ABSTRACT

Title of Dissertation:	EXAMINING THE INTERACTION OF INTERNALIZING AND EXTERNALIZING DISORDERS WITH HIV STATUS IN RELATION TO RESIDENTIAL SUBSTANCE USE TREATMENT DROPOUT
	Christopher Jonathan Seitz-Brown, Doctor of Philosophy, 2018
Dissertation directed by:	Edward Bernat, PhD, Assistant Professor, Department of Psychology

Each year approximately 34 billion dollars are spent on treatment for alcohol and drug use problems in the United States, yet less than half of clients complete their programs. Treatment dropout is a significant predictor of negative outcomes including substance use relapse and incarceration. The consequences of dropping out of substance use treatment are more severe for HIV-positive individuals—active drug use is associated with poor HIV medication adherence and higher mortality. Previous literature on risk factors for dropout has not explored what predictors are most relevant to HIV-positive clients and most studies have focused primarily on outpatient treatment settings, which may not generalize to residential programs. For example, substance users who enter residential care frequently present with a history of co-occurring medical and psychiatric problems,

such as HIV, internalizing disorders (INT), and externalizing disorders (EXT). Internalizing and externalizing psychopathology are known to relate to both substance treatment dropout and worse health outcomes among people living with HIV. Thus, this study aimed to explore the interactions of HIV status with INT and EXT as predictors of residential substance use treatment dropout. Utilizing intake data from 1613 clients entering residential substance use treatment, we used regression models to examine several hypotheses concerning dropout risk. We hypothesized that the two-way interactions between HIV status and 1) INT and 2) EXT would be associated with dropout, such that HIV-positive individuals with higher INT or EXT would be more likely to drop out. We also predicted that those interactions would relate to fewer days spent in treatment until dropout. For the three-way interaction between HIV, INT, and EXT, we hypothesized that greater INT *and* EXT among HIV-positive individuals would relate to a greater likelihood of dropout and fewer days in treatment. We did not find differences between HIV-positive and HIV-negative clients in dropout rates, and the interactions between HIV and INT/EXT were not significant predictors of dropout. Results suggest that other variables such as age, education level, marital status, and court-mandated treatment status may be stronger predictors of residential substance use treatment dropout. Future directions are discussed in light of these nonsignificant findings.

EXAMINING THE INTERACTION OF INTERNALIZING AND EXTERNALIZING DISORDERS WITH HIV STATUS AND ITS ASSOCIATION WITH RESIDENTIAL SUBSTANCE USE TREATMENT DROPOUT

by

Christopher Jonathan Seitz-Brown

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2018

Advisory Committee:
Professor Edward Bernat, Chair
Professor Julia Felton
Professor Jessica Magidson
Professor Andres De Los Reyes
Professor Eric Wish

Table of Contents

List of Tables ii
List of Figures iii
Introduction 1
Substance Use, Substance Use Disorders, and Treatment in the United States 1
Residential Substance Use Treatment 3
HIV-positive Substance Users 5
Internalizing and Externalizing Disorders among HIV-positive Individuals 6
Dropout from SUD Treatment and Implications 8
Prior Research on Predictors of SUD Treatment Dropout 10
Psychopathology and its Association with SUD Treatment Dropout 13
Psychopathology among HIV-positive Substance Users as a Potential Dropout Risk 14
Present Study 16
Method 21
Participants and Procedures 21
Measures 25
Data Analytic Strategy 26
Results 29
Preliminary Analyses 29
Hypothesis 1a 33
Hypothesis 1b 35
Hypothesis 2 36
Discussion 38
Study Limitations 46
Future Directions 50
Bibliography 53

List of Tables

1. Treatment Outcomes (pg. 22)

2. Current Drug of Choice (pg. 22)

3. Demographics and Treatment Variables as a Function of Treatment Completion Status (pg. 30)

4. Demographics and Treatment Variables as a Function of HIV Status (pg. 31)

5. Bivariate correlations for treatment non-completers (pg. 32)

6. Number of Days in Treatment among Dropouts (pg. 32)

7. Logistic Regression of HIV x INT on Dropout (pg. 33)

8. Regression of HIV x INT on Days in Treatment (pg. 34)

9. Logistic Regression of HIV x EXT on Dropout (pg. 35)

10. Regression of HIV x EXT on Days in Treatment (pg. 36)

11. Logistic regression of HIV x INT x EXT on dropout from treatment (pg. 37)

12. Regression of HIV x INT x EXT on Days in Treatment (pg. 38)

List of Figures

1. Model 1: Internalizing and HIV status interact to predict SUD treatment dropout (pg. 18)

2. Hypothesis 1a: Proposed interaction between internalizing and HIV status (pg. 18)

3. Model 2: Externalizing and HIV status interact to predict SUD treatment dropout (pg. 19)

4. Hypothesis 1b: Proposed interaction between externalizing and HIV status (pg. 19)

5. Model 3: Three-way interaction of internalizing, externalizing, and HIV status to predict SUD treatment dropout (pg. 20)

6. Hypothesis 2: Proposed three-way interaction between externalizing, internalizing, and HIV status (pg. 20)

7. The hierarchical structure of psychopathology in a psychiatric sample that incorporates clinical and personality disorders (from Forbes et al., 2017). The INT and EXT composites from the current study were created using the classification of disorders from this structure (pg. 28)

Introduction

Substance Use, Substance Use Disorders, and Treatment in the United States

Drug and alcohol use in the United States is a major public health concern, and the percentage of Americans who report using drugs has increased over the last decade (SAMHSA, 2015). In the 2014 National Survey on Drug Use and Health (SAMHSA, 2015), 27.0 million people aged 12 or older, representing 10.2% of the population, had used an illicit drug within the last month. Further, alcohol use has remained relatively steady in recent years with over half of individuals in the U.S. reporting drinking within the last month. Rates of binge drinking (5 or more drinks on one occasion) and heavy drinking (5 binge drinking episodes within 30 days) at 23.0% and 6.2% respectively, suggest alcohol use at problematic levels is quite common. Indeed, approximately 21.5 million people met criteria for a substance use disorder (SUD) in 2014, including 17.0 million with an alcohol use disorder alone, 7.1 million with an illicit drug use disorder alone, and 2.6 million with both types of disorder. Unfortunately, only about 2.5 million of those with substance use disorders received treatment for substance use within that year (SAMHSA, 2015).

Gaps in treatment coverage and ineffective treatment negatively impact substance users as individuals, but also contribute to the high costs of substance use borne by society. The National Drug Intelligence Center (2011) reports that illicit drug use cost the U.S. economy more than $193 billion in 2007. Costs associated with alcohol use reached nearly a quarter of a trillion dollars per year in 2010 (Sacks, Gonzales, Bouchery, Tomedi, & Brewer, 2010). These costs include losses in workplace productivity, crime and criminal justice costs, and accidents related to

substance use. Money spent on treatment accounts for a surprisingly small portion of these totals—$23 billion on alcohol-related care and $11 billion on other drug-related care—despite the potential savings that come from investments in treatment. One analysis estimated that diverting 40% of offenders eligible for treatment from state prison to substance use programs had the potential to save $22.5 billion over the lifetime of those individuals in societal costs and to save an additional $12.9 billion in criminal justice costs (Zarkin et al., 2015).

Given the cost effectiveness of providing substance use treatment, researchers have focused considerable attention on improving current models of care in addition to developing new treatments. Residential substance use treatment programs are sometimes considered the option of last resort in the continuum of addiction care, as they are more equipped to meet the needs of substance users who are homeless, require medical care, or suffer from co-occurring mental health problems (ASAM, 2001; Reif et al., 2014). Admissions to residential treatment represent roughly one fifth of clients entering substance use programs in the United States, and these clients are more likely to be referred by a substance use professional, supporting the idea that they may present as more severe (SAMHSA, 2015). Participating in residential substance use treatment is moderately effective in helping to improve drug and alcohol use, employment, medical problems, and psychiatric symptoms, according to a systematic review of the research (Reif et al., 2014). However, a significant barrier to achieving positive treatment outcomes is the large proportion of admitted clients who drop out of residential care (between 22% and 38%; SAHMSA, 2009). Average costs for one course of residential treatment can be more than double than those of outpatient programs (French, Popvici,

& Tapsell, 2008), which underscores the economic incentive to programs and funders to retain clients in care and improve post treatment results. High rates of dropout from treatment highlight the importance of efforts to identify risk factors that predict who is more or less likely to complete substance use programs and why, especially in residential facilities.

Residential Substance Use Treatment

Providing a comprehensive description of the characteristics of adult residential substance use treatment programs in the United States is complicated by the high degree of variability in sources of funding for residential programs (e.g. government funds, private non-profit, private for-profit), reporting requirements followed by residential programs, as well as the definitions and adherence to common treatment approaches within these programs. However, SAMHSA's 2013 National Survey of Substance Abuse Treatment Services indicated that 24% of facilities identified as residential programs (non-hospital), with 20% offering long-term treatment (longer than 30 days) and 12% providing short-term care of 30 days or less. Residential treatments were three times as common among non-profit providers (33%) compared to for-profit facilities (11%). Across residential facilities in the U.S., 97% of their 103.776 beds were utilized, and short-term residential programs reported a median total of 8 clients per facility.

The term "residential" refers to a treatment setting in which clients are provided substance-free housing and typically remain in the facility 24 hours a day, except to attend outside appointments. Residential programs often offer medical care onsite, and may have a nurse, physician and/or psychiatrist on staff. Models of treatment and vary

widely. The most common approaches that residential programs reported to SAMHSA included "substance abuse counseling" (which is not defined further), relapse prevention, cognitive behavioral therapy, motivational interviewing, and 12-step programs. Facilities were able to list multiple approaches, and most programs indicated that they used all of these strategies "always or often" while few of them indicated that they never used one of the above approaches (1-16% never used, depending on the approach). The 12-step philosophy was incorporated into 83.7% of programs to some degree, for example. These figures were not differentiated by facility type (i.e. outpatient vs. residential). Other research on substance use outcomes specifically for residential programs has tested the most common approaches including therapeutic communities, 12-step programs, psychosocial interventions, and undifferentiated strategies. Moos and colleagues (1999) found that at one year follow-up, clients from 88 residential programs showed similar improvements in substance use abstinence, psychiatric symptoms, and functioning across all *defined* approach types (therapeutic communities, 12-step programs, and psychosocial interventions), which all outperformed the undifferentiated programs. Findings also indicated that successfully completing treatment and attending a program with a directed treatment orientation were independently related to better one-year outcomes such as lower rates of relapse, substance use problems, and psychiatric symptoms. These relationships held for individuals diagnosed with a co-occurring psychiatric disorder as well.

Residential substance use treatment programs vary widely in their size, staff education level and licensure, availability of onsite medical and mental health services, treatment approaches, mixed or single-gender client base, among many other factors.

Regional differences in client characteristics and most common drugs of choice are quite common. This heterogeneity points towards potential difficulties in generalizing research findings from one residential facility to others. Focusing research attention on characteristics of substance users who enter residential treatment, such as those entering with co-occurring medical and mental health problems, would allow for a narrower examination of dropout risks.

HIV-positive Substance Users

One subpopulation of substance users who are particularly at risk for negative outcomes are HIV-positive individuals. Substance use disorders, HIV infection, and HIV transmission are highly associated with each other; substance users are more likely to be infected with HIV (Drumright, Patterson, & Strathdee, 2006; Plankey et al., 2007; Schneider, Chersich, Neuman, & Parry, 2012) and HIV-positive individuals use substances at higher rates than the general population (Bing et al., 2001; McGowan et al., 2011).

To put the dangerous impact of substance use on the wellbeing of HIV-positive individuals into context, it is important to understand the critical role that stable access to medical care and medication plays in their lives. The overall impact of HIV on morbidity and mortality has decreased since the availability of highly active antiretroviral therapy (HAART) in the late 1990s, to the point where the virus is no longer seen as a death sentence (Crum et al., 2006). While HAART has improved the health and quality of life for many, those outcomes are tied to high levels of adherence to medication regimens (Mannheimer et al., 2005; Shuter, Sarlo, Kanmaz, Rode, & Zingman, 2007). Suboptimal

adherence can lead to failure to suppress the virus, disease progression, emergence of medication-resistant strains, and death (Bangsberg et al., 2000; Bangsberg et al., 2001; Wood, Hogg, Yip, Harrigan, O'shaughnessy, & Montaner, 2003).

For individuals who are HIV-positive, active substance use is associated with poorer HIV medication adherence and higher morbidity and mortality (Altice, Kamarulzaman, Soriano, Schechter, & Friedland, 2010). For example, Martini and colleagues (2004) found that current substance users were more likely to report nonadherence (48%) compared to nonusers (32%), and there were significantly fewer highly adherent individuals among the cocaine and heroin users in this sample. The negative consequences of failing to complete substance use treatment entail more serious implications for HIV-positive substance users. Because dropout from SUD treatment predicts relapse, it follows that HIV-positive substance users who drop out and begin active substance use are then more likely to be nonadherent to medication and to experience poor health outcomes.

Internalizing and Externalizing Disorders among HIV-positive Individuals

Compared to HIV-negative individuals, people living with HIV are more likely to suffer from mental health disorders. These can include internalizing disorders, which are diagnoses defined by negative affect including depressed or anxious feelings, or externalizing disorders, which are typified by antisocial and aggressive behavior as well as impulsivity (Forbes, Kotov, Ruggero, Watson, Zimmerman, & Krueger, 2017; Kotov, Ruggero, Krueger, Watson, Yuan, & Zimmerman, 2011). Studies have demonstrated concurrent diagnoses of internalizing or externalizing disorders with substance use

disorders at rates between 23% and 79% among HIV-positive groups (Dew et al., 1997; Maj et al., 1994; Stall & Leigh, 1994; Whetten et al., 2005), significantly higher than for their HIV-negative peers. Internalizing symptoms and disorders including depression are associated with poor HIV-medication adherence (Chesney et al., 2000); it may be that depressed HIV-positive individuates do not possess the physical and mental energy to sustain high levels of adherence (Tucker et al., 2004). Personality disorders are also more prevalent among HIV-positive individuals and are associated depression, anxiety, and social conflict (Perkins, Davidson, Leserman, Liao, & Evans, 1993).

Individuals who are triply diagnosed with HIV, a substance use disorder, and a psychiatric disorder are overrepresented in the patient populations of many treatment settings due to the severity and chronic nature of their symptomatology (Gupta, Kumar, & Garg, 2013). A disproportionate number of HIV-positive individuals utilize services for both mental health and substance use treatment. Burnam and colleagues (2001) estimated that 3% of individuals who received HIV care also attended residential substance use treatment within the previous six months, while 26% had visited a mental health provider, 15% attended group therapy for mental health, 30% took psychiatric medication, 6% reported outpatient substance use treatment, and 12% attended self-help/NA/AA groups for substance use. Clients with lower socioeconomic status were less likely to report using mental health services but accessed substance use services more frequently (Burnam et al., 2001). This may suggest that economic barriers to mental health care translate to HIV-positive individuals with substance use and mental health problems receiving treatment through substance use programs. Because HIV-positive individuals are an at-risk group of substance users who are overrepresented in substance

use treatment settings, it is a natural extension of this literature to examine risks for dropout such as psychopathology as a function of HIV status.

Dropout from SUD Treatment and Implications

Every year, less than half of clients who begin substance use treatment complete their programs (SAMSHA, 2009). The dropout rate varies somewhat by program type, with longer and less structured treatments typically experiencing more client attrition (SAMHSA, 2009). Specifically, within short-term residential programs (30-days or less), the government reports that 59% of clients completed treatment at state-licensed treatment facilities across the United States (SAMSHA, 2009). However, rates of dropout are difficult to compare across research studies because of differences in definitions of dropout.

Studies have defined treatment dropout in a number of ways. Terms that have been used to refer to early discharge from a substance use program before treatment is completed include *attrition*, *dropout, premature termination*, and *unilateral exit* (Pulford, Adams, & Sheridan, 2010). Dropout is often simply equated to failure to complete treatment, regardless of the reason for discharge. This definition is problematic because the reasons for discharge can vary widely to include transfer to another program, medical needs, violating policies of the program, being required to attend a court trial and/or becoming incarcerated, as well as voluntarily leaving treatment prematurely (SAMHSA, 2009). Definitions are most effective when they describe all early discharges by the reason for exit, and/or separate them into whether the discharge was due to factors within a client's control. Throughout this study, the term *dropout* will indicate an outcome in

which a client left treatment against clinical advice or due to sanctions by the treatment program or criminal justice system for behavior during treatment.

There is broad consensus that dropping out from substance use treatment is associated with a variety of negative outcomes for the individual and the program (Brorson, Arnevik, Rand-Hendriksen, & Duckert, 2013; Moos, Moos, & Andrassy, 1999). Dropout from substance use treatment negatively impacts outcomes in several ways. Numerous trials have demonstrated that interventions may only be effective if participants are in care for some minimum amount of time or number of sessions (Siqueland, Crits-Christoph, & Gallop, 2002; Turner & Deane, 2016; Wallace & Weeks 2004). Individuals who drop out of substance use treatment are more likely to experience relapse, poorer health, incarceration, and unemployment after doing so, prompting comparison to substance users who were never engaged in care (Brorson et al., 2013; Moos, Moos, & Andrassy, 1999; Stark, 1992). Indeed, the length of time spent in residential treatment (including for those who drop out) is a strong predictor of substance use abstinence from alcohol, heroin, and crack among other positive outcomes (Gossop, Stewart, Browne, & Marsden, 2002; Simpson, Joe, & Brown, 1997). Although studies show support for varying ideal lengths of treatment, client dropout frequently occurs in the early stages—often within the first few days or weeks (Pulford & Wheeler, 2007). Therefore, clients who drop out have limited contact with treatment professionals, and individuals at risk for dropout should be identified as close to treatment entry as possible if intervention to retain them is a priority.

More recent models of care allow providers to tailor the type or amount of an intervention a client receives to be more appropriate for his or her needs (e.g. stepped

care), but this tailoring is not possible if a client leaves treatment and is not in contact with the provider or refuses to consider treatment alternatives (Drummond et al., 2009; Kay-Lambkin, 2008; Pekarik, 1985). Dropout also impacts treatment programs financially; after providers invest time and other resources in intake procedures and therapy with clients who leave treatment early, agencies cut funding for those clients who drop out and the facility loses its investment in that client. Further, staff morale can be negatively affected when clients routinely terminate treatment prematurely (Wilson & Sperlinger, 2004). To address the issue of substance use treatment dropout, work is needed to identify factors that predict premature termination so that researchers and programs can develop strategies to utilize that information to retain clients in care.

Prior Research on Predictors of SUD Treatment Dropout

Several individual client demographic and clinical factors have been shown to be associated with the likelihood of completing treatment. The most frequently studied and consistent demographic factor as a predictor of dropout is client age. For instance, in their 2013 systematic review of risk factors for addiction treatment dropout, Brorson and colleagues found that younger age was related to significantly higher dropout risk in roughly half of the larger studies included in their analysis, and was also significantly related to dropout in residential programs (Meier, Donmall, McElduff, Barrowclough, & Heller, 2006). Most studies that have shown younger clients are more likely to dropout have been conducted with outpatient samples (Agosti, Nunes, & Ocepeck-Welikson, 1996; Marrero et al., 2005; Raylu & Kaur, 2012; Roffman, Klepsch, Wertz, Simpson, & Stephens, 1993; Sosin & Durkin, 2007; Teichner, Horner, Roitzsch, Herron, & Thevos,

2002). Several took place in residential programs outside the United States (López-Goñi, Fernández-Montalvo, Illescas, Landa, & Lorea, 2008; Meier et al., 2006; Poulopoulos & Tsiboukli, 1999). Mutter and colleagues (2015) conducted a large-scale study of risks of dropout from residential treatment in the United States utilizing 104,999 cases from SAMHSA's 2010 Treatment Episode Dataset, and also found younger clients were more likely to drop out.

Gender, on the other hand, has been more inconsistently linked to drop-out. Most studies that have examined gender as a risk factor for dropout have found no significant effects (Brorson et al., 2013). Only ten out of the 64 studies that explored gender as a predictor found an association with dropout, and these were split evenly with five studies reporting males were more likely to drop out and the other half finding that females were more at risk for doing so. Few recent studies of residential substance use treatment (as opposed to outpatient) have tested or found a significant association between gender and dropout (Brorson et al., 2013, Mutter et al., 2015). These inconsistent findings are incongruous with a common narrative that predicts that females are more likely to terminate treatment early due to higher levels of clinical symptoms, increased likelihood of a physical or sexual abuse history, parenting responsibilities, lower income and employment opportunities. There may be several factors leading to inconsistent findings regarding gender and its relation to dropout. Most of the available studies of this topic examine a single treatment site in a particular geographical area. Also, evidence of a gender effect on dropout could actually be tapping into other risk factors associated with gender, such as co-occurring psychopathology, that may vary depending on the sample, geography, or type of program.

Other established risk factors for substance use treatment dropout include lower education (Brecht, Greenwell, & Anglin, 2005; Fowler, Groat, & Ulanday, 2013; Vendetti et al., 2002), being unemployed (Hiller, Knight, & Simpson, 1999; Mutter et al., 2015), not being mandated to treatment (Mutter et al., 2015), and marital status (Callaghan, 2003; Mutter et al., 2015; Salamina et al., 2010). However, Mutter's recent residential dropout study found that clients who were married were more likely to drop out, whereas another study with 3649 males entering residential treatment found that single marital status was a predictor (McKellar, Kelly, Harris, & Moos, 2006). On the whole, more studies have linked single marital status to dropout, but more research is needed to clarify marital status' role in dropout from residential treatment.

For programs that treat multiple types of drugs and alcohol, studies have examined dropout rates comparing clients' substance of choice. There is support for the idea that alcohol users (Li, Sun, Purl, Marsh, & Anis, 2007; McKellar, Kelly, Harris, & Moos, 2006; Scott-Lennox, Rose, Bohlig, & Lennox, 2000), cocaine users (Salamina et al., 2010; Veach, Remley, Kippers, & Sorg, 2009), and opioid users (Blondell, Amadasu, Servoss, & Smith, 2006; Callaghan & Cunningham, 2002; Gilchrist, Langohr, Fonseca, Muga, & Torrens, 2012) are more likely to fail to complete treatment. By contrast, Mutter and colleagues (2015) found that alcohol users were more like to complete residential treatment compared to all other drugs of choice. Not surprisingly, individuals who present to treatment with multiple substance use disorders or higher levels of substance use severity are at higher risk for failing to complete SUD treatment (Brecht, Greenwell, & Anglin, 2005; Maglione, Chao, & Anglin, 2000; Passos & Camacho, 2000).

The overwhelming majority of studies that have examined risk factors for dropout were conducted with outpatient populations and programs (Brorson et al., 2013; Craig, 1985; Stark, 1992), especially the studies with the largest sample sizes. The authors of a recent large-scale study of residential substance use treatment dropout highlighted that to their knowledge it was the first of its kind (Mutter et al., 2015), which is consistent with there being a gap in this literature. More research on predictors specific to residential programs is needed. Additionally, future studies should not evaluate client demographic or other risk factors in isolation, nor should they ignore the potential interactions between risk factors. There is also a gap in the literature for studies of dropout that incorporate client characteristics as moderators, asking for whom a potential predictor of dropout matters (such as HIV-positive individuals). Many of the demographic risk factors described above are useful as a means of identifying individuals who are at risk for dropout, yet most of these variables do not lend themselves to obvious means of intervention. Co-occurring psychiatric disorders, by contrast, are an attractive target for intervention in SUD treatment programs, because there are numerous empirically supported approaches to address psychopathology among substance users specifically (see Drake, O'Neal, & Wallach, 2008 for a review).

Psychopathology and its Association with SUD Treatment Dropout

Evidence suggests that substance users with co-occurring psychopathology are more likely to drop out of residential treatment, to experience substance use relapse, and to be readmitted for additional treatment in the future (Alterman, McLellan, & Shifman, 1993; Brown et al., 1998; Chawdhary et al., 2007; Greenfield et al., 1998; Hasin et al.,

2002; Lejuez et al., 2008; Moos, Mertens, & Brenna, 1994). Internalizing disorders/symptoms that have shown to predict dropout include depressive symptoms (Curran, Kirchner, Worley, Rookey, & Booth, 2002), anxiety sensitivity (Lejuez et al., 2008), or broader categories of depression and anxiety (Hattenschwiler, Ruesch, & Modestin, 2001), whereas diagnoses such as posttraumatic stress disorder have consistently failed to predict dropout (see Brorson et al., 2013). Regarding externalizing psychopathology, antisocial personality disorder (ASPD) is a consistent predictor of SUD treatment dropout (McMahon, Kelley, & Kouzekanani, 1993; Ravndal, Vaglum, & Lauritzen, 2005; Samuel, LaPaglia, Maccarelli, Moore, & Ball, 2011).

Most work on internalizing and externalizing disorders and their relation to SUD treatment dropout has examined specific disorders, or considered the presence of any mood or anxiety disorder as the variable of interest. For example, Hattenschwiler and colleagues (2001) determined that clients in residential treatment who presented with substance dependence and co-occurring affective disorders were more likely to dropout compared to those with substance dependence alone. To our knowledge, no studies to date have utilized the number of lifetime internalizing or externalizing disorders as a predictor of SUD dropout. This is a gap in the literature that is especially relevant to HIV-positive individuals, because evidence suggests that as their number of risk factors grows, negative outcomes can increase exponentially.

Psychopathology among HIV-positive Substance Users as a Potential Dropout Risk

The combination of psychiatric disorders and substance use among individuals living with HIV is thought to be associated with worse prognosis compared to the effects

of a psychiatric disorder or substance use disorder alone (Nnadi et al., 2002). This pattern of risk factors interacting to increase the odds of poorer outcomes is common in research on individuals who are at risk for or living with HIV. For instance, greater numbers of health problems were found to have an additive effect in predicting risky sexual behaviors and HIV infection among men who have sex men (Stall et al., 2003). And in terms of impacts on medication adherence, one study examined the impact of stressful events (e.g. housing instability, physical or sexual assault, legal or final problems) and found as the number of events participants experienced grew, the odds of nonadherence increased (Mugavero et al., 2009). Blashill and colleagues (2015) assessed multiple types of psychosocial risk factors including psychiatric disorders, childhood abuse, and current violence. As participants reported a greater number of risk factors, there was an increase in their odds of nonadherence—those with 3-4 risk factors had 5 times greater odds of nonadherence than those with none (Blashill et al., 2015). These studies add to an emerging line of research into syndemics theory in the HIV literature.

Syndemics theory is based on notion that multiple risk factors act together to exacerbate the negative effects of each other, and the term *syndemics* has been to examine risk for contracting HIV as well as medication nonadherence among those who are HIV-positive (Blashill et al., 2015; Singer, & Clair, 2003). Given research establishing that co-occurring internalizing and externalizing disorders are linked to negative health and substance use outcomes among HIV-positive individuals, syndemic theory suggests that HIV-positive substance users may be at increased risk of negative outcomes including dropout from residential treatment. Evidence suggests that risk factors can interact with each other to increase the odds of medication nonadherence or

substance use relapse above combined contributions of main effects. The current study aims to examine whether psychopathology interacts with HIV status to predict residential substance use treatment dropout. To our knowledge, no studies have examined whether the greater internalizing and externalizing disorders are associated with dropout outcomes for HIV-positive clients relative to HIV-negative peers in residential substance use treatment.

Present Study

The current study utilized a longitudinal design to examine whether internalizing and externalizing disorders will separately interact with HIV status to predict dropout from residential substance use treatment. We will also test whether a there is a three-way interaction between HIV status, internalizing, and externalizing in predicting dropout.

Primary Aim: To examine the interaction between psychopathology and HIV status in predicting treatment outcome. We will test two separate models looking at: (1) INT x HIV status and (2) EXT x HIV status, both predicting dropout from SUD treatment.

Hypothesis 1a: Consistent with literature showing that HIV-positive substance users are at greater risk for negative substance use outcomes when they also have mood or anxiety disorders, we hypothesize that there will be a significant interaction between internalizing disorders and HIV status predicting whether or not a client dropped out of treatment. We also predict that this interaction will be related to the number of days of treatment that clients complete in treatment among those who drop out. Specifically, we predict that individuals with higher lifetime internalizing disorders who are HIV-positive will be more likely to drop out of

treatment, and among dropouts will stay in treatment for fewer days than individuals with HIV who are low in internalizing or HIV-negative individuals.

Hypothesis 1b: Consistent with research on externalizing disorders (e.g. substance dependence) interacting with HIV to predict later psychopathology, we hypothesize that lifetime externalizing disorders at treatment entry will interact with HIV status to predict whether or not a client dropped out of treatment, as well as the number of days in treatment among dropouts. Specifically, HIV-positive individuals higher in externalizing disorders will be more likely to drop out of treatment and will do so more quickly than individuals who are low in externalizing or HIV-negative.

Secondary Aim: To examine a potential three-way interaction between internalizing, externalizing, and HIV status in predicting dropout.

Hypothesis 2: HIV medication adherence literature suggests that multiple diseases or risk factors can interact to exacerbate the negative outcomes of those factors above and beyond any main effects they may show in isolation. Thus, we hypothesize that the interaction of internalizing, externalizing, and HIV status will predict both measures of treatment dropout described above. Specifically, we hypothesize that HIV-positive clients higher in INT and EXT will be more likely to drop out of treatment compared to their HIV-negative counterparts, individuals lower in internalizing, and individuals lower in externalizing.

Figure 1. Model 1: Internalizing and HIV status interact to predict SUD treatment dropout

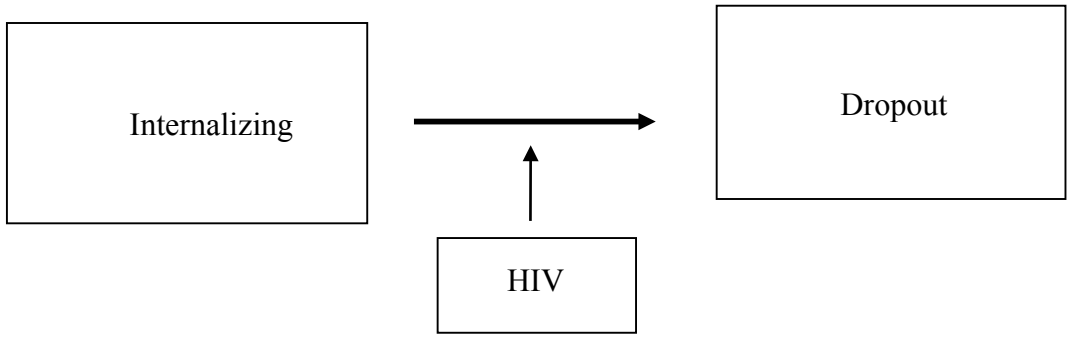


Figure 2. Hypothesis 1a: Proposed interaction between internalizing and HIV status

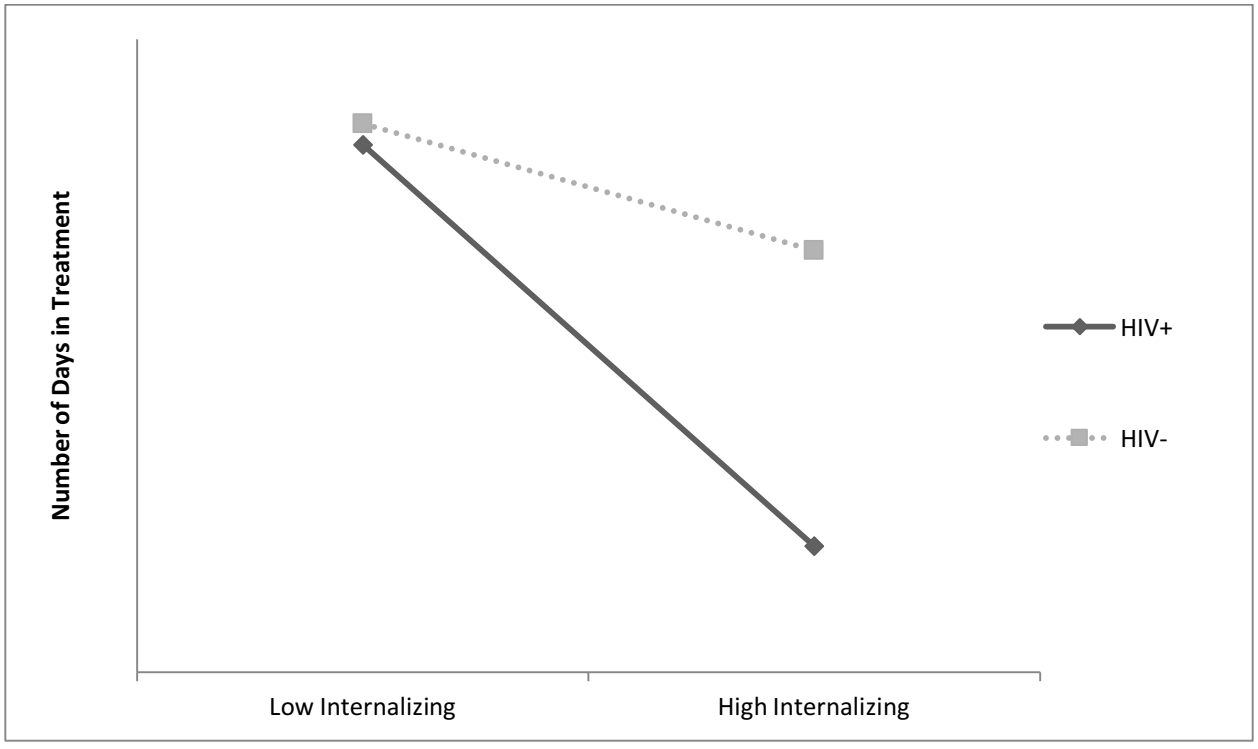


Figure 3. Model 2: Externalizing and HIV status interact to predict SUD treatment dropout

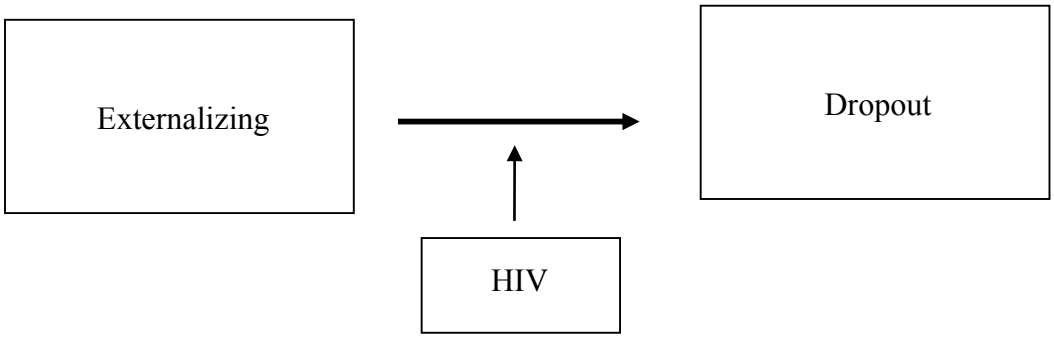


Figure 4. Hypothesis 1b: Proposed interaction between externalizing and HIV status

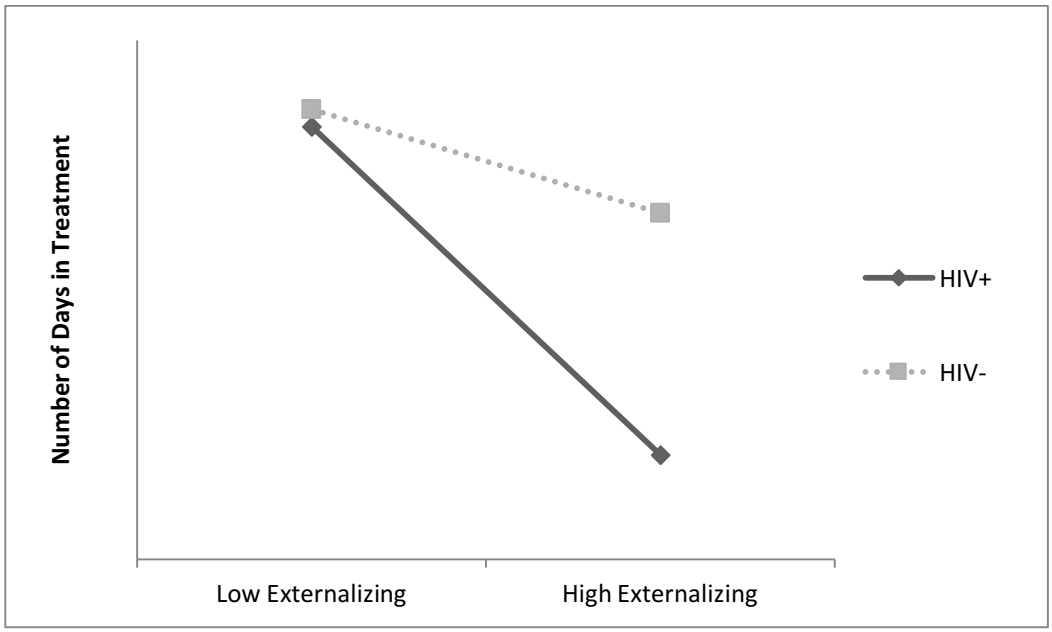


Figure 5. Model 3: Three-way interaction of internalizing, externalizing, and HIV status to predict SUD treatment dropout

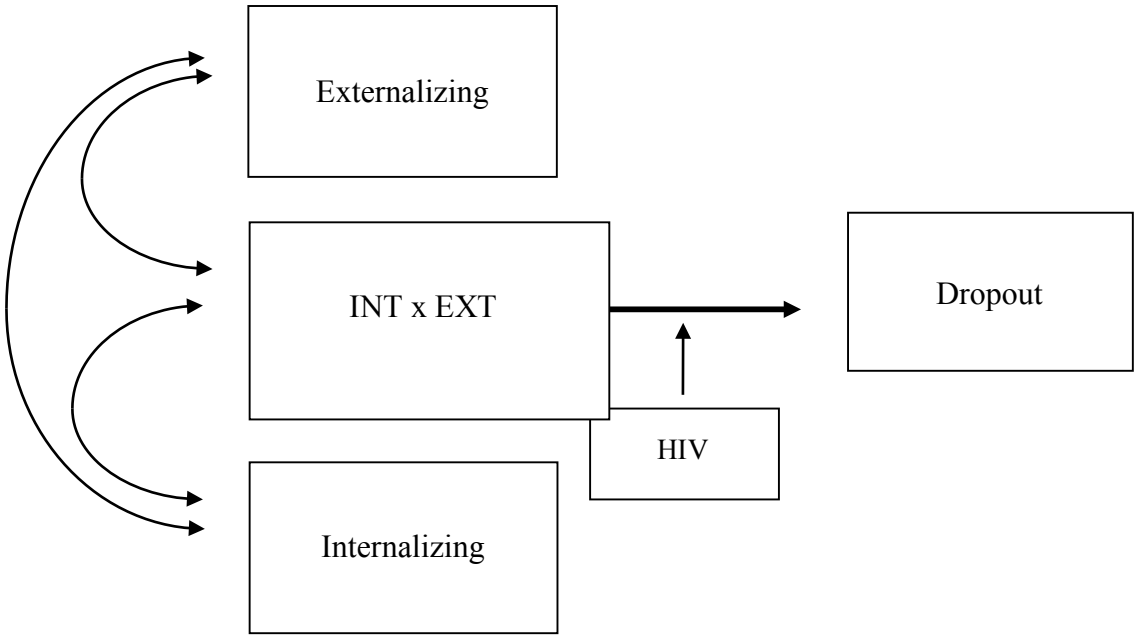
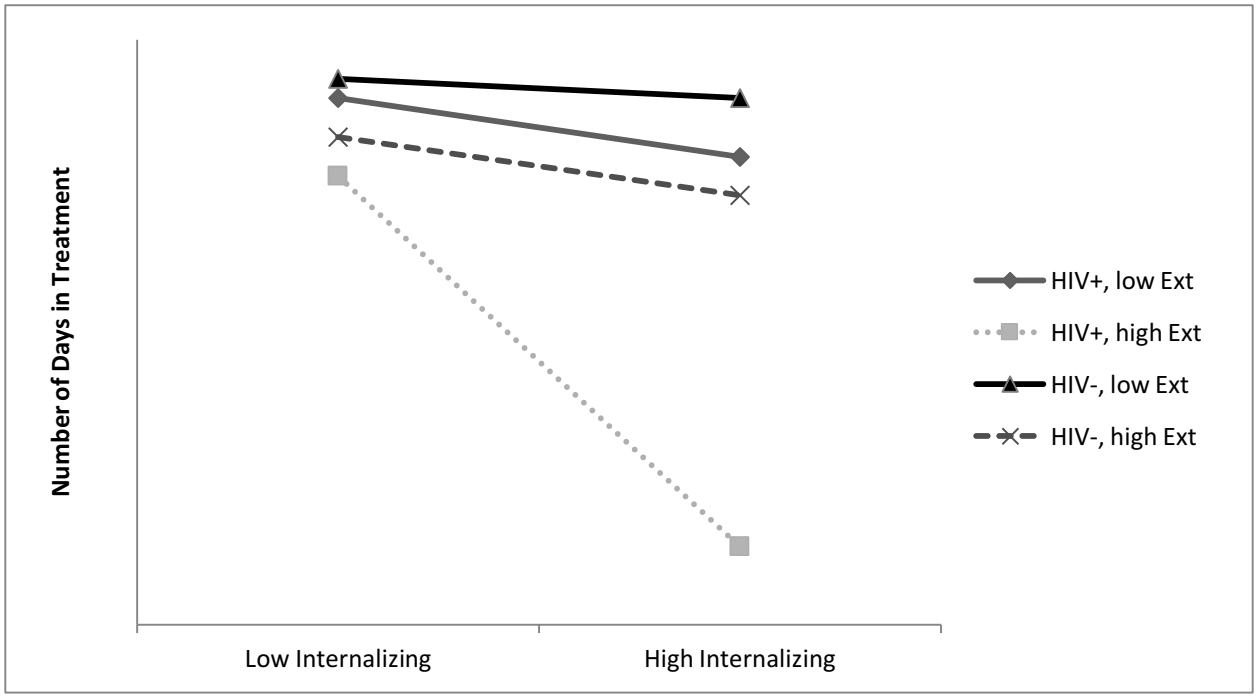


Figure 6. Hypothesis 2: Proposed three-way interaction between externalizing, internalizing, and HIV status



Method

Participants and Procedures

The current study utilized data collected from 1613 participants who attended substance use treatment at a residential program in Northeast Washington D.C. on 28- or 30-day contracts, who consented to participate in research between August 2008 and June 2016. The mean age of the sample was 42.7 years old (SD 11.2) and 65.6% identified as male. The majority of the sample identified as Black/African-American (90.5%), followed by Hispanic (3.3%), Caucasian (3.1%), American Indian/Alaskan Native (.6%), Asian (.4%), and individuals identifying as "Other" (2.1%). Individuals who identified as HIV-positive represented 6.8% of the sample.

Participants who entered treatment on 28- or 30-day contracts and completed 28 days of treatment were categorized as treatment completers (79.5% of participants completed treatment; see Table 1). No clients on 30-day contracts left treatment on day 28-30 of their contracts. Clients who left treatment before the 28-day mark due to voluntary withdrawal (11.8%), termination of their contract by their counselor due to substance use or other rule violations (5.3%), or non-compliance with terms of their court mandated status or other facility policies (1.3%) were considered part of the dropout group. Those who left treatment due to medical discharge, transition or transfer to a different facility, or due to an outside change in their legal status (2.1% across categories) were excluded from future analyses because these reasons represented factors that were at least in part outside of the clients' control. ANOVA and chi-square analyses revealed that participants who were excluded did not significantly differ from clients in the dropout

and treatment completer groups across variables of interest including their HIV status, court mandated status, age, gender, or other demographics.

Table 1. Treatment Outcomes

Treatment Outcomes	Total (%)
Completed Treatment	79.5
Voluntary Withdrawal	11.8
Counselor Discharge	5.3
Non-compliance	1.3
Medical Discharge	1.2
Other (transfer, transition, legal change)	.9

The most commonly reported drug of choice was crack-cocaine, and primary crack users were the most likely to complete treatment.[1] Comparatively few participants identified their drug of choice as methamphetamine, sedatives, MDMA, non-opioid prescription drugs, or other hallucinogens; these drugs of choice were combined into an "Other" category for future analyses.

Table 2. Current Drug of Choice

Drug Class	Drug of Choice % (DOC)	Tx Completion % by DOC
Crack	24.4	86.5
Cocaine	13.9	83.9
Cannabis	19.3	75.4
PCP	14.7	74.2
Heroin	14.6	80.9
Alcohol	12	83.2
Other	1.1	85.7

[1] The crack and cocaine categories are listed separated in Table 2; however, all analyses below were also conducted with cocaine and crack combined into one drug of choice class and the results were unaffected.

Upon entering treatment at this center, clients participated in a structured clinical intake assessment administered by interviewers who were University of Maryland doctoral level graduate students or senior research staff. In addition to providing diagnostic information to the clinical treatment staff of the center, the assessment was also used to gather data for the current study. Upon finishing the interview, clients were informed of the opportunity to participate in a research project and, if they agreed, informed consent was obtained. To limit coercion, counselors were unaware of whether clients agreed to participate in research. Historically, less than 5% of clients decline to participate in research at this site (Lechner et al., 2013). Individuals who consented to participate in research also provided permission for the researchers to access information pertaining to their treatment completion or dropout status from the treatment facility records. The University of Maryland Institutional Review Board reviewed and approved all aspects of the study protocol.

Participants were recruited during their first week of residential treatment after completing detoxification and submitting a negative urine screen. The length of treatment contracts at this facility typically ranges from 28 to 180 days and depends on the agency providing funding for the client. However, only clients on contracts of 30 days or below were included in this study. More than 30% of clients in this setting enter treatment voluntarily through the Addiction Prevention and Recovery Administration (APRA). The remainder are court-mandated to attend the program by criminal justice institutions: Court Services and Offender Supervision Agency (CSOSA) and Pretrial Services Agency (PSA). Treatment programming includes a variety of groups from 8 am to 9 pm daily based on the 12-step philosophy, as well as small groups that focus on specific client

needs, such as Anger Management, Grief and Loss, Family Issues and Trauma, and Dual Diagnosis. Any member of the clinical staff is also able to refer a client with mental health needs for individual therapy led by interns from psychology graduate programs. Clients are only permitted to leave the facility for approved scheduled appointments with psychiatrists, primary care physicians, and for court appearances (free transportation is provided to all appointments). Onsite basic medical care is available, and psychiatric and other medications are administered and directly observed by staff. Although the program fills prescriptions for psychiatric and health-related medications, including HIV medication, it does not provide or allow medication assisted therapy (MAT) to treat substance use disorders.

All interviewers were extensively trained and supervised to ensure the accuracy of diagnoses. Trainees first watched the full video protocol for the Structured Clinical Interview for the DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1995). After reviewing the protocol, trainees next conducted two mock interviews using the SCID-IV and the Diagnostic Interview for Personality Disorders (DIPD; Zanarini, Frankenburg, Chauncey, Gunderson, 1987). The final stages of the training included observing two full diagnostic assessments performed by experienced interviewers at the treatment center, completing a final certification practice interview with the training director, and administering two real interviews observed by supervisors at the treatment center. Once training was completed, all interviewers participated in an ongoing weekly supervision meeting led by a clinical psychologist. Any clinical questions regarding specific clients or diagnoses were addressed through group discussion and feedback.

Measures

Demographic Variables. Participants self-reported their HIV status, gender, age, race, marital status, income, education, previous treatment for substance use or psychiatric disorders, incarceration history, and drug use frequency. Participants' HIV status was corroborated with records from the medical staff at the treatment center. If a client disclosed their HIV-positive status and the medical/clinical staff were unaware of this information, interviewers confidentially informed the client's counselor and the medical staff (clients were notified in advance that any information they shared during the intake interview would be communicated to the treatment teams).

Diagnostic Assessments. The Structured Clinical Interview for the DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1995) was used to assess the following Axis I disorders: major depressive disorder, bipolar I disorder, panic disorder, social phobia, obsessive compulsive disorder, posttraumatic stress disorder, generalized anxiety disorder, and drug dependencies. Substance abuse was not assessed given the severity of the drug use among this inpatient sample. In order to differentially diagnose Axis I disorders that were substance-induced or the result of other underlying causes, interviewers established a comprehensive symptom timeline with each participant, ensuring that diagnoses were made only in cases when symptoms were not the direct result of the pharmacological effects of substance use or a general medical condition. We also assessed participants for antisocial personality disorder (ASPD) using the SCID-IV and borderline personality disorder using the DIPD.

Treatment Dropout and Referral Agency Information. The treatment center provides researchers from the University of Maryland with a database of treatment information for clients who consented to participate in research on a monthly basis. Participants are matched on a unique number assigned to them by the facility and these data are merged to match the subject number used by the researchers for each participant. This treatment information includes the clients' treatment completion status, reason for contract termination (if applicable), entry and exit dates, the number of days spent in treatment until dropout, the contract length, and voluntary or court-mandated status.

Data Analytic Strategy

1. *Preliminary Analyses.* After excluding participants who were medically discharged from treatment or left for other reasons outside their control, we examined all variables for univariate normality and did not have to transform any them. Then, we examined differences in demographic and treatment background variables as a function of dropout status, comparing dropout and treatment completer groups. We also correlated the days in treatment outcome variable with HIV status, INT, EXT, and age and examined the percentage of clients who dropped out of treatment within specified ranges of days in treatment.
2. *Creating INT and EXT Composites.* In order to examine the potential impact of internalizing and externalizing disorders, we created INT and EXT composites of lifetime diagnoses that fell under these domains in a recent model of psychopathology that incorporates both clinical and

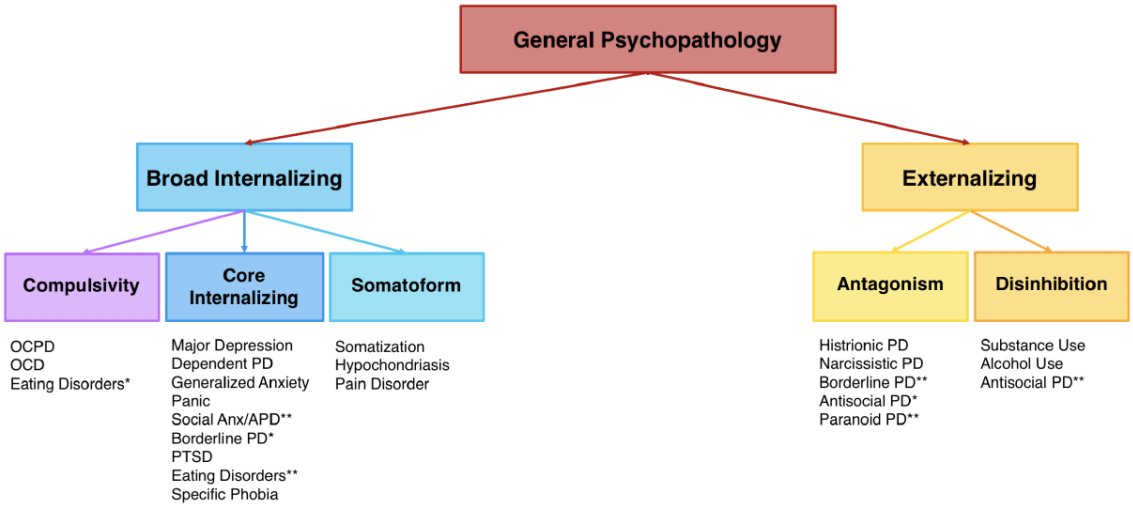
personality disorders (Forbes et al., 2017; see figure 7). The INT composite was comprised of the following disorders: major depressive disorder, obsessive compulsive disorder, generalized anxiety disorder, panic disorder, social anxiety disorder, posttraumatic stress disorder, and borderline personality disorder. Disorders included in the EXT composite are antisocial personality disorder, borderline personality disorder, and substance dependence diagnoses (alcohol, cannabis, sedatives, stimulants, methamphetamine, PCP, and cocaine). Each composite was a sum of the number of lifetime disorders in that category. Finally, we standardized two sets of the composites based on the dropout outcome analyzed. For the dichotomous (yes/no) dropout variable, INT and EXT were standardized based on the entire sample; whereas, for analyses predicting the number of days in treatment, only individuals who dropped out were included in the analysis, therefore INT and EXT were standardized based on that subset of participants.

3. *Primary Aim.* Our first two hypotheses state that HIV status will interact with a) INT and b) EXT to predict dropout status and days in treatment. We used logistic regression to predict likelihood of dropout and linear regression to predict the number of days in treatment. In both models, the first step included covariates that we identified in the literature: age, education level, unemployment status, court mandated status, and drug of choice. Drug of choice was dummy coded using the drug with the lowest dropout rate (or highest treatment completion) as the reference category,

which was the crack category. The second step included the main effects of HIV and either a) INT or b) EXT. The two-way interactions, HIV x INT or HIV x EXT, were included in the last step.

4. *Secondary Aim.* Our last hypothesis was that the three-way interaction of HIV, INT, and EXT would predict dropout status and days in treatment. These analyses followed the same structure above with covariates in the first step, main effects (HIV, INT, and EXT) in the second, all two-way interactions between HIV, INT, and EXT in the third, and the three-way interaction of HIX x INT x EXT in the fourth step.

Figure 7. The hierarchical structure of psychopathology in a psychiatric sample that incorporates clinical and personality disorders (from Forbes et al., 2017). The INT and EXT composites from the current study were created using the classification of disorders from this structure.



Results

Preliminary Analyses

First, we examined all variables for univariate normality and found no variables to be outside the acceptable ranges for skewness and kurtosis (utilizing a ≥1 cutoff for skewness and ≥3 for kurtosis). Next, we compared participants who completed treatment to those who dropped out on demographic and treatment background variables (see Table 3 below). A Chi-square test suggests that participants who dropped out of treatment were more likely to be female χ^2 (1) = 5.96, p = .015. The percentage of dropouts who were unemployed (79.2%) was significantly greater than for treatment completers (72.6%), χ^2 (1) = 5.59, p = .018. A one-way ANOVA suggests that individuals who dropped out were significantly younger than completers, $F(1,1577) = 44.58$, $p < .001$. Those in the dropout group were also more likely to report their marital status as single, χ^2 (1) = 6.00, p = .014. In terms of their treatment-related characteristics, dropouts were significantly less likely to have been court-mandated to treatment (48.6% vs. 63.5%), were more likely to have been prescribed psychiatric medication in their lifetime (61.8% vs. 52.7%), and to have previously attended inpatient or outpatient psychiatric treatment (67.5% vs. 59.8%).

Table 3. Demographics and Treatment Variables as a Function of Treatment Completion Status

	Total Sample	Completers (N=1282)	Dropout (N=297)	*p* value	χ^2/F
Demographics					
Age *[M (SD)]*	42.7 (11.2)	43.6 (10.9)	38.9 (11.7)	**<.001**	44.58
Gender (% male)	66.2	67.7	60.3	**.015**	5.96
Race (% Black/African-American)	90.5	91.2	87.8	.067	3.36
Income (% <$10,000)	78.5	78.0	82.2	.113	2.51
Education (% <HS education)	39.5	39.4	40.2	.796	0.67
Marital Status (% single)	65.6	64.5	71.8	**.014**	6.00
HIV-positive (% positive)	6.8	6.9	6.5	.819	0.05
Employment Status (% unemployed)	73.8	72.6	79.2	**.018**	5.59
Treatment and Other Experiences					
Referral Status (% court mandated)	60.7	63.5	48.6	**<.001**	23.31
Inpatient/outpatient treatment for SUDs	71.7	72.4	69.2	.273	1.20
Inpatient/outpatient psychiatric treatment	62.8	59.8	67.5	**.013**	6.10
Previous 12-step group attendance	64.3	65.2	60.9	.155	2.03
Psychiatric medication (lifetime)	54.7	52.7	61.8	**.006**	7.67
Spent time in jail or prison	91.0	91.0	90.7	.865	0.03

Note: p values are based on chi-square analyses and ANOVAs. Significant analyses are bolded.

In comparing HIV-positive and HIV-negative groups, a one-way ANOVA suggests that clients were significantly younger in the HIV-negative group, $F(1,1577) = 11.45$, $p = .001$. Although there was not a significant difference in the dropout rate depending on HIV status, we did find that several past treatment characteristics differed across groups. HIV-positive clients reported previous psychiatric treatment (74.5%) and lifetime prescriptions (65.05%) more often than their HIV-negative peers (61.1% and 53.6%, respectively). In terms of prior substance use treatment, HIV-positive participants were more likely to report experience with 12-step groups (76.5% vs. 63.2%) and inpatient or outpatient treatment for SUDs.

Table 4. Demographics and Treatment Variables as a Function of HIV Status

	HIV-positive (N=107)	**HIV-negative** (N=1472)	***p* value**	χ^2/F
Demographics				
*Age *[M (SD)]*	46.2 (9.8)	42.3 (11.3)	**.001**	11.45
Gender (% male)	59.2	66.9	.111	2.54
Race (% Black/African-American)	92.2	90.2	.507	.439
Income (% <$10,000)	83.8	78.9	.243	1.66
Education (% <HS education)	37.9	39.3	.767	.088
Marital Status (% single)	61.8	65.9	.401	705
Employment Status (% unemployed)	76.5	73.4	.503	.450
Treatment and Other Experiences				
Dropout	18.6	19.6	.819	.052
Referral Status (% court mandated)	56.3	61.4	.311	1.027
Inpatient/outpatient treatment for SUDs	85.4	71.1	**.002**	9.75
Inpatient/outpatient psychiatric treatment	74.5	61.1	**.007**	7.23
Previous 12-step group attendance	76.5	63.2	**.007**	7.26
Psychiatric medication (lifetime)	65.0	53.6	**.024**	5.70
Spent time in jail or prison	89.1	91.2	.476	.508

Note: p values are based on chi-square analyses and ANOVAs. Significant analyses are bolded.

Next, we correlated the days in treatment dropout outcome with age, INT, EXT, and HIV status. Days in treatment was not significantly related to these variables. However, we did find positive significant correlations between age and externalizing (r = .138, p = .010) as well as between internalizing and externalizing (r = .388, p = <.001). See Table 5 for a correlation matrix.

Table 5. Bivariate correlations for treatment non-completers

	1	2	3	4	5
1. Days in TX	--				
2. Age	-.076	--			
3. Internalizing	-.066	.017	--		
4. Externalizing	-.023	.138*	.388**	--	
5. HIV Status	.037	.064	.027	-.194	--

Note: ***p<.001, *p<.05

The mean number of days in treatment until dropout among clients who did not complete the program was 15.99 (*SD* 6.89). The percentage of clients who dropped out was relatively evenly distributed throughout the course of a 28-day contract, with the exception of the first four days of treatment, which included 3.7% of those who dropped out (see Table 6).

Table 6. Number of Days in Treatment among Dropouts

Day Range	**Dropout (%)**
1-4 days	3.7
5-8 days	12.5
9-12 days	18.1
13-16 days	17.5
17-20 days	16.4
21-24 days	17.5
25-28 days	14.1

Hypothesis 1a

Our first hypothesis was that HIV-positive clients who were also high in internalizing would be more likely to drop out of treatment than HIV-negative or low internalizing clients. To examine this hypothesis, we tested a model with logistic regression in which HIV x INT was entered as a predictor of participants' dropout status (yes=1, no=0) after controlling for covariates and potential main effects. In the final model, the interaction of HIV x INT was not significantly associated with dropout status, B = .22, SE = .26; p = .397, OR: .96 [.75,2.01]. [2] Similarly, there was no main effect of INT or HIV status on dropout. However, the model indicated that age was associated with dropout, B = -.05, SE = .01; p < .001, OR: .95 [.94,.97]. This suggests that as a client's age increases, the likelihood of dropout decreases. Participants were also more likely to drop out if they reported being unemployed or if they were not court mandated to treatment. See Table 7 for odds ratios and other statistics associated with these predictors.

Table 7. Logistic Regression of HIV x INT on Dropout

Predictor	B	Standard Error	Exp(B)	CI [lower,upper]
Intercept	-.45	.44	.64	---
Age	-.05***	.01	.95	[.94,.968]
Court Mandated Status	.86***	.16	2.37	[1.74,3.227]
High School Education	-.001	.15	1.00	[.75,1.338]
Unemployed Status	.40*	.18	1.49	[1.05,2.11]
DOC: Crack [Reference]				
DOC: Cocaine	.35	.27	1.42	[.83,2.43]
DOC: Heroin	.47	.26	1.60	[.96,2.68]

[2] All analyses reported in the results were also conducted with INT and EXT composites computed utilizing current (as opposed to lifetime) diagnoses. Similarly, we also ran all sets of analyses with variables that were associated with dropout (e.g., gender) in the current study. No additional significant associations were found in these models.

DOC: PCP	.47	.27	1.61	[.95,2.72]
DOC: Alcohol	.10	.29	1.11	[.63,1.95]
DOC: Cannabis	.44	.26	1.56	[.94,2.56]
DOC: Other	.36	.61	1.43	[.44,4.70]
HIV Status	.17	.29	1.18	[.67,2.08]
Internalizing	-.31	.30	.74	[.41,1.32]
HIV x Internalizing	.22	.26	1.25	[.75,2.10]

Note: $^{***}p<.001$, $^{*}p<.05$

Another hypothesis we made regarding the HIV x INT interaction was that it would predict the number of days in treatment before exit among dropouts. Our prediction mirrored that for the dichotomous dropout outcome, and to test it we used a linear regression model with the same predictors. The final model was not significant, $F(13,273) = 1.08$, $R^2 = .05$, $p = .377$, and HIV x INT was not a significant predictor of days in treatment. None of the included covariates were related to this dependent variable (see Table 8).

Table 8. Regression of HIV x INT on Days in Treatment

Predictor	**Unstandardized Betas**	**Standardized Betas**
Intercept	17.29***	---
Age	.01	.02
Court Mandated Status	-.50	-.04
High School Education	-.90	-.06
Unemployed Status	.21	.01
DOC: Crack [Reference]		
DOC: Cocaine	.45	.02
DOC: Heroin	.53	.03
DOC: PCP	-2.83	-.16
DOC: Alcohol	1.03	.05
DOC: Cannabis	-.42	-.03
DOC: Other	-2.85	-.06
HIV Status	1.11	.04
Internalizing	-.20	-.03
HIV x Internalizing	-.34	-.06

Note: $^{***}p<.001$

Hypothesis 1b

Next we hypothesized that HIV and EXT would interact to predict drop out, with HIV-positive clients high in externalizing more likely to drop out than HIV-negative or low externalizing clients. We tested this hypothesis using the same model in logistic regression as in Hypothesis 1a, but substituting EXT for INT. Results showed no significant relationship between HIV x EXT and dropout, B = -.15, SE = .30; p = .621, *OR*: .86 [.47,1.56]. The same covariates from Hypothesis 1a remained significant, while there was no evidence of a main effect of EXT on dropout (see Table 9).

Table 9. Logistic Regression of HIV x EXT on Dropout

Predictor	B	Standard Error	Exp(B)	CI [lower,upper]
Intercept	-.46	.44	.63	---
Age	-.05***	.01	.95	[.94,.97]
Court Mandated Status	.87***	.16	2.38	[1.74,3.24]
High School Education	.00	.15	1.00	[.75,1.34]
Unemployed Status	.40*	.18	1.49	[1.05,2.11]
DOC: Crack [Reference]				
DOC: Cocaine	.34	.27	1.41	[.82,2.41]
DOC: Heroin	.46	.26	1.59	[.95,2.66]
DOC: PCP	.46	.27	1.58	[.936,2.68]
DOC: Alcohol	.08	.27	1.08	[.61,1.90]
DOC: Cannabis	.44	.26	1.55	[.94,2.55]
DOC: Other	.40	.60	1.49	[.46,4.86]
HIV Status	.16	.29	1.18	[.67,2.07]
Externalizing	.09	.33	1.10	[.57,2.10]
HIV x Externalizing	-.15	.30	.86	[.47,1.56]

Note: ***p<.001, *p<.05

For our hypothesis that HIV x EXT would predict the number of days in treatment, we predicted HIV-positive clients high in externalizing would drop out from treatment more quickly than HIV-negative and low externalizing clients. The final model was not significant, $F(13,273) = 1.17$, $R^2 = .05$, $p = .306$. No covariates or main effects were associated with days in treatment, nor was the interaction of HIV x EXT (see Table 10).

Table 10. Regression of HIV x EXT on Days in Treatment

Predictor	Unstandardized Betas	Standardized Betas
Intercept	15.68***	---
Age	.02	.03
Court Mandated Status	-.55	-.04
High School Education	.91	.86
Unemployed Status	-.14	-.01
DOC: Crack [Reference]		
DOC: Cocaine	.306	.01
DOC: Heroin	.60	.03
DOC: PCP	-2.77	-.16
DOC: Alcohol	.955	.04
DOC: Cannabis	-.34	-.02
DOC: Other	-2.65	-.06
HIV Status	.18	.01
Externalizing	3.00	.42
HIV x Externalizing	-3.25	-.49

Note: ***p<.001

Hypothesis 2

To examine the potential relation between the interaction of HIV, INT, and EXT with dropout we conducted a logistic regression analysis. Our prediction was that clients high in both internalizing and externalizing who were HIV-positive would be more likely

to drop out than low internalizers, low externalizers, and HIV-negative participants. Results indicated that HIV x INT x EXT was not significantly associated likelihood of dropout, B = .03, SE = .31; p = .913, OR: 1.03 [.57,1.88]. The two-way interaction between INT and EXT was also unrelated to dropout.

Table 11. Logistic regression of HIV x INT x EXT on dropout from treatment

Predictor	B	Standard Error	Exp(B)	CI [lower,upper]
Intercept	-.39	.44	.68	---
Age	-.05***	.01	.95	[.94,.97]
Court Mandated Status	.86***	.16	2.37	[1.73,3.24]
High School Education	.01	.15	1.01	[.75,1.35]
Unemployed Status	.41*	.18	1.51	[1.06,2.14]
DOC: Crack [Reference]				
DOC: Cocaine	.34	.28	1.40	[.82,2.40]
DOC: Heroin	.46	.26	1.58	[.94,2.65]
DOC: PCP	.46	.27	1.58	[.93,2.68]
DOC: Alcohol	.08	.29	1.08	[.61,1.91]
DOC: Cannabis	.45	.26	1.56	[.95,2.58]
DOC: Other	.39	.62	1.48	[.44,4.93]
HIV Status	.09	.31	1.09	[.59,2.01]
Internalizing	-.32	.34	.73	[.37,1.42]
Externalizing	.26	.37	1.29	[.63,2.65]
HIV x Internalizing	.30	.30	1.35	[.75,2.45]
HIV x Externalizing	-.28	.34	.76	[.39,1.47]
Internalizing x Externalizing	-.18	.34	.83	[.43,1.61]
HIV x Internalizing x Externalizing	.03	.31	1.03	[.57,1.88]

Note: ***p<.001, *p<.05

Finally, we tested the same hypothesis above with the three-way interaction predicting the number of days in treatment. Among clients who dropped out, we conducted a regression analysis predicting number of days in treatment that showed that the final model was not significant and the three-way interaction of HIV x INT x EXT

was not significantly associated with days in treatment before dropout ($F(17,269) = .98$, $R^2 = -.01$, $p = .479$). See Table 12 for the full model including the three-way interaction.

Table 12. Regression of HIV x INT x EXT on Days in Treatment

Predictor	Unstandardized Betas	Standardized Betas
Intercept	17.29***	---
Age	.01	.02
Court Mandated Status	-.49	-.04
High School Education	.96	.07
Unemployed Status	-.08	-.01
DOC: Crack [Reference]		
DOC: Cocaine	.47	.02
DOC: Heroin	.60	.03
DOC: PCP	-2.71	-.16
DOC: Alcohol	1.05	.05
DOC: Cannabis	-.34	-.02
DOC: Other	-2.66	-.06
HIV Status	.37	.01
Internalizing	-1.06	-.15
Externalizing	3.42	.48
HIV x Internalizing	.50	.08
HIV x Externalizing	-3.46	-.52
Internalizing x Externalizing	.61	.09
HIV x Internalizing x Externalizing	-.66	-.10

Note: ***p<.001

Discussion

The purpose of this study was to examine the interactions between HIV status, internalizing disorders, and externalizing disorders and their association with dropout from a residential substance use treatment program. Our results showed that the dropout rate did not significantly differ between HIV-positive and HIV-negative participants. In our primary aim, we examined models that tested whether HIV interacts with INT or EXT to predict dropout and days spent in treatment. Results showed that neither two-way

interaction was related to the dropout outcomes. We also hypothesized that the three-way interaction of HIV, INT, and EXT, would relate to dropout and number of days in treatment in our secondary aim; the models testing this three-way interaction found no evidence to support HIV x INT x EXT as a predictor of either dropout outcome.

Our results do contribute, however, to the limited literature on predictors of dropout from substance use treatment specific to residential facilities. While we did not find evidence of our proposed interactions as predictors, several clients characteristics were significantly associated with dropout in this study. First, younger client age was related to an increased risk of dropout, such that each year decrease in age was associated with 1.05 times the odds of dropout. Younger client age is one of the most common predictors of dropout in substance use programs in general (Brorson et al., 2013) and has also been linked to dropout from residential programs (Meier et al., 2006; Mutter et al., 2015). Other significant predictors of dropout in this study that were consistent with past research include having a lower education level, being unemployed, and attending treatment voluntarily (i.e., non-mandated; Brecht et al., 2005; Hiller et al., 1999; Mutter et al. 2015). In their examination of national data on residential substance use treatment discharge, Mutter and colleagues (2015) found no evidence of an effect of gender on dropout, and being married was associated with dropout. By contrast, participants in the current study were more likely to drop out if they were single or female. This may reflect differences in the severity of psychopathology and substance use among females our sample. A potential confounding factor with marital status may be the level of social support provided by the partner. Another difference in predictors was race—previous research has shown inconsistent results for a potential effect of race in relation to

dropout. While Mutter and colleagues (2015) showed that Black and Native American clients were at higher risk of dropout, we did not find this to be the case. However, our sample differs strongly from the racial makeup of many other studies, in that over 90% of participants identified as Black. Rather than considering racial background alone, examining whether clients hold a majority or minority status within the context of a particular program may be affect race's association with dropout (Brown, Joe, & Thompson, 1985). We also saw higher dropout rates among clients who reported receiving psychiatric treatment (either inpatient or outpatient) or reported being prescribed psychiatric medications in their lifetime. Hiller and colleagues (1999) found that a history of psychiatric treatment predicted dropout for patients in a residential therapeutic community substance use treatment program as well.

Although our hypotheses were informed by literature illustrating that substance use and psychopathology can interact with HIV status to predict poorer medication adherence and increased psychiatric problems, the current study found no evidence of interactions between HIV, INT, and/or EXT predicting dropout from residential substance use treatment. There are several possible explanations for these nonsignificant findings. The first is that HIV-positive substance users are not impacted by internalizing or externalizing disorders any differently than their HIV-negative peers when it comes to likelihood of dropout and length of stay in residential substance use treatment. Indeed, we found no evidence of main effects of INT or EXT on dropout outcomes, and the dropout rate did not differ as a function of HIV status.

We were surprised by the lack of main effects of HIV, INT, and EXT in light of previous literature that has linked psychopathology to substance use treatment dropout

(see Brorson et al., 2013 for a review). HIV-positive individuals who enter treatment at the facility in the current study are frequently identified within days of arrival either through client self-disclosure or from medical information provided by the funding agency. Counselors and medical staff recognize the importance of ensuring that prescriptions for HIV-positive clients are filled as quickly as possible, and staff will facilitate engagement with outside medical providers, encouraging HIV-positive clients who have been disconnected from care to attend appointments during the course of treatment. HIV-positive clients may also be more likely to vocally and consistently advocate for staff to address their medical needs compared to HIV-negative clients. A focus on the health of HIV-positive clients (from the client, counselor, or both) could have a halo effect that translates to an added focus on also addressing any mental health needs among HIV-positive clients. For example, if a counselor meets with an HIV-positive client to call to set up an appointment for them to get bloodwork and to reinitiate HAART, the client may mention that they have also been disconnected from their community mental health provider and ask to make an appointment with a case worker, therapist, or psychiatrist. In turn, that discussion of the client's mental health history might motivate the counselor to suggest the HIV-positive client as a good candidate for additional group or individual treatment to the rest of the clinical staff. Ensuring that prescriptions for HIV medication are provided as quickly as possible is likely to mean that psychiatric medications are available faster for these clients as well. Unfortunately, our study did not measure variables such as the number of outside medical or mental health appointments attended, participation in individual or group therapy, or the impact of any of this care on mental health during treatment, so we were not able to assess

whether HIV-positive clients received more treatment attention or if engagement in care affected the likelihood of dropout.

There is evidence to suggest that aspects of residential substance use treatment may motivate HIV-positive clients to remain in care. In a systematic review of research on the effects of substance use on HIV medication adherence, Malta and colleagues (2008) found that the highest adherence rates were reported in settings that offered both treatment for addiction and mental health, and/or provided directly observed therapy (supervised medication administration). The authors of one of these studies suggested that the high adherence rate may be due to the drug-free (more stable) environment, the availability of providers with experience treating HIV, and/or reduced client fears of negative interactions between HAART medication and drugs of abuse (Altice, Mostashari, & Friedland, 2001).

The residential program in the current study provided many of the services associated with better HIV medication adherence and dropout outcomes in previous research, such as use of psychiatric medication, directly observed administration of medication, and mental health therapy (Malta et al., 2008). However, no drugs designed to treat substance use disorders were prescribed or allowed in the program. This is unfortunate because receiving medication assisted therapy (MAT) in residential substance use treatment predicts a decreased likelihood of dropout (Mutter et al., 2015). Researchers were already advocating the use of medication to assist in the treatment of a variety of substance use disorders in residential programs long before there was more national attention focused on recent increases in opioid-related deaths (Kranzler & Kirk, 2001; Saxon, & McCarty, 2005; Volkow, Frieden, Hyde, & Cha, 2014). Yet studies

have shown that MAT has not been widely adopted—it is important to highlight potential reasons this is the case despite evidence of MAT's effectiveness.

Medications have been shown to be effective in the treatment of alcohol use disorders (Miller & Wilbourne, 2002), opioid use disorders (Amass, Kamien, & Mikulich, 2000), nicotine dependence (Stead et al., 2012), and many trials have shown promising results for the treatment of cocaine use disorder (Kampman, 2005) as well as other drugs. The FDA has approved medications for addiction treatment of alcohol, opioids, and nicotine in adults. Residential substance use treatment facilities are utilizing a variety of treatment strategies, yet the adoption of these medications to assist in treatment for substance use has been limited. Roughly half of addiction treatment programs in the U.S. had adopted at least one drug for the treatment of psychiatric disorders or addiction in 2007 (SAMHSA, 2008). But 75% of those programs reported using psychiatric medication compared to only 36% using one of the FDA-approved medications to treat alcohol, opioid, or nicotine use (less than 17% of all total facilities). In terms of actually implementing MAT in programs that used it, one study found that the percentage of eligible clients who actually received any medication for substance use ranged from 8-41% depending on the drug available (Knudsen, Abraham, & Roman, 2011).

Probing attitudes towards MAT (buprenorphine, methadone, and naltraxone) and reasons for slow adoption, Fitzgerald and McCarty (2009) analyzed 2,269 provider responses from 247 treatment units and showed that individual provider factors such as holding a graduate degree and being licensed predicted positive attitudes and accounted for more variance in attitudes than differences across treatment units. These researchers

found that support for psychiatric medications on the individual provider level was the only consistent predictor of positive attitudes across all medications for substance use. Thus, the use and acceptance of psychiatric medications may be more important than other services in setting the groundwork for facilitating MAT. Most relevant to the current study, emphasis on the 12-step model has been identified as a salient barrier to MAT adoption (Abraham, & Roman, 2010; Ducharme, Knudsen, & Roman, 2006), and not only on the program level. Providers who are in recovery themselves or who subscribe more strongly to the 12-step model are less likely to endorse medications for substance use as an effective or acceptable approach (Abraham, Ducharme, & Roman, 2009; Knudsen, Ducharme, Roman, & Link, 2005). These characteristics that are known barriers to MAT adoption are consistent with the treatment philosophy and background of staff at the residential program in the current study.

Another possible explanation of the nonsignificant findings in this study is the unique aspects of the client population and the treatment program. In Washington D.C., many local residential substance use treatment programs do not provide services for individuals with co-occurring psychiatric disorders (APRA, 2012). Funding agencies send clients with mental health disorders to our study's treatment facility specifically because it is one of the programs that offers services to support individuals who are prescribed psychiatric medication and may need mental health treatment. Over half of clients in this study met criteria for an internalizing disorder in their lifetime, and 89% were diagnosed with either substance dependence, antisocial personality disorder, or borderline personality disorder. In other geographical areas or treatment environments

with less severe samples, HIV-status and psychopathology may be more likely to interact to predict dropout.

Finally, treatment dropout, as indexed here, may be a poor indicator of treatment outcome for clients attending this program. A larger proportion of participants in our study completed treatment (79.5%) compared to national averages for short-term residential treatment (59.5%; SAMHSA, 2006). High rates of substance use relapse have been shown both in research on other samples, as well as in a study at this facility that found relapse rates of 70% after 3 months and 85% after 6 months (Daughters, Magidson, Anand, Seitz-Brown, Chen, & Baker, submitted). Perhaps factors that may have contributed to the high treatment retention in this study, such as utilization of medical and mental health care or the threat of incarceration or other sanctions by the criminal justice system, would be less likely to influence any association between HIV, psychopathology, and substance use relapse.

The nonsignificant findings of the current study should not be interpreted as indicating that treatment resources targeting mental health (especially among HIV-positive clients) are not necessary in residential substance use care. Indeed, access to medical and mental health services both onsite and in the community through this residential program may be a factor that contributed to the high treatment completion rate in this sample. In this study's case, the nonsignificant findings paint a picture that can be interpreted in two positive ways. First, there may be no actual effect of psychopathology among HIV-positive users in increasing risk for dropout. Or, the effect of psychopathology may have been mitigated by access to mental health or medical care while in treatment that motivated these individuals to remain in care. Based on the results

of this study, the treatment program could improve retention by offering a brief motivational intervention to engage clients in treatment within the first few days after intake. Carroll and colleagues (2006) integrated motivational interviewing into the intake process for a substance use program and demonstrated that clients who received the intervention were more likely to be retained in treatment after 28 days. Because treatment resources are limited, the intervention could target clients who are younger, unemployed, single, female, and/or not mandated to treatment, as we determined these clients are more likely to drop out. Clients who have been previously prescribed psychiatric medication and/or report prior inpatient or outpatient psychiatric treatment are also more likely to dropout—providing them with individual and group therapy as appropriate may increase the odds that they complete treatment.

Study Limitations

The results of this study should be considered in the context of several limitations. First, although participants were interviewed within the first days (and at maximum one week) after entering treatment, some clients dropped out of the facility before we were able to interview them. We know this because interviewers reported instances in which they attempted to conduct an intake assessment with a client assigned to them who the facility reported had already dropped out of treatment. Unfortunately, because these clients dropped out before we had the opportunity to assess them, ask about their interest in research participation, and obtain consent to access their treatment completion information, we have no accurate estimate of the number of clients who dropped out

before an interview attempt was made and are unable to determine if these clients would differ on variables of interest compared to individuals who we were assessed.

Similarly, only clients who consented for their intake interview data to be used for research were included in this study. Clients who refused to be interviewed or refused research participation at the conclusion of the intake may have been more likely to drop out of treatment compared to those who were interviewed and participated in this study. Staff at the treatment center and the UMD interview staff informed clients multiple times that participation in the intake assessment is a routine and required component of the treatment process, while research participation is completely voluntary. In keeping with those guidelines, the center's clinical team asked that intake interviewers inform the counselor of any client who refused to be interviewed. That refusal could be cited as an example of non-compliance with rules (and potentially be communicated to a client's court supervision officer/agency if they were mandated to treatment). Again, our lack of consent and access to the treatment information for these clients prevented us from including them in our analyses and comparing them to other groups of participants.

Another potential limitation was our decision to only include clients who entered treatment on 28-day or 30-day contracts (short-term) and exclude those on 60-, 90-, 180-, or 730-day stays (long-term). This decision was informed by evidence that suggests that clients who are admitted to long-term residential treatment differ demographically and in their likelihood and reasons for dropout (Mutter et al., 2015, SAMHSA, 2009). Depending upon funding availability, however, some clients who completed short-term treatment remained in the facility after starting a new long-term contract. A proportion of those clients dropped out during the subsequent long-term contract period, but their

reasons for doing so may have been qualitatively different from their short-term dropout peers. For example, some homeless individuals on 30-day contracts have asked for contract extensions (between 60-730 days) because they want to obtain transitional or permanent housing before discharge. In other cases, funding agencies have extended the contracts of unemployed clients, giving them the opportunity to pursue job opportunities. For clients in these scenarios, leaving a long-term contract early may actually be an indication that they were able to improve their life circumstances outside of treatment. In part due to these complications that could not be identified effectively in our data for contract extensions or long term contracts, we ultimately elected to focus on dropout outcomes for short-term stays only.

As part of this study, we did not obtain or measure our participants' engagement or utilization of medical care before or during treatment. HIV-positive drug users are often low-income, have less stable access to health care, and experience logistical and other barriers to treatment (Wolfe, Carrieri, & Shepard, 2010). Thus, these clients may be more likely to stay in residential substance use treatment if they have stable access to their medication and medical care. This is a limitation because the literature on HIV-positive substance users indicates that those in residential drug treatment are more likely to be adherent to their medications (especially in supervised medication administration facilities such as this site; Malta et al., 2008). Similarly, there was no measure of satisfaction with medical care provided during treatment. Many clients reported during their intake interviews that they stopped taking their medications for psychiatric problems, medications for HIV, and/or ceased engagement with treatment providers while they were actively using substances (also consistent with the literature: Malta et al.,

2008). Because this particular residential treatment program filled prescriptions, provided basic medical services, and facilitated free transportation to off-site medical and mental health appointments, participants in this study who were prescribed medications or wanted to utilize medical or mental health care may have been more likely to complete treatment than if these services were not available or satisfactory. HIV-positive clients on HAART who entered without a filled prescription who wanted to drop out after they arrived had a potentially strong incentive to stay, if they valued waiting for that medication. Essentially, without this information we were unable to control for the potential effect of access and use of medical and mental health services on dropout outcomes.

We relied on self-report to determine participants' HIV-status (verified with the medical unit), thus, the lack of biological verification or HIV testing as part of the study protocol could be viewed as a limitation. In particular, this method was likely to have miscategorized HIV-positive clients who were either unaware of their status or were unwilling to disclose that information as HIV-negative. We felt that this concern was largely offset by 1) the frequency that clients have reported being tested for HIV in the past year; 2) the cost of HIV testing would prohibitively expensive for some residential programs and not generalize as a detection method; and 3) being able to target treatment or resources for HIV-positive clients who may be at risk of dropout assumes knowledge of their status.

Most variables related to increased risk for dropout are assumed to be relatively stable factors, yet it is not clear that the evidence supports that assumption. The measures of mental health diagnoses used in this study were calculated based on both lifetime and

current diagnoses, but a current depressive episode refers to the past month, and we considered substance use disorder diagnoses current if criteria were met within the past year. More recent measures of depression, such as of the past two weeks (Beck Depression Inventory-II, Beck, Steer, & Brown, 1996), may be valuable pieces of predictive information. Or more frequent assessment of symptoms, as through ecological momentary assessment techniques, could provide information on changes in mental health status throughout the entire course of care.

Finally, all of the intake interview data were gathered and entered by University of Maryland staff, while the dropout data were provided by the treatment center. While there is no reason to believe that the dropout data were intentionally manipulated or misrepresented, we did detect and correct several data entry errors. We also had no control over the categorization of reasons for exit for non-completers, and therefore cannot be sure that those labels were applied consistently.

Future Directions

Future research with this study's population and treatment site could address many of the limitations outlined above. Our team could gain greater confidence and control with respect to the dropout data by entering this data ourselves on an ongoing basis and gathering more information about each discharge to ensure that reasons for early exit are applied consistently. By incorporating the research consent process into clients' paperwork on the first day of their arrival, we would be able to collect more treatment outcome data for clients who drop out before we assess them, and could provide a clearer picture of the percentage of those who refuse to participate in the intake

interview or decline research participation. It will also be important to include additional measures in future research to capture variables including 1) medical and mental health needs at intake at intake, 2) engagement and satisfaction with medical, mental health and substance use treatment services both onsite and offsite and 3) post treatment outcomes of substance use, psychiatric disorders, and recidivism/incarceration. While this study focused on dropout as the outcome variable, the nonsignificant findings suggest that examining measures of treatment engagement and satisfaction as well as post-treatment substance use outcomes could answer remaining questions.

Although we chose to include as many participants in the current study as possible, there is valuable knowledge that may be gleaned by narrowing the focus of future work. Restricting inclusion criteria or analyses based on clients' court-mandated status and/or drug of choice, for example, may provide details on dropout out for a particular subgroup. Identifying mechanisms of dropout specific to these groups should enable treatment providers to be responsive to tailor treatment or target limited resources for those most at risk.

Another area that deserves more research attention is differences in dropout reasons and outcomes for clients in residential treatment as a function of contract length. Although we only included individuals on short-term contracts, we know from the literature that dropout outcomes differ based on the length of care (SAMSHA, 2009). Treatment programs that offer multiple lengths of care will benefit from knowledge about risks specific to contract length so that they are able to tailor their strategies to improve retention accordingly.

More broadly though, this study points to opportunities to explore what individual factors relate to residential substance use treatment dropout, for whom, and in what context. Our study was limited to one treatment site, but multi-site trials including programs that differ with respect to treatment approach, adoption and implementation of MAT, availability and quality of medical and mental health services, staff characteristics, and other institutional differences are the only way that we will be able to being to untangle the complicated picture of dropout. Future single site trials should gather and provide as much context about the program and its participants, and caution against generalizing any findings to residential substance use treatment facilities that are not similar in almost all relevant characteristics.

In conclusion, the current study sought to determine whether clients' HIV status interacts with internalizing and externalizing psychopathology to predict dropout. Although our hypotheses were not supported, we believe that this study raises important questions about how risks for dropout may differ depending upon the treatment context and client characteristics. More research is needed to address our study's limitations and to explore both narrow subgroups of clients for dropout risk as well as program-level contextual factors that influence client retention in treatment.

Bibliography

Abraham, A. J., Ducharme, L. J., & Roman, P. M. (2009). Counselor attitudes toward pharmacotherapies for alcohol dependence. *Journal of Studies on Alcohol and Drugs, 70(4)*, 628-635.

Abraham, A. J., & Roman, P. M. (2010). Early adoption of injectable naltrexone for alcohol-use disorders: Findings in the private-treatment sector. *Journal of Studies on Alcohol and Drugs*, *71*(3), 460-466.

Addiction Prevention and Recovery Administration (APRA). (2012) Drug Treatment Choice Program Provider Directory. Retrieved from https://doh.dc.gov/sites/default/files/dc/sites/doh/publication/attachments/Adult%20Provider%20Drectory_012810.pdf%20-%20Adobe%20Acrobat%20Professional.pdf

Agosti, V., Nunes, E., & Ocepeck-Welikson, K. (1996). Patient factors related to early attrition from an outpatient cocaine research clinic. *American Journal of Drug and Alcohol Abuse*, *22*(1), 29-39.

Agosti, V., Nunes, E., & Ocepeck-Welikson, K. (1996). Patient factors related to early attrition from an outpatient cocaine research clinic. *The American journal of drug and alcohol abuse*, *22*(1), 29-39.

Altice, F. L., Mostashari, F., & Friedland, G. H. (2001). Trust and the acceptance of and adherence to antiretroviral therapy. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, *28*(1), 47-58.

Amass, L., Kamien, J. B., & Mikulich, S. K. (2000). Efficacy of daily and alternate-day dosing regimens with the combination buprenorphinenaloxone tablet. *Drug and Alcohol Dependence, 58*, 143–152.

American Society of Addiction Medicine (ASAM). (2001). Patient Placement Criteria for the Treatment of Substance-Related Disorders, PPC-2R. Chevy Chase, Md.

Armenian, S. H., Chutuape, M. A., & Stitzer, M. L. (1999). Predictors of discharges against medical advice from a short-term hospital detoxification unit. *Drug and Alcohol Dependence*, *56*(1), 1-8.

Bangsberg, D. R., Hecht, F. M., Charlebois, E. D., Zolopa, A. R., Holodniy, M., Sheiner, L., ... & Moss, A. (2000). Adherence to protease inhibitors, HIV-1 viral load, and development of drug resistance in an indigent population. *AIDS*, *14*(4), 357-366.

Bangsberg, D. R., Perry, S., Charlebois, E. D., Clark, R. A., Roberston, M., Zolopa, A. R., & Moss, A. (2001). Non-adherence to highly active antiretroviral therapy predicts progression to AIDS. *AIDS*, *15*(9), 1181-1183.

Blashill, A. J., Bedoya, C. A., Mayer, K. H., O'Cleirigh, C., Pinkston, M. M., Remmert, J. E., ... & Safren, S. A. (2015). Psychosocial syndemics are additively associated with worse ART adherence in HIV-infected individuals. *AIDS and Behavior*, *19*(6), 981-986.

Brecht, M. L., Greenwell, L., & Anglin, M. D. (2005). Methamphetamine treatment: trends and predictors of retention and completion in a large state treatment system (1992–2002). *Journal of Substance Abuse Treatment, 29*(4), 295–306.

Brorson, H. H., Arnevik, E. A., Rand-Hendriksen, K., & Duckert, F. (2013). Drop-out from addiction treatment: A systematic review of risk factors. *Clinical Psychology Review*, *33*(8), 1010-1024.

Brown, B. S., Joe, G. W., & Thompson, P. (1985.) Minority group status and treatment retention. *International Journal of the Addictions, 20*(2), 319-335.

Callaghan, R. C. (2003). Risk factors associated with dropout and readmission among First Nations individuals admitted to an inpatient alcohol and drug detoxification program. *CMAJ, 169*(1), 23–27.

Carragher, N., Krueger, R. F., Eaton, N. R., & Slade, T. (2015). Disorders without borders: current and future directions in the meta-structure of mental disorders. *Social Psychiatry and Psychiatric Epidemiology*, *50*(3), 339-350.

Carroll, K. M., Ball, S. A., Nich, C., Martino, S., Frankforter, T. L., Farentinos, C., ... & Polcin, D. (2006). Motivational interviewing to improve treatment engagement and outcome in individuals seeking treatment for substance abuse: A multisite effectiveness study. *Drug and Alcohol Dependence*, *81*(3), 301-312.

Cartwright, W. S. (2000). Cost–benefit analysis of drug treatment services: review of the literature. *The Journal of Mental Health Policy and Economics*, *3*(1), 11-26.

Cartwright, W. S. (2008). Economic costs of drug abuse: Financial, cost of illness, and services. *Journal of Substance Abuse Treatment*, *34*(2), 224-233.

Crum, N. F., Riffenburgh, R. H., Wegner, S., Agan, B. K., Tasker, S. A., Spooner, K. M., et al. (2006). Comparisons of causes of death and mortality rates among HIV-infected persons: analysis of the pre-, early, and late HAART (highly active

antiretroviral therapy) eras. *Journal of Acquired Immune Deficiency Syndromes, 41*(2)*,* 194-200.

Daughters, S. B, Magidson, J. F., Anand, D., Seitz-Brown, C. J., Chen, Y. & Baker, S. (2017) Effects of a Behavioral Activation Treatment on 1-Year Post Treatment Substance Use Outcomes among Low Income Minority Substance Users. Manuscript submitted for publication.

Drake, R. E., O'Neal, E. L., & Wallach, M. A. (2008). A systematic review of psychosocial research on psychosocial interventions for people with co-occurring severe mental and substance use disorders. *Journal of Substance Abuse Treatment*, *34*(1), 123-138.

Drummond, C., Coulton, S., James, D., Godfrey, C., Parrott, S., Baxter, J., & ... Peters, T. (2009). Effectiveness and cost-effectiveness of a stepped care intervention for alcohol use disorders in primary care: Pilot study. *The British Journal of Psychiatry*, *195*(5), 448-456.

Ducharme, L. J., Knudsen, H. K., & Roman, P. M. (2006). Trends in the adoption of medications for alcohol dependence. *Journal of Clinical Psychopharmacology, 26*, S13-S19.

Friedmann, P. D., Jiang, L., & Alexander, J. A. (2010). Top manager effects on buprenorphine adoption in outpatient substance abuse treatment programs. *Journal of Behavioral Health Services and Research*, *37*(3), 322-337.

Forbes, M. K., Kotov, R., Ruggero, C. J., Watson, D., Zimmerman, M., & Krueger, R. F. (2017). Delineating the joint hierarchical structure of clinical and personality disorders in an outpatient psychiatric sample. *Comprehensive Psychiatry*.

Fowler, J. C., Groat, M., & Ulanday, M. (2013). Attachment style and treatment completion among psychiatric inpatients with substance use disorders. *The American Journal on Addictions, 22*(1), 14–17.

French, M. T., Popovici, I., & Tapsell, L. (2008). The economic costs of substance abuse treatment: Updated estimates and cost bands for program assessment and reimbursement. *Journal of Substance Abuse Treatment*, *35*(4), 462-469.

Gossop, M., Stewart, D., Browne, N., & Marsden, J. (2002). Factors associated with abstinence, lapse or relapse to heroin use after residential treatment: protective effect of coping responses. *Addiction*, *97*(10), 1259-1267.

Kay-Lambkin, F. J. (2008). Technology and innovation in the psychosocial treatment of methamphetamine use, risk and dependence. *Drug and Alcohol Review*, *27*(3), 318-325.

Kampman, K. M. (2005). New medications for the treatment of cocaine dependence. *Psychiatry (Edgmont)*, *2*(12), 44.

Knudsen, H. K., Abraham, A. J., & Roman, P. M. (2011). Adoption and implementation of medications in addiction treatment programs. *Journal of Addiction Medicine*, *5*(1), 21.

Knudsen, H. K., Ducharme, L. J., & Roman, P. M. (2007). The adoption of medications in substance abuse treatment: Associations with organizational characteristics and technology clusters. *Drug and Alcohol Dependence*, *87*(2), 164-174.

Knudsen, H. K., Ducharme, L. J., Roman, P. M., & Link, T. (2005). Buprenorphine diffusion: The attitudes of substance abuse treatment counselors. *Journal of Substance Abuse Treatment*, *29*(2), 95-106.

Kranzler, H. R., & Kirk, J. (2001). Efficacy of naltrexone and acamprosate for alcoholism treatment: A meta-analysis. *Alcoholism: Clinical and Experimental Research, 25*(9), 1335-1341.

Lechner, W. V., Dahne, J., Chen, K. W., Pickover, A., Richards, J. M., Daughters, S. B., & Lejuez, C. W. (2013). The prevalence of substance use disorders and psychiatric disorders as a function of psychotic symptoms. *Drug and Alcohol Dependence*, *131*(1), 78-84.

Lejuez, C.W., Zvolensky, M. J., Daughters, S. B., Bornovalova, M. A., Paulson, A., Tull, M. T., et al. (2008). Anxiety sensitivity: A unique predictor of dropout among inner-city heroin and crack/cocaine users in residential substance use treatment. *Behaviour Research and Therapy, 46*(7), 811–818

Li, X., Sun, H., Purl, A., Marsh, D. C., & Anis, A. H. (2007). Factors associated with pretreatment and treatment dropouts among clients admitted to medical withdrawal management. *Journal of Addictive Diseases, 26*(3), 77–85.

López-Goñi, J. J., Fernández-Montalvo, J., Illescas, C., Landa, N., & Lorea, I. (2008). Razones para el abandono del tratamiento en una comunidad terapéutica. *Trastornos Adictivos, 10*(2), 104-111.

Mannheimer, S. B., Matts, J., Telzak, E., Chesney, M., Child, C., Wu, A. W., ... & Terry Beirn Community Programs for Clinical Research on AIDS. (2005). Quality of life in HIV-infected individuals receiving antiretroviral therapy is related to adherence. *AIDS Care*, *17*(1), 10-22.

Marrero, C. A., Robles, R. R., Colón, H. M., Reyes, J. C., Matos, T. D., Sahai, H., ... & Shepard, E. W. (2005). Factors associated with drug treatment dropout among injection drug users in Puerto Rico. *Addictive Behaviors*, *30*(2), 397-402.

Martini, M., Recchia, E., Nasta, P., Castanotto, D., Chiaffarino, F., Parazzini, F., & Agnoletto, V. (2004). Illicit drug use: Can it predict adherence to antiretroviral therapy? *European Journal of Epidemiology, 19*(6), 585-587.

McGowan, C. C., Weinstein, D. D., Samenow, C. P., Stinnette, S. E., Barkanic, G., Rebeiro, P. F., ... & Hulgan, T. (2011). Drug use and receipt of highly active antiretroviral therapy among HIV-infected persons in two US clinic cohorts. *PloS One*, *6*(4), 1-8.

McKellar, J., Kelly, J., Harris, A., & Moos, R. (2006). Pretreatment and during treatment risk factors for dropout among patients with substance use disorders. *Addictive Behaviors, 31*(3), 450–460.

Messina, N., Wish, E., & Nemes, S. (2000). Predictors of treatment outcomes in men and women admitted to a therapeutic community. *American Journal of Drug & Alcohol Abuse, 26*(2), 207-227.

Meier, P. S., Donmall, M. C., McElduff, P., Barrowclough, C., & Heller, R. F. (2006). The role of the early therapeutic alliance in predicting drug treatment dropout. *Drug and Alcohol Dependence*, *83*(1), 57-64.

Miller, W. R., & Wilbourne, P. L. (2002). Mesa Grande: A methodological analysis of clinical trials of treatments for alcohol use disorders. *Addiction, 97*, 265–277.

Mugavero, M. J., Raper, J. L., Reif, S., Whetten, K., Leserman, J., Thielman, N. M., & Pence, B. W. (2009). Overload: impact of incident stressful events on

antiretroviral medication adherence and virologic failure in a longitudinal, multisite human immunodeficiency virus cohort study. *Psychosomatic Medicine, 71*(9), 920–926.

Moos, R. H., Moos, B. S., & Andrassy, J. M. (1999). Outcomes of four treatment approaches in community residential programs for patients with substance use disorders. *Psychiatric Services*, *50*(12), 1577-1583.

National Drug Intelligence Center (NDIC). (2011). *National Drug Threat Assessment*. Washington, DC: United States Department of Justice.

Pekarik, G. (1985). Coping with dropouts. *Professional Psychology: Research and Practice*, *16*(1), 114.

Perkins, D. O., Davidson, E. J., Leserman, J., Liao, D., & Evans, D. L. (1993). Personality disorder in patients infected with HIV: a controlled study with implications for clinical care. *The American journal of psychiatry*, *150*(2), 309.

Poulopoulos, C., & Tsiboukli, A. (1999). Socio-demographic differences, patterns of use and drop-out from Greek drug-free treatment programmes. *Drugs: Education, Prevention and Policy, 6*(1), 99-110.

Pulford, J., Adams, P., & Sheridan, J. (2010). Responding to treatment dropout: A review of controlled trials and suggested future directions. *Addiction Research & Theory*, *18*(3), 298-315.

Pulford, J., & Wheeler, A. (2007). Documenting client attendance norms: raw data and implications for treatment practice. *Journal of Substance Use*, *12*(2), 95-102.

Raylu, N., & Kaur, I. (2012). Relationships between treatment expectations and treatment outcomes among outpatients with substance use problems. *International Journal of Mental Health and Addiction*, *10*(5), 607-621.

Roffman, R. A., Klepsch, R., Wertz, J. S., Simpson, E. E., & Stephens, R. S. (1993). Predictors of attrition from an outpatient marijuana-dependence counseling program. *Addictive Behaviors*, *18*(5), 553-566.

Sacks, J. J., Gonzales, K. R., Bouchery, E. E., Tomedi, L. E., & Brewer, R. D. (2015). 2010 national and state costs of excessive alcohol consumption. *American Journal of Preventive Medicine*, *49*(5), 73-79.

Salamina, G., Diecidue, R., Vigna-Taglianti, F., Jarre, P., Schifano, P., Bargagli, A. M. The VEde TTE Study Group (2010). Effectiveness of therapies for heroin addiction in retaining patients in treatment: Results from the VEdeTTE study. *Substance Use & Misuse, 45*(12), 2076–2092

Saxon, A. J., & McCarty, D. (2005). Challenges in the adoption of new pharmacotherapeutics for addiction to alcohol and other drugs. *Pharmacology & Therapeutics, 108*(1), 119-128.

Simpson, D. D., Joe, G. W., & Brown, B. S. (1997). Treatment retention and follow-up outcomes in the drug abuse treatment outcome study (DATOS). *Psychology of Addictive Behaviors, 11*(4), 294-307.

Singer, M., & Clair, S. (2003). Syndemics and public health: reconceptualizing disease in bio-social context. *Medical Anthropology Quarterly*, *17*(4), 423-441.

Siqueland, L., Crits-Christoph, P., & Gallop, R. (2002). Retention in psychosocial treatment of cocaine dependence: Predictors and impact on outcome. *American Journal on Addictions, 11*(1), 24-40.

Sosin, M. R., & Durkin, E. (2007). Perceptions about services and dropout from a substance abuse case management program. *Journal of Community Psychology*, *35*(5), 583-602.

Stall, R., Mills, T. C., Williamson, J., Hart, T., Greenwood, G., Paul, J., … Catania, J. A. (2003). Association of Co-Occurring Psychosocial Health Problems and Increased Vulnerability to HIV/AIDS Among Urban Men Who Have Sex With Men. *American Journal of Public Health*, *93*(6), 939–942.

Stark, M. J. (1992). Dropping out of substance abuse treatment: A clinically oriented review. *Clinical Psychology Review*, *12*(1), 93-116.

Stead, L. F., Perera, R., Bullen, C., Mant, D., HartmannBoyce, J., Cahill, K., & Lancaster, T. (2012). Nicotine replacement therapy for smoking cessation. *The Cochrane Library*.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2008). *National Survey of Substance Abuse Treatment Services (N-SSATS): 2007. Data on Substance Abuse Treatment Facilities,* DASIS Series: S-44, DHHS Publication No. SMA 08-4348, Rockville, MD, 2008.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2009). *Treatment Episode Data Set (TEDS): 2006 Discharges from Substance Abuse Treatment Services*, DASIS Series: S-46, DHHS Publication No. SMA 09-4378, Rockville, MD, 2009.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2014). *National Survey of Substance Abuse Treatment Services (N-SSATS): 2013, Data on Substance Abuse Treatment Facilities,* BHSIS Series S-73, HHS Publication No. SMA 14-4890. Rockville, MD, 2014.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2015). *Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health* (HHS Publication No. SMA 15-4927, NSDUH Series H-50). Retrieved from http://www.samhsa.gov/ data/

Substance Abuse and Mental Health Services Administration (SAMHSA). (2015). *Treatment Episode Data Set (TEDS): 2003-2013. National Admissions to Substance Abuse Treatment Services,* BHSIS Series S-75, HHS Publication No. SMA 15-4934, Rockville, MD, 2015.

Teichner, G., Horner, M. D., Roitzsch, J. C., Herron, J., & Thevos, A. (2002). Substance abuse treatment outcomes for cognitively impaired and intact outpatients. *Addictive Behaviors*, *27*(5), 751-763.

Turner, B., & Deane, F. P. (2016). Length of stay as a predictor of reliable change in psychological recovery and well being following residential substance abuse treatment. *Therapeutic Communities: The International Journal of Therapeutic Communities*, *37*(3).

Vendetti, J., McRee, B., Miller, M., Christiansen, K., Herrell, J. The Marjuana Treatment Project Research Group (2002). Correlates of pre-treatment drop-out among persons with marijuana dependence. *Addiction, 97*, 125–134.

Wallace, A. E., & Weeks, W. B. (2004). Substance abuse intensive outpatient treatment: Does program graduation matter? *Journal of Substance Abuse Treatment*, *27*(1), 27-30.

Wallack, S. S., Thomas, C. P., Martin, T. C., Chilingerian, J., & Reif, S. (2010). Substance abuse treatment organizations as mediators of social policy: Slowing the adoption of a congressionally approved medication. *Journal of Behavioral Health Services and Research*, *37*(1), 64-78.

Wilson, M., & Sperlinger, D. (2004). Dropping out or dropping in? A re-examination of the concept of dropouts using qualitative methodology. *Psychoanalytic Psychotherapy*, *18*(2), 220-237.

Wolfe, D., Carrieri, M. P., & Shepard, D. (2010). Treatment and care for injecting drug users with HIV infection: A review of barriers and ways forward. *The Lancet*, *376*(9738), 355-366.

Wood, E., Hogg, R. S., Yip, B., Harrigan, P. R., O'shaughnessy, M. V., & Montaner, J. S. (2003). Is there a baseline CD4 cell count that precludes a survival response to modern antiretroviral therapy? *AIDS*, *17*(5), 711-720.

Zarkin, G. A., Cowell, A. J., Hicks, K. A., Mills, M. J., Belenko, S., Dunlap, L. J., & Keyes, V. (2015). Lifetime benefits and costs of diverting substance-abusing offenders from state prison. *Crime & Delinquency*, *61*(6), 829-850.