

CLINICAL RISK FACTORS FOR SUBSTANCE ABUSE: THE POTENTIAL EFFECTS ON
TREATMENT OUTCOMES

A thesis presented to the faculty of the Graduate School of Western Carolina University in
partial fulfillment of the requirements for the degree of Master of Arts in Psychology

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January 2016

ACKNOWLEDGMENTS

I would like to thank my committee members and director for their assistance in completing this thesis, I could not have done this without them. I appreciate their encouragement and support throughout this entire process.

I also sincerely thank the following people, without whom this thesis would not have been possible: Dr. Al Kopak, Professor David Scales, and Melissa McGehee. Finally, I thank my parents and extended family for their continued support.

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ABSTRACT

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Alcohol and illicit drug abuse continues to be a significant problem in the United States.

Although access to treatment remains a hurdle for many who struggle with addiction, the extent to which treatment (once available) is effective in promoting recovery and preventing relapse remains unclear. Thus, the present study examined the relationship between clinical risk factors for substance abuse and their effects on treatment outcomes. Data was obtained from the Comprehensive Addiction Treatment Outcome Registry (CATOR; N=13,051), which was designed to provide substance abuse treatment programs with uniform forms that cover intake information and discharge, as well as treatment outcomes for 12 months post-treatment. From the original CATOR sample, predictors of treatment outcomes (i.e., relapse) at follow-up were examined in a total of 10,405 participants with complete data. Results suggested several variables to be significant indicators of relapse, including needle use, age of first drink, using multiple substances, depression, multiple substance diagnoses, the Big 5 cocaine items (craving, failing to fulfill responsibilities, withdrawal symptoms, giving up pleasant activities to use substances, and inability to reduce or stop substance use), history of substance abuse and past psychiatric history, as well as all of the behavioral risk items (meeting conduct disorder criteria as an adolescent, being arrested within the past year, and being arrested for a DUI/DWI). Secondary multivariate analyses, specifically a series of logistic regressions, were used to

determine if demographic factors were significant in the context of the clinical risk items. Results suggested that age, race, employment status and marital status remained significant and these variables were included as control variables. Third, it was determined that the significant clinical risk variables listed above, as well as the four demographic control variables, would be used to construct a global assessment tool measuring clinical risk factors of relapse for the purpose of identifying high risk clients.

INTRODUCTION

Currently, the area of examining clinical risk factors for substance use is a diverse avenue of study. Randomized clinical trials, one of the most common ways to evaluate evidence-based treatments, do not address which patients benefit the most from treatment. Since the DSM-5 criteria lists different levels of severity for Substance Use Disorders, acknowledging that different levels of severity need different levels of intervention is important to acknowledge and deserves further study. In addition, often, experiments involving individuals in treatment often have small sample sizes, which significantly limits both statistical power and clinical inferences that can be drawn. The present study aimed to address some of these limitations, in part by utilizing data from the Comprehensive Addiction Treatment Outcome Registry (CATOR; N=13,051). With its large sample size, the CATOR dataset provides a unique opportunity for exploring the role of clinical risk factors in the prediction of relapse.

Nothing paints a clearer picture of the importance of investigating risk factors of relapse than the prevalence of substance use disorders (SUDs) in the United States. Alcohol and illicit drug abuse has been found to be quite prevalent in the US adult population, with lifetime rates of 12 percent for alcohol abuse and 2 to 3 percent for abuse of illicit drugs (Merikangas & McClair, 2012). In addition, according to recent surveys of private and publicly funded substance treatment centers, 22.7 million individuals age 12 or older have sought treatment for substance abuse problems, and only 2.5 million of those seeking services received treatment specifically for substance abuse (Substance Abuse and Mental Health Services Administration; SAMHSA, 2014), irrespective of the type of substance that is being abused¹.

¹ The DSM-5 combined the previous two mutually exclusive categories of substance *abuse* and substance *dependence* into a new category called Substance Use Disorders (SUD; American Psychiatric Association, 2013). Research prior to the DSM-5 will refer to abuse or dependence as separate diagnoses and the literature review for this thesis will therefore reflect the language of the original studies. As such, substance abuse is viewed as a less

While there is a plethora of studies comparing SUD treatment outcomes for different treatment *models*, there is little on what clinical or other characteristics are associated with positive outcomes or prognosis. Studies that do consider variables that influence post-treatment outcomes tend to focus only on a single facet. For example, diagnoses such as nicotine addiction and smoking cessation (Baker, Piper, Schlam, Cook, Smith, Loh, & Bolt, 2012; Killen, Fortmann, Kraemer, Varady, & Newman, 1992; Reid, Jiang, Fallon, Sonne, Rinaldi, Turrigiano, Arfken, Robinson, Rotrosen, & Nunes, 2012; Van Zundert, Ferguson, Shiffman, & Engels, 2012) are popular avenues of research, but have a very narrow focus. In fact, there is a dearth of findings that can be generalized to a broader population of substance abusers. In addition to the narrow focus on specific diagnoses, studies on factors that have an effect on substance use treatment outcomes are often limited to very narrow populations, such as substance users with other co-occurring diagnoses, rural community based women, American Indians/Alaska Natives, or hospitalized veterans (Cridland, Deane, Hsu, & Kelly, 2011; Patitz, Anderson, & Najavitz, 2015; Raylu & Kaur, 2012; Spear, Crevecoeur-MacPhail, Denering, Dickerson, & Brecht, 2013; Vayalapalli, Fareed, Byrd-Sellers, Stout, Casarella, Drexler, 2013).

Adverse consequences of drug and alcohol use have also been cursorily examined, but further research into the clinical utility of these instruments as predictors of treatment outcomes is needed (e.g., Kazdin, 2006; Kiluk, Dreifuss, Weiss, Morgenstern, & Carroll, 2013; Tonigan & Miller, 2002). Furthermore, there is a noticeable gap in the literature on areas related to clinical and other risk factors that influence substance abuse diagnosis and severity as well as treatment outcomes. Finally, there is little agreement among researchers as far as key factors that affect

severe form of SUD compared to substance dependence. Moreover, the term *addiction*, which is used commonly in the substance use literature, refers to the loss of control that is inherent in the SUDs. Finally, *substance misuse* implies use that is typically consistent with an SUD, but where a formal diagnosis may not have been rendered.

treatment outcomes and relapse (Belin, Belin-Rauscent, Murray, and Everitt, 2013; Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000; Tiffany, Friedman, Greenfield, Hasin & Jackson, 2011) and the validity of the current diagnostic criteria in the DSM for substance abuse diagnoses is widely debated (Martin, Chung, & Langenbucher, 2008; Kopak, Proctor, & Hoffmann, 2012, 2014; Kopak, Metze, & Hoffmann, 2014). The present study aimed to add to the body of research by examining clinical risk factors as predictors of treatment outcomes (e.g., relapse vs. abstinence) in a large sample of individuals who completed substance abuse treatment. Findings may further assist in the development of a risk assessment tool, and may generalize to the broader population of individuals who abuse substances.

CHAPTER ONE: SUBSTANCE USE DISORDERS: PREVALENCE AND DESCRIPTION

Substance Use Disorder (SUD), which involves impaired control, social impairment, risky use, and pharmacological criteria (DSM-5; American Psychiatric Association, 2013) is one of the most common psychiatric problems in the United States, with a 12-month prevalence rate around 15 percent (i.e., alcohol and illicit drugs; Merikangas & McClair, 2012). Individuals with an SUD (i.e., mild, moderate, or severe SUD; DSM-5; APA, 2013) engage in recurrent use of alcohol and/or drugs that causes clinically and functionally significant impairment, such as health problems, disability, and failure to meet major responsibilities at work, school, or home. Despite its prevalence, only a small fraction of individuals with an SUD receive treatment (National Institute on Drug Abuse, 2011) and there is little consensus as to which treatments are most effective in promoting positive outcomes (e.g., recovery, abstinence) and prevent relapse (e.g., Belin, Belin-Rauscent, Murray, and Everitt, 2013; Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000; Tiffany, Friedman, Greenfield, Hasin & Jackson, 2011). Additionally, research on variables that predict treatment outcomes for SUD has yielded mixed findings, with no clear consensus on which clinical variables pose the greatest risk of poor outcomes. Given the prevalence of SUD, the barriers to treatment, and the inconsistent findings regarding treatment outcomes among those who do need and seek treatment, the present study addressed the aforementioned limitations in an effort to increase our understanding of SUD treatment outcomes, with a focus on select clinical variables that can be used in the assessment of risk in this population.

Substance Use and Treatment Seeking

According to SAMHSA's National Survey on Drug Use and Health, 23.5 million individuals who are 12-years of age or older met the criteria for needing treatment for an illicit

drug or alcohol abuse problem in 2009. Of these, only 2.6 million, totaling 11.2 percent of those who needed treatment, received it at a facility specifically focused on the treatment of substance abuse problems (NIDA, 2011). In addition, there were 1.8 million admissions in 2008 for treatment of alcohol and drug abuse to facilities that report to State administrative data systems. The largest proportion of admissions, 41.4 percent, involved alcohol abuse. Heroin and other opiates accounted for the largest percentage of drug-related admissions at 20 percent, followed by marijuana at 17 percent. Publicly funded substance abuse treatment programs had similar statistics, with alcohol being the largest source of admissions, with the slight difference of marijuana admissions surpassing any other drugs (NIDA, 2011). These statistics show that not only are high proportions of the population in need of treatment for substance related issues, but that a significant number of those seeking treatment do not find the resources needed to effectively address their problems. Further, these data indicate the importance of examining risk factors for SUD severity (so as to identify those in most dire need of treatment), as well as the need to identify variables that contribute to outcomes among those who do access treatment.

SUD Risk Factors and Treatment Outcomes

As noted, prior to the year 2000, there was a significant gap in research focused on specific predictors of outcome in substance use treatment. A few exceptions (Rounsaville, Tierney, Crits-Cristoph, Weissman, & Kleber, 1982) focused on predictor variables that affected treatment outcomes, such as program retention, psychological symptoms, illicit drug use, illegal activities, and occupational functioning. However, the past fifteen years have seen an increase in the number of studies aimed at identifying risk factors for substance use, misuse (formerly abuse and dependence), and SUD treatment outcomes (e.g., Belin, Belin-Rauscent, Murray, and Everitt, 2013; Kilpatrick, Acierno, Saunders, Resnick, Best, & Schnurr, 2000; Laffey, McKellar,

Ilgen, & Moos, 2008; Tiffany, Friedman, Greenfield, Hasin & Jackson, 2011). For example, Laffey et al. (2008) found that having more severe substance use, more psychiatric symptoms, having more arrests prior to treatment, and belief in AA-style philosophy predicted substance use problem improvement four years post-treatment. Although several psychosocial variables (involvement with the criminal justice system, severity of psychiatric problems) play a role in treatment outcomes for substance use, clinical risk factors or specific symptoms of SUD have garnered recent attention.

SUD Risk Factors and Craving

One such risk factor worth examining is craving, which was added to the DSM-5 criteria for SUD (APA, 2013). Tiffany, Friedman, Greenfield, Hasin and Jackson (2011) and Belin, Belin-Rauscent, Murray, and Everitt (2013) examined craving as a factor in the diagnosis and/or treatment of substance abuse, and both found results that supported their claims. Moreover, Belin et al. (2013) added to the motivation-focused models of addiction, which posit that craving for substances is overwhelming and the person “has to take drugs”. In brief, Belin and colleagues pointed out that these models do not take into account adaptations such as ‘incentive sensitization’, where the individual will develop a strong desire (craving) due to the brain becoming hypersensitized to an addictive substance. Initially, this increases pleasure, which further increases craving (Robinson & Berridge, 2008). Both of these theories have merit, but more importantly, these theories both consider craving to be a significant area of study that should be included when examining risk factors of substance use and treatment outcomes.

Along the same lines, Tiffany, Friedman, Greenfield, Hasin and Jackson (2011) evaluated currently accepted treatments for SUDs and the degree to which craving, self-efficacy, psychosocial functioning, quality of life, and social network/social support have an effect on

treatment outcomes. Examination of a multitude of variables suggested that the factors of change, self-efficacy, craving, psychosocial functioning, quality of life, and social network/social support met the guidelines for inclusion as predictors in future research and were recommended in treatment studies.

As noted, most contemporary conceptualizations of drug disorders acknowledge that craving plays a central role in addictive processes, serving as both a cause and consequence of chronic drug use (Tiffany et al., 2011). Clinically, craving has substantial diagnostic and predictive relevance, and has been incorporated into DSM-5 as a defining feature of addiction. In sum, the domain of craving meets all the guidelines outlined above and should be included routinely as an outcome in studies of treatments for substance abuse (Tiffany et al., 2011). Collectively, these findings (e.g., Belin et al., 2013; Kopak et al., 2012, 2014; Tiffany et al., 2011) suggest that although craving and other risk factors differ in their relative contribution to substance abuse and relapse, these variables should be the subject of future research. The CATOR has several items related to craving (i.e., preoccupation with getting high, scheduling their day around obtaining and/or using substances, desire for and/or inability to stop using), which were included in the present study.

Evaluation of SUD Diagnostic Criteria

Despite the clear importance of clinical indicators in the assessment and prognosis of SUDs, researchers and clinicians have not been able to reach a consensus regarding the current diagnostic criteria and if/how it should be revised (Kopak, Proctor, & Hoffmann, 2012, 2014; Kopak, Metze, & Hoffmann, 2014; Martin, Chung, & Langenbucher, 2008). Kopak and colleagues (2014) focused on the argument that five of the eleven DSM-5 criteria for SUDs have been found previously to be more strongly associated with a severe diagnosis and that these

criteria could be involved in an overarching loss of control that negatively impacts a person's treatment outcome. This belief in an overarching loss of control is similar to the research of others mentioned previously (e.g., Belin et al., 2013; Tiffany et al., 2011), emphasizing craving as a risk factor which significantly impacts diagnosis and treatment outcomes.

In order to test the validity of the current DSM diagnostic criteria, as well as bolster the argument that some criteria should be considered more important than others, Kopak, Proctor, and Hoffmann specifically examined the substance disorders criterion change from the DSM-IV. They did this by comparing the old criteria to the initial two DSM-5 diagnoses for cannabis use disorders (2012) and later published a related article discussing the implication of changes from the DSM-IV to the DSM-5 (2014), with the options of mild, moderate or severe SUD. Both of these articles focused on analysis of the idea that certain diagnostic criteria are more clinically significant than others and that those criteria need further research to prove their efficacy in substance abuse treatment. The specific criteria they evaluated, coined "The Big Five" by Dr. Hoffmann, were: experiencing withdrawal symptoms, desire and/or inability to stop or reduce use, no longer participating in recreational or other activities due to substance use, failing to fulfill obligations at home, school, or work, and craving or strong urge to use a substance.

Using the criteria mentioned above, Kopak and colleagues suggested that some of the criteria measured were "cardinal indicators" of Severe Cannabis Use Disorder. This was based on the finding that certain criteria were present almost exclusively when the individual was classified in that diagnostic designation. Items representing the criteria of withdrawal symptoms, sacrificing activities in order to use, and craving substance use were almost exclusively endorsed by those inmates with SCUD for cannabis, with similar findings reported for alcohol. Kopak, Metze, and Hoffmann (2014) expanded upon the cannabis findings by studying an incarcerated

population to not only examine the DSM-IV compatibility of the recent changes in the DSM-5 in the area of alcohol use disorders, but also to test the hypothesis that certain diagnostic criteria could be used as indicators of a severe alcohol use disorder. Their results supported the hypothesis that not all diagnostic criteria were created equal and that some could be cardinal indications of more serious alcohol-related behavioral problems compared with others (Kopak et al., 2012, 2014). These findings are significant as they lend credence to the hypothesis that the presence of specific factors such as craving could be more significant than the presence of other factors, and further research should examine craving and other significant factors as predictors of outcomes².

Genetic Factors and Family History

In addition to craving and other subjective psycho-emotional constructs, the recent decade has seen a search in the identification of quantifiable biological components of addiction. Although beyond the scope of the proposed study, research focusing on genetic and physiological components of substance abuse (Erblich, Bovbjerg, & Diaz, 2012; Hutchison, LaChance, Niaura, Bryan, & Smolen, 2002) has come to conclusions similar to Tiffany et al. (2011) and Kopak et al (2012; 2014) in the area of the significance of craving. For example, Hutchison et al. (2002) found that participants who were homozygous or heterozygous for the DRD4 VNTR allele, which has been linked to cue-elicited craving for tobacco, demonstrated significantly greater craving, more arousal, less positive affect and paid more attention to smoking cues than participants who were not homo- or heterozygous for the DRD4 VNTR allele (Hutchison et al., 2002). This lends evidence to the hypothesis that genetic factors (via craving,

² The DSM-5 criteria will be used for the purpose of this study, and information from the CATOR database will be used that reflects this diagnostic criteria as closely as possible.

arousal, affect, and attention to cues) contribute to substance use, and may contribute also to risk for relapse.

In addition, Erblich and colleagues' study tested the hypothesis that cue and stress induced smoking had the same genetic predictors. Contrary to past research, findings indicated that variants in the glycine and dopamine pathways correlated with cue-induced craving, while variants in the stress-corticotrophin pathways were more strongly correlated with stress-inducing craving (Erblich et al., 2012). While the CATOR database does not include genetic factors specifically, it does contain questions regarding a family history of substance abuse, which could show a proximal link to the risk factors described above.

Demographic Variables and Substance Use

In addition to the investigation of genetic factors and family history, demographic variables such as age and gender are commonly researched areas in substance use treatment. There is a significant body of research supporting the claim that older clients (ranging from 35-55, depending on the study) have a higher probability of positive treatment outcomes (Oslin, Pettinatti, & Volpicelli, 2002; Satre, Mertens, Arian, & Weisner, 2004; Simpson, Joe, & Rowan-Szal, 1997) than younger clients. Positive treatment outcomes include longer program retention, a higher percentage of abstinence from substances, and greater adherence to treatment.

Gender differences are also important to mention, as research has shown that men reported more drug use and criminal involvement than women of similar age entering treatment at the same point (Hser, Huang, Teruya, & Anglin, 2003). Other psychiatric disorders have also been shown to affect substance use treatment outcomes differently across genders, as women with phobias have been shown to have better treatment outcomes than other disorders such as major depression, personality disorders, and generalized anxiety. Also, men with psychiatric

disorders in general had worse treatment outcomes, most specifically men with major depression and antisocial personality disorder (Compton, Cottler, Jacobs, Ben-Abdallah, & Spitznagel, 2003).

For the purpose of this study – which focuses on clinical predictors of SUD treatment outcomes – some of the demographic and descriptive variables, such as gender, have been excluded. In contrast, given that previous research (e.g., Merline, O’Malley, Schulenberg, Bachman, Johnston, 2003) and preliminary examination of the CATOR data suggested that age, race, marital status, and employment status may have a significant effect on relapse and may influence also the clinical risk factors of interest to this study, these demographic variables have been retained as control variables in subsequent analyses of treatment outcomes.

Needle Use and Risk for Relapse.

Another variable that has been found to influence relapse following treatment is the use of needles to inject drugs intravenously. Most of the literature surrounding intravenous drug use focuses on reducing the risk of contracting common “needle diseases” such as hepatitis and HIV/AIDS, which occurs when intravenous drug users (IDUs) share infected needles. These included factors such as perceived risk and willingness to receive treatment among IDUs (Stein, Maksad, & Clarke, 2001), reducing the risk of contracting HIV/AIDS using treatments such as methadone (Ball, Lange, Myers, & Friedman, 1988) and the effectiveness of commonly used risk-reduction interventions for IDUs (Booth & Watters, 1994). However, one study (Shah et al., 2006) examined the longitudinal predictors of needle use cessation and relapse for IDUs from 1988 to 2000, following subjects from initial cessation to potential relapse. By the time the study concluded, three fourths of their 1327 subject sample had relapsed and begun using needles again, with the median time to relapse being 1 year. Shah and colleagues found several variables

associated with shorter time to injection relapse, such as being male, homelessness, HIV seropositivity, use of alcohol, cigarettes, non-injection cocaine, and having a longer time to the first cessation (Shah et al., 2005). Since needle use (to inject drugs) clearly has an effect on the possibility of relapse, it was included in the current study.

SUDs and Drug Use Consequences

When examining treatment outcomes and risk of relapse among individual with SUDs, a majority of the research has focused on changes in symptoms. However, symptom reduction (e.g., decrease in craving) and promotion of factors associated with abstinence (increase in coping) may not be sufficient in preventing relapse. In fact, adverse consequences of substance abuse (i.e., physical problems such as hangovers, feelings of guilt, and problems in interpersonal relationships) may also be important. In a meta-analysis of the Inventory of Drug Use Consequences (InDUC), Tonigan and Miller (2002) found that reductions in the frequency of drug use among polysubstance users did not consistently produce reductions in consequences of use. Specifically, Tonigan and Miller (2002) observed a 40 percent decline in frequency of substance use and a 33 percent decline in drug-related consequences. These findings suggest that changes in substance use *consequences* should be assessed separately from mere frequency of use, and that treatment may focus on both areas as possible avenues for intervention.

Similarly, Kiluk, Dreifuss, Weiss, Morgenstern, and Carroll (2013) evaluated the reliability and validity of the Short Inventory of Problems – Revised (SIP-R) across a large sample of individuals with substance use disorders. Findings suggested that the SIP-R measured an overall construct of substance use consequences *independent of frequency of use*. The results also supported the internal reliability and convergent validity of this tool for measuring consequences of drug and alcohol use. Most important, higher SIP-R scores were strongly

associated with poorer treatment retention even after controlling for baseline substance use, Addiction Severity Index composite scores, and readiness to change. At the time, this was the first study to demonstrate the SIP's ability to predict treatment retention, which strengthened the utility of the SIP-R as a baseline assessment tool in treatment-seeking populations.

Overall, these studies provide evidence that consequences of drug and alcohol use can reliably be measured and are important factors to consider when discussing treatment outcomes.³

SUDs and Arrest

In addition to the many physical-, interpersonal-, and intrapersonal problems, and the high rate of relapse, substance use problems are associated also with a risk for involvement with the criminal justice system (i.e., e.g., arrests, incarceration; Asberg & Renk, 2013; Beck, Harrison, & Karberg, 2002). According to 2012 statistics from the Department of Justice's Bureau of Justice Statistics, the total correctional population was estimated to be 6,937,600, with 4,794,000 individuals on probation or under parole supervision, and drug law violations accounting for the most common type of criminal offense (Glaze & Herberman, 2013). In a survey of State and Federal prisoners, the BJS estimated that about half of the prisoners met DSM-IV criteria for drug abuse or dependence, and yet fewer than 20 percent who needed treatment received it (Chandler, Fletcher, & Volkow, 2009; Karberg & Mumola, 2006). Specifically, of those surveyed, 14.8 percent of State and 17.4 percent of Federal prisoners reported having received drug treatment since admission (Karberg & Mumola, 2006).

³ Findings are also of relevance to the current study in that one of the aims is to create an additive scale. Such a scale would include questions similar to those on the InDUC and the SIP-R. A short scale focused on very specific risk factors with an easy scoring template would allow clinicians to administer the instrument and have results quickly, as well as be able to identify those clients with risk factors that will need to be addressed in treatment.

Overall, although the past several decades have seen an increased interest in providing substance abuse treatment services for criminal justice offenders and reducing recidivism, only a small percentage of offenders has access to adequate services, especially in smaller jails and correctional facilities (Sabol, West, & Cooper, 2010; Taxman, Perdoni, & Harrison, 2007). Not only is there a gap in the availability of these services for offenders, but often there are few choices in the types of services provided. Treatment that is of insufficient quality and intensity or that is not well suited to the needs of offenders may not yield meaningful reductions in drug use and recidivism (citation). Untreated substance abusing offenders are more likely than treated offenders to relapse to drug abuse and return to criminal behavior. This can lead to re-arrest and re-incarceration, jeopardizing public health and public safety and taxing criminal justice system resources (citation). Treatment is the most effective course for interrupting the drug abuse/criminal justice cycle for offenders with drug abuse problems. Given that the research shows an important and complex relationship between incarceration and substance use and the fact that the CATOR gives access to data such as incarceration within the past year as well as arrests related to substance use, these variables were included in the present study.

Substance Abuse and Behavioral Risk Factors

In addition to identifying risk factors related to relapse, researchers have also concentrated their efforts to determine the factors that can help predict long-term outcomes among individuals with substance use problems (Clingempeel, Henggeler, Pickrel, Brondino, & Randall, 2005; Squeglia, Jacobus, Nguyen-Louie, & Tapert, 2014). For example, Clingempeel and colleagues examined predictors of use in adults that had been treated for substance abuse as adolescents. Findings suggested that frequency of marijuana use and the number of comorbid psychiatric disorders diagnosed in adolescence predicted later cannabis use (Clingempeel et al.,

2005). Moreover, Squeglia et al. (2014) utilized a longitudinal design and found that adolescents who were less inhibited prior to engaging in any form of substance abuse were more likely to engage in frequent and heavy alcohol and marijuana use by the time they reached late adolescence. Overall, specific characteristics in adolescence (i.e., illicit substance use, conduct problems, impulsivity) may be important risk factors to consider also among adults diagnosed with SUD given their association with more severe or chronic use.⁴

For example, a recent study by Lister, Ledgerwood, Lundahl, and Greenwald (2015) explored how cocaine use consequences affected the relationship between impulsiveness and depressive symptoms in a sample of cocaine users. Lister et al., (2015) found that impulsiveness subscales (attentional, non-planning, and motor) were all positively correlated with an earlier age of first use, a higher degree of current depression symptoms, and a greater number of consequences linked to lifetime cocaine use (Lister et al., 2015). These results suggest that further analysis of the relationship between traits such as impulsiveness and substance use is needed, as well as the role that substance use consequences can play on co-occurring disorders such as depression (Lister et al., 2015).

Moreover, the research by Lister et al. serves to bridge the gap between researchers studying particular traits or consequences in regard to treatment outcomes and those that are studying the effects of particular treatment approaches, particularly Cognitive Behavioral Therapy (CBT), on individuals with co-occurring disorders such as substance abuse and depression (e.g., Boger, Auerbach, Pechtel, Busch, Greenfield, & Pizzagalli, 2014; Hunter,

⁴ Since all of the subjects in the CATOR database are over the age of eighteen it could be difficult to examine this in the proposed study, but participants did answer questions that included the DSM-IV criteria for diagnosing a Conduct Disorder in adolescence. The presence of three or more of these criteria, which would constitute a diagnosis, was used in an attempt to examine adolescent behavioral risk factors and risk of relapse.

Witkiewitz, Watkins, Paddock, & Hepner, 2012; Lydecker, Tate, Cummins, McQuaid, Granholm, & Brown, 2010).

Boger et al. (2014) added a reward responsiveness task to the treatment of an adolescent inpatient sample to measure whether depressive symptoms and motivation for change were improved over the course of treatment using the two therapeutic approaches of CBT and Dialectical Behavioral Therapy. Findings supported the hypothesis that adolescents demonstrated significant reductions in depressive symptoms and improved motivation for change in relation to drug use over the course of acute residential treatment, as well as improved reward responsiveness from admission to discharge. These results show promise for the future of treating comorbid depression and substance abuse, particularly in adolescents as it suggests that addressing reward responsiveness would improve treatment outcomes in this population (Boger et al., 2014).

In a similar vein, Hunter et al. (2012) and Lydecker et al. (2010) both used adult populations and CBT to study the effectiveness of treatments targeting co-occurring depression and substance abuse. Both found that both variations of Cognitive-Behavioral Therapy (CBT), when compared to either standard inpatient substance abuse treatment or a traditional Twelve Step Facilitation therapy (TSF), were linked to more stable symptom reduction for both depression and substance use. Both of these studies suggest that the longitudinal relationship between depression and substance abuse disorders is important, and that both can be improved using evidence-based treatment such as CBT.

In addition to depression, eating disorders and past physical abuse have been found to commonly co-occur with substance use (Liebschutz, Savetsky, Saitz, Horton, Lloyd-Travaglini, & Samet, 2002 ; Puhl, Cason, Wojnicki, Corwin, & Gripton, 2011). For example, Liebschutz et

al. found that a history of physical and/or sexual abuse was highly associated with substance use and substance use consequences measured on the InDUC, while Puhl et al.'s findings suggested a link between binge eating and addiction to other substances such as cocaine. These findings may point to underlying problems with impulse control or disinhibition, or with disturbances in self-regulation (Liebschutz et al., 2002; Puhl et al., 2011). Although clients with co-occurring disorders may be more difficult to treat (Hunter et al., 2010; Lydecker et al., 2012) and face also poorer outcomes following treatment (Boger et al., 2014; Hunter et al., 2010; Lydecker et al., 2012), current research clearly emphasizes the importance of treating the SUD and any co-morbid clinical issue. Collectively, studies suggest that evidence-based treatment approaches can be effective and have the potential to improve treatment outcomes, but more research is needed. Thus, identifying disorders that commonly occur with SUDs is an important component of the proposed study, as it may not only aid in getting clients the focused or individualized treatment that they need, but may help also to improve long-term treatment outcomes such as the potential for relapse. The CATOR database gives access to information about past psychiatric history, as well as detailed questions related to depression and past substance use treatment.

CHAPTER TWO: PRESENT STUDY

Based on previous research, there is evidence suggesting that factors such as family history of substance abuse, use of multiple substances, severity of alcohol consumption, age of beginning substance use, and arrests, have effects on substance abuse treatment outcomes. In addition, the role of craving has garnered significant attention in recent years, and is now included in the DSM-5 as a criteria for SUD. This research highlights the importance of examining the link between clinical risk factors and treatment outcomes for individuals with SUD (Aguiar et al., 2012; Hien et al, 2010; Madoz-Gurpide et al., 2004; McClellan et al., 1983, Simpson, Joe, & Broome, 2002). Most of the existing research, however, only mentions risk factors in the context of comparing treatment models, and, to our knowledge, none of the studies have prognostic indicators as the main reason for the study. The present study aimed to specifically identify prognostic factors of relapse, not in the context of any treatment models.

Given the prevalence of substance use in the United States (NIDA, 2011), combined with the lack of research focused solely on prognostic factors related to relapse following treatment, the present study examined the relationship between selected clinical risk factors and the association with the negative treatment outcome of relapse. The focus was on identifying prognostic indicators of relapse as identified by the body of research and availability of information in the CATOR database. Additionally, the present study will examine the complex relationship between substance use disorders and commonly co-occurring disorders such as depression, eating disorders, and past abuse, as well as the relationship between behavioral risk factors (e.g., meeting the criteria for a conduct disorder as an adolescent, an arrest in the past year, and an arrest for a DUI) and substance use disorders, and how these factors can contribute to relapse.

Research Questions

This study sought to answer the following questions: Which, if any, of the Big Five risk factors for alcohol, cannabis and cocaine use predict *relapse*? What, if any, clinical severity items for substance abuse predict *relapse*? What, if any, historical risk items for substance use predict *relapse*? Are there significant relationships between the commonly co-occurring disorders selected and *relapse*? Are there relationships between the three behavioral risk items and *relapse*?

Hypotheses

Several preliminary hypotheses were identified pre-analysis. It is believed that the Big Five risk factors for alcohol, cannabis and cocaine use as measured by the CATOR will be significant predictors to severity of SUD as the number of symptoms positively endorsed by a participant increase. Significant relationships predicted to exist for all of the clinical severity items (needle use, age of first drink, Big 5 alcohol, cannabis, and cocaine, time since last substance use, and number of substances used in the past week). Dependencies are predicted to exist for all four of the historical risk items (history of physical abuse, history of seeking psychiatric services, history of depression, and/or history of eating disorders) identified on the Comorbid Disorders scale. All three of the behavioral risk items (conduct disorder, number of arrests one year prior to treatment, DUI/DWI arrests) should be significantly related to *relapse*.

CHAPTER THREE: METHODS

Participants

Of the included 13,051 subjects in the database, 2,646 were excluded for a variety of reasons, such as not completing the CATOR forms, falling outside the 18 to 65 age range, non-completion of treatment, or non-completion of 12-months of follow-up. This left a sample of 10,405 subjects for analysis. Thus, the sample for the study is comprised of 10,405 individuals who completed substance use treatment, as well as 12 months of post-treatment follow up. The sample was predominantly male 7,505 (72%) with 2,900 (28%) females. The sample included only those individuals between the ages of 18 and 65 years, making it a purely adult sample. The median age of subjects who did not relapse within a year of completing treatment was 37.15 years old and a standard deviation of 10.76 years, while the median age of subjects who relapsed within a year of completing treatment was 34.14 years old, with a standard deviation of 10.39 years. The majority of the participants were Caucasian, forming 8,966 (87%) of the sample, with a combination of Asian, Native American, African American, Biracial, Hispanic and 'Other' comprising the remaining 1,288 (13%) subjects.

Data

This quantitative study used archival data. Data collection ended in 1995, so the data set is dated from a psychological standpoint, but it is useful as it reflects results from a time when substance abuse treatment was more driven by clinical significance than economics. The data was stripped of all personal identifiers and imported into SPSS for analysis. In addition to SPSS, Stata 11 statistical software (StataCorp, 2009) was used to code and analyze the data (N=10,405). Collection and use of the data was approved by the IRB through the Education Research Foundation and Ramsey Clinic Associates.

Materials and Procedures

All participants filled out the fourth version of the Comprehensive Addiction Treatment Outcome Registry (CATOR), which was designed to provide substance abuse treatment programs with uniform forms that cover intake information and discharge, as well as treatment outcomes for 12 months post-treatment. This registry was headquartered out of Minnesota and was the largest commercial outcome monitoring service at the time of data collection, which as stated above ended in 1995. The CATOR forms consisted of eight pages that attempted to gather an extensive history on all subjects entering inpatient or outpatient treatment programs. These included questions regarding demographic factors such as race, age, gender, education level, etc. as well as past psychiatric diagnoses and treatment history, if any. A comprehensive history of substance use and family history of substance use was also included in the CATOR forms. Based on the hypotheses (see page 20) and available information retrieved from the archival data, four sets of variables were created to encompass clinical and behavioral risk factors, as well as factors related to co-occurring disorders to explore substance use disorder indicators.

Variable Set 1: Addiction Severity

The first set, named Addiction Severity Items, included constructs identified by previous research (Dutra, Stathopoulou, Basden, Leyro, Powers, & Otto, 2008; Kopak et al, 2012, 2014; Shah et al, 2006) as measuring the scope and severity of addictions. These items were needle use, time since last use, number of substances used in the past week, age of first drink, Big 5 indicators of alcohol use disorder, Big 5 indicators of cannabis use disorder, and Big 5 indicators of cocaine use disorder. All of the items chosen to be measured were then coded into Stata 11. For time since last use the item was coded with a 0 or 1, measuring the longest period of sobriety in the past year. Subjects received a 1 if they had gone more than a month in the past year

without using substances, 0 is anyone who had not gone more than one month without using alcohol or drugs in the past year. All three of the Big 5 indicators of substance use disorders were sum scales ranging from zero to six, and if anyone endorsed the items listed in the Big 5, they received a one for each item independently. These were then tallied up, and the final score became the Big 5 score for alcohol, cocaine, or cannabis. The first item included in the Big 5 measures was a desire to cut down on substance use, second was being consistently preoccupied with drinking or getting high, the third item was missing work or school because of drinking or drug use, fourth was neglecting responsibilities because of drinking or drug use, and the fifth item was having drunk or used drugs to relieve a hangover. Anyone with a score of zero did not endorse any of those items, and anyone who said yes to any of the five received a one for each item they endorsed. Needle use was coded with a zero or one, where people who had used needles to inject drugs got a one, people who had never used drugs intravenously were coded as a zero. Age of first drink simply reported the age of the subject at first drink, ranging from 9-50 years. Ultimately, the purpose was to analyze if age of first drink predicted relapse, with the hypothesis that the younger the age of initiation of drinking, the higher the probability of relapse. Number of substances used in the past week measured how many substances subjects used daily in the year prior to entering treatment. It ranged from zero to five, with zero meaning the subject had used no substances daily in the year prior to treatment all the way up to five, meaning the subject had used five substances daily in the year prior to treatment.

Variable Set 2: Co-Occurring Disorders

The second set of indicators of treatment outcome, named Co-Occurring Disorders, included assessments of depression or an eating disorder in conjunction with substance abuse diagnoses. Number of diagnoses measured specifically substance use diagnoses. It ranged from

1-6, as anyone in treatment had at least one substance use disorder diagnosis for alcohol, marijuana, cocaine, stimulants, opiates, and other drugs (includes sedatives, tranquilizers, and painkillers). Participants were coded with a six if they had met criteria for six substance use disorder diagnoses. Depression was coded with zero and one, with one representative of a time lasting at least two weeks that the subject felt depressed or did not care about or enjoy anything. Eating disorder was framed similarly to depression, asking if there was ever a time that lasted at least three months when the subject binged on large quantities of food at least twice a week and then vomited or used laxatives to counteract the effects of the binge. Additionally, it asked if there was ever a time where they thought themselves overweight even though others said they were already thin. If they said yes to either or both, they received a one for the presence of an eating disorder, and were scored a zero if they answered no to both questions.

Variable Set 3: Behavioral Risk.

The third set of indicators of treatment outcome, Behavioral Risk Factors, included measures of behavioral and/or antisocial issues as indicated by arrests, behavioral risk factors as indicated by meeting the criteria for a conduct disorder diagnosis, and arrest for a DUI. It is important to include impulsivity and arrests within the past year on the same scale due to the possibility of a continuum of impulsivity to antisocial behavior. An arrest as an adult was considered to be consistent with Antisocial Personality Disorder. Since not all adolescents with conduct disorder indications go on to become antisocial, giving a point independently for adolescent conduct disorder symptoms and arrests gives the most weight for those who meet both. The conduct disorder scale had 8 items that responders were told to answer about themselves before the age of 15. These items included whether participants had ever skipped school more than 10 times, been suspended or expelled from school, gotten arrested, run away

from home overnight more than once, vandalized or destroyed property, shoplifted or stolen, had sexual intercourse with more than one person, or started physical fights. This Conduct Disorder measure was recorded as zero if there was the presence of only 2 or less conduct disorder indicators and one, if participants endorsed 3 or more conduct disorder indicators, which would meet the diagnostic criteria for a conduct disorder. Arrests a year prior to entering treatment measured how many times the participant had been arrested for 10 types of offenses in the year prior to entering treatment, including speeding/moving violations, disorderly conduct, assault/battery, theft/robbery/burglary, prostitution, vandalism/destruction of property, possession of drugs/paraphernalia, selling drugs, other. Number of arrests ranged from 0-20. The hypothesis was that the more times a subject was arrested, the more likely they were to relapse. An item was designed specifically to measure whether subjects had ever been arrested for a DWI/DUI, with a zero meaning no DUI/DWI, and a one meaning they had at least one DUI/DWI.

Variable Set 4: Historical Risk

The fourth set of indicators of treatment outcome, Historical Risk Items, included a family history of substance abuse, the subject's past psychiatric history, as well as a history of physical abuse. Physical abuse measured if participants had ever been hit or beaten so hard that it had left marks or it injured the person who hurt them, with a yes to either question receiving a one and no to both a zero. Family history of substance abuse asked whether drinking or drug use by a family member had repeatedly caused family health or legal problems, with a yes scored as a one and a no as a zero. Past psychiatric history asked if they had ever been treated by a psychiatrist or psychologist for any emotional disorder, with a yes scored as a one and no a zero.

As mentioned above, certain demographic factors (age, marital status, employment status, and race) were included in the analyses as control variables. The intent of this is to minimize the effect these variables have on the clinical items identified.

Data Analysis Plan

First, bivariate methods, specifically Chi-square tests and ANOVAs were conducted with Stata 11 software to determine if the constructs of the four sets of items were associated with the treatment outcome of relapse and to investigate associations between items. Specifically, Chi-square tests were used for categorical variables. Chi-square tests determine whether the distribution observed in the data is significantly different than what could be expected due to chance. If evidence supports the presence of a significant bivariate association, further tests can be conducted to determine if these relationships remain while controlling for other factors. Other variables, such as the number of weeks of longest sobriety, required the use of analysis of variance (ANOVA) due to the fact that they were measured at the interval or ratio level, and had two or more categories to compare. ANOVAs allow to test for differences among the means of two or more groups without conducting numerous t-tests and increasing the chances of making a Type I error. Additionally, ANOVAs measure the amount of variability both within and between groups, as well as how similar the groups are to each other.

Lastly, multivariate methods, specifically a series of logistic regression model, were examined for each of the four sets of items. Logistic regression was the appropriate technique given that the outcome (relapse) is categorical, as well as giving the opportunity to determine the relative importance of certain predictors.

CHAPTER FOUR: RESULTS

Descriptive Statistics

Participants were divided into two categories based on the dependent variable, whether they had relapsed in the 12 months after leaving treatment or whether they had remained abstinent (Table 1). Significant differences were found for age, race, employment status and marital status when it came to whether a client relapsed. The analysis showed that the group highest at risk for relapse was younger ($M = 34.14$, $SD = 10.39$, $F(47, 10,357) = 5.82$, $p = .000$), disproportionately non-white ($\chi^2(1, N=10,405) = 23.4$, $p < .01$), disproportionately unemployed ($\chi^2(1, N=10,405) = 40.11$, $p < .01$), and disproportionately never married ($\chi^2(1, N=10,405) = 102.82$). There were no significant differences found across gender in relation to relapse. No differences in relapse outcomes by gender group ($\chi^2(1, N=10,405) = 0.05$, $p < .01$).

Table 1. Descriptive statistics of 10,405 substance use treatment patients by 1 year post – treatment outcome

Variable	Relapse	No Relapse
	% / <i>M(SD)</i>	% / <i>M(SD)</i>
Age*	34.14(10.39)	37.15(10.76)
Gender		
Female	41%	58%
Male	41%	58%
Race*		
Non-White	48%	52%
White	41%	59%
Employment status*		
Unemployed	47%	53%
Employed	40%	60%
Marital status*		
Never married	49%	51%
Other	39%	61%

Note. Differences between outcome groups were tested using chi-square tests for categorical variables and *t*-tests for continuous variables.

* $p < .001$

Clinical Risk Factors

Logistic regression analysis found statistically significant factors in each of the four blocks. Table 2 shows that in the Addiction Severity Items scale, Big 5 Cocaine, needle use, and

number of weeks of longest sobriety were found to be significant $\chi^2(1, N = 10,405) = 390.21, p = .000$, even when the selected demographic factors (age, race, employment status and marital status) were controlled for. For every additional year of age, participants experienced an average 2% decrease ($OR = 0.98, 95\% C.I. = 0.97 - 0.98$) in the odds of relapse.

Table 2. Addiction Severity Items Logistic regression results predicting relapse within 1 year of discharge from treatment

Variable	Odds ratio	Standard Error	z	P> z	95% CI	
					Lower	Upper
Age*	0.98	0.00	-8.12	0.000	0.97	0.98
Race*	1.23	0.07	3.28	0.001	1.09	1.39
Unemployed*	1.31	0.06	5.59	0.000	1.19	1.43
Never married*	1.19	0.06	3.38	0.001	1.08	1.31
Time since last use	1.07	0.04	1.68	0.092	0.99	1.17
Big 5 Alcohol	1.01	0.01	0.51	0.614	0.98	1.03
Big 5 Cannabis	0.98	0.01	-1.68	0.094	0.95	1.00
Big 5 Cocaine*	1.05	0.01	3.67	0.000	1.02	1.08
Needle use*	1.33	0.08	4.55	0.000	1.18	1.50
Age of first drink	1.00	0.01	0.82	0.414	0.99	1.01
Number of substances used in a week*	1.14	0.02	6.62	0.000	1.10	1.19

* $p \leq .001$

Table 3 shows that a subject's past psychiatric history as well as a history of physical abuse were found to be significant (having a past history of abuse increased the odds of relapse by 11% ($OR = 1.11, 95\% C.I. = 1.01-1.21$) and being treated for an emotional disorder in the past increased the odds of relapse by 16% ($OR = 1.16, 95\% C.I. = 1.07-1.27$)) when demographic factors were controlled for. Inconsistent with past research, a history of prior physical abuse or family history of substance abuse was not shown to be a significant contributor in post-treatment relapse.

Table 3. Historical Risk Items Logistic regression results predicting relapse within 1 year of discharge from treatment

Variable	Odds ratio	Standard Error	z	P> z	95% CI	
					Lower	Upper
Age*	0.98	0.00	-10.56	0.000	0.97	0.98
Race*	1.34	0.08	4.87	0.000	1.19	1.51
Unemployed*	1.28	0.06	5.18	0.000	1.17	1.41
Never married*	1.18	0.06	3.19	0.001	1.06	1.30
Physical abuse*	1.11	0.05	2.22	0.027	1.01	1.21
Family history of substance use	0.93	0.04	-1.61	0.108	0.86	1.02
Psychiatric history*	1.16	.0516793	3.44	0.001	1.07	1.27

* $p \leq .001$

Series of regression analysis of the Co-Occurring Disorders scale contained in Table 4 shows that the subject's number of psychiatric diagnoses was found to be significant, as well as meeting the criteria for a depression diagnosis. Having either several substance specific diagnoses (OR = 1.12, 95% C.I. = 1.06-1.18) or suffering from depression (OR = 1.12, 95% C.I. = 1.03-1.22) both increased the odds of relapse by 12% each.

Table 4. Co-Occurring Disorders Logistic regression results predicting relapse within 1 year of discharge from treatment

Variable	Odds ratio	Standard Error	z	P> z	95% CI	
					Lower	Upper
Age*	0.98	0.00	-8.99	0.000	0.97	0.98
Race*	1.32	0.08	4.58	0.000	1.17	1.49
Unemployed*	1.29	0.06	5.38	0.000	1.18	1.42
Never married*	1.17	0.06	3.03	0.002	1.06	1.29
Depression*	1.12	0.05	2.71	0.007	1.03	1.22
Number of substance diagnoses*	1.12	0.03	4.40	0.000	1.06	1.18
Eating disorder	0.87	0.07	-1.67	0.094	0.75	1.02

* $p \leq .001$

Analysis of the Behavioral Risk Items shows that all three items (conduct disorder as an adolescent, an arrest 1 year prior to entering treatment, and a DUI arrest) were all found to be significant factors related to relapse. Surprisingly, a DUI/DWI arrest decreased the odds of

relapse (OR = 0.80, 95% C.I. = 0.71-0.90). Additionally, an arrest one year prior to entering treatment (OR = 1.07, 95% C.I. = 1.03-1.12) only increased the odds of relapse by 7 percent, which is also lower than might be expected. Conduct Disorder as an adolescent had the largest effect, increasing the odds of relapse by 26 percent (OR = 1.26, 95% C.I. = 1.15-1.39). These results, particularly the large effect that meeting the criteria for a Conduct Disorder as an adolescent had on relapse, lend credence to the hypothesis that impulsivity can have a significant effect on a person's likelihood to relapse.

Table 5. Behavioral Risk Items Logistic regression results predicting relapse within 1 year of discharge from treatment

Variable	Odds ratio	Standard Error	z	P> z	95% CI	
					Lower	Upper
Age*	0.98	0.00	-8.93	0.000	0.98	0.98
Race*	1.31	0.08	4.46	0.000	1.16	1.48
Unemployed*	1.28	0.06	5.27	0.000	1.17	1.41
Never married*	1.17	0.06	3.10	0.002	1.06	1.29
Conduct disorder as an adolescent*	1.26	0.06	4.95	0.000	1.15	1.39
Arrested 1 year prior to entering treatment*	1.07	0.02	3.40	0.001	1.03	1.12
DUI/DWI arrest *	0.80	0.05	-3.79	0.000	0.71	0.90

* $p \leq .001$

CHAPTER FIVE: DISCUSSION

Given the prevalence of substance use and misuse in the adult US population, the high risk of relapse among those who access treatment for problems associated with their use, and the staggering emotional, financial, and societal costs associated with SUDs, research that examines risk factors and aims to improve on current assessment of risk is of utmost importance. The main objective of the present study was to examine clinical risk factors previously identified in research and determine their utility as predictors of outcomes. Utilizing a large (>10,000 participants) sample of treatment completers, this study presents also a unique opportunity to examine treatment outcomes independent of specific treatment models. Findings also allowed us to identify items for inclusion in a brief instrument to predict risk of relapse in this population.

As hypothesized, findings showed that certain clinical risk factors were more important than others in predicting negative treatment outcomes. Among variables included in the Addiction Severity Index, the Big 5 cocaine items, needle use, and the number of different substances a responder used daily in the year prior to treatment were all found to be significantly correlated with relapse. However, since cocaine use has been found to be less popular in recent years compared to newer drugs such as methamphetamines, measuring cocaine use specifically was not considered as important as measuring general substance use. For the purpose of designing the instrument, the five significant SUD diagnostic criteria (craving or strong urge to use substances, inability to stop/reduce use, failing to fulfill responsibilities at home, work, or school, experiencing withdrawal symptoms, not engaging in activities previously enjoyed, and preoccupation with getting/using substances) were included in reference to non-specific substance use.

Next, findings suggested that two Historical Risk items were significant predictors of relapse: a history of experiencing physical abuse and being treated for an emotional disorder in the past. These items were retained for inclusion in the instrument. It is important to point out that programs such as Seeking Safety (Najavits, 2002), which are designed to treat trauma and substance use concurrently by teaching healthy coping skills, may be particularly helpful to substance using clients who endorse abuse and/or psychological symptoms stemming from trauma. In addition, maladaptive avoidance coping in the form of using substances has been shown to mediate fully the association between trauma symptoms and substance use consequences among female survivors of trauma (child sexual abuse; Asberg & Renk, 2012), suggesting the importance of assessing for a history of abuse, as well as for current ways of coping.

Moreover, in the set of items pertaining to Co-Occurring Disorders, meeting the criteria of a diagnosis of depression and the number of substance specific diagnoses were found to be significantly and positively correlated with relapse in this sample. For the substance specific diagnoses, the higher the number of diagnoses, the higher the risk of relapse. This is consistent with previous research on the link between psychiatric diagnoses and relapse. For the purposes of a truncated instrument, questions were shortened to ask clients if they had multiple substance specific diagnoses (rather than asking them to give a specific number of diagnoses) and whether or not they had ever been diagnosed or treated for depression. Meeting the criteria of an eating disorder did not predict relapse, and an explanation for that may be that since this was a primarily male sample and eating disorders are found to be more prevalent in females, a more female sample might prove to have different results.

Next, all three of the items grouped into Behavioral Risk items were found to be significantly correlated with relapse. These items were: meeting the criteria for a Conduct Disorder as an adolescent, being arrested in the year prior to entering treatment, and being arrested for a DUI/DWI. Interestingly, being arrested for DUI/DWI decreased the risk of relapse. Although legal problems are no longer a criteria for SUD in the DSM-5, it is possible that such an arrest provides additional incentive in terms of abstaining from substance use. Moreover, the inclusion of these behavioral risk items in the truncated scale included some modifications. Specifically, since the general population cannot be assumed to be familiar with the diagnostic criteria of Conduct Disorders, the truncated instrument created in the study included questions outlining the criteria for a Conduct Disorder. Moreover, instead of specifically asking about the 10 types of offenses outlined in the CATOR database, one question asked about general arrests, and a second question inquired about being arrested for a DUI/DWI. Despite the anomalous results of finding that an arrest for a DUI/DWI *decreased* the risk of relapse, it was still considered important to include in the instrument.

Additional Clinical Implications

Since this study focused primarily on identifying clinical risk factors that predict relapse, demographic factors did not receive a lot of attention. However, analysis showed that several demographic items could not be ignored. In line with previous research, participants' age, race, employment and marital status were all shown to play important roles in the nature of risk factors for relapse, and thus were included as control variables. Even after being controlled for, they were almost universally predictive in all of the models, so clearly there is importance in these factors. For example, age has long been associated with substance use. Past research has linked the age of first substance use with several issues, such as more serious substance use problems in

adulthood, more negative treatment outcomes than those who started drinking later in life, and higher psychopathology (Hawkins, Graham, Maguin, Abbott, Hill, & Catalano, 1997; McGue, Iacono, Legrand, Malone, & Elkins, 2001; Musher-Eizenman, Holub, & Arnett, 2003). The findings of the study were consistent with the body of research.

Being a minority was a significant predictor for relapse despite making up only a small portion of the sample compared to Caucasians, which is a common outcome of studies examining issues such as substance use (Alegria, Canino, Ríos, Vera, Calderón, Rusch, & Ortega, 2014). More specifically, African Americans seem to be consistently over-represented when it comes to an increased risk of relapse (Cooper, Peirce, & Huselid, 1994).

Also, findings of the current study regarding employment and marital status are in line with those of McCaul, Svikis, and Moore (2001), who found that employment and being married, as well as being Caucasian and male, improved treatment retention, irrespective of the type of substance (i.e., alcohol, drugs, or combined substance use). A 2004 study found very similar results, with being unemployed and substance use in high school increasing the chances of substance use in adulthood, while being married decreased the likelihood of substance use (Merline, O'Malley, Schulenberg, Bachman, & Johnston, 2004). In contrast to our findings and those of McCaul et al., however, a 2003 study found that employment did not seem to reduce adolescent substance use, and, in fact, being employed full time increased prevalence rates for heavy drug use, heavy alcohol use, and heavy cigarette smoking (Wu, Schlenger, & Galvin, 2003). Based on these results, they suggested implementing substance use education and early intervention in the workplace for adolescent substance users.

Conclusions

As mentioned, the ultimate goal of the study was to identify risk factors and combining relevant items into a truncated instrument that clinicians could quickly administer and score. This, in turn, could improve the chances of a person with numerous risk factors for relapse of getting targeted care. After analysis, the constructs that proved to be significant from those four sets of variables were used to create an additive scale with the goal of use as a global assessment tool for predictors related to a high risk of post-treatment relapse. As stated above, a simple additive scale measuring clinical risk factors similar to that of the InDUC or SIP-R could prove to be useful for clinicians when trying to identify high risk subjects. A mockup of this instrument is included, with an example of a simple 1 and 0 scoring system. Using this scoring system, the more questions that a responder answers yes to, the higher the score they would have, indicating an increased risk level. Two questions, the current age of the responder and how many substances they use in a typical week, had to be included as write in answers out of necessity. Results showed that the older a person is, the lower their risk of relapse, so a practitioner could expect older clients to be less high risk than younger clients. Also, the results showed that the more substances a person used in a week, the higher their risk of relapse was, so practitioners could expect someone who reported using more substances to be more high risk than someone who used fewer or only one substance in a typical week.

Please write in the answers for the first two questions.		
What is your age?		
How many substances do you use in a typical week?		
Please circle either a 1 for Yes or a 0 for No.	Yes	No
Are you a male?	1	0
Are you currently unemployed?	1	0
Have you never been married?	1	0
Have you ever been preoccupied with obtaining/using substances?	1	0
Have you ever failed to fulfill responsibilities at home, work, or school because of your substance use?	1	0
Have you ever unsuccessfully tried to reduce or stop your substance use?	1	0
Have you ever experienced withdrawal symptoms related to your substance use?	1	0
Have you experienced feelings of craving or a strong urge to use substances?	1	0
Have you stopped engaging in activities you used to enjoy due to your substance use?	1	0
Have you ever engaged in intravenous drug use?	1	0
Have you been treated for any psychiatric disorders in the past (including while in substance use treatment)?	1	0
Do you have multiple substance specific mental health diagnoses?	1	0
Before you were 18, were you ever aggressive to other people or animals? (this includes deliberate cruelty, physical fights, and menacing with a weapon)	1	0
Before you were 18, did you ever deliberately destroy other's property or deliberately set fires?	1	0
Before you were 18, did you ever engage in deceitfulness or theft?	1	0
Before you were 18, did you ever break serious rules, such as staying out at night without permission, running away from home overnight at least twice, or frequently skipping school?	1	0
Have you been arrested within the last year?	1	0
Have you ever experienced physical abuse?	1	0

This is an example of an attempt to describe and assess for the multitude of risk factors that contribute to substance use relapse. This instrument, or one very similar, could be very practical in clinical settings. For example, it can have two very different uses, as the instrument

could be used on a global basis to look at the general risk of relapse, and on an individual basis to deal with specific risk factors identified. Clinically, a provider could look at the overall relapse risk score to determine how likely that person is to relapse, and they could also look at specific items endorsed to change the duration, intensity, or type of treatment needed for that subject. For example, if the subject was high risk and had polysubstance use, then they could benefit from treatment that differs from someone who endorsed having been treated or diagnosed with depression. Additionally, someone who endorses several of the Behavioral Risk items, which showed up as very significantly related to relapse, could benefit from treatment that specifically addresses that impulsivity that has been shown to be related to these factors.

Limitations

While this dataset had several unique advantages, there were also significant limitations. As discussed previously, data collection was halted in 1995, making the data over fifteen years old. Collecting newer data, with updated questions that reflects the changes in diagnostic criteria for substance use disorders in the DSM-5, as well as reflecting current trends in substance use, could show important differences.

In addition, inclusion of more females and more minority subjects could potentially show important differences, as past research has shown that gender and race can make a difference in substance use, as well as rates of relapse. Gathering more data points would enable future researchers to make stronger claims about these hypothesized relationships. Given research on diversity of treatment needs among these populations, it is important to look at.

The programs may not be reflective of substance use treatment in general because these were all programs that were willing to subject themselves to outside evaluation, so they were likely more confident that the evaluation was going to reflect positively on them. Facilities that

were less confident that the evaluation would reflect positively on their program would potentially be less likely to volunteer for the study, skewing the outcomes. The addition of programs that may not have the highest success rate could give more generalizable results.

On a similar note, only patients who completed treatment and 12 months of follow up were included in the study, so the true number of those who relapsed or did not relapse in the year following treatment could not be calculated. Similarly, since it has been shown that so few of those who need treatment actually receive it, only those who were most able to obtain treatment were represented in this study. Future studies could attempt to contact and include patients who dropped out of treatment, or did not complete 12 months of follow up using alternative methods. Future studies could attempt also to include those who met the criteria for needing treatment but were unable to receive treatment for substance use.

Finally, access to genetic factors were not available in the CATOR database. Since this information was not available, having a family history was instead used to infer that those genetic factors were present. Since this is a tenuous connection, being able to actually measure genetic factors such as alleles would aid in being able to make more assertive claims.

Future Considerations

This research, and the instrument designed, could be used as a starting point that leads to research into more individualized treatment. Based on the items endorsed by a patient could assist practitioners in creating a more personalized treatment focused on specific problem areas. There has already been research in specialized treatment for gender and ethnic groups, as well as with specific comorbid disorder, so the addition of the clinical risk factors identified in this study could fuel many additional research projects.

Furthermore, in their examination of craving and how it fits into the incentive sensitization theory, Belin et al. (2013) stated that drug seeking behaviors depend as much on the presentation of conditioned reinforcers as the drug itself, which suggests that environmental factors such as repeated exposure facilitate the development of incentive habits, which in this case would be the habitual use of substances to engage reward systems (Belin et al., 2013). The research demonstrated that administration of specific targeted drugs all reduced instrumental drug seeking, decreasing the likelihood of drug taking. This has significant implications for future treatments that may prevent relapse as well as promote abstinence, especially when drug-seeking may be increased by environmental cues. This gap in the research shows there is a need for an addition to the current body of research.

Additionally, this study suggests that a large number of variables have effects on substance use treatment, and those items could be explored in the future with different samples. As suggested in the limitations section, using samples featuring primarily women or minorities could have very different results from the ones found in this study.

Finally, despite the fact that the data could be considered old, the large sample size has allowed strong claims to be made about several items that can be examined in future studies.

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