A

How did you experience it?

- It happened to me directly
- I witnessed it
- I learned about it happening to a close family member or close friend
- I was repeatedly exposed to details about it as part of my job (for example, paramedic, police, military, or other first responder)
- Other, please describe

If the event involved the death of a close family member or close friend, was it due to some kind of accident or violence, or was it due to natural causes?

Accident or violence, Not applicable (the event did not involve the death of a close family member or close friend) , Yes , Natural causes

PCL-5 with Criterion A (14 August 2013) National Center for PTSD with scoring

Second, below is a list of problems that people sometimes have in response to a very stressful experience. Keeping your worst event in mind, please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem <u>in the past month</u> . In the past month, how much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

Appendix D

BAM Questionnaire

Brief Addiction Monitor (BAM) With Scoring & Clinical Guidelines

Participant ID:

Date:

Interviewer ID (Clinician Initials):

Method of Administration:

Clinician Interview Self Report Phone

Time Started:

Instructions

This is a standard set of questions about several areas of your life such as your health, alcohol and drug use, etc. The questions generally ask about the past 30 days. Please consider each question and answer as accurately as possible.

1. In the past 30 days, would you say your physical health has been?

- Excellent (0)
- Very Good (1)
- Good (2)
- Fair (3)
- Poor (4)

2. In the past 30 days, how many nights did you have trouble falling asleep or staying asleep?

- 0 (0)
- 1-3 (1)
- 4-8 (2)
- 9-15 (3)
- 16-30 (4)

3. In the past 30 days, how many days have you felt depressed, anxious, angry or very upset

throughout most of the day?

- 0 (0)
- 1-3 (1)
- 4-8 (2)
- 9-15 (3)
- 16-30 (4)

4. In the past 30 days, how many days did you drink ANY alcohol?

- 0 (Skip to #6) (0)
- 1-3 (1)
- 4-8 (2)

9-15 (3)
16-30 (4)

5. In the past 30 days, how many days did you have at least 5 drinks (if you are a man) or at least 4 drinks (if you are a woman)? [One drink is considered one shot of hard liquor (1.5 oz.) or 12- ounce can/bottle of beer or 5 ounce glass of wine.]

0 (0)
1-3 (1)
4-8 (2)
9-15 (3)
16-30 (4)

6. In the past 30 days, how many days did you use any illegal/street drugs or abuse any prescription medications?

0 (Skip to #8) (0)
1-3 (1)
4-8 (2)
9-15 (3)
16-30 (4)

7. In the past 30 days, how many days did you use any of the following drugs:

7A. Marijuana (cannabis, pot, weed)?

0
1-3
4-8
9-15
16-30

7B. Sedatives/Tranquilizers (e.g., “benzos”, Valium, Xanax, Ativan, Ambien, “barbs”, Phenobarbital, downers, etc.)?

0
1-3
4-8
9-15
16-30

7C. Cocaine/Crack?

0
1-3
4-8
9-15
16-30

7D. Other Stimulants (e.g., amphetamine, methamphetamine, Dexedrine, Ritalin, Adderall, "speed", "crystal meth", "ice", etc.)?

- 0
- 1-3
- 4-8
- 9-15
- 16-30

7E. Opiates (e.g., Heroin, Morphine, Dilaudid, Demerol, Oxycontin, oxy, codeine (Tylenol 2,3,4), Percocet, Vicodin, Fentanyl, etc.)?

- 0
- 1-3
- 4-8
- 9-15
- 16-30

7F. Inhalants (glues/adhesives, nail polish remover, paint thinner, etc.)?

- 0
- 1-3
- 4-8
- 9-15
- 16-30

7G. Other drugs (steroids, non-prescription sleep/diet pills, Benadryl, Ephedra, other over-the-counter/unknown medications)?

- 0
- 1-3
- 4-8
- 9-15
- 16-30

8. In the past 30 days, how much were you bothered by cravings or urges to drink alcohol or use drugs?

- Not at all (0)
- Slightly (1)
- Moderately (2)
- Considerably (3)
- Extremely (4)

9. How confident are you in your ability to be completely abstinent (clean) from alcohol and drugs in the next 30 days?

- Not at all (0)
- Slightly (1)
- Moderately (2)
- Considerably (3)
- Extremely (4)

10. In the past 30 days, how many days did you attend self-help meetings like AA or NA to support your recovery?

- 0 (0)
- 1-3 (1)
- 4-8 (2)
- 9-15 (3)
- 16-30 (4)

11. In the past 30 days, how many days were you in any situations or with any people that might put you at an increased risk for using alcohol or drugs (i.e., around risky “people, places or things”)?

- 0 (0)
- 1-3 (1)
- 4-8 (2)
- 9-15 (3)
- 16-30 (4)

12. Does your religion or spirituality help support your recovery?

- Not at all (0)
- Slightly (1)
- Moderately (2)
- Considerably (3)
- Extremely (4)

13. In the past 30 days, how many days did you spend much of the time at work, school, or doing volunteer work?

- 0 (0)
- 1-3 (1)
- 4-8 (2)
- 9-15 (3)
- 16-30 (4)

14. Do you have enough income (from legal sources) to pay for necessities such as housing, transportation, food and clothing for yourself and your dependents?

No (0)

Yes (4)

15. In the past 30 days, how much have you been bothered by arguments or problems getting along with any family members or friends?

Not at all (0)

Slightly (1)

Moderately (2)

Considerably (3)

Extremely (4)

16. In the past 30 days, how many days were you in contact or spent time with any family members or friends who are supportive of your recovery?

0 (0)

1-3 (1)

4-8 (2)

9-15 (3)

16-30 (4)

17. How satisfied are you with your progress toward achieving your recovery goals?

Not at all (4)

Slightly (3)

Moderately (2)

Considerably (1)

Extremely (0)

PCL-5 with Criterion A: Specific items to attend to, and suggested referrals, include:

- #1 (health), if scored 3 or 4, refer to primary care
- #3 (mood), if scored 2, 3, or 4, proceed to further assessment and address within SUD specialty care or refer to mental health clinic if indicated
- #5,6,7 (heavy alcohol use, any drug use, specific drug use), if any scored 1 or higher, discuss with patient and consider adjusting treatment (e.g., higher level of care or changing modality)
- #8 (craving), if scored 3 or 4, consider medication such as Naltrexone
- #14 (adequate income), if scored 0, refer to case management
- #16 (social support), if scored 0, 1, or 2 consider adding network support
- #17 (satisfaction with progress), if scored 3 or 4, discuss modifying or supplementing treatment

Note: Examining scores from individual items as described above is the most clinically relevant use of this measure. Summary scores are more useful for aggregating across patients. Aggregate scoring, or subscale scoring, is supplementary and very preliminary, based on clinical judgment rather than empirical data.

Preliminary Subscale Scoring information

- Sum of Items 4, 5, & 6 = Use (Scores range from 0 to 12 with higher scores meaning more Use)
- Sum of Items 1, 2, 3, 8, 11, & 15 = Risk factors (Scores range from 0 to 24 with higher scores meaning more Risk)

- Sum of Items 9, 10, 12, 13, 14, & 16 = Protective factors (Scores range from 0 to 24 with higher scores meaning more Protection)
 - Number in () is points for each response
 - *Item 7 (7A-7G) are not scored as part of the subscales but provide elaboration for item 6.
 - *Item 17 can be used as an overall assessment of treatment progress but is not scored on any of the specific subscales.

Clinical guidelines: subscales

Use: If a patient scores a 1 or greater, it calls for further examination and clinical attention, e.g. consider addition of pharmacotherapy or higher level of care, add motivational interviewing. ○ Any alcohol use (item #4)

- Heavy alcohol use (item #5)
- Any drug use (item #6)
 - If a patient scores a 12 or greater, it calls for further examination and clinical attention, e.g. refer for medical or mental health consultation, add CBT or relapse prevention skills training.
 - Cravings (item #8)

Physical Health (item #1)

- Sleep (item #2)
- Mood (item #3)
- Risky situations (item #11)
- Family/social problems (item #15)

Risk Factors

- If a patient scores a 12 or below, it calls for further examination and clinical attention, e.g. treatment plan might include building sober support networks, 12 step facilitation, or work with a case manager for work or income assistance.

Self-efficacy (item #9)

- Self-help behaviors (item #10)
- Religion/spirituality (item #12)
- Work/school participation (item #13)
- Adequate Income (item #14)
- Sober support (item #16)

Notes:

- It is important to compare most recent BAM scores with prior BAM scores to assess changes in functioning and risk status.
- The goal is to see sizeable changes on each scale with each administration of the BAM.
- It is important to take into consideration the relative scores on risk and protective factors

- If protective factor score is greater than risk factor score, the patient is less at risk for use.

Appendix E.

BSCS Questionnaire

Module

Brief Substance Craving Scale (BSCS)

A. Identify the primary substance dependence for which the participant is being treated at this clinic.

- Downers or Sedatives (Barbiturates, etc.)
- Benzos (Valium, Xanax, etc.)
- Hallucinogens (including ecstasy)
- Alcohol
- Heroin or other Opiates (Morphine, etc.)
- Marijuana
- Stimulants (cocaine, amphetamine)
- Other (specify): _____

Please answer the following questions with regard to your craving for the primary drug.

1. The INTENSITY of my craving, that is, how much I desired this drug in the past 24 hours was:

- None at all
- Slight
- Moderate
- Considerable
- Extreme

2. The FREQUENCY of my craving, that is, how often I desired this drug in the past 24 hours was:

- N e v e r
- Almost never
- Several times
- Regularly
- Almost constantly

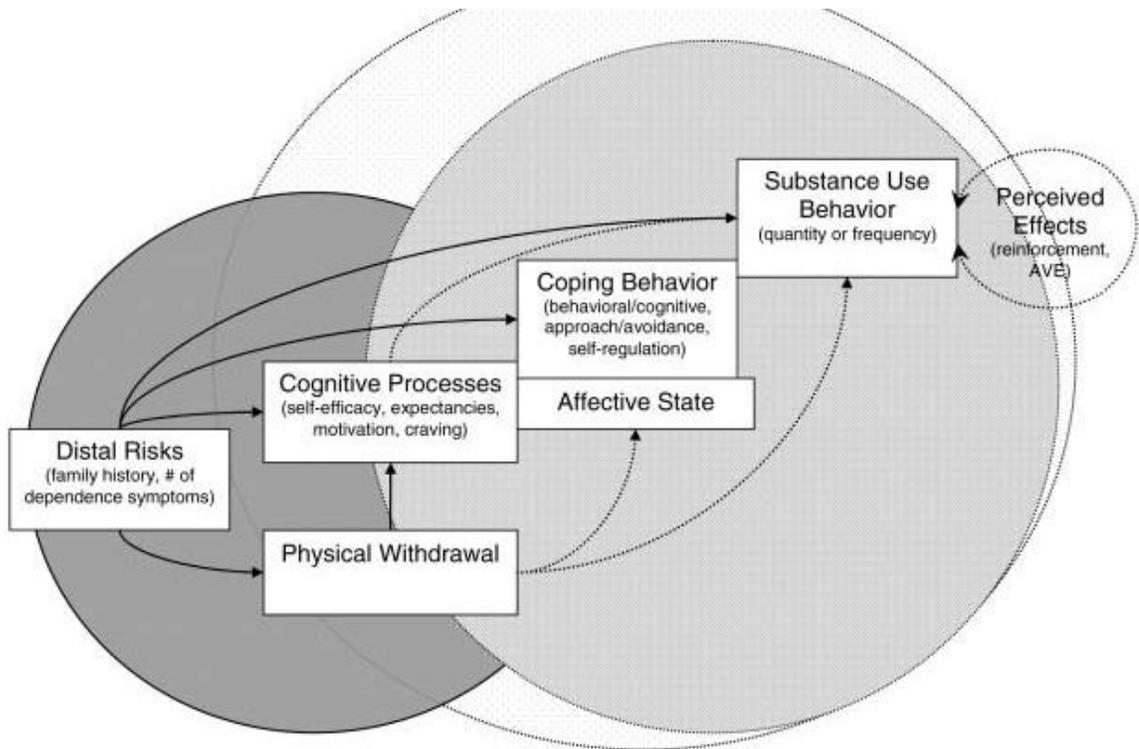
3. The LENGTH of time I spent in craving this drug during the past 24 hours was:

- None at all
- Very short
- Short
- Somewhat long
- Very long

4. Write in the NUMBER of times you think you had craving for this drug during the past 24 hours. _____

Appendix F.

Dynamic Model of Relapse



Dynamic model of relapse (Witkiewitz & Marlatt, 2004).

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