Abstract

The Relationship Between Internalized HIV/AIDS Stigma and Smoking Behaviors In People Living With HIV/AIDS

Introduction

People living with HIV/AIDS (PLWHA) smoke cigarettes at a high prevalence. PLWHA experience internalized HIV/AIDS stigma (IHAS) at high rates and smoking and IHAS are associated with negative health outcomes. This study was the first to examine the relationship between IHAS and smoking behaviors (i.e., smoking status, nicotine dependence, motivation to quit smoking) in a sample of PLWHA in the United States (US).

Methods

A convenience sample of 287 PLWHA at the Montefiore Center for Positive Living (145 current smokers, 43.9% female, 55% Latina/o) completed a survey on psychological and personality factors and smoking behaviors. IHAS was assessed using the Internalized AIDS-Related Stigma Scale (IARSS). Smoking status was assessed via self-report and confirmed via expired carbon monoxide levels. Nicotine dependence was assessed using the Fagerström Test for Nicotine Dependence, and motivation to quit smoking was assessed using the Contemplation Ladder. The relationship between IHAS and each smoking behavior was examined using direct logistic regressions. Additional analyses adjusted for age, current marijuana use, and self-reported diagnosis of AIDS. Exploratory analyses explored depression as a possible moderator and mediator in the relationship between IHAS and smoking behaviors.

Results

No significant associations between IHAS, smoking status, nicotine dependence, and motivation to quit were found. For the individual IARSS item "I sometimes feel worthless because I am HIV positive," current smokers were more likely to answer yes to the item compared to non-current smokers [$\chi 2$ (1, n = 287) = 6.73, p < 0.01]. For item "I hide my HIV status from others," non-current smokers were more likely to answer yes to the item compared to current smokers [$\chi 2$ (1, n = 287) = 4.28, p = 0.04]. For item "I feel guilty that I am HIV positive," smokers with high nicotine dependence were more likely to answer yes to the item compared to smokers with low ND [χ^2 (1, n = 145) = 4.45, p = 0.04].

Conclusions

While overall IHAS was not associated with smoking variables, some specific aspects of IHAS were. Given the high rate of smoking and IHAS experienced by PLWHA, research on other barriers to optimal smoking outcomes in PLWHA is needed.

The Relationship Between Internalized HIV/AIDS Stigma and Smoking Behaviors In People Living With HIV/AIDS

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Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in the Ferkauf Graduate School of Psychology

Yeshiva University

August 2019

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Acknowledgments

I am deeply thankful to all my committee members, fellow students, and family for supporting me through the process of completing my dissertation. I am extremely grateful to Dr. Andrea H. Weinberger for kindly welcoming me into her lab, and providing me with her invaluable guidance, mentorship, and kindness throughout the last five years of my doctoral training. I am especially thankful to my dear friend and fellow lab-mate, Channah Esan for not only co-leading data collection, data cleaning, and proof reading, but supporting me throughout graduate school. Thank you to my fellow lab-mates Ester Yadgaran, and Jennifer Birchwale, who assisted with the data collection and data cleaning processes. Thank you to Dr. Jonathan Shuter for being a valuable committee member, and for making my acclimation to Montefiore Medical Center a smooth and gratifying experience. Thank you to Dr. Elizabeth Seng for her excellent statistical support and being a member of my committee. Additionally, I would like to thank Dr. Fred Foley and Dr. Alyson Moadel-Robblee for kindly agreeing to be readers for this dissertation. Thank you to my mother and father, Ellie and Gerry, whose comfort and support through graduate school have been essential to my success.

Dedication

To my husband Christophe, for his amazing support, encouragement, and patience throughout this process, and to my son Henry, whose sweetness is significantly associated with my joy!

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Chapter I: Background

Overview of HIV/AIDS

Human immunodeficiency virus (HIV) is a virus that attacks CD4 cells (T cells). These cells aid the body's immune system to fight infections. However, if HIV is left untreated, it can lower the number of CD4 cells in the body, which increases the risk of life-threatening opportunistic infections (Secretary's Minority AIDS Initiative Fund [SMAIF]. 2015a). HIV is transmitted via the blood, semen, pre-seminal fluid, rectal fluids, vaginal fluids, and breast milk of a person living with HIV/AIDS (PLWHA). Contact with infected secretion or blood with a mucous membrane, damaged tissue, or bloodstream of a HIV positive individual can transmit HIV. In the US, HIV is most commonly spread via unprotected anal or vaginal sex, and the sharing of needles or syringes or other materials used for injection drug use with someone who is HIV positive (SMAIF, 2015b).

There are three stages of HIV infection with the earliest stage being acute HIV infection (U.S. Department of Health and Human Services [USDHHS], 2017). Acute HIV infection develops in the first few weeks after a person is infected with HIV. In this stage; flu-like symptoms are experienced, HIV multiplies at rapid rates, and attacks CD4 cells. Additionally, the risk of HIV transmission is high during this stage. The middle stage is chronic HIV infection: HIV multiplies at lower levels, and the person living with HIV may not experience symptoms but can still transmit HIV. Without treatment, HIV will advance to acquired immunodeficiency syndrome (AIDS), the final stage, in approximately ten years.

AIDS is diagnosed when PLWHA has a CD4 count of less than 200 cells/mm or if they have acquired certain opportunistic infections (i.e., infections that occur more often or are more serious in people with weakened immune systems). If left untreated, a person living with AIDS will survive for about three years (USDHHS, 2017).

Currently, there are approximately 1.1 million PLWHA in the US, with one in seven unaware they are living with the HIV (Centers for Disease Control and Prevention [CDC], 2017a). The current treatment for HIV is antiretroviral medication (ART) which works by lowering viral load and increasing the number of CD4 cells in the body (CDC, 2016a). In 2017, President Obama allocated 27.5 billion dollars in the domestic budget for HIV care. The lifetime cost for individuals who become infected with HIV at age 35 is approximately $326,500 (Henry J Kaiser Family Foundation, 2016; Schackman et al., 2015). When taken properly, ART enables HIV to be a chronic disease, rather than a terminal one (Deeks, Lewin, & Havlir, 2013). However, with AIDS-related illness no longer the primary cause of mortality among PLWHA, other variables, such as cigarette smoking, have emerged, and are linked to serious health consequences and high mortality in PLWHA (Crothers et al., 2009; Helleberg et al., 2013; Deeks, et al., 2013).

Smoking and PLWHA

Prevalence of smoking among PLWHA. Approximately 36.5 million adults in the US currently smoke cigarettes and over 16 million Americans are living with a disease caused by smoking (CDC, 2016b; USDHHS, 2014). More than 480,000 deaths per year in the US are caused by cigarette smoking (USDHHS, 2014). Additionally, more than 300 billion dollars are spent every year in the US on: adult medical care related to diseases caused by smoking, lost productivity due to early death from smoking, and second-hand smoke (Xu,

Bishop, Kennedy, Simpson, & Pechacek, 2014; USDHHS, 2014). While the prevalence of adult smoking in the US has declined from 20.9% in 2005 to 14% in 2016 (CDC, 2016b; CDC, 2017d), the prevalence of cigarette smoking in PLWHA continues to be high (Mdodo et al., 2015; Park, Hernandez-Ramirez, Silverberg, Crothers, & Dubrow, 2016; Reynolds, 2009). Over 40% of PLWHA smoke cigarettes, which is more than double the prevalence of smoking in the US general population (Mdodo et al., 2015; Park et al., 2016; Reynolds, 2009).

Prevalence of nicotine dependence among PLWHA. According to the DSM-IV-TR (American Psychiatric Association [APA], 2000), nicotine dependence was categorized in an individual exhibiting the following symptoms in a 12-month period of daily nicotine use: a) compulsive nicotine use; b) tolerance to nicotine; c) withdrawal symptoms occurring within a 24-hour period when decreasing or stopping nicotine use in the form of irritability, frustration, anger, anxiety, difficulty concentrating, restlessness, decreased heart rate, increased appetite or weight gain, dysphoric or depressed mood, and insomnia; d) difficulty quitting or cutting back; e) reduction in filling or stopping role obligations due to nicotine use; and f) continuing use despite knowing nicotine's contribution to physical or psychological problems. The DSM-5 no longer includes a diagnosis of nicotine dependence (APA, 2013). However, a diagnosis of Tobacco Use Disorder is included in the DSM-5 and involves three criteria with 15 symptoms, which include symptoms of nicotine dependence, such as: craving, tolerance, and withdrawal (APA, 2013). Approximately 13% of adults in the US meet criteria for current nicotine dependence (Grant, Hasin, Chou, Stinson, & Dawson, 2004) and 17.5% meet criteria for lifetime nicotine dependence (Goodwin, Pagura, Spiwak, Lemeshow, & Sareen, 2011).

Studies on the prevalence of nicotine dependence among PLWHA or the relationship between nicotine dependence and HIV/AIDS in the US have been limited. Many of these studies have small sample sizes and/or samples consisting of subgroups of PLWHA, such as PLWHA in New York, PLWHA of low socioeconomic status, or injection drug users (Tesoriero, Gieryic, Carrascal, & Lavigne, 2010; Shuter, Bernstein, & Moadel, 2012; Gritz, Vidrine, Lazev, Amick, & Arduino, 2004; Marshall et al., 2011). One of the larger studies of the relationship between nicotine dependence and PLWHA examined a sample of 1,094 PLWHA in New York State (62% male, 47% above the age of 45, 54% African American, 29% Hispanic, 64% residing in New York City). Among current smokers (n = 631), 54.8% reported moderate or high nicotine dependence levels, with differences by gender and race. Sixty percent of male smokers reported moderate to high nicotine dependence compared to 47.8% of female smokers (adjusted odds ratio (aOR) = 1.5, 95% confidence interval (CI)= 1.0-2.2) while African American smokers were significantly less likely to report moderate to high nicotine dependence compared to white smokers ([50.6% versus 68.9%, respectively]; [multivariate OR = 0.56, 95% CI=0.33-0.99]; Tesoriero et al., 2010).

A study that recruited participants from the same HIV clinic as the proposed study, the Center for Positive Living (CPL) at Montefiore Medical Center in the Bronx, New York, examined psychosocial characteristics of 60 PLWHA who smoked cigarettes (53.3% male, mean age 46.8, 50% Latino) and found that 65% percent of participants reported medium to high levels of nicotine dependence (Shuter et al. 2012). A similar prevalence of high nicotine dependence (62%) was found in a sample of 385 multiethnic low-income PLWHA in Houston, Texas (78% male, mean age 40.2 years, 25% White, 44% Black, and 29% Hispanic; 46% reported they acquired HIV via being men who have sex with men, 35% via

heterosexual contact, and 11% via injection drug use; Gritz, et al., 2004). Finally, a study of HIV infected and uninfected injection drug users who smoke cigarettes (n = 1052; median age 49, 64% male, 91.35% Black, 74% less than $5,000 annual income) found no significant differences between nicotine dependence levels among injection drug use groups with 17.6% of HIV positive participants reporting high levels of nicotine dependence compared to 19.9% having high nicotine dependence among non-HIV positive participants (Marshall et al., 2011). In summary, while most studies on the prevalence of nicotine dependence among PLWHA in the US have been limited to samples of subgroups of PLWHA, these studies generally show a considerably higher prevalence of nicotine dependence among PLWHA compared to the prevalence of nicotine dependence in the general population.

Consequences of smoking among PLWHA. HIV positive smokers have worse medical outcomes compared to HIV negative smokers and HIV positive non-smokers (Baugher et al., 2017; Helleberg et al., 2013; CDC, 2017b; SMAIF, 2017). HIV positive smokers are more likely to be diagnosed with chronic obstructive pulmonary disease, cardiovascular disease, stroke and lung, head, neck, anal, and cervical cancers, compared to HIV negative smokers (SMAIF, 2017). Additionally, HIV positive smokers are more likely to develop HIV-related medical illnesses such as hairy leukoplakia, bacterial pneumonia, pneumocystis pneumonia, and AIDS dementia compared to HIV positive non-smokers (Boulter et al., 1996; Burns et al., 1996; Chattopadhyay et al., 2005a; Chattopadhyay et al., 2005b; Conley et al., 1996; Crothers et al., 2005; Greenspan, Barr, Sciubba, & Winkler, 1992; Hirschtick et al., 1995; Kohli et al., 2006; Le Moing et al., 2006; Miguez-Burbano et al., 2005; Miguez-Burbano et al., 2003; Palacio, Hilton, Canchola, & Greenspan, 1997; Reardon, Kim, Wagner, Koziel, & Kornfeld, 1996). Furthermore, smoking in PLWHA is

associated with poor adherence to ART, which in turn puts a person at risk for infection, as well as for ART resistance, and transmission of treatment resistant strains of HIV (Chesney, 2006; Feldman et al., 2006; Mehta, Moore, & Graham, 1997; Shuter & Bernstein, 2008; Webb, Vanable, Carey, & Blair, 2009). Cigarette smoking has also been associated with obstructing the efficacy of HAART via several mechanisms. One mechanism has been linked to the chemicals in cigarettes activating cytochrome P450 enzymes, which lead to further activation of genes that support HIV replication (Ande, McArthur, Kumar, & Kumar, 2013; Feldman et al., 2009; Rossouw, Anderson, Feldman, 2015). Moreover, cohort studies have found smoking in PLWHA to be associated with greater mortality rates compared to both HIV positive non-smokers and HIV negative smokers (Crothers et al., 2009; Helleberg et al., 2013).

In addition to poorer medical outcomes, cigarette smoking in PLWHA has been associated with a number of negative behavioral and psychological consequences. Compared to former and never smokers, current smoking among PLWHA has a negative impact on quality of life and health-related quality of life (Crothers et al., 2005; Turner et al., 2001; Vidrine, 2009; Vidrine, Arduino, & Gritz, 2007). Current smoking in PLWHA is independently associated with lower general health perception, energy, role functioning, and cognitive functioning when compared to non-smokering PLWHA (Turner et al., 2001). Current smoking in PLWHA is also linked to comorbid substance and alcohol use disorders, lower education, and lower income (Cropsey et al., 2016; Pacek, Harrell, & Martins, 2014; Webb, Vanable, Carey, & Blair, 2007; Akhtar-Khaleel et al., 2016; Mdodo et al., 2015; Webb et al., 2007). Furthermore, substance use is a risk factor for acquiring HIV and is

associated with worse health outcomes in PLWHA (Barrett, Darredeau, & Pihl, 2006; Reynolds, 2009).

With regard to smoking in PLWHA and emotions and mood, one study examined factors associated with loneness in HIV positive smokers and found higher loneliness to be independently associated higher daily cigarette consumption (Stanton, Moadel, Kim, Weinberger, & Shuter, 2015). Depression in PLWHA is associated with higher nicotine dependence and lower readiness to quit (Benard et al., 2007; Burkhalter, Springer, Chhabra, Ostroff, & Rapkin, 2005). In a study of 509 HIV positive smokers, 70% of participants who reported depressive symptoms met criteria for medium or high nicotine dependence compared to 48% of participants who did not report depressive symptoms (Benard et al., 2007). Additionally, a study exploring factors associated with smoking and readiness to quit in PLWHA (n = 428) found that greater current illicit drug use, greater emotional distress, and a lower number of quit attempts were significantly associated with less readiness to quit smoking (Burkhalter et al., 2005). Given the negative health outcomes associated with smoking among PLWHA, it is essential that research be conducted to learn more about unique and remediable barriers to quitting smoking in PWLHA. These barriers could be the targets of future smoking cessation interventions. One potential barrier is internalized HIV stigma.

Origins of HIV Stigma: Social Stigma Theory

Much of the literature on HIV stigma is based on Goffman's (1963) social stigma theory. Goffman (1963) worked with samples of people who were viewed by society as "socially deviant," such as people living with mental illness, physical deformities, people who engaged in criminal activity, or people who identified as homosexual. He defined stigma

as when an individual living with a discredited characteristic is seen and treated as flawed in character and social identity (Goffman 1963; Parker & Aggleton, 2003). According to social stigma theory, at the society level, a quality is stigmatized if it is considered different or, as Goffman (1963) refers to, "deviant" from what is thought of as "normal." In addition to society viewing an individual as deviant and stigmatized, the person who becomes stigmatized also begins to see themselves as such (Goffman 1963; Parker & Aggleton, 2003). The stigma of illness can be considered "socially deviant" because it is a phenomenon that impedes life at the biological, interpersonal and intrapersonal levels, and is seen as straying from what individuals have come to expect or told to expect about their functioning from medical professionals (Alonzo & Reynolds, 1995). According to Conrad (1986), illnesses can either produce what some cultures may consider a "deviant behavior" or be the product of a "deviant behavior." Furthermore, some communities and cultures view certain illnesses as "evil" or "sinful" (Sontag, 1978; Alonzo & Reynolds, 1995). According to Goffman (1963), the "sinfulness" of an illness itself may then become associated with the person afflicted with the illness, leading to rejection because the illness is perceived of as a "sin."

HIV Stigma

PLWHA are stigmatized for several reasons, including having a disease that they are thought to have acquired on their own volition, being considered contagious and thus threatening to society, and due to a lack of understanding about HIV/AIDS from their community and health care providers (Alonzo & Reynolds, 1995). Additionally, HIV/AIDS stigma is complex in that the various stigmas experienced by PLWHA may stem not only from the disease itself but from factors associated with HIV risk, such as sexual promiscuity,

male homosexuality, engaging in unprotected sex, and injection drug use (Novick, 1997; Kalichman et al., 2009).

In 2002, the Joint United Nations Programme on HIV/AIDS (UNAIDS) reported that HIV stigma was one of the "greatest barriers" in the prevention new HIV infections and relieving the overall adverse effect of HIV/AIDS (Aggleton & Parker, 2002; Reidpath & Chan 2006). As recently as 2016, UNAIDS and the World Health Organization's Global Health Workforce Alliance launched the Agenda for Zero Discrimination in Health Care, with the goal of confronting HIV stigma and discrimination in health care settings (UNAIDS, 2017). Results of a meta-analysis of 55 qualitative studies that examined the intersection of stigma and health among PLWHA found that HIV stigma occurs in multiple social domains, including health care settings (Chambers et al., 2015). In healthcare settings, HIV stigma has been shown to manifest by workers denying PLWHA treatment, HIV testing without patient consent, worker violations of patient confidentiality, and negative attitudes by healthcare workers towards PLWHA (Elford, Ibrahim, Bukutu, & Anderson, 2008; Schuster et al., 2005; Sears, 2008).

HIV stigma has been associated with myriad adverse physical and mental health outcomes among PLWHA in the US (Logie & Gadalla, 2009). These outcomes include psychological and emotional distress, lowered self esteem, lower physical, psychological and social functioning, poor adherence to ART, stress related to disclosure of serostatus, depression, anxiety, hopelessness, negative affect, lower quality of life, lower access to care, lower utilization of health care services, and lower social support (e.g., Siegel, Lekas, & Schrimshaw, 2005; Kang, Rapkin, Remien, Mellins, & Oh, 2005; Heckman et al., 2004; Black & Miles, 2002; Murphy, Austin, & Greenwell, 2007; Lee, Kochman, & Sikkema,

2002; Kang, Rapkin, & DeAlmeida, 2006; Vanable, Carey, Blair, & Littlewood, 2006; Vance, 2006; Holzemer et al., 2009; Fife & Wright, 2000; Kinsler, Wong, Sayles, Davis, & Cunningham, 2007; Rueda et al., 2016).

Research on HIV stigma has categorized HIV stigma into four subtypes including internalized HIV/AIDS stigma (IHAS), enacted stigma, perceived stigma, and anticipated stigma. These categories of stigma are defined as follows: 1) IHAS is believing external negative beliefs regarding one's HIV as true about oneself; 2) enacted HIV stigma is experiencing overt prejudice by others surrounding one's HIV; 3) perceived HIV stigma is awareness of the existence of HIV stigma; and 4) anticipated HIV stigma, anticipating future prejudice surrounding one's HIV (Earnshaw & Chaudoir, 2009; Scambler, 1989; Herek, Gillis, & Cogan, 2015).

Approximately 80% of people receiving HIV care in the US report some level of IHAS (Baugher et al., 2017). Unlike the other types of stigma, internalized stigma could lead to one to become more aware and reactive to enacted, perceived, and anticipated stigma (Lee et al., 2002). IHAS has been associated with a number of negative mental health outcomes among PLWHA including depression, anxiety, low self-esteem, low quality of life, and greater PTSD symptomatology (Turan et al., 2017; Earnshaw, Smith, Chaudoir, Amico, & Copenhaver, 2013; Fuster-Ruizdeapodaca, Molero, Holgado, & Mayordomo, 2014; Gonzalez et al., 2016). IHAS has also been associated with substance dependence, poorer ART adherence, engaging in sexual risk behavior, and lower health care utilization (Levi-Minzi & Surratt, 2014; Helms et al., 2017; Earnshaw et al., 2013; Earnshaw & Chaudoir, 2009; Calabrese et al., 2016). There is a lack of research on the relationship between smoking and HIV stigma in general or by stigma subtype such as IHAS.

Internalized HIV/AIDS Stigma

IHAS and cigarette smoking in PLWHA. To date, there has been only one study, besides the current study, that examined the relationship between smoking status and IHAS. This study was conducted by Zhang et al. (2016) in a sample of 2,987 PLWHA from China characterized by 70.8% Han ethnicity, 66.5% married, 92.2% without a religious belief, 86.5% with no more than a nine-year education, and 80.2% living in rural regions (age and gender were not reported). While the relationship between smoking status and IHAS was not significant (adjusted *OR* (*aOR*) = 1.00, 95% CI = 0.97-1.02), the odds of smoking were higher among participants who reported higher levels of enacted stigma (*aOR* = 1.35, 95% CI = 1.04-1.76). It is worth noting that the only smoking-related variable analyzed in the study was whether participants had ever smoked in their lifetime or in the past 6 months. Additionally, the study was conducted in a sample of PLWHA from Guangxi, a culture that may view smoking and HIV differently than in the US. The population prevalence of HIV in China is approximately 0.058% (National Health and Family Planning Commission of the People's Republic of China, 2015) compared to 0.348% in the US (Huang et al., 2016). Additionally, in 2010, 28.1% of Chinese adults were current smokers, almost double the rate of current smoking in the general US adult population (Li, Hsia, & Yang, 2011). To this author's knowledge, no study has examined the relationship between IHAS and smoking behaviors among PLWHA in the US.

IHAS and correlates of smoking in PLWHA. While there has been minimal exploration into the relationship between IHAS and smoking in PLWHA, variables related to smoking among PLWHA, such as substance abuse and depression, have been correlated with IHAS (see Figure 1; Benard et al., 2007; Burkhalter et al., 2005; Lee et al., 2002; Levi-Minzi

& Surratt, 2014). One study examined IHAS and substance use among 503 PLWHA in South Florida with histories of cocaine, crack, or heroin use. Severe substance dependence, based on DSM-IV criteria (APA, 2000), was associated with higher levels of IHAS related to self-acceptance compared to non-dependent participants ($\beta = 1.02$, $p<0.001$; Levi-Minzi & Surratt, 2014). Because IHAS is correlated with substance use in PLWHA in the US, the proposed study will examine the possible relationship between IHAS and nicotine use.

PLWHA experience high rates of both IHAS and depression, with the rate of current depression among PLWHA being two to three times higher than in the general population (Bing et al., 2001; Ferrando & Freyberg, 2008; Rabkin et al., 1997). A study of an ethnically diverse sample of 268 PLWHA from Wisconsin and New York City (64.9% male, mean age = 40.1 years, 54.1% African American, 12.7% Latina/o, education level mean (M) = 12.8 years of school) found, using hierarchical regression analysis, that IHAS score significantly contributed to depression symptom scores on the Hamilton Depression Scale (HAM-D; $\beta = 0.17$, $p = 0.003$) after controlling for demographics, health status, level of grief, styles of coping with illness, and perceived social support (Lee et al., 2002). These results led the authors to conclude that PLWHA with IHAS are at higher risk of psychological distress. Although IHAS has been significantly associated with depression in PLWHA (Lee et al., 2002) and in turn, both depression and emotional distress have been significantly associated with smoking behaviors, including higher levels of nicotine dependence (Benard et al., 2007), and lower readiness to quit smoking (Burkhalter et al., 2005) in PLWHA, the role of IHAS and smoking remains unstudied. Therefore, this study examined the relationship between IHAS, depression, and smoking behaviors.

IHAS and correlates of nicotine dependence in PLWHA. To date, no studies, aside from the current study, have examined the relationship between nicotine dependence and IHAS in PLWHA. However, similar to smoking, studies have looked at correlates of IHAS, such as self-efficacy and depression, and nicotine dependence in PLWHA (Shuter, Moadel, Kim, Weinberger, & Stanton, 2014; Lloyd-Richardson et al., 2008; Bernard et al., 2007). A study by Shuter et al. (2014) combined data from two randomized controlled trials of tobacco treatment of 272 PLWHA at the CPL clinic at Montefiore Medical Center in the Bronx, New York (M age = 46.8 years, 52.9% male, 66.9% African American). Higher nicotine dependence levels were significantly correlated with lower self-efficacy (Spearman's rank-order correlation coefficient = 0.412; $p < 0.001$) and higher nicotine dependence was also retained in a final multiple regression model with the outcome of self-efficacy ($\beta = 0.346$, $p < 0.001$) with other covariates of HIV acquisition such as injection drug use, abstinence from alcohol for the past 30 days, loneliness, depression, and anxiety (Shuter et al., 2014).

Another study examined characteristics of 444 PLWHA who smoke cigarettes recruited from New England (63.3% male, M age = 42.1, 52% European American, 36% 11th grade or less education, 78.8% unemployed; Lloyd-Richardson et al., 2008). Lower self-efficacy was significantly associated with higher levels of nicotine dependence, using partial correlation (P = 0.50, 95% CI = 0.40- 0.60). A study examined motivation to quit smoking, depression, and nicotine dependence among 509 PLWHA recruited from hospitals in France (74% male, M age = 44 years, 19% infected through injection drug use, 50.5% reported daily cigarette smoking). In this sample, 60% of participants reported medium to high levels of nicotine dependence. The odds of reporting medium to high nicotine dependence levels was significantly higher among people with depressive symptoms compared to those without

depressive symptoms (*OR* = 2.46, 95% CL= 1.41–4.29, p = 0.002; Benard et al., 2007). While no studies have looked at the relationship between IHAS and nicotine dependence, studies have found significant relationships between correlates of IHAS and nicotine dependence. Given these findings, this study will examine the relationship between IHAS and nicotine dependence.

IHAS and its potential role in motivation to quit smoking in PLWHA. Having the motivation to quit is essential to begin to move through the quitting process of any substance or addictive behavior, including cigarette smoking (Buczkowski, Marcinowicz, Czachowski, & Piszczek, 2014). One of the most influential theories regarding motivation to quit is the transtheoretical model of behavior change (TTM; Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992). A central construct of the TTM is the Stages of Change, which are five stages that individuals move through, not necessarily in order, when changing a behavior, such as quitting smoking. The stages include Precontemplation, Contemplation, Preparation, Action, and Maintenance (Velicer, Prochaska, Fava, Norman, & Redding, 1998). In the context of smoking, individuals in the Precontemplation Stage are not planning or thinking about quitting, they may be unaware of consequences of continuing to smoke, and may feel discouraged in their ability to quit smoking due to numerous unsuccessful previous quit attempts. Individuals in the Contemplation Stage are aware of the pros of quitting and cons of continuing to smoke and are planning to quit in the next six months. It has been theorized that the tension between the pros and cons of quitting smoking can cause feelings of ambivalence, which can lead individuals to remain in this stage for long periods of time (Velicer et al., 1998). Individuals in the Preparation Stage are planning to quit in the immediate future and have a plan of action. For example, someone in this stage may be

planning to begin a smoking cessation medication in the next month (Velicer et al., 1998). Individuals in the Action Stage are modifying their life to make behavioral changes (i.e. quitting smoking) and the goal of individuals in the Maintenance Stage is relapse prevention (Velicer et al., 1998).

Between 38% and 58% of PLWHA treated in outpatient clinics report not being ready to think about quitting smoking (Gritz et al., 2004; Niaura, Morrow, Flanigan, & Abrams, 1999). Lower readiness to quit smoking is associated with: current illicit drug use, greater emotional distress, lower number of quit attempts since HIV diagnosis, and lower income (Burkhalter et al., 2005; Nguyen et al., 2015). To date there have been no studies examining the relationship between IHAS and motivation to quit smoking.

Higher levels of IHAS have been associated with lower access to HIV treatment and care. A study looking at the association between IHAS and access to HIV treatment in a sample of 202 PLWHA recruited from community organizations in Los Angeles (45.9% male, 54% between the ages of 36–49, 56% African American, 10% Latina/o, 46% graduated high school) found using multivariate analysis that participants who reported higher levels of IHAS were more likely to report poor access to care (*OR* = 4.42, 95% CI =1.88-10.37); Sayles, Wong, Kinsler, Martins, & Cunningham, 2009). It has been theorized that the relationship between IHAS and poor access to care could be associated with several constructs: 1) perceived discrimination from providers; 2) feeling they do not deserve care; or 3) avoidance of thinking about their HIV disease status (Earnshaw et al., 2013; Sayles et al., 2009). It is possible that PLWHA who smoke are less motivated to seek help for quitting smoking for similar reasons. Perhaps addressing IHAS in interventions to improve motivation to quit smoking or as part of smoking cessation interventions, may improve self

worth, which, in turn, could aid in self-confidence in ability to quit smoking. Additionally, addressing IHAS in these types of interventions may aid in making the interaction with the provider feel safe and non-judgmental.

Coping with HIV Stigma: A Theoretical Model

According to the Transactional Model of Stress and Coping, initially developed by Lazarus and Folkman (1984), after an individual is exposed to a stressor (i.e., an event that is interpreted as challenging to an individual's resources and welfare; Carey, Snel, Carey, & Richards, 1989), two stages of appraisal occur. First an individual evaluates the severity and impact the stressor has on their life, termed *primary appraisal*. The next level of appraisal involves the individual's evaluation of how well they think they can manage the stressor, termed *secondary appraisal*. Once the two appraisals are made, a coping response can occur and the adaptiveness of the coping response depends on several factors such as level of social support and personality factors of problem management and emotional regulation (Carey et al., 1989). Social support and these personality factors can influence an individual's coping style in either adaptive or maladaptive ways depending on how present each is within the individual's life and personality. Depending on the individual's appraisal and coping response, according to the model, coping outcomes fall into three categories: emotional well-being, functional status (including health status and disease progression), and health behaviors (Lazarus & Folkman, 1984; Carey et al., 1989).

Applying the Transactional Model of Stress and Coping (Lazarus & Folkman,1984) to the potential relationship between IHAS and cigarette smoking in PLWHA, it is theorized that as a response to the stressor of internalized HIV stigma, a PLWHA who smokes' primary appraisal interprets IHAS to be a severe and unmanageable stressor. This

interpretation may be more likely as IHAS has been linked to depression and other negative mental health outcomes (e.g., Turan et al., 2017; Earnshaw et al., 2013), which could hinder the potential for perceived self-efficacy and optimistic appraisals of a stressor. Following this appraisal, the level of social support may be poor, as there has been a documented relationship with PLWHA experiencing perceived HIV stigma in health care settings and in their communities (e.g., Chambers et al., 2015; Elford et al., 2008; Schuster et al., 2005; Sears, 2008; Mahajan et al., 2008). Additionally, the negative mental health outcomes associated with IHAS could lead to poor problem management abilities within the individual. PLWHA who experience HIV stigma may develop coping mechanisms to deal with HIV stigma-related stress that are maladaptive and may negatively affect health outcomes (Turan et al., 2017).

One method of coping with HIV-stigma by PLWHA is *avoidant coping* which is characterized by avoiding behaviors or things that remind them of their HIV status (Turan et al., 2017) which can include: avoiding HIV-related health care services, avoiding disclosure of one's HIV status, altering HIV medical labels or storing medications in alternate containers, and substance use (Chambers et al., 2015, Turan et al., 2017). Substance use can temporarily alleviate negative affect associated with HIV stigma (Turan et al., 2017; Gonzalez et al., 2013). A study that examined substance use as a way to cope with HIV-stigma and its role in HIV medication adherence among PLWHA enrolled in opioid dependence treatment (n = 121, 41% female, M age = 47) found that substance use coping mediated the relationship between cocaine, poly-substance use, and decreased HIV medication adherence (Gonzalez et al., 2013). The authors concluded that PLWHA engage in substance use as a method of coping because they believe it will manage negative mood

associated with HIV stigma (Gonzalez et al., 2013). The Committee for Accessible AIDS Treatment (2008) examined barriers to health care services and treatments among immigrants, refugees and non-status PLWHA in Canada (*n* = 47, 68.1% male, 55.3% aged 30-39, 23.4% Black, 25% Spanish-speaking, 48.9% heterosexual) found that participants cited alcohol and drug use as a primary method of coping with HIV stigma (Chen, Li, Fung, & Wong, 2015).

Despite the fact that substance use has been identified as a coping mechanism for HIV stigma and there are high rates of cigarette smoking among PLWHA compared to other types of smoked drugs (e.g., marijuana; Mdodo et al., 2015; Park et al., 2016; Reynolds, 2009; Okafor et al., 2017), to the author's knowledge, there are no studies that have examined cigarette smoking behaviors as potential coping outcome for HIV-stigma in general or for specific subtypes of stigma. Since IHAS may lead to increased awareness and reactivity to other HIV stigmas (i.e., perceived stigma, enacted stigma, anticipated stigma) and given what is known about the use of substances to cope with stressors, it is possible that PLWHA use smoking to try to manage the negative affect associated with IHAS. Coping outcomes specifically related to smoking to cope with IHAS could include continuing to smoke, low motivation to quit smoking, and higher levels of nicotine dependence.

Summary

Smoking is a major health issue for PLWHA and is associated with a number of negative psychological and medical outcomes (e.g., Mdodo et al., 2015; CDC, 2017b; Crothers et al., 2005; Vidrine et al., 2007). Learning more about important factors that contribute to smoking among PLWHA is essential to reducing the prevalence of smoking in this population. While there are high rates of stigma, specifically IHAS, among PLWHA

(Baugher et al., 2017), little research exists on stigma and its relationship to smoking behaviors such as smoking status, nicotine dependence, and motivation to quit smoking among PLWHA. The purpose of this study was to explore the potential relationship between IHAS and these smoking behaviors in a sample of PLWHA with the goal of better understanding the role that stigma plays in the maintenance of smoking in this population (see Figures 1-7). Should there have been a significant relationship between IHAS and smoking, it could have been useful to develop and test an intervention that combines smoking cessation counseling with efforts to reduce IHAS (e.g., use of support groups and community membership to reduce social isolation associated with stigma) to improve smoking cessation outcomes among PLWHA .

Specific Aims

Primary aim 1. This study examined the relationship between IHAS and smoking status among PLWHA (see Figure 2). ***Hypothesis 1.*** It was expected that participants who endorsed higher levels of IHAS would be more likely to identify as current smokers than former or never smokers, compared to participants who endorsed lower levels of IHAS.

Primary aim 2. This study examined the relationship between IHAS and nicotine dependence among PLWHA who smoke (see Figure 3). ***Hypothesis 2.*** It was expected that participants who endorsed higher levels of IHAS would be more likely to endorse high or moderate levels of nicotine dependence compared to participants who endorsed lower levels of IHAS.

Primary aim 3. This study examined the relationship between IHAS and motivation to quit smoking among PLWHA who smoke (see Figure 4). ***Hypothesis 3***. It was expected that current smokers who endorsed higher levels of IHAS would be less likely to report higher

motivation to quit smoking, compared to current smokers who endorsed lower levels of IHAS.

Exploratory Aim 1. This study examined whether depression moderated the relationship between IHAS and level of nicotine dependence in PLWHA (see Figure 5).

Exploratory Aim 2. This study examined whether depression moderated the relationship between IHAS and level of motivation to quit in PLWHA (see Figure 6).

Exploratory Aim 3. This study examined whether depression mediated the effect of the IHAS on smoking status (see Figure 7).

Significance

Cigarette smoking among PLWHA contributes to a number of serious negative medical outcomes, psychological outcomes, and PLWHA who smoke cigarettes have greater mortality rates compared to both HIV positive non-smokers and HIV negative smokers (e.g., Mdodo et al., 2015; CDC, 2017b; Crothers et al., 2005; Vidrine et al., 2007; Crothers et al., 2009). Furthermore, the prevalence of smoking in PLWHA is more than double the prevalence of smoking in the US general population (e.g., Mdodo et al., 2015). The more that is known about factors that are associated with smoking behaviors among PLWHA, the better understanding there can be about why PLWHA smoke and what unique factors make it difficult for PLWHA to quit smoking. With this knowledge, interventions could be developed that can target these factors with the goal of helping PLWHA quit smoking. Should there have been a relationship between IHAS and smoking behaviors, IHAS may be a potentially modifiable risk factor for smoking to be targeted in smoking cessation interventions for PLWHA.

Innovation

This study provided novel data in several meaningful areas that currently lack research. 1) Despite high rates of both smoking and IHAS in PLWHA, no studies were identified that examined the relationship between IHAS and in-depth smoking behaviors such as cigarettes per day, level of nicotine dependence, and motivation to quit. The only study to date that examined the relationship between smoking status and IHAS was conducted by Zhang et al. (2016) in a sample of PLWHA from China (n = 2,987) and found no significant relationship between smoking status and IHAS. However, the smoking related variables were only related to smoking status (lifetime smoking and past 6 months smoking). 2) No studies have examined the relationship between IHAS and smoking in a US population. The Zhang et al. (2016) study was conducted in a sample of PLWHA from China and it is not clear that results would generalize to a US sample; 3) No studies had explored HIV stigma and smoking in samples of African American and Latina/o adults, which make up a sizable percentage of PLWHA in the US (Stone, 2012); 4) No studies had explored the relationship between IHAS, smoking variables, and depression in PLWHA; 5) To this author's knowledge, this study was the first to examine the reliability of the PROMIS Depression Short Form, and the Fagerström Test for Nicotine Dependence (FTND). Cronbach's alphas were calculated for internal consistency for these instruments to assess if these measures could be reliably used for future studies in PLWHA.

Chapter II: Research Design and Methods

Overview of Research Design

This study used a cross-sectional design to examine the association of IHAS to smoking behaviors in PLWHA. This study was a secondary analysis from its parent study titled "Self-Control and Adults with HIV/AIDS," which was approved by the Albert Einstein College of Medicine (AECOM) Institutional Review Board (IRB # 2016-7308: PI: Dr. Weinberger). The aim of the parent pilot study was to examine the relationship between self-control and cigarette smoking measures in a sample of PLWHA.

Recruitment and Data Collection

Recruitment and data collection took place at The Montefiore CPL, a comprehensive clinic caring for PLWHA and other infectious diseases. The clinic services over 2,800 PLWHA in the Bronx, New York. A majority of the patients at the CPL are unemployed or have disability benefits, two-thirds have a diagnosis of AIDS, 56% are male, 54% are Latina/o, 39% are African-American, and 4% are White/non-Latina/o (Shuter et al., 2012). Research assistants (RAs) were trained by study coordinators, who were originally trained by study principal investigator, Dr. Weinberger. RAs were trained in obtaining informed consent, understanding and administering study instrument items, paying participants, answering common questions from participants, navigating recruitment at the CPL, data entry and storage, and administering protocols for adverse events such as suicidality and homicidality. Trained RAs approached potential participants in the CPL waiting room and explained general information about the study. If the participant was interested in

participating, the RA invited the potential participant into a private clinic room to explain the purpose of the study, study procedures, reimbursement, confidentiality, and stated that participation was voluntary. RAs provided the potential participant the name and contact information of the principal investigator and the AECOM IRB, and asked questions to confirm that the potential participant understood the information provided. Oral consent was then obtained and participants received a copy of the information provided in the consent document. The study was approved with oral consent procedures, and no names were collected.

Procedure

The study consisted of an expired breath carbon monoxide (CO) level collected by the RA in a private clinic room to provide data on current smoking status, followed by a 35-minute questionnaire. Questionnaires were completed by participants in the CPL waiting room unless the participant was unable to read. In which case, the RA in a private clinic room administered the questionnaire. After completing the questionnaire, participants received a $20 gift card for their participation and information about mental health resources. Additionally, smokers received information about the New York State Smoking Quit Line. RAs recorded the number of participants recruited, including the number of smokers and non-smokers, on a weekly basis throughout the data collection process.

This study posed little risk to participants as it entailed filling out a questionnaire and staff did not collect name-based information. However, participants may have felt uncomfortable answering questions about HIV/AIDS, IHAS, smoking behaviors, cigarette and other substance use, and depression. All participants were given a list of mental health resources upon completion of the questionnaire. Additionally, while the names of

participants were not collected, other identifying information such as age, gender, ethnicity, HIV status, and marital status were collected. To reduce the risk of a breach of confidentiality, all information was stored in locked file cabinets and/or password protected digital files, only accessible to the study staff. All data will be shredded following the conclusion of the study and after being retained for the period of time required by federal and state laws. If at any time during the study a participant indicated suicidiality or homicidality to an RA without prompting, as this study did not directly assess risk, RAs contacted Dr. Shuter at the CPL, conducted a formal risk assessment, and took any additional needed actions to protect the safety of the participant and others.

Participants

Inclusion and exclusion criteria. Participants included people who met the following criteria: 1) Over 18 years of age; 2) confirmed HIV/AIDS status by self-report; 3) confirmation of receiving care at CPL via self-report; and 4) English speaking. Participants were excluded if they met the following criteria: 1) Inability to provide informed consent; 2) Suicidality or homicidality. If there was indication of either suicidality or homicidality. RAs followed procedures established by the CPL, as described above.

Additional inclusion criteria for smokers. Participants were considered current smokers if they self-reported current cigarette smoking since midnight of the current day. Additionally, participants had to have self-reported smoking at least part of one cigarette in the past 24 hours to be considered a current cigarette smoker. Current smoking was biochemically verified via expired breath carbon monoxide (CO) levels of 8 ppm or greater based on prior research on optimal cutoffs (Crowley, Andrews, Cheney, Zerbe, & Petty, 1989; Jarvis, Tunstall-Pedoe, Feyerabend, Vesey, & Saloojee, 1987). Differences between a

participants' self-reported smoking status and their CO level (e.g., a participant who self-reported current smoking and their CO level was < 8ppm), could be due to the fact that not every participant was a daily smoker. Discrepancies were discussed with the PI. In general, self-report of current smoking was given more weight over CO levels that were < 8 ppm.

Measures

Demographics. Demographic data included age, gender, race, ethnicity, sexual orientation, marital status, years of education, height, weight, and current and lifetime substance use history (i.e., alcohol, marijuana, cocaine, crack, other amphetamines, heroin, other opioids, hallucinogens, and benzodiazepines).

HIV Status. Participants were asked to self-report the year that they were diagnosed with HIV and whether they had received a diagnosis of AIDS.

IHAS. The Internalized AIDS-Related Stigma Scale (IARSS) is a six-item measure of self-reported IHAS (Kalichman et al., 2009). Items are based on Goffman's (1963) social stigma theory. The items focus on guilt, shame, and self-worth related to HIV status and withholding HIV status from others (e.g., "It is difficult to tell people about my HIV status", "Being HIV positive makes me feel dirty", "I feel guilty that I am HIV positive"). Item responses are in a binary yes/no format (yes=1, no=0). Each item is worth one point and one's total score can range from 0-6 with higher scores representing greater internalized stigma. The IARSS has demonstrated satisfactory internal consistency (Cronbach's alpha = 0.73-0.76) and test re-test reliability ($r = 0.45$ (Capetown, Africa) and $r = 0.62$ (US), $p < 0.01$) in samples of PLWHA in Africa and the US (Kalichman et al., 2009; Tsai et al., 2013). The Cronbach's alpha for this study's total sample was 0.80, indicating good internal consistency in this sample of PLWHA.

Depression. The Patient-Reported Outcomes Measurement System (PROMIS) depression short form 8a is an eight-item measure of self-reported depressive symptoms in the past seven days (PROMIS, 2015). Items from this scale are derived from larger item banks developed by the National Institutes of Health (NIH) to help measure scientific study of patient-reported outcomes (PROs) for common medical conditions in a standardized manner for researchers (Cella et al., 2007). Individual items are scored on a five-point Likert scale that ranges from 1 = Never to 5 = Always. Items include: "I felt that nothing could cheer me up" and "I felt helpless." Scoring is based on raw scores that are translated into T-scores, with higher T-scores representing increased levels of depression. T-scores can range from 38.2 - 81.3. This measure has shown excellent internal consistency in large samples of people representative of the US population (Cronbach's alpha = 0.92; Cella et al., 2010) and persons with depression outside of the US (Cronbach's alpha = 0.95; Vilagut et al., 2015). To this author's knowledge, reliability had not been assessed in a sample of PLWHA. The Cronbach's alpha for this study's total sample was 0.95, indicating excellent internal consistency reliability for this sample of PLWHA.

Smoking status. Participants reported whether they are current, former, or never smokers using the following response options: (1) I currently smoke cigarettes, (2) I used to smoke cigarettes but do not smoke now, and (3) I never smoked cigarettes. Current smoking was confirmed by expired CO levels using the Micro Smokerlyzer® by Bedfont Scientific as described in the inclusion criteria above.

Cigarettes per day. To determine the average number of cigarettes smoked per day, participants were asked to complete the question: "On days that I smoke, I smoke _____ cigarettes."

Smoking frequency. To determine smoking frequency, participants were asked "How many days each week do you smoke right now? I smoke _____ days each week ____ I smoke less than once a week ____ I do not currently smoke cigarettes."

Nicotine dependence. The Fagerström Test for Nicotine Dependence (FTND) is a 6-item measure with scores that can range from 0 - 10, with higher numbers reflecting greater nicotine dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991). Previous studies have typically treated the outcome of FTND scores as continuous (Fu et al., 2012; Li et al., 2015). The FTND has demonstrated acceptable internal consistency in samples of adult smokers (Cronbach's alpha = 0.64 - 0.68; Etter, 2005; Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). However, to this author's knowledge, there were no studies that had looked at the reliability or validity of the FTND in samples of PLWHA. The Cronbach's alpha in the current sample was equal to 0.69, indicating a questionable level of reliability. This alpha level is consistent with past research on the FTND with other samples of adults (e.g., Etter, 2005; Pomerleau et al., 1994.

Motivation to quit smoking. The Contemplation Ladder (Biener & Abrams, 1991) is a single item measure that uses a 10-point Likert scale based on the stages of change framework by Prochaska et al. (1992). Higher scores represent greater motivation to quit smoking (1 = no thoughts about quitting; 10 = action stage of quitting; (Biener & Abrams, 1991). Previous research has treated the outcome of Contemplation Ladder scores as a continuous variable (Weinberger, Mazure, & McKee, 2010). The Contemplation Ladder has been validated in samples of adults, college students, and workers from manufacturing companies (McDermut & Haaga, 1998; Biener & Abrams, 1991) and has demonstrated good concurrent and predictive validity when compared to number of previous quit attempts (r =

0.39, $p < 0.001$) and the probability of making a quit attempt in the next six months ($r = 0.64$, $p < 0.001$; Biener & Abrams, 1991). The Contemplation Ladder has also demonstrated convergent validity when given to smokers who identified as being in the precontemplation or contemplation stages (McDermut & Haaga, 1998).

This study examined convergent validity between the Contemplation Ladder and the Thoughts About Abstinence Scale (TAAS) motivation to quit item, which is assessed on a 10-point Likert scale (1 - 10, higher scores reflect higher motivation to quit smoking; Hall, Havassy, & Wasserman,1991). Convergent validity between the Contemplation Ladder and the motivation to quit TAAS item was calculated for the sample of current smokers by using Kendall's Tau bivariate correlations between the total scores of each scale. Kendall's Tau was used instead of Spearman's rho for the non-normally distributed variables as Kendall & Gibbons (1990) report that the (CIs) for Kendall's Tau are more reliable and easier to interpret than Spearman's rho. Divergent validity for the Contemplation Ladder was calculated for the sample of current smokers by correlating the total scores of the Contemplation Ladder with participant height using Kendall's Tau.

Data Analysis

Power and sample size. To estimate the required sample size for this study, power calculations were conducted using the statistical software G*Power 3.1. As mentioned above, there is only one study by Zhang et al. (2016) that examined the relationship between IHAS and smoking status in a sample of PLWHA. Zhang (personal communication, July 13th, 2017) provided data to calculate their effect size between IHAS and smoking and it was of negligible size (Cohen's $D = 0.076$). A power analysis with a negligible effect size at 80% power would require a sample of over 4000, which was not feasible. Additionally, their

sample was of PLWHA in China, which differs greatly from PLWHA in NYC. They also used a crude dichotomous measure of smoking. Effect sizes in studies of perceived discrimination and smoking behaviors were then examined with samples that share characteristics of PLWHA, such as sexual and racial minorities. These studies found small rather than negligible effect sizes (sexual minorities: *OR* = 1.29, 95% CI = 1.08-1.54; Johns et al., 2013; racial minorities: *aOR* = 1.46, 95% CI = 1.17-1.82; Purnell et al., 2012). Small effect sizes were chosen for Aims 1 through 3 of this study that reflect the small effect sizes found in these studies.

Primary Aim 1 hypothesized that participants who endorsed higher levels of IHAS would be more likely to identify as current smokers compared to past or never smokers. Since IHAS is correlated with depression and previous research has generally shown a positive relationship between smoking and depression in PLWHA, a one tailed test was used. With a small OR of 1.46, an alpha level of < 0.05, and power of 80%, it was estimated that a sample size of 276 participants was needed to detect a desired effect using a one-tailed logistic regression. To be conservative, 298 participants were recruited for Aim 1.

An additional power analysis was done for Aims 2 and 3 as these aims solely focused on smokers. With a small effect size of $f^2 = 0.07$, an alpha level of < 0.05, and power of 80%, it was estimated that a sample size of 141 smokers was needed to detect the desired effects for each aim, using linear multiple regression analyses. The estimated prevalence of smoking in PLWHA in the US is approximately 54% - 55% % (Park et al., 2016; Weinberger, Smith, Funk, Rabin, & Shuter 2017) and approximately 50% of participants who had already completed the parent study at the time the power analysis was completed were current smokers. It was assumed that the rate of 50% would continue, and thus approximately 150 of

participants who would be recruited for aim 1 would be current smokers. As Aims 2 and 3 required 141 smokers, smokers were not expected to be over sampled. However, had the rate of recruitment of smokers changed (i.e., if < 50% were smokers), the IRB had approved focused recruitment of people who smoke.

Preliminary analyses. To examine whether measures of nicotine dependence (using FTND scores; scores range from 0 - 10), IHAS (IARSS scores; scores range from 0 - 6), and motivation to quit (contemplation ladder; scores range from 0 - 10) could be analyzed as continuous variables, the following analyses were conducted: First, descriptive statistics (e.g., means, medians, ranges, frequencies, skewness and kurtosis) were examined for each primary variable and histograms and scatter plots were graphed to visualize the data and to look for distinct cut offs that enabled the variable to be analyzed continuously and signify a normal distribution. Due to results of the Shapiro-Wilk test, indicating all variables to be non-uniformly dispersed; non-continuous methods were used (Supplemental Tables 1 and 2; Supplemental Figures 1 and 2).

For the variable of IHAS, median splits were used as a cut off. The median IHAS score in our sample was two (M = 2.3, Mode = 0). Therefore, low IHAS was equal to scores of 0-2 and high IHAS equaled scores of 3-6. The developers of the IARRS had not established a known cut-off score for the instrument (Kalichman et al., 2009). However, a study by Chan et al. (2017) dichotomized IARSS at the median (0–2, 3–6) and explored its relationship to depression in a sample of PLWHA in India. They found that 23% of their sample with an IARSS score that fell between 3–6 screened positive for depression, compared to 2% with an IARSS score of 0 - 2 ($X^2 = 62.2$, $P < 0.001$).

As the variable of nicotine dependence was also determined to not be normally distributed, FTND total scores were transformed into a dichotomous variable by first classifying scores into the following categories of nicotine dependence as proposed by Fagerström et al. (1992): scores of 0-2 equaled very low, 3-4 equaled low, 5 equaled medium, 6-7 equaled high, and 8-10 equaled very high nicotine dependence. A median split (median score = 4, M = 3.9, Mode = 0) was then used to dichotomize the FTND total score variable into the following: scores of ≤ 4 equaled low nicotine dependence and scores of ≥ 5 equaled high nicotine dependence. Additionally, because non-continuous methods were used for the variables of motivation to quit, contemplation ladder scores were dichotomized based on previous literature, which classified individuals with scores of 0 through 7 to be in the contemplation stage of quitting and scores of 8 through 10 to be in the preparation/action stage of quitting (Joseph, Lexau, Willenbring, Nugent, & Nelson, 2004).

As both outcome variables of the aim 2 and 3 main analyses of nicotine dependence and/or motivation to quit were dichotomized into binary variables, direct (without covariates) and sequential logistic regressions (controlling for relevant demographic variables identified in the preliminary analyses) were used to examine the relationship between the IHAS score in relation to the outcomes of both nicotine dependence (low versus high nicotine dependence) and motivation to quit (contemplation stage versus preparation/action stage).

Model covariates. For each primary aim separate regression model covariates were determined by examining and then selecting demographics and substance use variables that were significantly correlated with the independent variable of IHAS score by calculating zero order correlations between the binary independent variable IHAS and potential model covariates using Mann-Whitney U tests for continuous demographic variables and chi-square

(X^2) tests for binary and categorical demographics and substance use variables. Zero order correlations that reached p values < 0.1 were retained. If two continuous non-normally distributed variables were significantly correlated with the dichotomized variable of IHAS, multicollinearity tests were run in SPSS using Mann-Whitney U tests. Two-tailed p-values of < 0.05 indicated multicollinearity among selected continuous predictors. If two binary variables were significantly correlated with IHAS, multicollinearity tests were run in SPSS using X^2 tests. P-values of < 0.05 indicted multicollinearity. If multicollinearity was found between two variables of interest, one variable was removed based on both theory and degree of association to IHAS (e.g., the variable with a higher p-value regarding its association with IHAS was dropped) to prevent analysis of redundant information.

Missing data. Any missing values were coded as 99 as this value did not correspond to a naturally occurring data value and was an appropriate value for SPSS to interpret as missing. A missing value analysis was then conducted in SPSS to evaluate the pattern and extent of missing data using a display table sorted using the variables by missing value pattern option in SPSS. For categorical variables, a limit on the number of categories was entered using the Maximum Categories option. The estimate means, standard deviations, and correlations for various missing value methods such as listwise, pairwise, regression, and expectation-maximization (EM) were calculated. If the data appeared to be missing completely at random then listwise, pairwise, or regression estimation were used. If the data was not missing completely at random, EM estimation was used to handle missing data (IBM Corporation, 2013).

Primary aim 1: Examination of the relationship between IHAS and smoking status among PLWHA. A direct logistic regression was used to examine the relationship

between IHAS score in relation to the outcome of smoking status (current smoker versus non-current smoker). A logistic regression entered in a planned manner in sequential blocks was then conducted to examine the relationship between the IHAS score in relation to the outcome of smoking status, controlling for relevant demographic variables identified in the preliminary analysis. For both direct and sequential logistic regressions, ORs and 95% CI were calculated to evaluate the odds of being a current smoker, with non-current smokers as the reference group. Additionally, each item of the IARSS (score of 0 or 1) and its relationship to smoking status were further explored using chi square tests.

Primary aim 2: To examine the relationship between IHAS and nicotine dependence. A direct logistic regression was used to examine the relationship between IHAS score in relation to the outcome of nicotine dependence (low nicotine dependence versus high nicotine dependence). A logistic regression entered in a planned manner in sequential blocks was then conducted to examine the relationship between the IHAS score in relation to the outcome of nicotine dependence, controlling for relevant demographic variables identified in the preliminary analysis. For both the direct and sequential logistic regressions, ORs and 95% CI were calculated to evaluate the odds of having a level of high nicotine dependence, with low nicotine dependence as the reference group. Additionally, each item of the IARSS (score of 0 or 1) and its relationship to nicotine dependence was further explored using chi square tests.

Primary aim 3: To examine the relationship between IHAS and motivation to quit smoking. A direct logistic regression was used to examine the relationship between IHAS score in relation to the outcome of motivation to quit smoking (contemplation stage versus preparation/action stage of quitting). A logistic regression entered in a planned

manner in sequential blocks was then conducted to examine the relationship between the IHAS score in relation to the outcome of motivation to quit smoking, controlling for relevant demographic variables identified in the preliminary analysis. For the direct and sequential logistic regressions, ORs and 95% CI were calculated to evaluate the odds of being a in the preparation/action stage of quitting, with being in the contemplation stage of quitting as the reference group. Additionally, each item of the IARSS (score of 0 or 1) and its relationship to motivation to quit smoking was further explored using chi square tests.

Exploratory aim 1 and aim 2: To examine whether depression moderated the relationship between (1) IHAS and nicotine dependence and (2) IHAS and motivation to quit smoking. Two separate logistic regressions entered in planned manners in sequential blocks were conducted to test whether depression moderated the relationship between: (1) IHAS and nicotine dependence, and (2) IHAS and motivation to quit smoking. For each regression, first, the variables of IHAS and depression were centered (Aiken & West, 1991) and an interaction term for IHAS and depression was created. Block one of the sequential logistic regression included two variables: depression and IHAS; block two included the addition of the interaction term. Omnibus Tests of Model Coefficients and the Hosmer-Lemeshow Goodness of Fit Tests were conducted as well as Cox & Snell R Square values, to show the variability explained by each model. Classification rates were also analyzed. Wald Criterion, ORs. and 95% CI were calculated for Block one and Block two models. Should moderation have occurred, as determined by the 95% CI not containing zero, the SPSS macro PROCESS (Hayes, 2013) would be used to visualize the interaction. PROCESS options of mean center for products, heteroscedasticity consistent SEs, OLS/ML CIs, and generate data

for plotting would be selected (Elite Research LLC, 2013) One thousand bootstrap samples would be used for bias correction and to establish 95% CI.

Exploratory aim 3: To examine whether depression mediated the relationship between IHAS and smoking status. A logistic regression analysis was used to explore the hypothesis that depression (variable m) mediated the effect of the independent dichotomized variable IHAS (variable x) on the binary dependent variable of smoking status (smoker versus non-smoker; variable y). Model 4 of PROCESS by Hayes (2013) was used and the first step of the mediation model calculated path C, the relationship between IHAS (variable x) and smoking status (variable y), controlling for the covariates of current marijuana use and AIDS diagnosis. The second step calculated path A, the relationship between IHAS and the mediator of depression (variable m), while controlling for the covariates. The third step of the mediation calculated path B, the relationship between depression (variable m) and smoking status (variable y), while controlling for IHAS and the covariates. The fourth step of the mediation analysis calculated path c', the relationship between IHAS (variable x) and the outcome of smoking status (variable y), while controlling for depression, to calculate the direct effect. Bootstrapping techniques were used to examine the significance of the indirect effect. The unstandardized indirect effects were calculated for each 10,000 bootstrapped sample, and the 95% CI was calculated by determining the indirect effects at the 2.5th and 97.5th percentiles. Mediation was considered to have occurred if the 95% CI did not contain zero (Hayes, 2013)

Chapter III: Results

Preliminary Analyses

Participant recruitment and study sample. From 3/22/2017 through 4/19/2018, a total of 445 patients in the CPL waiting room were approached by RAs and asked if they wanted to participate in the study. One hundred forty-seven of the 445 CPL patients approached did not complete the study questionnaire. Reasons for study non-completion at this stage of recruitment included a) a lack of interest in study participation (n =128); b) being non-English speaking (n = 41); and c) declining to participate after being read the consent form (n = 7). Please note, at this stage of study recruitment, some CPL patients did not complete the study for more than one reason (e.g., some CPL patients were both not interested in study participation and non-English speaking). Additionally, after completing the oral consent procedures, three CPL patients started to fill out the study packet but did not complete the packet for reasons that included: lacking the time to complete the packet, walking away with the packet and not returning it, and being HIV negative. In total, 298 CPL patients completed the questionnaire. Of the 298 participants who completed the questionnaire, eleven were excluded from the analyses due to errors in reporting (i.e., disclosing they were HIV negative after completing the questionnaire, not reporting cigarette smoking status, leaving significant and essential information blank, or being non-English speaking). In total, 287 participants completed the questionnaire and were included in the final analysis.

Descriptive statistics. Means, medians, ranges, frequencies, skewness and kurtosis,

and Shapiro-Wilk tests were generated for every potential covariate and primary variable. Scatter plots and histograms were generated from every primary variable to evaluate whether variables were normally distributed (see Supplemental Table 1, Supplemental Table 2, Supplemental Figures 1-6, and Table 1). For continuous variables, among the entire sample (n = 287), and for current smokers (n = 145), all variables were distributed significantly different than a normal curve based on results of the Shapiro-Wilk tests. Due to these results, the variables of IHAS, Nicotine Dependence, Motivation to Quit, and PROMIS Depression total score were transformed into binary variables and non-parametric tests were then conducted for all variables as discussed previously in the data analysis section.

Missing data. In the total sample (N = 287), 1% of participants were missing values for IHAS (missing cases n = 3); and zero participants were missing values for PROMIS Depression. Although variables of IHAS and PROMIS Depression were transformed from being continuous to binary due to results from the Shapiro-Wilk test for normality, a Little's MCAR test was run on these variables in their continuous form and results showed that the data were missing at random (Little's MCAR test: X^2 = 0.52, DF = 1, p = 0.47). Pairwise deletion was used for all main and exploratory analyses of the total sample.

In the sample of current smokers (n = 145), 1.4% of participants were missing values for IHAS (missing cases n = 2); 2.1% of participants were missing values for Nicotine Dependence (missing cases n = 3); and 0.7% of participants were missing values for Motivation to Quit (missing case n = 1). One participant was missing values for two different variables (IHAS and PROMIS Depression) and another participant was missing a value for IHAS. Both of these participants were not included in any main analyses of current smokers. Four participants were missing values for only one main variable. Although variables of

IHAS, PROMIS Depression, Nicotine Dependence, and Motivation to Quit, were transformed from being continuous to binary due to results from the Shapiro-Wilk test for normality, a Little's MCAR test was run on these variables in their continuous form and results showed that the data were missing at random (Little's MCAR test: $X^2 = 10.53$, DF = 8, $p = 0.23$). Pairwise deletion was used for all analyses of current smokers.

Demographics, substance use, and HIV characteristics among the full sample. Table 1 displays the demographic and HIV characteristics of the full sample. Among the 287 participants, just under half were female, the mean age was approximately 50 years old, approximately half of the participants identified as Latina/o and the other half identified as Black. More than half of the sample reported being single, the highest level of education completed was 9^{th}-11^{th} grade for just over a quarter of the sample, and almost three quarters of the sample identified as heterosexual. With regards to HIV/AIDS related information, based on self-report, the average years since HIV diagnosis was approximately 20 years and just under 50% of the sample self-reported having a diagnosis of AIDS. More than half of the sample reported lifetime use of alcohol and marijuana.

Demographics, substance use and HIV characteristics by smoking status. Table 2 displays demographic, substance use, and HIV characteristics by cigarette smoking status (current cigarette smokers versus non-cigarette smokers). BMI was significantly higher among non-smokers than current smokers ($p < 0.01$). Additionally, the percentage of participants who self-reported having an AIDS diagnoses was significantly higher among current smokers compared to non-smokers ($p = 0.03$). The percentage of participants who self-reported current use of marijuana ($p < 0.01$), cocaine ($p < 0.01$), and heroin ($p = 0.03$) was significantly higher among current smokers than non-smokers. No other variables were

significantly associated with smoking status.

Cigarette smoking characteristics of current smokers. Table 3 displays information with regard to the smoking behavior among the 145 participants who reported current cigarette smoking. The mean number of days per week that participants reported smoking cigarettes was six (standard deviation (SD) = 1.2, range 1-7) and the mean number of cigarettes smoked per day was seven (SD = 7.1; range 0.5-60.0). Among current smokers, over 90% reported smoking at least 100 cigarettes in their lifetime. The average level of nicotine dependence was a mild level of dependence (M = 3.9, SD = 2.6, range 0-10). With regard to motivation to quit smoking, almost half of the current smokers reported being in the contemplation stage of quitting smoking and the other half reported being in the preparation stage of quitting smoking. With regard to the TAAS, participants reported a moderate desire to quit smoking (M=6.6, SD=2.8, range 1-10) and reported moderate confidence in their ability to quit smoking cigarettes (M = 6, SD = 2.6, range 1-10).

Main Analyses

Primary Aim 1. To examine the relationship between IHAS and smoking status among PLWHA.

***Individual level IHAS data and smoking status*.** Table 4 displays item level frequency data for the IARSS Scale by smoking status. X^2 tests were computed between individual IARSS items and Smoking Status (current smoker versus non-current smoker). The percentage of participants within each smoking status who endorsed the item did not differ significantly for items one through four. However, for item five, "I sometimes feel worthless because I am HIV positive," current smokers were significantly more likely to answer yes to the item compared to non-current smokers [χ^2 (1, n = 287) = 6.73, $p < 0.01$].

Additionally, for item six, "I hide my HIV status from others," non-current smokers were significantly more likely to answer yes to the item compared to current smokers [χ^2 (1, n = 287) = 4.28, p = 0.04].

Association of IHAS and smoking status (no covariates). A direct logistic regression analysis as performed to assess the association between IHAS (low versus high IHAS) and Smoking Status (current cigarette smoker versus non-current cigarette smoker). After listwise deletion of three cases with missing values on IHAS, 284 of 287 participants were included in the analysis (143 current cigarette smokers and 141 non-current cigarette smokers). Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model [X^2 (1, n = 284) = 2.16, p = 0.14]. Additionally, the Hosmer-Lemeshow Goodness of Fit Test showed no significant improvements over the baseline model, [X^2 (0, n = 284) = 5.38, $p < 0.01$)]. Cox & Snell R Square (0.008) and the Nagelkerke R Square (0.01) values suggested that between 0.8% and 1.0% of the variability was explained by the model. On the basis of IHAS alone, correction classification rates were 45.5% for current cigarette smokers and 63.1% for non-current cigarette smokers; the overall correct classification rate was 54.2%. Table 5 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for IHAS. According to the Wald Criterion, IHAS was not significantly associated with Smoking Status [X^2 (1, n = 284) = 2.15, p = 0.14].

Association of IHAS and smoking status (including covariates of AIDS diagnosis and current marijuana use). A logistic regression entered in a planned manner in sequential blocks was then run to assess the association between IHAS level (low versus high IHAS) and Smoking Status (current covariates that were significantly correlated with IHAS for the total sample determined in the preliminary analysis (see Tables 6 and 7). Multicollinearity

was assessed for the binary variables of AIDS Diagnosis (yes or no), Lifetime Marijuana Use, and Current Marijuana Use using X^2 tests. Lifetime Marijuana Use was significantly associated with Current Marijuana Use ($X^2 = 68.46$, $p < 0.01$). Lifetime Marijuana Use was removed from the sequential logistic regression model in the main analysis for several reasons: (1) it had a slightly higher p-value regarding its correlation with IHAS ($p = 0.044$) compared to Current Marijuana Use ($p = 0.038$), (2) it was theorized that Current Marijuana Use would have a greater relationship with current IHAS and current Smoking Status than Lifetime Marijuana Use, and (3) Lifetime Marijuana Use included participants who were both current marijuana users and past marijuana users. Consequently, Lifetime Marijuana Use would be expected to be a more heterogeneous group and therefore more difficult to interpret the implications of a significant relationship. Thus, AIDS Diagnosis and Current Marijuana Use were retained as covariates in the main model. However, a second sequential logistic regression analysis was conducted as a follow-up analysis to see whether the results would stay the same when replacing Current Marijuana Use with Lifetime Marijuana Use in the model. Results differed between each regression. Results from each sequential regression are presented below, with the main analysis presented first.

Block one in the logistic regression included relevant covariates of AIDS Diagnosis and Current Marijuana Use (see Table 6 and Table 7 for relevant covariates). Block two included the addition of the independent variable of interest, IHAS. After listwise deletion of participants missing values for IHAS (missing $n = 3$), AIDS Diagnosis (missing $n = 14$), Current Marijuana Use (missing $n = 5$), the total sample included in the analysis consisted of 271 participants. In Block one, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model [X^2 (2, $n = 271$) =11.32, $p < 0.01$]. The Hosmer-

Lemeshow Goodness of Fit Test showed support for the model [X^2 (2, n = 271) = 3.57, p = 0.17]. Cox & Snell R Square (0.041) and the Nagelkerke R Square (0.055) values suggested that between 4.1% and 5.5% of the variability was explained by the Block one model. After the addition of IHAS in Block two, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model [X^2 (3, n = 271) = 15.02, p < 0.01]. However, there was no significant improvement over Block one [X^2 (1, n = 271) = 3.7, p = 0.054]. The Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (5, n = 271) = 5.09, p = 0.41). Cox & Snell R Square (0.054) and the Nagelkerke R Square (0.072) values suggested that between 5.4% and 7.2% of the variability was explained by the Block two model.

In Block one, correction classification rates were 69.9% for current cigarette smokers, 51.9% for non-current cigarette smokers, and 60.9% for the overall correct classification rate. After controlling for the covariates in Block two, with the addition of IHAS, correction classification rates were 45.6% for current cigarette smokers and 76.3% for non-current cigarette smokers; the overall correct classification rate was 60.9%.Table 8 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for the two covariates in Block one and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, Current Marijuana Use was significantly associated with smoking status (X^2 (1, n = 271) = 7.0, p < 0.01, B = 0.78, OR = 2.17, 95% CI = 1.22 – 3.86). The odds of a person being a current cigarette smoker was 2.17 times higher for someone who reported current marijuana use than for a person who reported no current marijuana use. Additionally, in the Block one model, AIDS Diagnosis was significantly associated with smoking status (X^2 (1, n = 271) = 4.24, p = 0.04, B = -0.51, OR = 0.6, 95% CI = 0.37– 0.98). The odds of a

person being a current cigarette smoker was 40% less for someone who reported having a diagnosis of AIDS than for a person who did not report having a diagnosis of AIDS.

In Block two, after the addition of IHAS, according to the Wald Criterion, IHAS was not significantly associated with Smoking Status (X^2 (1, n = 271) = 3.66, p = 0.056, B=0.5, *aOR* = 1.65, 95% CI = 0.988 – 2.737). However, in the Block two model, Current Marijuana Use was significantly associated with Smoking Status (X^2 (1, n = 271) = 5.74, p = 0.02, B = 0.71, *aOR* = 2.04, 95% CI = 1.14 – 3.65). The odds of a person being a current cigarette smoker was 2.04 times higher for someone who reported current marijuana use than for a person who reported no current marijuana use. Additionally, in the Block two model, AIDS Diagnosis was significantly associated with Smoking Status (X^2 (1, n = 271) = 5.31, p = 0.02, B = -0.59, *aOR* = 0.56, 95% CI = 0.34– 0.92). The odds of a person being a current cigarette smoker was 44% less for someone who reported having a diagnosis of AIDS than for a person who did not report having a diagnosis of AIDS. In summary, there was no significant association between IHAS and Smoking Status when Current Marijuana Use and AIDS diagnosis were inserted into the model (See Table 8).

Association of IHAS and smoking status (including covariates of AIDS diagnosis and lifetime marijuana use). Block one of the second sequential logistic regression model included the covariates of AIDS Diagnosis and Lifetime Marijuana Use (See Tables 6, 7, and Supplemental Table 3). Block two included the addition of the independent variable of interest, IHAS. After listwise deletion of participants missing values for IHAS (missing n = 3), AIDS Diagnosis (missing n = 14), lifetime marijuana use (missing n = 0) the total sample included in the analysis consisted of 273 participants.

In Block one, the Omnibus Tests of Model Coefficients showed no significant

improvement over the baseline model (X^2 (2, n = 273) = 5.32, $p < 0.05$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (2, n = 273) = 3.1, p = 0.21). Cox & Snell R Square (0.02) and the Nagelkerke R Square (0.03) values suggested that between 2.0% and 3.0% of the variability was explained by the Block one model. After the addition IHAS in Block two, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model (X^2 (3, n = 273) = 10.02, p = 0.02) and showed significant improvement over Block one (X^2 (1, n = 273) = 4.7, p = 0.03). The Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (5, n = 273) = 4.5, p = 0.48). Cox & Snell R Square (0.04) and the Nagelkerke R Square (0.05) values suggested that between 4.0% and 5.0% of the variability was explained by the Block two model.

In Block one, correction classification rates were 51.8% for current cigarette smokers, 61.0% for non-current cigarette smokers, and 56.4% for the overall correct classification rate. After controlling for the covariates in Block two, with the addition of IHAS, correction classification rates were 67.9% for current cigarette smokers and 45.6% for non-current cigarette smokers; the overall correct classification rate was 56.8%.

Supplemental Table 3 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for the two covariates in Block one and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, AIDS Diagnosis was significantly associated with Smoking Status (X^2 (1, n = 273) = 4.66, p = 0.03, B = -0.53, *aOR* = 0.59, 95% CI = 0.36– 0.95). The odds of a person being a current cigarette smoker was 41% less for someone who reported having a diagnosis of AIDS than for a person who did not report having a diagnosis of AIDS. Lifetime Marijuana Use was not significantly

associated with smoking status in the Block one model (X^2 (1, n = 273) = 0.76, p= 0.39). In the Block two model, after the addition of IHAS, according to the Wald Criterion, IHAS was significantly associated with Smoking Status (X^2 (1, n = 273) = 4.64, p = 0.03, B = 0.55, *aOR*=1.74, 95% CI = 1.05 – 2.88). The odds of a person being a current cigarette smoker was 1.74 times higher for someone who reported having high IHAS than for a person who reported low IHAS.

In the Block two model, AIDS Diagnosis was significantly associated with Smoking Status (X^2 (1, n = 273) = 5.91, p = 0.02, B = -0.61, *aOR* = 0.54, 95% CI = 0.33– 0.89). The odds of a person being a current cigarette smoker was 46% less for someone who reported having a diagnosis of AIDS than for a person who did not report having a diagnosis of AIDS. In the Block two model, Lifetime Marijuana Use was not significantly associated with Smoking Status (X^2 (1, n = 273) = 0.36, p = 0.55). In summary, IHAS was associated with Smoking Status when Lifetime Marijuana Use and AIDS Diagnosis were inserted into the model.

Primary aim 2: To examine the relationship between IHAS and nicotine dependence.

Individual level IHAS data and nicotine dependence. Nicotine Dependence was not significantly associated with overall IHAS level (low versus high). A total of 31.4% of participants reported low IHAS and low nicotine dependence (n = 44), 22.9% of participants reported low IHAS and high nicotine dependence (n = 32), 25% of participants reported high IHAS and low nicotine dependence (n = 35), and 20.7% of participants reported high IHAS and high nicotine dependence (n = 29; X^2 = 0.15, p = 0.7). Table 9 displays item level frequency data for the IARSS Scale by Nicotine Dependence. X^2 tests were computed

between individual IARSS items (yes/no) and Nicotine Dependence (low versus high nicotine dependence). For item three, "I feel guilty that I am HIV positive," smokers with high nicotine dependence were significantly more likely to answer yes to the item compared to smokers with low nicotine dependence (χ^2 (1, n = 145) = 4.45, p = 0.04). No other IARSS items were significantly related to Nicotine Dependence.

Association of IHAS and nicotine dependence (no covariates). A direct logistic regression analysis was performed to assess the association between IHAS level (low versus high IHAS) and Nicotine Dependence (low nicotine dependence versus high nicotine dependence). After listwise deletion of two cases with missing values on IHAS and three cases with missing values for Nicotine Dependence, 140 of 145 participants were included in the analysis. Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (1, n = 140) = 0.15, p = 0.7). Additionally, the Hosmer-Lemeshow Goodness of Fit Test showed no significant improvements over the baseline model, (X^2 (0, n = 140) < 0.01, p < 0.01). Cox & Snell R Square (0.001) and the Nagelkerke R Square (0.001) values suggested that 0.1% of the variability was explained by the model. On the basis of IHAS alone, correction classification rates were 100% for smokers with low nicotine dependence and 0% for smokers with high nicotine dependence; the overall correct classification rate was 56.4%. Table 10 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for IHAS. According to the Wald Criterion, IHAS was not significantly associated with Nicotine Dependence (X^2 (1, n = 140) = 0.15, p = 0.7).

Association of IHAS and nicotine dependence (with the covariate of age). A logistic regression entered in a planned manner in sequential blocks was then run to assess the association between IHAS (low versus high IHAS) and nicotine dependence (low versus high

nicotine dependence) controlling for the influence of relevant covariates that were significantly correlated with IHAS for the sample of current smokers determined from the preliminary analysis (see Tables 11, 12 and 13). Multicollinearity was assessed for the continuous variables of Age and Years Since HIV Diagnosis using a linear regression. Age was significantly associated with Years Since HIV Diagnosis ($\beta = -0.56$, $p < <0.01$). Years Since HIV diagnosis was dropped from the sequential logistic regression model in the main analysis as both variables (Years Since HIV Diagnosis and Age) had a similar relationship to IHAS (Age, $p = 0.01$; Years Since HIV Diagnosis, $p = 0.02$) and Age was believed to contain a more broad demographic. Thus, Age was retained as the only covariate in the main model (See Table 13). However, a second sequential logistic regression analysis was conducted to see if the results would stay the same when replacing Age with Years Since HIV Diagnosis in the model (See Supplemental Table 4). Results differed between each sequential regression. Results from each sequential regression are presented below with the main model presented first.

Block one included the covariate of Age and Block two included the addition of the independent variable of interest, IHAS. After listwise deletion of participants missing values for IHAS (missing $n = 2$), Age (missing $n = 1$), and Nicotine Dependence (missing $n = 3$), the sample included in the analysis consisted of 139 participants.

In Block one, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (1, $n = 139$) = 0.01, $p = 0.91$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 138$) = 6.11, $p = 0.64$). Cox & Snell R Square (0.00) and the Nagelkerke R Square (0.00) values suggested that 0.0% of the variability was explained by the Block one model. After the

addition IHAS in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (2, n = 139) = 0.22, p = 0.9) and showed no significant improvement over Block one (X^2 (1, n = 139) = 0.2, p = 0.65). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, n = 139) = 2.63, p = 0.96). Cox & Snell R Square (0.002) and the Nagelkerke R Square (0.002) values suggested that 0.2% of the variability was explained by the Block two model.

In Block one, correction classification rates were 100% for smokers with low nicotine dependence, 0.0% for smokers with high nicotine dependence, and 56.1% for the overall correct classification rate. After controlling for the Age in Block two, with the addition of IHAS, correction classification rates remained 100% for smokers with low nicotine dependence and 0% for smokers with high nicotine dependence; the overall correct classification rate was 56.1%.

Table 13 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for Age in Block one and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, Age was not significantly associated with Nicotine Dependence (X^2 (1, n = 139) = 0.01, p = 0.91). In Block two, after the addition of IHAS, according to the Wald Criterion, IHAS was not significantly associated with Nicotine Dependence (X^2 (1, n = 139) = 0.2, p = 0.65) and Age was not significantly associated with Nicotine Dependence (X^2 (1, n = 139) < 0.01, p = 0.99). In summary, no association was found between IHAS and Nicotine Dependence when the covariate of Age was inserted into the model.

Association of IHAS and nicotine dependence (with the covariate of years since HIV diagnosis; Supplemental table 4). Block one of the second sequential logistic

regression model included the covariate of Years Since HIV Diagnosis and Block two included the addition of the independent variable of interest, IHAS. After listwise deletion of participants missing values for IHAS (missing $n = 2$), Years Since HIV Diagnosis (missing $n = 7$), and Nicotine Dependence (missing $n = 3$) the sample included in the analysis consisted of 128 participants.

In Block one, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (1, $n = 139$) = 3.43, $p = 0.06$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 128$) = 4.54, $p = 0.81$). Cox & Snell R Square (0.026) and the Nagelkerke R Square (0.035) values suggested between 2.6% and 3.5% of the variability was explained by the Block one model. After the addition IHAS in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (2, $n = 128$) = 5.06, p =0.08) and showed no significant improvement over Block one (X^2 (1, $n = 128$) = 1.63, $p = 0.2$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 128$) = 8.14, $p = 0.42$). Cox & Snell R Square (0.039) and the Nagelkerke R Square (0.052) values suggested between 3.9% and 5.2% of the variability was explained by the Block two model.

In Block one, correction classification rates were 80.8% for smokers with low nicotine dependence, 23.6% for smokers with high nicotine dependence, and 56.3% for the overall correct classification rate. After controlling for the Years Since HIV Diagnosis in Block two, with the addition of IHAS, correction classification rates were 76.7% for smokers with low nicotine dependence and 32.7% for smokers with high nicotine dependence; the overall correct classification rate was 57.8%.

Supplemental Table 4 displays regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for Years Since HIV Diagnosis in Block one and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, Years Since HIV Diagnosis was not significantly associated with Nicotine Dependence (X^2 (1, n = 128) = 3.3, p = 0.07*).* In Block two, after the addition of IHAS, according to the Wald Criterion, IHAS was not significantly associated with Nicotine Dependence (X^2 (1, n = 128) = 1.61, p = 0.2). However, Years Since HIV Diagnosis was significantly associated with Nicotine Dependence (X^2 (1, n = 128) = 4.23, p = 0.04, B=0.04, *aOR*=1.05, 95% CI = 1.0 – 1.09). While not a large difference, for one unit increase in years since HIV diagnosis, the odds of a person having high nicotine dependence (compared to low nicotine dependence) increased by 1.05 times.

Primary aim 3: To examine the relationship between IHAS and motivation to quit smoking.

Individual level IHAS data and motivation to quit smoking. A total of 36.4% of participants reported low IHAS and being in the contemplation stage (n = 52), 18.2% of participants reported low IHAS and being in the preparation/action stage (n = 26), 30.8% of participants reported high IHAS and being in the contemplation stage (n = 44), and 14.7% of participants reported high IHAS and were in the preparation/action stage of quitting smoking (n = 2; X^2 = 0.02, p = 0.90). Table 14 displays item level frequency data for the IARSS Scale by Motivation to Quit. χ^2 tests were computed between individual IARSS items (yes/no) and Motivation to Quit (contemplation stage versus preparation/action stage of quitting smoking). Results showed that no IARSS items were significantly related to Motivation to Quit. Motivation to quit was not significantly associated with overall IHAS level (low versus

high).

Association of IHAS and motivation to quit smoking (no covariates). A direct logistic regression analysis was performed to assess the association between IHAS level (low IHAS versus high IHAS) and Motivation to Quit (being in the contemplation stage versus the preparation/action stage of quitting cigarette smoking; table 15). After listwise deletion of two cases with missing values for IHAS and one case with missing values for Motivation to Quit (note: this case overlapped with another case that was missing an IHAS score), 143 of 145 participants were included in the analysis.

The Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (1, n = 143) = 0.02, p = 0.9). Additionally, the Hosmer-Lemeshow Goodness of Fit Test showed no significant improvements over the baseline model, (X^2 (0, n = 143) < 0.01, p < 0.01). Cox & Snell R Square (0.0) and the Nagelkerke R Square (0.0) values suggested that 0% of the variability was explained by the model. On the basis of IHAS alone, correction classification rates were 100% for participants in the contemplation phase of quitting cigarette smoking and 0% for participants in the preparation/action stage of quitting cigarette smoking; the overall correct classification rate was 67.1%. Table 15 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for IHAS. According to the Wald Criterion, IHAS was not significantly associated with Motivation to Quit (X^2 (1, n = 143) = 0.02, p = 0.9).

Association of IHAS and motivation to quit smoking (covariate of age). A logistic regression entered in a planned manner in sequential blocks was then run to assess the association between IHAS (low versus high IHAS) and Motivation to Quit Smoking, controlling for the influence of relevant covariates that were significantly correlated with

IHAS for the sample of current smokers determined from the preliminary analysis (see Tables 11, 12, and 16). Multicollinearity was assessed for the continuous variables of Age and Years Since HIV Diagnosis using a linear regression. Age was significantly associated with Years Since HIV Diagnosis ($\beta = -0.56$, $p < <0.01$). Similar to the earlier analyses of Nicotine Dependence, Years Since HIV Diagnosis was dropped from the sequential logistic regression model in the main analysis as both variables (Years Since HIV Diagnosis and Age) had a similar relationship to IHAS (Age, $p = 0.01$; Years Since HIV diagnosis, $p = 0.02$) and Age was believed to contain a more broad demographic. Thus, Age was retained as the only covariate in the main model. However, a second sequential logistic regression analysis was conducted to see if the results would stay the same when replacing Age with Years Since HIV Diagnosis in the model. Results differed between each sequential regression. Results from each sequential regression are presented below, with the main analysis presented first.

Block one included the covariate of Age and Block two included the addition of the independent variable of interest, IHAS. After listwise deletion of participants missing values for IHAS (missing $n = 2$), Age (missing $n = 1$), and Motivation to Quit Smoking (missing $n = 1$), the sample included in the analysis consisted of 142 participants. In Block one, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model (X^2 (1, $n = 142$) = 4.48, $p = 0.03$). Additionally, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 142$) = 7.3, $p = 0.5$). Cox & Snell R Square (0.031) and the Nagelkerke R Square (0.043) values suggested that between 3.1% and 4.3% of the variability was explained by the Block one model. After the addition IHAS in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the

baseline model (X^2 (2, n = 142) = 4.52, p =0.1) and showed no significant improvement over Block one (X^2 (1, n = 142) = 0.04, p = 0.85). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, n = 142) = 6.68, p = 0.57). Cox & Snell R Square (0.031) and the Nagelkerke R Square (0.044) values suggested that between 3.1% and 4.4% of the variability was explained by the Block two model.

In Block one, correction classification rates were 100% for smokers in the contemplation stage, 0.0% for smokers in the preparation/action stage, and 67.6% for the overall correct classification rate. After controlling for the Age in Block two, with the addition of IHAS, correction classification rates remained the same (100% for smokers in the contemplation age smokers, 0.0% for smokers in the preparation/action stage, and 67.6% for the overall correct classification rate).

Table 16 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for Age in Block one, and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, Age was significantly associated with Motivation to Quit (X^2 (1, n = 142) = 4.15, p = 0.04, B=0.04, *aOR*=1.04, 95% CI = 1.0 – 1.08). For one unit increase in age, the odds of a person being in the preparation/action stage (compared to being in the contemplation stage of quitting smoking) increased by 1.04 times. In Block two, after the addition of IHAS, according to the Wald Criterion, IHAS was not significantly associated with Motivation to Quit (X^2 (1, n = 142) = 0.07, p = 0.85). However, Age was significantly associated with Motivation to Quit (X^2 (1, n = 142) = 4.13, p = 0.04, B=0.04, *aOR* =1.04, 95% CI = 1.0 – 1.08). For one unit increase in age, the odds of a person being in the preparation/action stage (compared to being in the contemplation stage of quitting smoking) increased by 1.04 times. In summary, no association was found between IHAS and

Motivation to Quit Smoking when the covariate of Age was inserted into the model.

Association of IHAS and motivation to quit smoking (covariate of years since HIV diagnosis). Block one of the second sequential logistic regression model included the covariate of Years Since HIV Diagnosis and Block two included the addition of the independent variable of interest, IHAS (Supplemental table 5). After listwise deletion of participants missing values for IHAS (missing $n = 2$), Years Since HIV Diagnosis (missing $n = 7$), and Motivation to Quit (missing $n = 3$) the sample included in the analysis consisted of 131 participants.

In Block one, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (1, $n = 131$) = 1.23, $p = 0.27$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 131$) = 6.31, $p = 0.61$). Cox & Snell R Square (0.009) and the Nagelkerke R Square (0.013) values suggested that 0.9% to 1.3% of the variability was explained by the Block one model. After the addition IHAS in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (2, $n = 131$) =1.28, p =0.53) and showed no significant improvement over Block one, (X^2 (1, $n = 131$) = 0.05, $p = 0.83$). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (8, $n = 131$) = 5.67, $p = 0.68$). Cox & Snell R Square (0.01) and the Nagelkerke R Square (0.014) values suggested that between 1.0% and 1.4% of the variability was explained by the Block two model.

In Block one, correction classification rates were 100% for contemplation stage smokers, 0.0% for preparation/action stage smokers, and 68.7% for the overall correct classification rate. After controlling for Years Since HIV Diagnosis in Block two, with the

addition of IHAS, correction classification rates remained the same (100% for smokers in the contemplation stage, 0.0% for smokers in the preparation/action stage, and 68.7% for the overall correct classification rate).

Supplemental Table 5 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for Years Since HIV Diagnosis in Block one and after the addition of IHAS in Block two. In the Block one model, according to the Wald Criterion, Years Since HIV Diagnosis was not significantly associated with Motivation to Quit (X^2 (1, n = 131) = 1.2, p = 0.27). In Block two, after the addition of IHAS, according to the Wald Criterion, IHAS was not significantly associated with Motivation to Quit (X^2 (1, n = 131) = 0.05, p = 0.83). Additionally, Years Since HIV Diagnosis was not significantly associated with motivation to quit (X^2 (1, n = 131) = 1.25, p = 0.26). In summary, no association was found between IHAS and Motivation to Quit Smoking when the covariate of Years Since HIV Diagnosis was inserted into the model.

Convergent and divergent validity of the contemplation ladder. Convergent validity between the Contemplation Ladder score and the TAAS item assessing motivation to quit among current smokers was calculated using Kendall's Tau. The variable of Contemplation Ladder score was missing one case; the analysis consisted of 144 participants. Those with higher scores on the Contemplation Ladder were more likely to have higher scores on the motivation to quit item of the TAAS [r_t=0.31, p < 0.001 (2-tailed)] suggesting evidence of convergent validity between the two instruments. Divergent validity between the Contemplation Ladder score and participant height (in inches) among current smokers was calculated using Kendall's Tau. Three participants were missing measurements for height and one participant was missing a Contemplation Ladder score; therefore, the analysis

consisted of 141 participants. Results showed no significant relationship between height and the Contemplation Ladder score [r_t=-0.1, p=0.11 (2-tailed)] suggesting evidence of divergent validity between the two measures.

Exploratory Analyses

Exploratory aim 1: To examine whether depression moderated the relationship between IHAS and nicotine dependence. A logistic regression entered in a planned manner in sequential blocks was conducted to test whether Depression moderated the relationship between IHAS and Nicotine Dependence (See Table 17). Due to results of the Shapiro-Wilk Normality test indicting depression (PROMIS total T-score, higher scores equal to greater depression) were not normally distributed, the variable was transformed from continuous to binary prior to the analysis. The cut off score was based off of literature, which suggests that a PROMIS T score of ≥ 60 indicates clinical depression (note: this score is one standard deviation above the mean T-score of 50) and this cut off has shown convergent validity with scores that represent clinical depression in the CESD and the PHQ-9 (Pilkonis et al., 2014). Following this transformation, the variables of IHAS and Depression were centered (Aiken & West, 1991) and an interaction term between IHAS and Depression was created. Block one of the sequential logistic regression included two variables: Depression and IHAS; Block two included the addition of the interaction term. After listwise deletion of participants missing values for IHAS (missing n = 2) and Nicotine Dependence (missing n = 3), the sample included in the analysis consisted of 140 participants.

In Block one, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (2, n = 140) = 0.51, p= 0.78). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (2, n = 140) =

0.49, $p = 0.78$). Cox & Snell R Square (0.004) and the Nagelkerke R Square (0.005) values suggested that between 0.4% and 0.5% of the variability was explained by the Block one model. After the addition of the interaction term in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (3, $n = 140$) = 1.0, $p = 0.8$) and there was no significant improvement over Block one (X^2 (1, $n = 140$) = 0.49, $p = 0.48$). The Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (2, $n = 140$) <0.01, $p = 0.99$). Cox & Snell R Square (0.007) and the Nagelkerke R Square (0.01) values suggested that between 0.7% and 1.0% of the variability was explained by the Block two model. In Block one, correction classification rates were 100% for participants with low nicotine dependence, 0.0% for participants with high nicotine dependence, and 56.4% for the overall correct classification rate. After the addition of the interaction term in Block two, correction classification rates remained the same as Block one.

Table 17 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for the Block one and Block two models. In the Block one model, according to the Wald Criterion, Depression was not significantly associated with Nicotine Dependence (X^2 (1, $n = 140$) = 0.36.0, $p = 0.55$). IHAS was not significantly associated with Nicotine Dependence (X^2 (1, $n = 140$) = 0.17, $p = 0.69$). In Block two, after the addition of the interaction term, according to the Wald Criterion, Depression was not significantly associated with Nicotine Dependence (X^2 (1, $n = 140$) = 0.44, $p = 0.51$), IHAS was not significantly associated with Nicotine Dependence (X^2 (1, $n = 140$) = 0.18, $p = 0.68$), and the interaction term was not significantly associated with nicotine dependence (X^2 (1, $n = 140$) = 0.49, $p = 0.49$). In summary, Depression did not moderate the relationship between IHAS and Nicotine Dependence.

Exploratory aim 2: To examine whether Depression moderated the relationship between IHAS and Motivation to Quit Smoking. To test whether Depression moderated the relationship between IHAS and Motivation to Quit Smoking, a logistic regression entered in a planned manner in sequential blocks, was conducted (Table 18). First, the variables of IHAS and Depression were centered (Aiken & West, 1991) and an interaction term between IHAS and Depression was created. Block one of the sequential logistic regression included two variables: Depression and IHAS; Block two included the addition of the interaction term. After listwise deletion of participants missing values for IHAS (missing $n = 2$) and Motivation to Quit Smoking (missing $n = 1$), the sample included in the analysis consisted of 143 participants. In Block one, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (2, $n = 143$) = 1.46, p =.0.48). However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (2, $n = 143$) = 0.95, $p = 0.62$). Cox & Snell R Square (0.01) and the Nagelkerke R Square (0.014) values suggested that between 1.0% and 1.4% of the variability was explained by the Block one model. After the addition of the interaction term in Block two, the Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model (X^2 (3, $n = 143$) = 2.42, $p = 0.49$) and no significant improvement over Block one (X^2 (1, $n = 143$) = 0.97, $p = 0.33$). The Hosmer-Lemeshow Goodness of Fit Test showed support for the model (X^2 (2, $n = 143$) < 0.01, $p = 0.99$). Cox & Snell R Square (0.017) and the Nagelkerke R Square (0.023) values suggested that between 1.7% and 2.3% of the variability was explained by the Block two model. In Block one, correction classification rates were 100% for participants with in the contemplation stage of quitting, 0.0% for participants with in the preparation/action stage of quitting, and 67.1% for the overall correct classification rate.

After the addition of the interaction term in Block two, correction classification rates remained the same as Block one.

Table 18 shows regression coefficients, Wald statistics, odds ratios, and 95% CI for odds for Block one and Block two. In the Block one model according to the Wald Criterion, Depression was not significantly associated with Motivation to Quit (X^2 (1, n = 143) = 1.35, $p = 0.25$) and IHAS was not significantly associated with Motivation to Quit (X^2 (1, n = 143) = 0.01, p = 0.94). In Block two, after the addition of the interaction term, according to the Wald Criterion, Depression was not significantly associated with Motivation to Quit (X^2 (1, n = 143) = 1.35, p = 0.25), IHAS was not significantly associated with motivation to quit (X^2 (1, n = 143) = 0.04, p = 0.85), and the interaction term was not significantly associated with Motivation to Quit (X^2 (1, n = 143) = 0.93, p = 0.34). In summary, Depression did not moderate the relationship between IHAS and Motivation to Quit.

Exploratory Aim 3: To examine whether depression mediated the relationship between IHAS and smoking status. To explore the hypothesis that Depression would mediate the effect of the IHAS on Smoking Status (smoker versus non-smoker), a mediation analysis was conducted using model 4 of PROCESS by Hayes (2013; See Table 19). Due to the results of the Shapiro-Wilk Normality test indicting Depression (PROMIS total T-score, higher scores equal to greater depression) were not normally distributed and due to the fact that model 4 of PROCESS does not allow for dichotomous moderators, the variable of Depression was transformed from continuous to ordinal. Cut-off scores were based on previous literature, which suggest that a PROMIS T scores from 0-55 represent no depression, 55.1-59.9 represent mild depression, 60-64.25 represent moderate depression, and over 64.26 represents severe depression (Levin et al., 2015). In this study, 163

participants had scores in the “no depression” range, 60 participant scores reflected mild depression, 28 participant scores reflected moderate depression, and 36 participant scores reflected severe depression. Additionally, the total effect model and effect size are not available with dichotomous Y (current smoker versus non-smoker) in PROCESS, therefore the categorical form of smoking status was used, which includes the following categories: current smoker (n = 145), former smoker (n = 85), and never smoker (n = 57).

The first step of the mediation model calculated path C, and regressed IHAS (variable x) onto Smoking Status (variable y), controlling for the covariates of Current Marijuana Use and AIDS Diagnosis, and showed no significant relationship between IHAS and Smoking Status, (b = -0.15, t (267) = -1.53, p = 0.13). However, the covariate of Current Marijuana Use was significantly associated with smoking status at this step (b = -0.24, t (267) = -2.18, p = 0.03, 95% CI = -0.45, 0.02). Current marijuana users were significantly less likely to be current smokers compared to non-current marijuana users. Additionally, the covariate of AIDS Diagnosis was significantly associated with Smoking Status at this step (b = 0.24, t (267) = 2.53, p = 0.01, 95% CI = 0.05, 0.42). Participants who received a diagnosis of AIDS were significantly more likely to be current smokers compared to participants who did not receive a diagnosis of AIDS.

The second step calculated path A, and regressed IHAS onto the mediator of Depression controlling for covariates, and showed no significant relationship between IHAS and Depression (b =-0.06, t (266) = -0.46, p = 0.66). The covariate of Current Marijuana Use was also not significantly associated with Smoking Status at this step (b = -0.21, t (267) = 1.43, p = 0.16). Additionally, the covariate of AIDS Diagnosis was not significantly associated with Smoking Status at this step (b = -0.07, t (267) = -0.54, p = 0.59).

The third step of the mediation calculated path b, and showed that Depression was not significantly associated with Smoking Status, while controlling for IHAS and covariates (*b* = -0.05, *t* (267) = -0.45, *p* = 0.25). However, the covariate of Current Marijuana Use was significantly associated with Smoking Status at this step (*b* = -0.24, *t* (266) = -2.18, *p* = 0.03, 95% CI = -0.45, -0.02). Current marijuana users were significantly less likely to be current smokers compared to non-current marijuana users. Additionally, the covariate of AIDS Diagnosis was significantly associated with Smoking Status at this step (*b* = 0.24, *t* (266) = 2.53, *p* = 0.01, 95% CI = 0.05, 0.42). Participants who received a diagnosis of AIDS were significantly more likely to be current smokers compared to participants who had not received a diagnosis of AIDS.

The fourth step of the mediation analysis calculated path c', and showed that IHAS was not associated with Smoking Status when controlling for Depression [*direct effect* = -0.14, *SE = 0.1, t (266) = -1.5, p* = 0.14*).* A measure of the indirect effect of IHAS on Smoking Status showed the effect was not significantly greater than zero due to the inclusion of zero in the bootstrap CI (indirect effect = -0.003, *SE* = 0.01, 95% CI = -0.03, 0.01). In summary, depression did not mediate the relationship between IHAS and smoking status (See Table 19).

Chapter IV: Discussion

This study explored the potential relationship between IHAS and smoking behaviors; such as smoking status, nicotine dependence, and motivation to quit smoking; in a sample of PLWHA in the Bronx, NY. IHAS was not significantly associated with smoking status, nicotine dependence, or motivation to quit smoking in the main analyses. However, IHAS was significantly associated with smoking status when lifetime marijuana use and AIDS diagnosis were included in the logistic regression as covariates. These results will be discussed below in more detail.

The first primary aim of the study was to examine the relationship between IHAS and smoking status among PLWHA. It was hypothesized that participants who endorsed high levels of IHAS would be more likely to identify as a current cigarette smoker compared to participants who endorsed low levels of IHAS. However, there was no significant relationship between IHAS and smoking status. This finding was consistent with the scant amount of previous literature that has examined the relationship between IHAS and smoking status. For example, Zhang et al. (2016) found no significant relationship between IHAS and smoking status in PLWHA from China. Conversely, research on other types of HIV stigma, other than internalized stigma, have found significant relationships with smoking status (Zhang et al., 2016; Shacham, Rosenburg, Önen, Donovan, & Overton, 2015). Zhang et al. (2016) found higher odds of current smoking among participants who reported higher levels of enacted stigma (aOR = 1.35, 95% CI = 1.04-1.76) and a study by Shacham et al. (2015)

found that participants with higher perceived stigma scores were more likely to be current smokers compared to non-smokers ($p = 0.02$) in a sample of 201 PLWHA in the US.

While there was no association of smoking status to overall IHAS, some individual items on the IARSS scale were significantly associated with smoking status. Current smokers were significantly more likely to answer yes to item five ("I sometimes feel worthless because I am HIV positive") compared to non-current smokers. It is possible that experiencing multiple types of stigma (i.e., smoking stigma and HIV stigma) feelings of worthlessness could have been particularly amplified compared to non-smoking participants who didn't experience smoking stigma. Interestingly, for item six ("I hide my HIV status from others"), non-current smokers were significantly more likely to answer yes to the item compared to current smokers. It is unclear why non-current smoking would be associated with hiding one's HIV status. However, one possible explanation could be that smoking is difficult to conceal, and current smokers may be more open to revealing stigmatized statuses and behaviors such as a positive HIV status and smoking. However, future research is needed to further examine differences in IHAS by smoking behavior including possible explanations for these differences. It also it might be useful for future research to examine elements of IHAS such as worthlessness and guilt associated with HIV status in further detail and not just total score.

One factor that may be related to the finding that overall IHAS was not associated with smoking status, compared to the relationship between smoking status and other HIV stigmas, may be due to difficulty in reporting negative thoughts about oneself. It may be easier for one to report when one perceives HIV stigma from others (stigma from external sources), such as stigma from healthcare workers and family/friends, then when one is

perpetuating the stigma towards oneself (stigma from an internal source). While there is a lack of research on a pattern of under reporting IHAS in primary care settings, research has documented under reporting of a correlate of IHAS, depression, in primary care settings. Reasons for non-disclosure of depressive symptoms in primary care settings, such as the CPL, include feeling a primary care setting is a unfitting location to discuss emotional issues (Bell et al., 2010), thinking that medical issues are of higher concern than mental health issues (Kadam, Croft, McLeod, & Hutchinson, 2001), aversion to mental health care such as psychiatric medication and psychotherapy (Dwight-Johnson, Sherbourne, Liao, & Wells, 2000; Backenstrass et al., 2006), mental health stigma (Bell et al., 2010; Kravitz et al., 2011; Kadam et al., 2001), and a hesitance to discuss personal matters (Mohr et al., 2006). Authors Bell et al. (2011) contacted 1,054 adults who had participated in the California Behavioral Risk Factor Survey System and asked participants about reasons for nondisclosure of depressive symptoms to their primary care physician. Bell et al. (2011) found that 43% of participants reported at least one reason for non-disclosure, with the most frequent reason being worry about being prescribed antidepressants (22.9%; 95% CI = 18.8%–27.5%). Additionally, the authors found that the endorsement of a larger number of potential barriers to depression disclosure was associated with female gender, Hispanic ethnicity, and having lower SES.

The rates of key variables examined in this study differed between this sample and samples examined in other studies of PLWHA. Regarding rates of IHAS, a study by Baugher et al. (2017) of 13,841 PLWHA who participated in The Medical Monitoring Project (MMP), a HIV surveillance system intended to collect data representing behavioral and clinical characteristics of HIV in a nationally representative sample, found 79.1% of the sample had

an IARSS score ≥1 on the IARRS. Another study of 188 PLWHA receiving HIV care in Miami, Florida found only 16% of the sample reported experiencing no internalized HIV stigma at all, using the 13-item HIV Stigma Scale (Valverde, Rodriguez, White, Guo, & Waldrop-Valverde, 2018). In contrast, in this study, 60.3% of participants in this study had an IARSS score ≥1, and 27% reported experiencing no IHAS at all. Studies of the rates of nicotine dependence have found rates of 52% - 65% of moderate or high nicotine dependence levels (Tesoriero et al., 2010; Shuter et al. 2012; Gritz, et al., 2004; Marshall, et al., 2011). In this study, 42.8% of current smokers met criteria for moderate to high nicotine dependence. In terms of rates of depression, global prevalence rates of depression in PLWHA have been found to be between 31% - 39% (Rezaei, et al., 2019; Uthman, Magidson, Safren, & Nachega, 2014). Regarding rates of depression in PLWHA in the US, studies show a range of 11% - 37% (Gaynes, Pence, Eron, & Miller, 2008; Asch,et al., 2003). In this study 22.9% of the total sample of PLWHA reported some amount of depressive symptoms. Given the different rates of key variables of our study compared to other studies, it's possible results of the analysis conducted in this study would differ if different samples of PLWHA were examined.

While the CPL does offer mental health services on site, the majority of participants in this study were recruited in the primary care waiting area, located in a separate waiting room from mental health services waiting area. Participants in this study may have been less inclined to self-report IHAS and depression in this setting for similar reasons noted in the research on under reporting of depression in primary care settings. The IARSS touches on potentially painful topics that, in order to report, may require higher levels of introspection and emotional capacity. For example, the IARSS asks responders to assess if they feel "dirty"

and “guilty” due to their HIV/AIDS status, in the form of six ‘yes or no’ questions. While the Reece stigma scale, which measures perceived stigma and was used by Shacham et al. (2015) mentioned above, asks a mix of internally and externally oriented questions, such as whether the respondent feels blamed by others due to their HIV status (Reece, 2003; Eldridge-Smith, Loew & Stepleman, 2019). However, future research is needed to assess whether IHAS is more difficult to report than other HIV stigmas. It may be useful to examine this research question by using qualitative analyses, such as focus groups. For example, focus groups appeared to be a successful method in enabling participants to feel comfortable discussing ways to motivate care-seeking behavior in people living with depression in primary care settings (Bell et al., 2010).

Cultural factors may also play a role in the under reporting of IHAS. In this study, 55% of participants identified as Latina/o. This percentage mirrors past percentages of Latina/o patients receiving care in the CPL (54% Latina/o; Shuter et al., 2012). Previous research has suggested that, compared to non-Latina/o White people, people of Latina/o descent are more likely to conceal psychiatric illness and have higher levels of self-mental health stigma (Wong, Collins, Cerully, Seelam, & Roth, 2017). Wong et al. (2017) contacted 1,066 adults with mild to moderate psychological distress, who had previously completed the California Well-Being Survey. The California Well-Being survey collected information on various health issues, including mental health. Wong et al. (2017) found that Latina/o participants who were originally interviewed in English reported higher levels of self-mental health stigma ($p < 0.05$) and were more likely to report that they would hide a possible mental health problem from coworkers and classmates ($p < 0.01$), compared to White participants. Since IHAS is a correlate of mental health issues such as depression, low-self

efficacy, and low self-worth, and due to the high proportion of participants in this study of Latina/o descent, it is possible that IHAS was under reported due to cultural factors. Future research should assess whether cultural factors relate to the non-disclosure of IHAS using a qualitative or a mixed methods approach. The potential rapport between interviewer and interviewee that occurs in qualitative interviewing methods may encourage participant disclosure about IHAS, a potential topic that may be prone to non-disclosure.

It is worth noting that IHAS was significantly related to smoking status when lifetime marijuana use and AIDS diagnosis were included in the logistic regression as covariates, in contrast to the analysis where IHAS was not significantly related to smoking status when current marijuana use and AIDS diagnosis were model covariates. This finding may be due to the fact that lifetime marijuana use contained both current and lifetime users and captured a wider proportion of participants than current marijuana users alone.

The second primary aim of the study was to examine the relationship between IHAS and nicotine dependence among PLWHA. It was hypothesized that current smokers who endorsed high levels of IHAS would have been more likely to endorse moderate to high levels of nicotine dependence rather than low levels of nicotine dependence, compared to participants who endorsed low levels of IHAS. However, results showed no significant relationship between IHAS and nicotine dependence. One individual item on the IARSS scale was significantly associated with nicotine dependence. For item three (“I feel guilty that I am HIV positive”), smokers with high nicotine dependence were significantly more likely to answer yes to the item compared to smokers with low nicotine dependence. It is possible that the potential of experiencing guilt associated with both nicotine dependence and IHAS led to increased feelings of guilt related to HIV status in smokers with high nicotine

dependence, compared to smokers with low nicotine dependence who may have less compounded guilt from not being as dependent on smoking. Future research is needed to examine this hypothesis.

To date, no previous research was identified that examined the relationship between IHAS (total score or items) and nicotine dependence prior to this study. Studies that looked at IHAS and correlates of nicotine dependence in PLWHA (e.g., self-efficacy, depression) have linked higher nicotine dependence levels to lower self-efficacy (Shuter et al., 2014; Lloyd-Richardson et al., 2008) and the presence of depression (Benard et al., 2007). Given that IHAS is not the same as depression and self-efficacy, one cannot directly compare these results. However, one of the major differences between depression and IHAS is that depression can been linked to biological and circumstantial causes, while IHAS is a much more specific construct and directly relates to ones feelings about their HIV/AIDS status. Currently, there is not enough research to make definitive conclusions about nicotine dependence and IHAS. Future research is needed to explore IHAS and nicotine dependence, as well as other stigmas and nicotine dependence. Being able to rule out a relationship between IHAS and nicotine dependence could further help developers of smoking cessation interventions for PLWHA know what barriers to quitting smoking to target when developing such interventions.

The third primary aim of the study was to examine the relationship between IHAS and motivation to quit smoking. It was hypothesized that current smokers who endorsed high levels of IHAS would report higher motivation to quit smoking, compared to current smokers who endorsed low levels of IHAS. Overall, the relationship between IHAS and motivation to quit smoking was not significant. While there is a lack of research examining the relationship

between motivation to quit smoking and IHAS in PLWHA, it has been previously reported that higher levels of IHAS are associated with poor access to care (Sayles et al., 2009) and the relationship between IHAS and poor access to care could be associated with perceived discrimination from providers, feeling they do not deserve care, and avoidance of thinking about their HIV disease status (Earnshaw et al., 2013; Sayles et al., 2009). Given this information, this author hypothesized that PLWHA who smoke may be less motivated to seek help for quitting smoking for similar reasons. Future research is needed to explore the relationship between IHAS and motivation to quit smoking.

While there were no significant relationships between smoking behaviors and IHAS, there were some significant relationships between smoking status and three of the covariates: current marijuana use, whether someone reported a diagnosis of AIDS, and participant age. First, the odds of a person being a current cigarette smoker was 2.04 times higher for someone who reported current marijuana use than for a person who reported no current marijuana use. This could be due to the fact that dual usage of marijuana and tobacco is common (Agrawal, Budney, & Lynskey, 2012). Additionally, the odds of a person being a current cigarette smoker was 41% less for someone who reported having a diagnosis of AIDS compared to a person who did not report having a diagnosis of AIDS. It is unclear why this result occurred. It should be noted that AIDS diagnosis was determined through self-report and may have been under reported in this study. Previous research has found cigarette smoking to be an independent risk factor for AIDS diagnosis (Feldman et al., 2006). However, future research is needed to examine whether people living with AIDS are less likely to be current smokers compared to PLWH who are living without AIDS.

There was also a significant relationship between motivation to quit smoking and age. Results of the aim 3 sequential logistic regression exploring the relationship between IHAS and motivation to quit smoking, while accounting for the covariate of age, found that for one unit increase in age, the odds of a person being in the preparation/action stage (compared to being in the contemplation stage of quitting smoking) increased by 1.04 times. This finding is consistent with results of previous research, which has found that older adults with higher rates of distress and health problems are more likely to quit smoking (Salive & Blazer, 1993; Abdullah et al., 2006; Chaaya, Mehio-Sibai, & El-Chemaly, 2006).

The first exploratory aim of this study was to examine whether depression moderated the relationship between IHAS and nicotine dependence in PLWHA. Depression alone, and IHAS alone were each not significantly associated with nicotine dependence, and the interaction term (depression x IHAS) was also not significantly associated with nicotine dependence. While there is no previous research examining depression as a moderator in the relationship between IHAS and nicotine dependence, previous research has found a significant association between depression and nicotine dependence in PLWHA (Benard et al., 2007). It is possible that participants in our study were under reporting IHAS and depression due to the cultural factors and setting factors (e.g., being in a primary care clinic) mentioned above, which could have led to the non-significant result. Future research examining under reporting of mental health variables such as IHAS and depression in PLWHA in primary care settings is needed to examine this hypothesis.

Similarly, the second exploratory aim of this study explored whether depression moderated the relationship between IHAS and motivation to quit smoking in PLWHA. Depression alone, and IHAS alone were each not significantly associated with motivation to

quit smoking, and the interaction term (depression x IHAS) was also not significantly associated with motivation to quit smoking. Previous research has found emotional problems to be significantly associated with lower readiness to quit smoking in PLWHA (Burkhalter et al., 2005). However, it is worth noting that Burkhalter et al. (2005) recruited participants from varied settings, including adult day health care programs that provided substance abuse treatment or mental health services. Thus, participants may have been more comfortable disclosing mental health issues, compared to participants in our study from a primary care setting.

Results from the analysis of the third exploratory aim found that depression did not mediate the relationship of IHAS and smoking status. Interestingly, depression was also not significantly associated with smoking status, while controlling for IHAS and covariates. This finding differs from previous research that has found significant relationships between depression and smoking variables in PLWHA (Stewart, Jones, & Minor, 2011; Benard et al., 2007; Burkhalter et al., 2005). For example, a study by Stewart et al. (2011) of 289 un- or under-insured African American PLWHA attending a community HIV clinic in the southeastern US, found that participants with a depressive disorder (assessed using the MINI-International Neuropsychiatric Interview) were more likely to be current smokers than non-depressed participants (*OR* = 1.69, 95% CI = 1.02–2.80). It is unclear why our study did not find a similar relationship between depression and smoking status; however, it could be due to the regional and demographic makeup of our sample, which was 52.9% Black and 55% Latina/o, compared to the Stewart et al. (2011) study of a 100% African American sample.

Another possible explanation for our finding is that other variables that were not measured, such as other types of stigma beyond HIV stigma, were mediating the effect of

IHAS on smoking status and other smoking behaviors. PLWHA who smoke may experience stigma related to areas of their lives other than HIV, such as perceived discrimination (the awareness of behaviors associated with of a negative bias and treatment of a particular group of people; e.g., Banks, Kohn-Wood, & Spencer, 2006), smoking-related stigma (discrimination toward cigarette smokers; e.g., Graham, 2012), sexual orientation stigma (discrimination surrounding those who desire members of the same sex and other sexual minority groups; e.g. Herek, 2016; Ross et al., 2013; Arnold, Rebchook, & Kegeles 2014), social stigma due to limited literary skills (Waite, Paasche-Orlow, Rintamaki, Davis, & Wolf, 2008), and poverty stigma (Leddy et al., 2019). There is a small amount of research to date on the relationship between other forms of stigma (i.e., stigma other than HIV stigma) and smoking behaviors among PLWHA. Perceived racism/perceived discrimination is associated with a range of negative health outcomes in PLWHA, including low motivation to quit smoking (e.g., Herskovits, Knackmuhs, Stanton, & Shuter, 2011; Bogart, Landrine, Galvan, Wagner, & Klein, 2013). Herskovits et al. (2011) examined the relationship between perceived discrimination and smoking behaviors in PLWHA (n = 54, M age = 51, 47% male, 46% Hispanic/Latina/o, 46% Black, 36% some high school) and found that higher perceived discrimination was significantly associated with less motivation to quit smoking (p = 0.007) and levels of perceived racial/ethnic discrimination were significantly higher than perceived HIV-related discrimination ($p < 0.001$).

Regarding sexual orientation stigma and HIV outcomes, internalized homophobia in men who have sex with men has been shown to have negative impacts on HIV risk behaviors including HIV testing, perceived control over sexual risk, and condom use (Ross et al., 2013). A qualitative study of 31 Black gay men and 9 service providers found that HIV-

related stigma and homophobia were related to sexual risk behavior, hesitancy in getting HIV testing or care, poor adherence to ART, and disclosure of positive HIV status to sexual partners. The participants reporting experiencing both homophobia and HIV stigma in churches and with families, as well as with friends in the Black gay community (Arnold, Rebchook, & Kegeles 2014).

With regard to substance use stigma in PLWHA, Earnshaw, Smith, Cunningham, and Copenhaver (2015) conducted a study of substance use stigma in 85 PLWHA with a history of substance use in the Bronx, New York and participants with IHAS reported increased depressive symptoms only if they experienced internalized substance use stigma. A systematic review on internalized smoking stigma in a non-HIV/AIDS population conducted by Evans-Polce, Castaldelli-Maia, Schomerus, & Evans-Lacko (2015) included one study in which 30–40% of current smokers experienced a high amount of disapproval of their smoking from their family and society in general. Additionally, 27% of current smokers felt they were treated differently due to their smoking status (Stuber, Galea, & Link, 2008). Among individuals who recently quit smoking, 39% felt that people think less of a person if they smoke (Stuber & Galea, 2009). The relationship between internalized smoking stigma and socioeconomic status (SES) showed mixed results with some research finding higher SES to be associated with higher internalized smoking stigma, compared to lower SES (Stuber et al., 2008) and other research finding the reverse (Farrimond & Joffe, 2006). It's possible that PLWHA who smoke or use other substances are experiencing smoking and substance use stigma in addition to HIV stigma.

Regarding SES and HIV outcomes, a cross-sectional study of 433 women living with HIV found that experienced poverty stigma was associated with lower adjusted odds of viral

suppression (aOR = 0.76, 95% CI= 0.61-0.96), CD4 cell count at least 350 cells/µl (aO= 0.69; 95% CI = 0.52-0.91), and attending all HIV care visits (aOR = 0.73; 95% CI = 0.54-0.98). The authors of this study also found that a minimum of 95% ART adherence significantly mediated the relationship between experienced poverty stigma, viral suppression, and CD4 cell count of at least 350 cells/µl (Leddy et al., 2019). In addition to poverty stigma, researchers have theorized PLWHA with limited literacy skills could become sensitive to shame and stigma due to social stigma related to limited reading proficiency. A study of 204 PLWHA receiving care at infectious disease clinics in the US found higher perceived social stigma mediated the relationship between limited literacy and lower ART adherence (Waite, Paasche-Orlow, Rintamaki, Davis, & Wolf, 2008).

It is difficult to tease apart the impact that specific stigmas; such as perceived discrimination, social stigma, poverty stigma, IHAS, smoking stigma, and sexual minority stigma; have on smoking behaviors in PLWHA. It is likely that PLWHA experience multiple forms of stigma beyond IHAS alone and they are compounded in such a way that may impact smoking behaviors. Future research accounting for other types of stigmas that may be compounding on IHAS and their relationship to smoking behaviors in the HIV/AIDS population is needed.

In summary, this study suggested no significant relationships between IHAS, and the smoking behaviors of smoking status, nicotine dependence, and motivation to quit smoking in a sample of PLWHA in the Bronx, NY. Although, there is an overall lack of previous research in this area, these findings do contrast some research indicating significant relationships between correlates of IHAS and smoking variables in PLWHA. Future research is needed to confirm if participants have different reporting patterns of mental health issues

like IHAS and depression depending on the setting in which they complete the study. Additionally, due to the lack of research on the relationship between IHAS, smoking status, nicotine dependence, and motivation to quit smoking, more studies are needed to verify the findings from this study. Additionally, due to the limitation of this study in that only IHAS and no other forms of HIV stigma (e.g., perceived, enacted and anticipated HIV stigma) or other stigmas (i.e., smoking, substance use, sexual orientation and racial stigmas) were explored in relation to smoking variables. Future research exploring how IHAS relates to smoking variables compared to and accounting for other forms of stigma, is needed.

Clinical Implications

PLWHA smoke cigarettes at a prevalence that is more than double the prevalence of smoking in the US general population (Mdodo et al., 2015; Reynolds, 2009). Compared to HIV negative smokers and HIV positive non-smokers, HIV positive smokers have worse medical (Baugher et al., 2017; Helleberg et al., 2013; CDC, 2017b; SMAIF, 2017) and psychological (e.g., Crothers et al., 2005; Turner et al., 2001; Webb et al., 2007; Mdodo et al., 2015; Barrett et al., 2006; Reynolds, 2009) outcomes. It is vital that research on the identification of barriers to smoking cessation and facilitators of smoking initiation that are unique to PLWHA are examined in order to design smoking cessation interventions that help lower the prevalence of smoking in this population.

This study explored IHAS and its potential association with the smoking behaviors of smoking status, nicotine dependence, and motivation to quit cigarette smoking. IHAS impacts many PLWHA (Baugher et al., 2017) and is associated with psychological outcomes that are associated with smoking behaviors in PLWHA, such as substance abuse, depression (e.g., Benard et al., 2007; Burkhalter et al., 2005; Lee et al., 2002; Levi-Minzi & Surratt,

2014). The UNAIDS reported that HIV stigma was one of the "greatest barriers" in the prevention new HIV infections and relieving the overall adverse effect of HIV/AIDS (Aggleton & Parker, 2002; Reidpath & Chan 2006). Yet, there has been no prior research examining the relationship between IHAS and cigarette smoking behaviors in PLWHA in the US.

While this study found no significant associations between IHAS and the smoking behaviors examined, the lack of significant results identified a practical matter that could be studied in further research. Research has documented resistance to disclosing depression in primary care settings (e.g., Bell et al., 2010; Kadam et al., 2001; Dwight-Johnson et al., 2000; Backenstrass et al., 2006; Kravitz et al., 2011; Mohr et al., 2006), and IHAS is a correlate of depression (e.g., Lee et al., 2002), further research is needed to examine the barriers to reporting of IHAS and potentially better ways to help patients report IHAS both in clinical and research settings.

Research on the under-reporting of depression in primary care settings has suggested displaying information about psychological issues in primary care waiting rooms as means to encourage patients to disclose depressive symptoms (Kadam et al., 2001). Presenting information on HIV stigma, including IHAS, could potentially be one way to improve IHAS disclosure. Another study used focus groups to identify ways to motivate care-seeking behavior in people living with depression in primary care settings. Study participants reported that it would be helpful to have doctors discuss depression as a chronic disease. They also reported that having doctors present depression as a disease that can affect any person would help normalize depression and was a preferred way to help lower embarrassment or shame associated with disclosing depression symptoms to a doctor. These

messages were favored over other messages that directly focused on the shame associated with disclosing depressive symptoms to a primary care doctor (Bell et al., 2010). It is possible that by providing messages that normalize IHAS and data on the high prevalence of IHAS in PLWHA, either from primary care doctors or in research study instruments, it could improve the disclosure rates of IHAS in primary care and research settings. This could help future studies that focus on IHAS and cigarette smoking behaviors.

Addressing IHAS and depression in association with HIV/AIDS goes beyond physiological symptoms of the disease and aligns with the idea of viewing a patient as a whole person. By providing messages that normalize IHAS and provide data on the prevalence of IHAS in waiting rooms and during patient-doctor discussions, and by screening for IHAS, other HIV stigmas, and psychological issues associated with HIV/AIDS, patients could receive the necessary referrals to psychological or psychiatric care. This could in turn improve HART adherence rates, other medical outcomes, and improve the quality of life for these individuals.

Should future studies find a significant relationship between IHAS and smoking behaviors, it may suggest that interventions targeting IHAS (e.g., ways to adaptively cope with IHAS other than smoking) may help PLWHA quit smoking. Furthermore, in this study, individual IARSS items that focused on worthlessness and guilt associated with HIV status were associated with current smoking and high nicotine dependence. These identified items could be targeted through clinical interventions.

Research is lacking on specific interventions that aim to reduce IHAS and smoking and the research on reducing HIV stigma has not focused solely on IHAS. In a review of 22 studies of interventions to reduce HIV stigma by Brown et al. (2003), different types of HIV

stigma interventions were categorized into four types: 1) information-based approaches by providing written information to participants; 2) teaching settings used to build skills to improve negative thoughts; 3) support groups; and 4) organized contact between PLWHA and the general population. Of the 22 studies, only two focused on teaching coping strategies to PLWHA, while most studies focused on changing the fear-based attitudes of the general public and health providers of PLWHA. Additionally, the authors concluded that more research was needed to learn how interventions could achieve long-term success (Brown Macintyre, & Trujillo, 2003; Stangl, Lloyd, Brady, Holland, & Baral, 2013). Sengupta, Banks, Jonas, Miles, and Smith (2011) evaluated whether populations that participate in HIV-related interventions have lower levels of HIV/AIDS stigma. Only three of the 19 studies tested interventions to reduce stigma. These interventions used in the studies included information-based interventions, skills learning, and counseling and were linked to less reported HIV stigma among participants. The authors identified gaps in evidenced-based interventions to reduce HIV stigma which were 1) a lack of interventions focused on HIV stigma; 2) using insufficient instruments to measure changes in stigma; 3) a lack of knowledge about whether significant stigma reduction would be relevant on a public health level; and 4) lack of internal validity. More recent structural approaches to reduce HIV stigma have focused on societal components that promote stigma, such as discrimination towards PLWHA from healthcare providers and staff in health care settings (Nyblade, Stangl, Weiss, & Ashburn, 2009; Stangl et al., 2013). However, in some structural approaches, legal aid is available to PLWHA who are experiencing discrimination and stigma (UNAIDS, 2006).

Another recent type of intervention to reduce stigma are biomedical prevention approaches, such as ART provision. Results of the effectiveness of biomedical prevention approaches to reduce HIV stigma have been mixed, as some end up normalizing HIV, while others lead to unwanted sero-disclosure (Wolfe et al., 2008; Roura, Urassa, Busza, Mbata, Wringe, & Zaba, 2009; Stangl et al., 2013). The most recent literature review that assessed the effectiveness of interventions to decrease HIV stigma and discrimination between 2002 and 2013 by Stangl et al. (2013) evaluated 48 studies (40 peer-reviewed articles, six grey literature reports, and two dissertations). The authors found most studies focused on a single aspect of stigma at the individual level (stigma produced from fear-based attitudes of others toward PLWHA) rather than at the structural level. The authors point out that it is important to deal with individual-level issues such as anticipated stigma, which, if not acknowledged could lead to avoiding health care and reducing prevention behaviors (Abdool Karim et al., 2008; Nachega et al., 2004; Stangl et al., 2013). One pilot study by Rao et al. (2012) evaluated the feasibility and acceptability of an intervention to reduce IHAS for 24 African American Women. The intervention consisted of a two-day workshop, which involved using videos to trigger discussions about issues related to IHAS, having a participant share coping mechanisms, and practicing role-playing. They found the intervention was feasible, and was associated with decreased stigma at both the end of the intervention and one week later. However, the long-term effects are unknown.

With few studies focusing on interventions to reduce IHAS specifically, it is unknown what an effective intervention that focuses on reducing IHAS in order to reduce cigarette smoking would involve. Looking to research on the association between racism and drug use may provide some answers. Broadly, social isolation and low social support have

been linked to negative health outcomes and higher morbidity and mortality (Ozbay et al., 2007). Specifically, research has linked low social support to depression and depression is comorbid with medical illness (Paykel, 1994; Mohr, Classen, & Barrera, 2004; Manne, Pape, Taylor, & Dougherty, 1999; Revenson, Schiaffino, Majerovitz, & Gibofsky 1991). Conversely, high social support has been shown to protect against these negative health consequences (Resick, 2001). HIV stigma has been shown to lead PLWHA to socially isolate to avoid sero-disclosure (e.g., Audet, McGowan, Wallston, & Kipp, 2013) and thus HIV stigma may be a worthwhile construct to include in studies that address social support. A study by Stevens-Watkins, Perry, Harp, & Oser (2012) explored associations between racism experiences and drug use and moderating factors of 204 African American women (M age = 36.39, M years of education = 12.75). The authors found that protective social factors, belonging to an ethnic community, and participating in cultural practices, served as protective factors against drug use. It is possible that interventions that combine smoking cessation counseling and promote the use of support groups, and community membership to reduce social isolation associated with stigma, may be a successful way to reduce IHAS and smoking in PLWHA.

Limitations

There are several limitations to the current study. 1) There is a lack of prior research on the topic. Only one study to date examined IHAS and smoking in PLWHA (i.e., Zhang et al., 2016). This limited the amount of prior research to include in the literature review on IHAS and smoking in PLWHA and made it difficult to choose an effect size for the power analyses. To address this limitation, previous research on topics related to IHAS and smoking were reviewed and effect sizes were based on studies of smoking and discrimination in

samples with shared characteristics of people living with HIV such as racial and sexual minorities. Future research exploring IHAS and other types of HIV stigma and their relationship to smoking behaviors in HIV is needed; 2) All measures were completed through self-report, which can lead to biases in reporting. This study asked questions about IHAS, depression, cigarette smoking and other substance use, which can be uncomfortable to report. This may increase the risk of providing responses that reflect a participant's desired image rather than the truth. To address this limitation, the study was IRB approved with oral consent procedures. The research staff did not collect name-based information from study participants in the hopes to increase feelings of anonymity; 3) There has been no report of the psychometric properties of the FTND, the Contemplation Ladder, and the PROMIS Depression Short Form for samples of PLWHA. It is unclear whether these instruments have satisfactory levels of reliability in PLWHA. To address this limitation, Cronbach's alphas were calculated for the FTND and The PROMIS Depression Short Form for reliability, and convergent and divergent validity were calculated for the single item Contemplation Ladder, in the current sample. The FTND had a questionable level of internal consistency, which as mentioned above, is consistent with past research on the FTND with other samples of adults. The PROMIS Depression Short Form had excellent internal consistency for this sample of PLWHA, indicating it can be used in samples of PLWHA. There was evidence for convergent validity between The Contemplation Ladder and the TAAS and divergent validity was found between the Contemplation Ladder and participant height in inches. Future studies are needed to explore if the psychometric properties of these instruments remain consistent in other samples of PLWHA; 4) The PROMIS Depression Short Form does not have an item that assesses the symptom of depression, anhedonia (APA, 2013). Due to this, this measure

may not have captured accurate depression levels in this sample and future studies should include measures of depression that assess all possible symptoms of depression, such as anhedonia; 5) The cross sectional design of this study prevented the ability to analyze the relationship between smoking and IHAS over time. This restricted the ability to assess the directionality of any found associations. Future studies are needed that explore these relationships over time.

6) This was a single site study, and the population of the clinic is not representative of the general population of PLWHA across the US. The sample was only from NYC. The study mentioned above by Tesoriero et al. (2010) of 1,094 PLWHA in New York State, found differences in nicotine dependence between NYC and non-NYC PLWHA. Smokers living outside of NYC were more likely to report moderate to high levels of nicotine dependence compared to those living in NYC (62.3% and 51.3% respectively; multivariate *OR* = 1.5, 95% CI = 1.0-2.2; Tesoriero et al., 2010). Although the prevalence of HIV among African American and Hispanic/Latina/o racial/ethnic groups is higher compared to other races and ethnicities in the US (CDC, 2017a), and the patients at the CPL clinic are 54% Latina/o and 39% African American (Shuter et al., 2012), the clinic does not have a high number of other subgroups that are affected by HIV in the US. In 2010, white men accounted for 35% of new HIV diagnoses in men in the US (CDC, 2013), and, in 2015, white women accounted for 19% of HIV diagnoses made in women in the US that year (CDC, 2016d). However, only 4% of the CPL patients are White (Shuter et al., 2012). In this study 30% of the participants were White (16% White males and 12% White females). Additionally, in 2010 the rate of HIV infection was five times higher in people who were actively incarcerated than those who were not (CDC, 2017c). Therefore, generalizability to the

national population of PLWHA may be limited. However, the population of patients at the CPL are largely comprised of people who belong to racial and ethnic minority groups (i.e., Latina/o and Black) and are of low SES. These groups are underrepresented in research in general. It is a strength of this study that it was able to examine IHAS and smoking in not just the HIV community but the specific disadvantaged community that makes up the patients of the CPL. Future research, using multi-site studies, is needed to explore the relationship between IHAS and smoking behaviors in samples that are more representative of the US broad population of PLWHA .

7) Because each item of the IARSS was analyzed in relation to the outcome variable of each aim, there was the possibility of making a Type I error. Alpha levels to determine significance for these analyses included both < 0.05 and a more conservative level of <0.01, to reduce the risk of a Type I error. Additionally, this study did not adjust for multiple comparisons; 8) The questionnaire was not translated into Spanish and non-English speaking/Spanish-speaking Latina/o PLWHA were not eligible to participate in the study. With 23% of new diagnosis of HIV between 2005 and 2014 occurring among Latina/o people in the US (CDC, 2016c), not offering the questionnaire in Spanish limited who was recruited from the clinic and further limited generalizability. Future studies should include Spanish versions of the questionnaire to acquire a more representative sample of Latina/o PLWHA; 9) Due to the nature of recruitment in the waiting rooms of the CPL, this study had a convenience sample and did not capture perhaps the most stigmatized patients, who may be avoiding the clinic. In order to capture a broader range of PLWHA, future studies should aim to recruit participants outside waiting rooms, using community outreach in settings other than primary care and HIV/AIDS treatment clinics; 10) PLWHA can experience other sources of

stigma that extend beyond HIV-stigma, such as race/ethnicity stigma, sexual minority stigma (e.g., Boarts, Bogart, Tabak, Armelie, & Delahanty, 2008) and smoking and substance use stigma for PLWHA who use substances or smoke cigarettes (e.g., Stuber et al., 2008; Earnshaw et al., 2015). The parent study only included the one type of stigma (IHAS) and did not assess other forms of stigma. This is why this author could not include them in the secondary analyses as a way to examine the intersectionality between IHAS and other potential forms of stigma, as well as to examine the intersectionality of these various stigmas and their relative and combined impact on smoking behaviors. Future research should collect data on other types of HIV stigma and stigma associated with behaviors or conditions that extend beyond HIV, such as substance use and smoking stigma, sexual identity stigma, and racial discrimination, as a means to study how they relate to smoking behaviors in PLWHA.

11) Due to the results of the Shapiro-wilk test showing the main variables of interest to be non-normally distributed, IHAS, nicotine dependence, and motivation to quit smoking were transformed into binary variables using cut points based on median splits and theory. These transformations led to the loss of information, and a loss of statistical power to detect a relationship between IHAS and the main outcome variables (MacCallum, Zhang, Preacher, & Rucker, 2002; Cohen, 1983), and risked the finding of false positive results (Austin & Brunner, 2004). In addition, the use of median splits made the results of this study difficult to compare to other studies that use median splits, as medians may differ for different samples (Buettner, Garbe, & Guggenmoos-Holzmann, 1997; Altman & Royston, 2006). Aims 2 and 3 of this study were originally planned to be analyzed using linear regressions with IHAS, nicotine dependence, and motivation to quit as continuous variables. The author of this study analyzed the data for aims 2 and 3 using linear regressions and the results were the same as

when run using logistic regression with dichotomized variables; IHAS was not significantly associated with nicotine dependence or motivation to quit. This suggests that the use of median split did not significantly change the results of the study when it was run using analyses involving continuous variables;

Conclusion

This study found that IHAS was not significantly associated with smoking status, nicotine dependence, and motivation to quit smoking in a sample of PLWHA in The Bronx, NY. These are valuable findings given the prevalence of both IHAS and cigarette smoking in PLWHA. It may be useful for future studies to structure their instruments to better assess IHAS using mixed methods and providing messages that normalize stigma. Additionally, these negative findings can help steer future research to study other factors that may be uniquely contributing to smoking initiation or barriers to quitting smoking in PLWHA in order to obtain better smoking prevention and smoking cessation outcomes in PLWHA.

Tables

Table 1
Total Sample Demographic Descriptive Statistics (n = 287)

Characteristics	*n* (%)	M (SD)	Min-Max (range)
Age (*n* = 286)		50.6 (11.3)	20-75
BMI (*n* = 284)		28.5(6.7)	17.1-55.8
Years Since HIV diagnosis (*n* = 263)		19.8 (9)	0-50
PROMIS depression total T-score (*n* = 287)		52.7 (11)	38.2 - 81.1
IHAS level (*n* = 284)[a]			
Low internalized stigma	167 (58.2)		
High internalized stigma	117 (48)		
Gender (*n* = 287)			
Female	126 (43.9)		
Male	159 (55.4)		
Transgender female	2 (0.7)		
Marital Status (*n* = 286)			
Single	163 (57.0)		
Married or living with a partner	68 (23.8)		
Separated	16 (5.6)		
Divorced	17 (5.9)		
Widower	17 (5.9)		
Other	5 (1.7)		
Ethnicity (*n* = 240)			
Latino/a	132 (55.0)		
Non-Latino/a	108 (45.0)		
Race (*n* = 276)			
Black/African-American	146 (52.9)		
White	83 (30.1)		
American Indian/Alaskan native	9 (3.3)		
Asian	1 (0.4)		
Native Hawaiian/Other Pacific Islander	1 (0.4)		
Other	36 (13.0)		
Education (*n* = 286)			
1st-8th grade	14 (4.9)		
9th-11th grade	74 (25.9)		
High school graduate	39 (13.6)		
GED	39 (13.6)		
Some college	72 (25.2)		

Junior College degree (such as an Associate's Degree)	22 (7.7)
College degree (BA, BS)	19 (6.6)
Some post-college work	2 (0.7)
Advanced degree (PhD, MD, MSW)	5 (1.7)
Sexual Orientation (*n* = 283)	
Heterosexual	204 (72.1)
Homosexual (Gay, Lesbian)	51 (18.0)
Bisexual	24 (8.5)
Other	4 (1.4)
AIDS Diagnosis (*n* = 276)[b]	
Yes	126 (45.7)
No	150 54.3)
Smoking Status (*n* = 287)	
Current smoker	145 (50.5)
Former smoker	85 (29.6)
Never smoker	57 (19.9)
Smoked 100 cigarettes in lifetime (*n* = 212)*	
Yes	194 (91.5)
No	18 (8.5)
Alcohol lifetime use (*n* = 287)	
Yes	205 (71.4)
No	82 (28.6)
Alcohol current use (*n* = 284)	
Yes	93 (32.7)
No	191(67.3)
Marijuana lifetime use (*n* = 287)	
Yes	165 (57.5)
No	122 (42.5)
Marijuana current use (*n* = 285)	
Yes	70 (24.6)
No	215 (75.4)
Cocaine lifetime use (*n* = 286)	
Yes	129 (45.1)
No	157 (54.9)
Cocaine current use (*n* = 287)	
Yes	27 (9.4)
No	260 (90.6)
Methamphetamine lifetime use (*n* = 287)	
Yes	22 (7.7)
No	265 (92.3)
Methamphetamine current use (*n* = 286)	
Yes	4 (1.4)
No	282 (98.6)
Heroin lifetime use (*n* = 287)	
Yes	53 (18.5)

No	234 (81.5)
Heroin current use (*n* = 285)	
Yes	6 (2.1)
No	279 (97.9)
Other opioid lifetime use (*n* = 286)	
Yes	83 (29.0)
No	203 (71.0)
Other opioid current use (*n* = 284)	
Yes	55 (19.4)
No	229 (80.6)
Hallucinogen lifetime use (*n* = 287)	
Yes	22 (7.7)
No	265 (92.3)
Hallucinogen current use (*n* = 285)	
Yes	1 (0.4)
No	284 (99.6)
Benzodiazepine lifetime use (*n* = 287)	
Yes	39 (13.6)
No	248 (86.4)
Benzodiazepine current use (*n* = 285)	
Yes	17 (6.0)
No	268 (94.0)
Other drug lifetime use (*n* = 275)	
Yes	6 (2.2)
No	269 (97.8)
Other drug current use (*n* = 274)	
Yes	4 (1.5)
No	270 (98.5)

Note. Key: M, mean, Max, maximum value; Min, minimum value; SD, standard deviation, IHAS, internalized HIV/AIDS stigma; Full sample *n* = 287, Specific numbers for each variable lists the final analytic sample for that variable after listwise deletion for missing data.

[a]IHAS level is based off of IARSS scores using the following criteria: scores of 0 - 2 = low IHAS, 3 - 6 = high IHAS.

[b]AIDS diagnosis was self-reported by study participants.

Table 2
Demographic and HIV Characteristics of Current Cigarette Smokers versus Non-Cigarette Smokers

Characteristics	Current Cigarette Smokers (*n* = 145)	Non-Current Cigarette Smokers (*n* = 142)	Significance
	% (n) or Median (IQR)	% (n) or Median (IQR)	
Age (*n* = 286)[a]	52 (14)	54 (15)	0.02
BMI (*n* = 284)[a]	25.79 (7.22)	29.03 (9.15)	< 0.01
Years Since HIV diagnosis (*n* = 263)[a,b]	21 (13.5)	20 (9.5)	0.73
PROMIS depression total score (*n* = 287)[b]	52.6 (13.35)	52.6 (23.03)	0.96
Gender (*n* = 287)			
Female	49.0 (71)	38.7 (55)	0.22
Male	50.3 (73)	60.6 (86)	
Transgender female	0.7 (1)	0.7 (1)	
Marital Status (*n* = 286)			
Single	56.3 (81)	57.7 (82)	0.28
Married or living with a partner	25 (36)	22.5 (32)	
Separated	5.6 (8)	5.6 (8)	
Divorced	4.9 (7)	7.0 (10)	
Widower	4.9 (7)	7.0 (10)	
Other	3.5 (5)	0	
Ethnicity (*n* = 240)			
Latino/a	51.3 (60)	58.8 (72)	0.32
Non-Latino/a	48.7 (57)	41.5 (51)	
Race (*n* = 276)			
Black/African-American	55.8 (77)	50 (69)	0.57
White	29.0 (40)	31.2 (43)	
American Indian/Alaskan native	2.9 (4)	3.5 (5)	
Asian	0.7 (1)	0	
Native Hawaiian/Other Pacific Islander	0	0.7 (1)	
Other	11.6 (16)	14.5 (20)	
Education (*n* = 286)			
1st-8th grade	6.3 (9)	3.5 (5)	0.23
9th-11th grade	28.5 (41)	23.2 (33)	
High school graduate	11.8 (17)	15.5 (22)	

GED	14.6 (21)	12.7 (18)	
Some college	35 (24.3)	26.1(37)	
Junior college degree (such as an Associate's Degree)	8.3 (12)	7.0 (10)	
College degree (BA, BS)	4.2 (6)	9.2 (13)	
Some post-college work	1.4 (2)	0	
Advanced degree (PhD, MD, MSW)	0.7 (1)	2.8 (4)	
Sexual Orientation (n = 283)			
Heterosexual	67.4 (95)	76.8 (109)	
Homosexual (Gay, Lesbian)	19.1 (27)	16.9 (24)	0.14
Bisexual	12.1 (17)	4.9 (7)	
Other	1.4 (2)	1.4 (2)	
AIDS Diagnosis (n = 276)[b]			
Yes	52.5 (73)	38.7 (53)	0.03*
No	47.5 (66)	61.3 (84)	
Alcohol lifetime use (n = 287)			
Yes	74.5 (108)	68.3 (97)	0.31
No	25.5 (37)	31.7 (45)	
Alcohol current use (n = 284)			
Yes	36.8 (53)	28.6 (40)	0.18
No	63.2 (91)	71.4 (100)	
Marijuana lifetime use (n = 287)			
Yes	60.7 (88)	54.2 (77)	0.32
No	39.3 (57)	45.8 (65)	
Marijuana current use (n = 285)			
Yes	31.9 (46)	17.0 (24)	< 0.01**
No	68.1 (98)	83.0 (117)	
Cocaine lifetime use (n = 286)			
Yes	51.4 (74)	38.5 (55)	0.04*
No	48.6 (70)	61.3 (87)	
Cocaine current use (n = 287)			
Yes	16.6 (24)	2.1 (3)	<0.01**
No	83.4 (121)	97.9 (139)	
Methamphetamine lifetime use (n = 287)			0.29
Yes	9.7 (14)	5.6 (8)	

No	90.3 (131)	94.4 (134)	
Methamphetamine current use (n = 286)			
Yes	0.7 (1)	2.1 (3)	0.37
No	99.3 (143)	97.9 (139)	
Heroin lifetime use (n = 287)			
Yes	21.1 (32)	14.8 (21)	0.15
No	77.9 (113)	85.2 (121)	
Heroin current use (n = 285)			
Yes	4.2 (6)	0	0.03*
No	95.8 (138)	100 (141)	
Other opioid lifetime use (n = 286)[c]			
Yes	29.2 (42)	28.9 (4)	0.99
No	70.3 (102)	71.1 (101)	
Other opioid current use (n = 284)[c]			
Yes	20.7 (30)	18.0 (25)	0.67
No	79.3 (115)	82.0 (114)	
Hallucinogen lifetime use (n = 287)			
Yes	7.6 (11)	7.7 (11)	0.99
No	92.4 (134)	92.3 (131)	
Hallucinogen current use (n = 285)			
Yes	0.7 (1)	0	0.99
No	99.3 (143)	100 (141)	
Benzodiazepine lifetime use (n = 287)[c]			
Yes	13.8 (20)	13.4 (19)	0.99
No	86.2 (125)	86.6 (123)	
Benzodiazepine current use (n = 285)[c]			
Yes	6.9 (10)	5.0 (7)	0.65
No	93.1 (134)	95.0 (134)	
Other drug lifetime use (n = 275)[c]			
Yes	2.2 (3)	2.2 (3)	0.99
No	97.8 (134)	97.8 (135)	
Other drug current use (n = 274)[c]			
Yes	0.7 (1)	2.2 (3)	0.62

No	99.3 (135)	97.8 (135)

Note. Full sample n = 287, total current smokers n = 145, total non-smokers n = 142; Specific numbers for each variable in column A lists the final analytic sample for that variable after listwise deletion for missing data. For categorical variables, percent reported is a percentage that does not include missing cases. * Significant at alpha <0.05; **Significant at alpha <0.01; Key: M, mean, SD, standard deviation.

[a]Mann-Whittney U tests were conducted for the non-normally distributed continious variables of Age, BMI, Years Since HIV Diagnosis, and PROMIS Depression Total Score. 2-tailed P-values are reported.

[b]Years since HIV diagnosis and AIDS diagnosis variables were self-reported by study participants.

[c]For other opioids, benzodiazepines, and other drug categories, both current and lifetime use includes data from individuals prescribed drug by doctor and those who were not prescribed.

Table 3

Cigarette Smoking Characteristics of Current Smokers Living with HIV/AIDS (n = 145)

Characteristics	% (*n*)	M (SD)	Min-Max (range)
Smoking days per week (*n* = 129)	--	5.8 (1.8)	1-7
Cigarettes per day (*n* = 138)	--	7.6 (7.1)	0.5 - 60
FTND total score (*n* = 142)[a]	--	--	--
Low nicotine dependence	80 (56.3)	--	--
High nicotine dependence	62 (43.7)	--	--
Contemplation Ladder (*n* = 144)[b]			1-8
Preconemplation/Contemplation stage	96 (66.2)	--	--
Preparation/Action stage	48 (33.1)	--	--
TAAS Motivation to quit (*n* = 145)[c]	--	6.1 (2.6)	1-10
TAAS Desire to quit (*n* = 145)[c]		6.6 (2.8)	1-10
TAAS Confidence to quit (*n* = 45)[c]		6.0 (2.6)	1-10
Smoked 100 cigarettes in lifetime (*n* = 135)	--	--	--
Yes	92.6 (125)	--	--
No	7.4 (10)	--	--

Note: Key: M, mean, Max, maximum value; Min, minimum value; SD, standard deviation; Total number of current smokers *n* = 145, Specific numbers for each variable lists the final analytic sample for that variable after listwise deletion for missing data.

[a] FTND, Fagerström Test for Nicotine Dependence; scores of ≤ 4 = very low/low nicotine dependence, scores of ≥ 5 = medium/very high nicotine dependence.

[b] Contemplation Ladder; scores of 0 - 7 = contemplation stage, scores of 8 - 10 = preparation/action stage.

[c]Thoughts About Abstinence Scale; range=0-10; 10 indicating greater desire, confidence, or motivation to quit, respectfully.

Table 4

Relationship Between Individual IARSS Items and Smoking Status

Item	Full Sample (N = 287)	Current Cigarette Smokers (n = 145)	Non-Current Cigarette Smokers (n = 142)	$\chi 2$ (df)
	% (N)	% (n)	% (n)	
Item 1- It is difficult to tell people about my HIV status[1]				1.21 (1)
Yes	58.7 (168)	55.6 (80)	62.0 (88)	
No	41.3 (118)	44.4 (64)	38.0 (54)	
Item 2-Being HIV positive makes me feel dirty[1]				0.93 (1)
Yes	20.6 (59)	22.9 (33)	18.3 (26)	
No	79.4 (227)	77.1 (111)	81.7 (116)	
Item 3-I feel guilty that I am HIV positive[2]				1.8 (1)
Yes	36.2 (104)	40.0 (58)	32.4 (46)	
No	63.8 (183)	60.0 (87)	67.6 (96)	
Item 4- I am ashamed that I am HIV positive[3]				1.1 (1)
Yes	36.4 (104)	39.3 (57)	33.3 (47)	
No	63.6 (182)	60.7 (88)	66.2 (94)	
Item 5- I sometimes feel worthless because I am HIV positive[2]				6.73 (1)**
Yes	25.8 (74)	32.4 (47)	19.0 (27)	
No	74.2 (213)	67.6 (98)	81.0 (115)	
Item 6- I hide my HIV status from others[2]				4.28 (1)*
Yes	50.9 (146)	44.8 (65)	57.0 (81)	
No	49.1 (141)	55.2 (80)	43.0 (61)	

Note. Key: IARSS, Internalized AIDS–Related Stigma Scale; Total number of current smokers n = 145, total number of non-cigarette smokers n = 142; Percent reported does not include missing cases.

* Item 6 asymptotic significance (2-sided) value, p = 0.04.

** Item 5 asymptotic significance (2-sided) value, p < 0.01.

[1] Full sample n = 286, current cigarette smokers n = 144, non-current cigarette smokers n = 142

[2] Full sample n = 287, current cigarette smokers n = 145, non-current cigarette smokers n = 142

[3] Full sample n = 286, current cigarette smokers n = 145, non-current cigarette smokers n = 141

Table 5

Logistic Regression Analysis of Smoking Status as a Function of IHAS

Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
				Lower	Upper
IHAS	0.36	2.15	1.43	0.89	2.29
(Constant)	-0.13	0.72			

Note. Dependent variable, smoking status; Key: IHAS, internalized HIV/AIDS stigma.

Table 6

Mann Whitney U Tests Of Continuous Demographic Variables and IHAS for Total Sample (n = 287)

Characteristics	Median (IQR)	Mann Whitney U	Asymptotic Significance (2-sided)
Age (*n* = 286)	53 (13)	8573.5	0.1
BMI (*n* = 284)	27.406 (8.33)	9406	0.81
Years Since HIV diagnosis (*n* = 263)[a]	21 (12)	7246	0.1
PROMIS depression total score (*n* = 287)	52.8 (14.9)	9653.5	0.86

Note. Key: IHAS, internalized HIV/AIDS stigma.

[a] Years since HIV diagnosis variables was self-reported by study participants.

Table 7

Chi-Square Tests for Binary and Categorical Demographic and Substance Use Variables and IHAS for Total Sample (n = 287)

Characteristics	% (*n*)	X^2
Marital status	100 (283)	
Single	57.2 (162)	0.94
Married or living with a partner	23.7 (67)	
Di/W/Sep/O	19.1 (54)	
Race	100 (273)	
Black/African-American	53.5 (146)	
White	29.7 (81)	4.15
AI/AN/A/NH/OPI	4.0 (11)	
Other race	12.8 (35)	
Education	100 (283)	2.44

1st-8th grade	4.9 (14)	
9th-11th grade	25.8 (73)	
High school graduate	13.8 (39)	
GED	13.4 (38)	
Some college	25.1 (71)	
Junior college degree	7.8 (22)	
College degree or more	9.2 (26)	
Sexual orientation	100 (280)	
Heterosexual	72.1 (202)	0.7
Homosexual (Gay, Lesbian)	18.2 (51)	
Bisexual/Other	9.6 (27)	
Gender	100 (284)	
Female/Transgender Female	44.7 (127)	0.65
Male	55.3 (157)	
Ethnicity	100 (237)	
Latino/a	45.6 (108)	2.82
Non-Latino/a	54.4 (129)	
AIDS diagnosis[a]	100 (273)	
Yes	45.4 (124)	4.93*
No	54.6 (149)	
Alcohol lifetime use	100 (284)	
Yes	71.1 (202)	0.73
No	27.9 (82)	
Alcohol current use	100 (281)	
Yes	32.7 (92)	0.91
No	67.3 (189)	
Marijuana lifetime use[b]	100 (284)	
Yes	57.0 (162)	2.05*
No	43.0 (122)	
Marijuana current use[c]	100 (282)	
Yes	24.5 (69)	4.3*
No	75.5 (213)	
Cocaine lifetime use	100 (283)	
Yes	44.9 (127)	0.07
No	55.1 (156)	
Other opioid lifetime use[d]	100 (283)	
Yes	29.3 (83)	0.2
No	70.7 (200)	
Other drug lifetime use[d,e]	100 (279)	
Yes	33.7 (94)	0.02
No	66.3 (185)	
Other drug current use[df]	100 (275)	2.09
Yes	34.5 (95)	

No	65.5 (180)

Note. Specific numbers reported are the final analytic sample for that variable after pairwise deletion of missing data. Percent reported is a percentage that does not include missing cases. Key: IHAS, internalized HIV/AIDS stigma; Di/W/Sep/O, divorced, widowed, separated, other; AI/AN/A/NH/OPI, American Indian and Alaskan Native *(n* = 9), Asian (*n* = 1), Native Hawaiian and Other Pacific Islander (*n* = 1), College degree or more (*n* = 19), Some post-college work (*n* = 2), Advanced degree (PhD, MD, MSW; *n* = 5). A total of two participants identified as transgender women and results did not change when female and male participants were compared without the transgender women. * Significant at alpha < 0.05 (2-sided); **Significant at alpha < 0.01 (2-sided).

[a] AIDS diagnosis was self-reported by study participants; $p = 0.03$)

[b] Marijuana lifetime use, $p = 0.044$)

[c] Marijuana current use, $p = 0.038$)

[d] For 'other opioids lifetime use' and drugs included in the 'other drug lifetime use' and "other drug current use' variables (i.e. benzodiazepines, other opioid current use, and other drug use) both current and lifetime use includes data from individuals prescribed drug by doctor and those who were not prescribed.

[e] Other drug lifetime use consists of the following substances: methamphetamine, hallucinogen, heroin, benzodiazepine, and other drugs.

[f] Other drug current use consists of the following substances: cocaine, heroin, other opioid, cocaine, methamphetamine, hallucinogens, and other drugs.

Table 8

Sequential Logistic Regression Analysis of Smoking Status as a Function of IHAS Controlling for AIDS Diagnosis and Current Marijuana Use (n = 271)

					95% Confidence Interval for Odds Ratio	
Block	Variables	B	Wald X^2-test	Odds Ratio	Lower	Upper
Block 1	AIDS diagnosis	-0.51	4.24	0.6	0.37	0.98
	Current marijuana use	0.78	7	2.17	1.22	3.86
	(Constant)	0.1	0.26	1.11		
Block 2	AIDS diagnosis	-0.59	5.31	0.56	0.34	0.92
	Current marijuana use	0.71	5.74	2.04	1.14	3.65
	IHAS	0.5	3.66	1.65	0.99	2.74
	(Constant)	-0.05	0.05	0.96		

Note. Dependent variable, smoking status; Key: IHAS, internalized HIV/AIDS stigma.

Table 9
Relationship Between Individual IARSS Items and Nicotine Dependence

Item	All Current Smokers (n = 145)	Low ND	High ND	$\chi 2$ (df)
	% (n)	% (n)	% (n)	
Item 1- It is difficult to tell people about my HIV status[1]				1.96 (1)
Yes	55.3 (78)	57.0 (45)	53.2 (33)	
No	44.7 (63)	43.0 (34)	46.8 (29)	
Item 2-Being HIV positive makes me feel dirty[2]				.01 (1)
Yes	23.4 (33)	23.8 (19)	23.0 (14)	
No	76.6 (108)	76.3 (61)	77.0 (47)	
Item 3-I feel guilty that I am HIV positive[3]				4.45 (1)*
Yes	40.1 (57)	32.5 (26)	50.0 (31)	
No	59.9 (85)	67.5 (54)	50.0 (31)	
Item 4- I am ashamed that I am HIV positive[3]				0.02 (1)
Yes	39.4 (56)	40.0 (32)	38.7 (24)	
No	60.6 (86)	60.0 (48)	61.3 (38)	
Item 5- I sometimes feel worthless because I am HIV positive[3]				2.6 (1)
Yes	33.1 (47)	27.5 (22)	40.3 (25)	
No	66.9 (95)	72.5 (58)	59.7 (37)	
Item 6- I hide my HIV status from others[3]				.03 (1)
Yes	55.6 (79)	45.0 (36)	43.5 (27)	
No	44.4 (63)	55.0 (44)	56.5 (35)	

Note. Key: ND, nicotine dependence, IARSS, Internalized AIDS–Related Stigma Scale. Total number of current smokers n = 145, total number of non-cigarette smokers n = 142; Percent reported does not include missing cases.
* Item 3 asymptotic significance (2-sided) value, p = 0.04.
[1] Current smokers n = 141, low ND n = 79, high ND n = 62
[2] Current smokers n = 141, low ND n = 80, high ND n = 61
[3] Current smokers n = 142, low ND n = 80, high ND n = 62

Table 10

Direct Logistic Regression Analysis of Nicotine Dependence as a Function of IHAS (n =140)

Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
				Lower	Upper
IHAS	0.13	0.15	1.14	0.58	2.23
(Constant)	-0.32	1.88	0.73		

Note. Dependent variable, nicotine dependence; Key: ND, Nicotine dependence; IHAS, internalized HIV/AIDS stigma.

Table 11

Mann Whitney U Tests Of Continuous Demographic Variables and IHAS for Current Smokers (n = 145)

Characteristics	Median (IQR)	Mann Whitney U	Asymptotic Significance (2-sided)
Age (*n* = 144)	52 (14)	1873	0.01
BMI (*n* = 142)	25.79 (7.22)	2395	0.88
Years Since HIV diagnosis (*n* = 133)[a]	21 (13.5)	1621	0.02
PROMIS depression total score (*n* = 145)	52.6 (13.35)	2488.5	0.85
Smoking days per week (*n* = 129)	7 (2)	1738	0.1
Cigarettes per day (*n* = 138)	5.5 (7)	2214.5	0.75

Note. Key: IHAS, internalized HIV/AIDS stigma.

[a] Years since HIV diagnosis variables was self-reported by study participants.

Table 12

Chi-Square Tests for Binary and Categorical Demographic and Substance Use Variables and IHAS for Current Smokers (n = 145)

Characteristics	% (*n*)	X^2
Marital Status	100 (142)	0.37
Single	56.3 (80)	

Married or living with a partner	24.6 (35)	
Di/W/Sep/O	27 (19)	
Race	100 (136)	
Black/African-American	56.6 (77)	4.51
White	27.9 (38)	
Other race	15.4 (31)	
Education	100 (142)	
1st-8th grade	6.3 (9)	
9th-11th grade	28.2 (40)	
High school graduate	12 (17)	1.3
GED	14.1 (20)	
Some college	24.6 (35)	
Junior college degree or more	14.8 (21)	
Sexual Orientation	100 (139)	
Heterosexual	67.6 (94)	
Homosexual (Gay, Lesbian)	19.4 (27)	2.31
Bisexual/Other	12.9 (18)	
Gender	100 (143)	
Female/Transgender Female	49.7 (71)	0.01
Male	50.3 (72)	
Ethnicity	100 (115)	
Latino/a	50.4 (58)	3.14
Non-Latino/a	49.6 (57)	
AIDS Diagnosis[a]	100 (137)	
Yes	51.8 (71)	1.57
No	48.2 (66)	
Smoked 100 cigarettes in lifetime[b]	100 (133)	
Yes	93.2 (124)	0.99
No	9 (6.8)	
Alcohol lifetime use	100 (143)	
Yes	74.1 (106)	0.7
No	25.9 (37)	
Alcohol current use	100 (142)	
Yes	37.3 (53)	0.01
No	62.7 (89)	
Marijuana lifetime use	100 (143)	
Yes	57 (86)	0.99
No	39.9 (57)	

Marijuana current use	100 (142)	
Yes	31.7 (45)	2.54
No	68.3 (97)	
Cocaine lifetime use	100 (142)	
Yes	50.7 (72)	0.02
No	49.3 (70)	
Other opioid lifetime use[c]	100 (142)	
Yes	29.6 (42)	1.42
No	70.4 (100)	
Other drug lifetime use[c,d]	100 (140)	
Yes	35.7 (50)	0.03
No	64.3 (90)	
Other drug current use[c,e]	100 (139)	
Yes	41.7 (58)	0.2
No	58.3 (81)	

Note. Key: IHAS, internalized HIV/AIDS stigma; Di/W/Sep/O, divorced, widowed, separated, other; Other race, American Indian and Alaskan Native (n = 4), Asian (n = 1), and Other race (n = 16); Junior college degree or more, Junior college degree (n = 12), College degree (n= 6), Some post-college work (n = 2), and Advanced degree (n = 1). A total of one participant who was a current smoker identified as a transgender woman and results did not change when female and male participants were compared without the transgender woman. No IARSS items were significantly related to Motivation to quit. No variables were significantly associated with IHAS at alpha levels of < 0.1.

[a]AIDS diagnosis was self-reported by study participants.

[b]Smoked 100 cigarettes in lifetime, 2 cells (50.0%) had expected count less than 5, therefore a Fisher's Exact Test was computed for this variable. Exact significance (2-sided) is reported in the X^2 column of this table.

[c]For 'other opioids lifetime use, and drugs included in the 'other drug lifetime use' and "other drug current use' variables (i.e. benzodiazepines, other opioid current use, and other drug use) both current and lifetime use includes data from individuals prescribed drug by doctor and those who were not prescribed.

[d]Other drug lifetime use consists of the following substances: methamphetamine, hallucinogen, heroin, benzodiazepine, and other drugs.

[e]Other drug current use consists of the following substances: cocaine, heroin, other opioid, cocaine, methamphetamine, hallucinogen, and other drugs.

Table 13
Logistic Regression Analysis of Nicotine Dependence as a Function of IHAS Controlling for Age (n = 139)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Age	-0.002	0.01	0.998	0.97	1.03
	(Constant)	-0.15	0.04	0.86		
Block 2	Age	<0.01	<0.01	1.0	0.97	1.03
	IHAS	0.16	0.2	1.17	0.59	2.33
	(Constant)	-0.3	0.12	0.74		

Note. Dependent variable, nicotine dependence; Key: IHAS, internalized HIV/AIDS stigma.

Table 14
Relationship Between Individual IARSS Items and Motivation to Quit Smoking

Item	All Current Smokers (n = 145)	Contemplation Stage	Preparation /Action Stage	$\chi 2$ (df)
	% (n)	% (n)	% (n)	
Item 1- It is difficult to tell				0.22 (1)

people about my HIV status[1]				
Yes	55.9 (80)	57.3 (55)	53.2 (25)	
No	44.1 (63)	42.7 (41)	46.8 (22)	
Item 2-Being HIV positive makes me feel dirty[2]				0.18 (1)
Yes	22.9 (33)	24.0 (23)	20.8 (10)	
No	77.1 (111)	76.0 (73)	79.2 (38)	
Item 3-I feel guilty that I am HIV positive[2]				0.71 (1)
Yes	40.3 (58)	42.7 (41)	35.4 (17)	
No	59.7 (86)	57.3 (55)	64.6 (31)	
Item 4- I am ashamed that I am HIV positive[2]				0.13 (1)
Yes	39.6 (57)	38.5 (37)	41.7 (20)	
No	60.4 (87)	61.5 (59)	58.3 (28)	
Item 5- I sometimes feel worthless because I am HIV positive[2]				0.06 (1)
Yes	32.6 (47)	33.3 (32)	31.3 (15)	
No	67.4 (97)	66.7 (64)	68.8 (33)	
Item 6- I hide my HIV status from others[2]				0.06 (1)
Yes	45.1 (65)	45.8 (44)	43.8 (21)	
No	54.9 (79)	54.2 (52)	56.3 (27)	

Note. Key: IARSS, Internalized AIDS–Related Stigma Scale; Total number of current smokers $n = 45$, total number of non-cigarette smokers $n = 142$; Percent reported does not include missing cases. No IARSS items were significantly associated with Motivation to Quit at alpha levels of $p < 0.05$.

[1] Current smokers $n = 143$, contemplation stage $n = 96$, preparation/action stage $n = 47$.

[2] Current smokers $n = 144$, contemplation stage $n = 96$, preparation/action stage $n = 48$.

Table 15

Direct Logistic Regression Analysis of Motivation to Quit Smoking as a Function of IHAS (n = 143)

	95% Confidence Interval for Odds Ratio

Variables	B	Wald X^2-test	Odds Ratio	Lower	Upper
IHAS	-0.05	0.02	0.96	0.47	1.93
(Constant)	-0.69	8.33	0.5		

Note. Dependent variable, motivation to quit smoking; Key: IHAS, internalized HIV/AIDS stigma.

Table 16

Sequential Logistic Regression Analysis of Motivation to Quit Smoking as a Function of IHAS Controlling for Age (n = 142)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Age	0.04	4.15	1.04	1.0	1.08
	(Constant)	-2.63	7.47	0.07		
Block 2	Age	0.04	4.13	1.04	1.0	1.08
	IHAS	0.07	0.04	1.08	0.52	2.25
	(Constant)	-2.7	6.87	0.07		

Note. Dependent variable, motivation to quit smoking; Key: IHAS, internalized HIV/AIDS stigma

Table 17

Sequential Logistic Regression Analysis Exploring Depression as a Moderator Between IHAS and Nicotine Dependence (n = 140)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Depression	-0.27	0.36	0.77	0.32	1.84
	IHAS	0.14	0.17	1.15	0.59	2.25
	(Constant)	-0.27	1.26	0.76		
Block 2	Depression	-0.30	0.44	0.74	0.3	1.8
	IHAS	0.14	0.18	1.16	0.59	2.27
	Depression*IHAS	0.12	0.49	1.13	0.8	1.6
	(Constant)	-0.28	1.29	0.76		

Note. Dependent variable, nicotine dependence; Key: IHAS, internalized HIV/AIDS stigma; Depression was measured using PROMIS depression short form 8A T-scores that were transformed into an original variable (T-scores from 0-55 represented no depression (*n* = 163), 55.1-59.9 represented mild depression (*n* = 60), 60-64.25 represented moderate depression (*n* = 28), and over 64.26 represented severe depression (*n* = 36; Levin et al., 2015).

Table 18
Sequential Logistic Regression Analysis Exploring Depression as a Moderator Between IHAS and Motivation to Quit (n = 143)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Depression	-0.59	1.35	0.56	0.21	1.5
	IHAS	-0.03	0.01	0.97	0.48	1.97
	(Constant)	-0.6	5.81	0.55		
Block 2	Depression	-0.6	1.35	0.55	0.2	1.51
	IHAS	-0.07	0.04	0.93	0.46	1.91
	Depression*IHAS	-0.2	0.93	0.82	0.55	1.23
	(Constant)	-0.59	5.26	0.56		

Note. Dependent variable, motivation to quit smoking; Key: IHAS, internalized HIV/AIDS stigma; Depression was measured using PROMIS depression shortform 8A T-scores that were transformed into an original variable (T-scores from 0-55 represented no depression (*n* = 163), 55.1-59.9 represented mild depression (*n* = 60), 60-64.25 represented moderate depression (*n* = 28), and over 64.26 represented severe depression (*n* = 36; Levin et al., 2015).

Table 19

Depression as a Mediator in the Relationship Between IHAS and Smoking Status

		M			95% Confidence Interval for Odds Ratio			Y		
Antecedent		Coeff.	SE	*p*	Lower	Upper		Coeff.	SE	*p*
X (IHAS)	*a*	-0.06	0.13	0.66	-0.32	0.2	*c'*	-0.14	0.1	0.14
M (Depression)		---	---	---			*b*	0.05	0.04	0.25
Covariates										
Current marijuana use		0.21	0.15	0.16	-.08	0.51		-0.24	0.11	0.03
AIDS dx		-0.07	0.13	0.59	-.33	0.19		0.24	0.09	0.01
Constant	*i1*	0.85	0.21	<0.001	0.43	1.27	*i2*	1.4	0.16	<.001
		R squared= 0.01 F = 0.82, *p = 0.49*						R squared= F = 03.56,		

Note. Key: IHAS, internalized HIV/AIDS stigma, AIDS dx, AIDS diagnosis, SE, s
Coeff., coefficients; Depression was measured using PROMIS depression short fo
that were transformed into an original variable (T-scores from 0-55 represented no
163), 55.1-59.9 represented mild depression (n = 60), 60-64.25 represented moder
(n = 28), and over 64.26 represented severe depression (n = 36; Levin, 2015); PRO
unable to use a dichotomous version of Y variable, smoking status (current smok
smoker), therefore the categorical form of smoking status was used, which include
categories: current smoker (n = 145), former smoker (n = 85), and never smoker (r

Figures

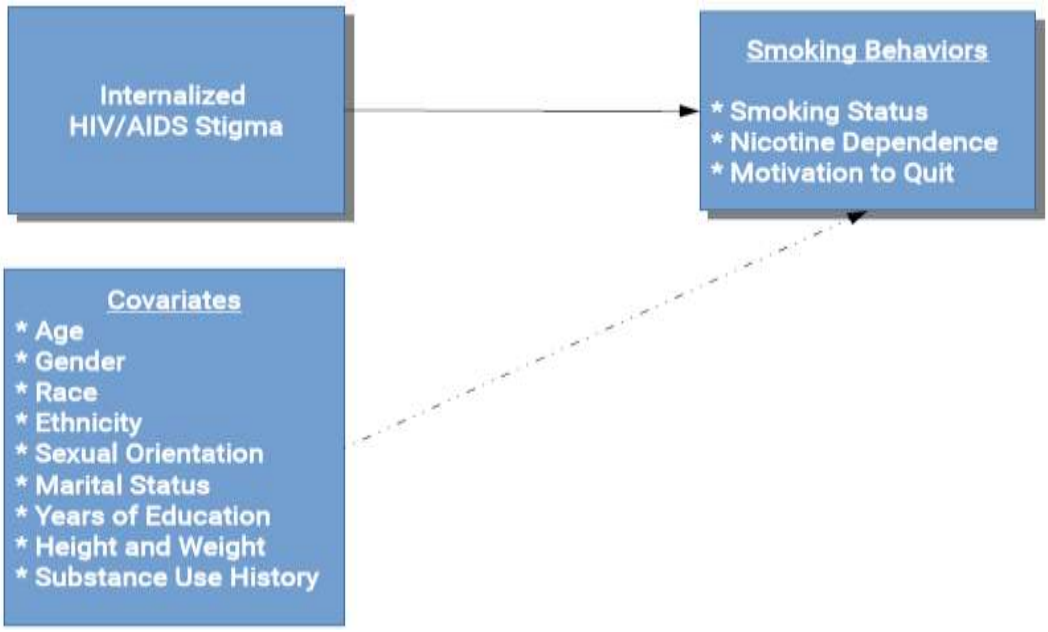

Figure 1. Overall model of IHAS as related to smoking behaviors in PLWHA

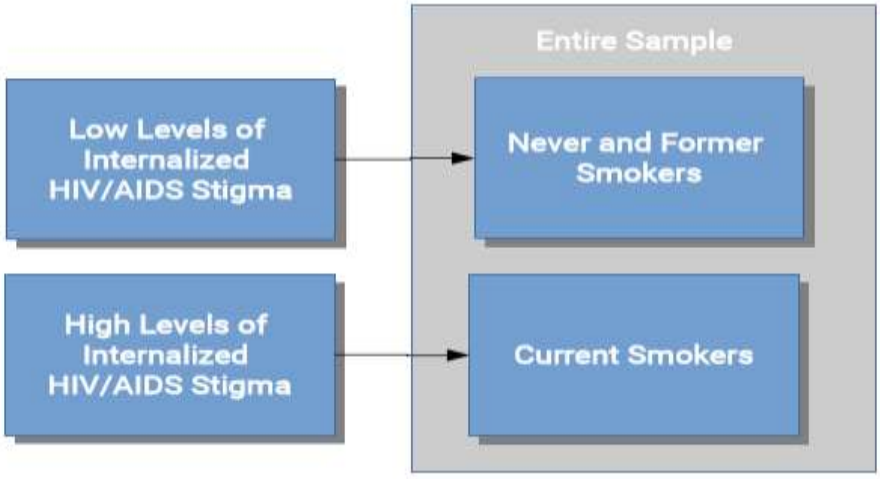

Figure 2. Primary aim 1: The relationship between IHAS and smoking status among PLWHA

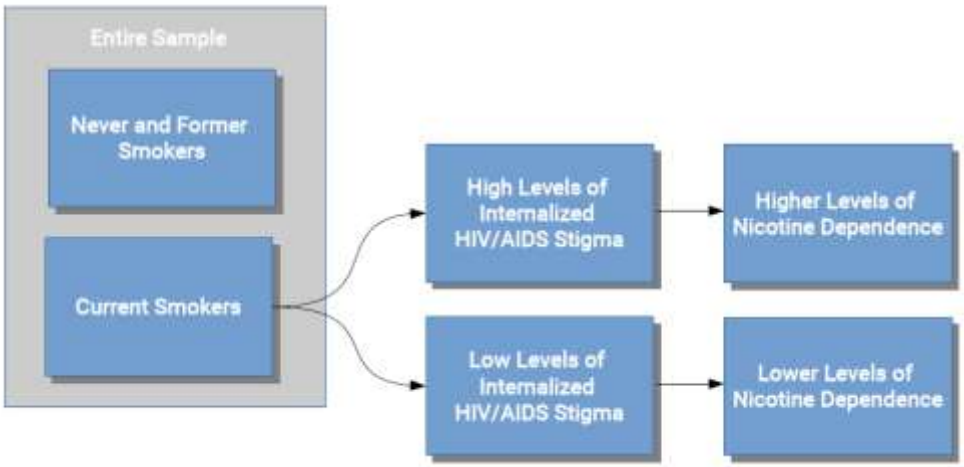

Figure 3. Primary aim 2: The relationship between IHAS and nicotine dependence among PLWHA who smoke

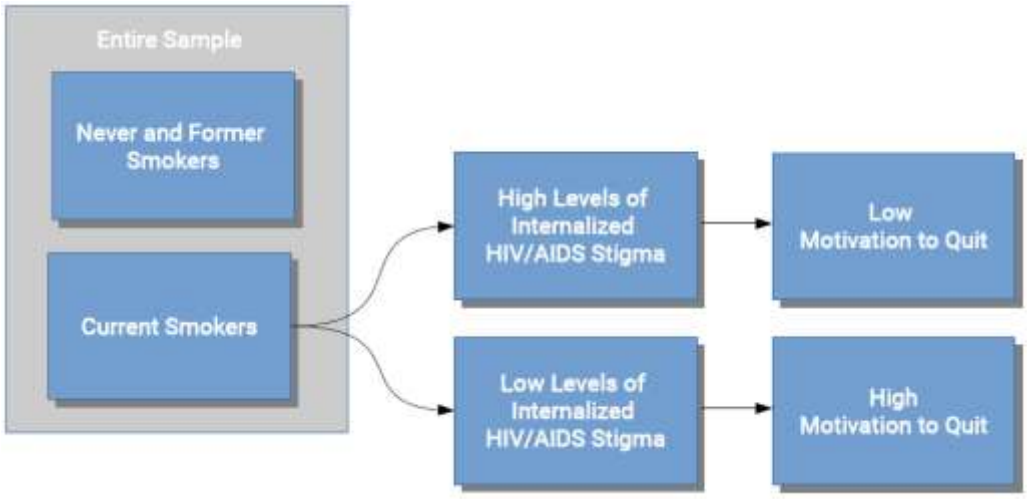

Figure 4. Primary aim 3: The relationship between IHAS and motivation to quit among PLWHA who smoke

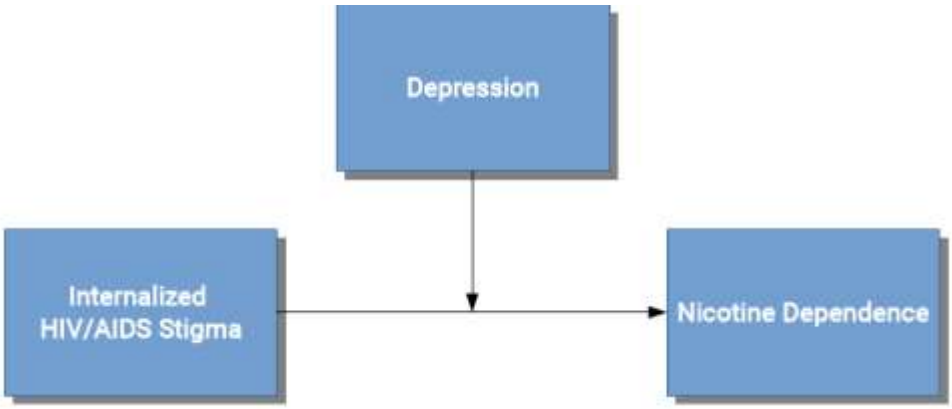

Figure 5. Exploratory aim 1: Depression as a moderator in the relationship between IHAS and nicotine dependence in PLWHA

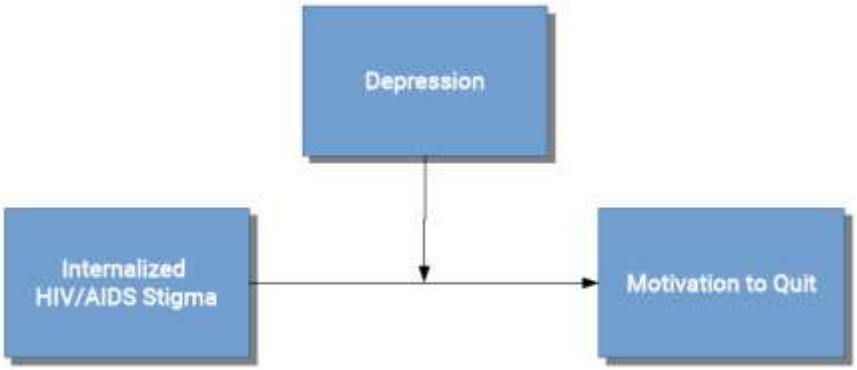

Figure 6. Exploratory aim 2: Depression as a moderator the relationship between IHAS and motivation to quit in PLWHA

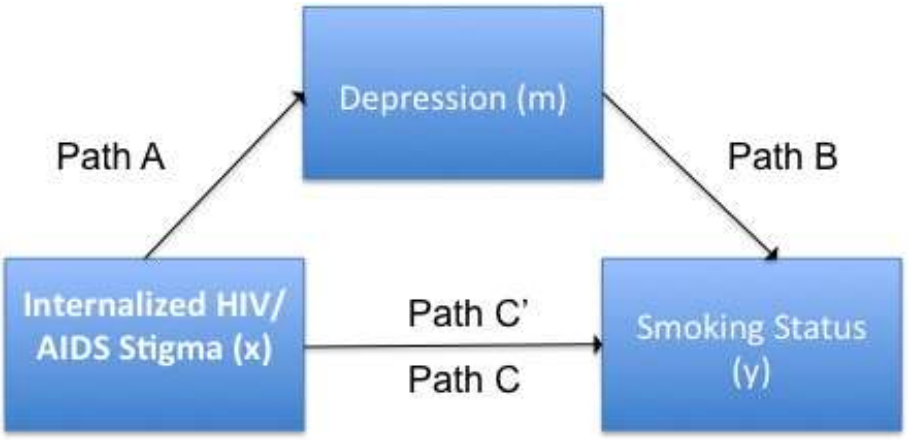

Figure 7. Exploratory aim 3: Depression as a mediator in the relationship between IHAS and smoking status.

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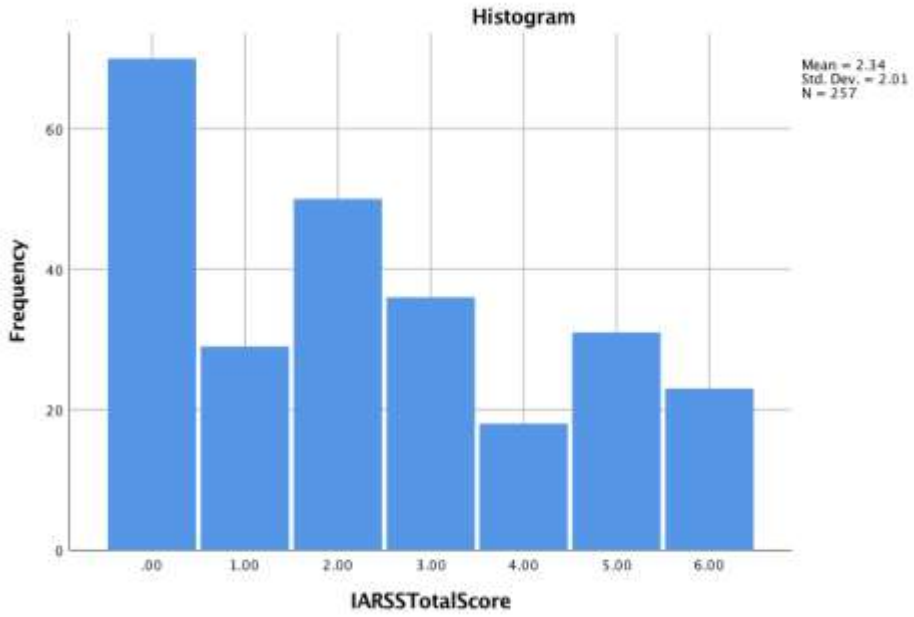
APPENDIX A

Supplemental Table 1.

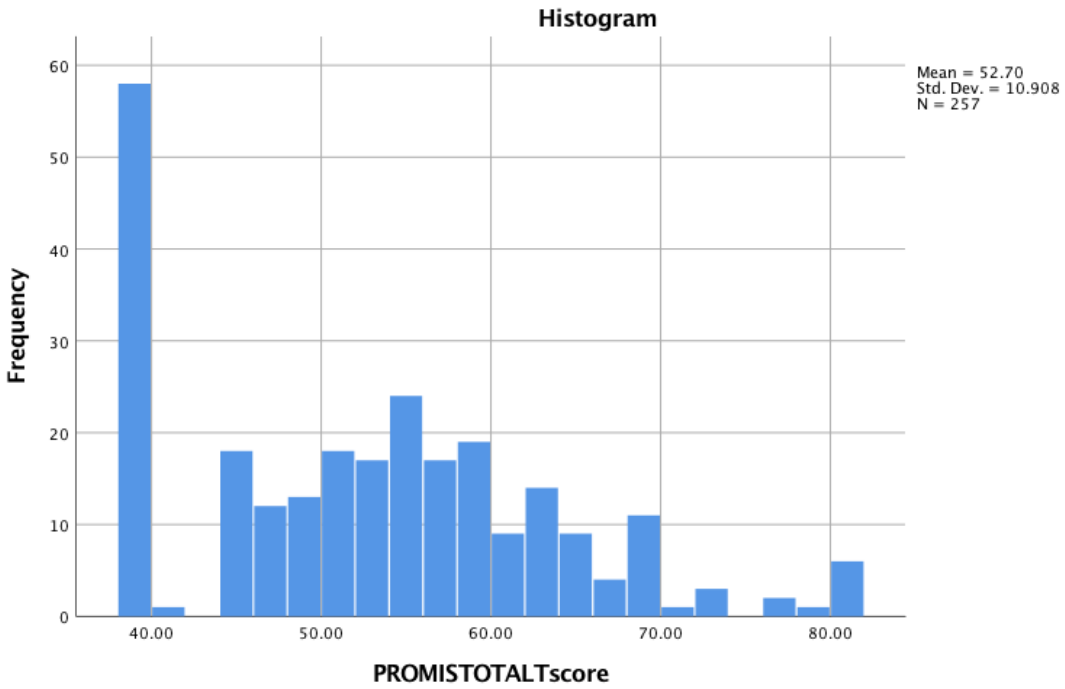
Skewness and Kurtosis of Main Continuous Variables for total sample

Variable (n)	Total Sample (*n* = 287)						
	Skewness		Kurtosis		Shapiro-Wilk Normality Test		
	Statistic	Standard Error	Statistic	Standard Error	Statistic	df	Sig.
Age (*n* = 286)	-0.71	0.15	-0.16	0.3	0.94	257	< 0.01
BMI (*n* = 284)	1.11	0.15	1.72	0.3	0.93	257	< 0.01
Years since HIV diagnosis (*n* = 263)	-0.05	0.15	0.11	0.3	0.98	257	< 0.01
IARSS total score (*n* = 284)	0.42	0.15	-0.31	0.3	0.94	257	< 0.01
PROMIS depression total score (*n* = 287	0.4	0.15	-1.07	0.3	0.89	257	< 0.01

Note. Key: IARSS, Internalized AIDS–Related Stigma Scale; Specific numbers for each variable lists the final analytic sample for that variable after pairwise deletion for missing data.



Supplemental Figure 1. Histogram of IARSS total scores for total sample (n = 287)



Supplemental Figure 2. Histogram of PROMIS depression short form 8A T-Scores for total sample (n = 284)

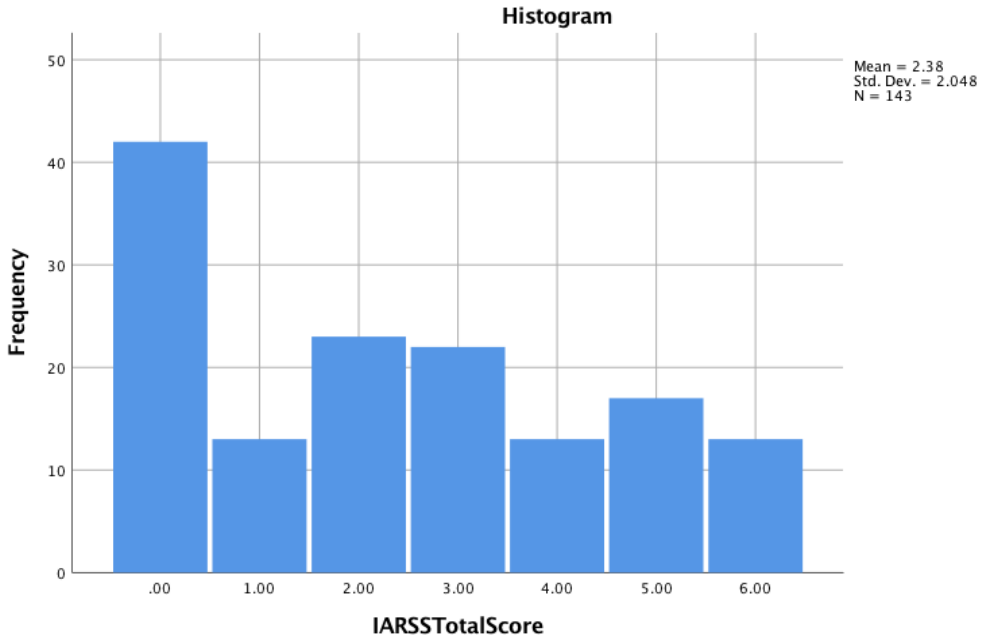
Appendix B

Supplemental Table 2.
Skewness and Kurtosis of Main Continuous Variables for Current Smokers

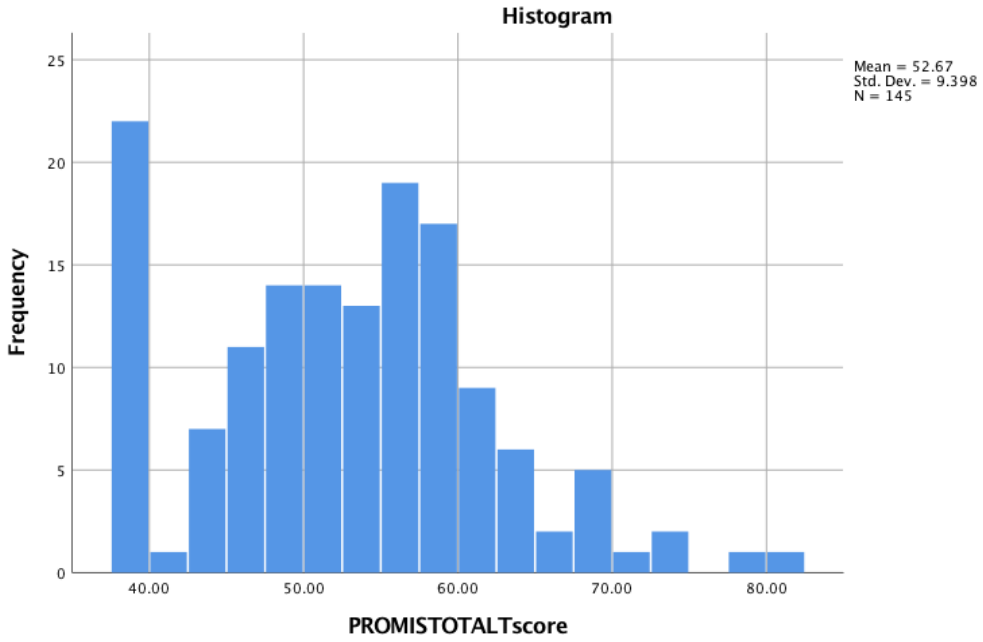
Variable (n)	Current Smokers (*n* = 145)						
	Skewness		Kurtosis		Shapiro-Wilk Normality Test		
	Statistic	Standard Error	Statistic	Standard Error	Statistic	df	Sig.
Age (*n* = 144)	-0.65	0.2	-0.24	0.4	0.95	144	< 0.01
BMI (*n* = 142)	1.78	0.2	4.82	0.4	0.87	142	< 0.01
Years Since HIV diagnosis (*n* = 133)	-0.38	0.21	-0.56	0.42	0.97	133	< 0.01
IARSS total score (*n* = 143)	0.32	0.2	-1.18	0.4	0.89	143	< 0.01
PROMIS depression total score (*n* = 145)	0.27	0.2	-0.11	0.4	0.97	145	< 0.01
CO level (*n* = 144)[a]	1.2	0.2	1.5	0.4	0.9	144	< 0.01
Smoking days per week (n = 129)[a]	-1.31	0.21	0.39	0.42	0.67	129	< 0.01
Cigarettes per day (n = 138)[a]	3.55	0.21	21.2	0.41	0.71	138	< 0.01
FTND total score (n = 142)[a]	0.05	0.2	-1.01	0.4	0.95	142	< 0.01
Contemplation Ladder (n = 144)[a]	-0.72	0.2	-0.09	0.4	0.88	144	< 0.01
TAAS Motivation to quit (n = 145)[a]	-0.34	0.2	-0.44	0.4	0.93	145	< 0.01

Note. Key: IARSS, Internalized AIDS–Related Stigma Scale FTND, Fagerström Test for Nicotine Dependence; Contemplation Ladder, a measure of motivation to quit smoking; TAAS, Thoughts About Abstinence Scale measuring desire, confidence, or motivation to quit smoking.

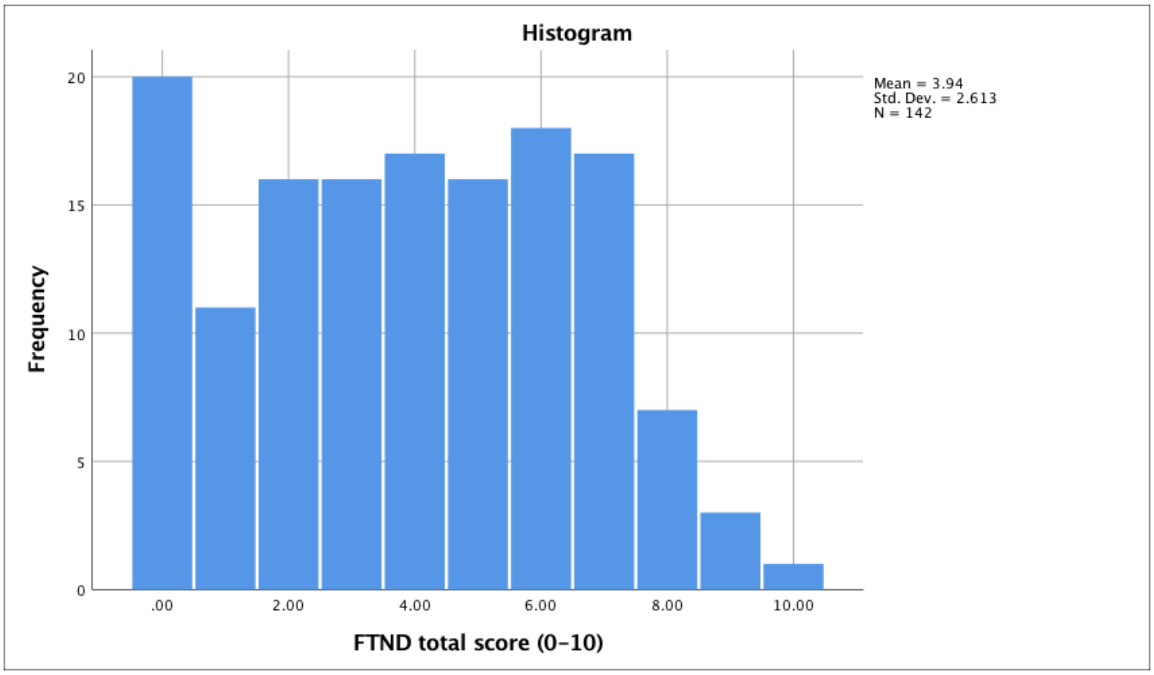
[a] These variables only include data from current smokers; Specific numbers for each variable lists the final analytic sample for that variable after pairwise deletion for missing data.



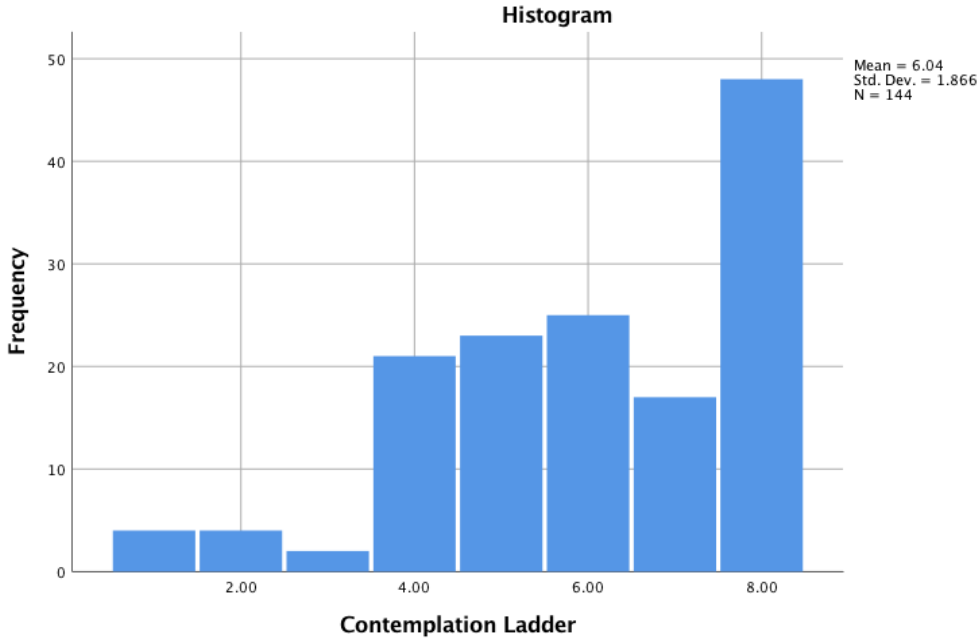
Supplemental Figure 3. Histogram of IARSS total scores for current smokers (n = 143)



Supplemental Figure 4. Histogram of PROMIS depression short form 8A T-Scores current smokers (n = 145)



Supplemental Figure 5. Histogram of FTND total scores for current smokers (n = 142)



Supplemental Figure 6.. Histogram of Contemplation Ladder scores for current smokers (n = 144)

Appendix C

Supplemental Table 3.

Sequential Logistic Regression Analysis of Smoking Status as a Function of IHAS Controlling for AIDS diagnosis and Lifetime Marijuana Use (n = 273)

					95% Confidence Interval for Odds Ratio	
Block	Variables	B	Wald X^2-test	Odds Ratio	Lower	Upper
Block 1	AIDS diagnosis	-0.53	4.66	0.59	0.363	0.95
	Lifetime marijuana use	-0.22	0.76	0.81	0.5	1.31
	(Constant)	0.39	3.32	1.48		
Block 2	AIDS diagnosis	-0.61	5.91	0.54	0.33	0.89
	Lifetime marijuana use	-0.15	0.36	0.86	0.53	1.41
	IHAS	0.55	4.64	1.74	1.05	2.88
	(Constant)	0.18	0.61	1.2		

Note. Dependent variable, smoking status; Key: IHAS, internalized HIV/AIDS stigma

Appendix D

Supplemental Table 4

Sequential Logistic Regression Analysis of Nicotine Dependence as a Function of IHAS Controlling for Years Since HIV Diagnosis (n = 128)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Years since HIV diagnosis	0.04	3.3	1.04	0.997	1.08
	(Constant)	-1.04	5.13	0.35		
Block 2	Years since HIV diagnosis	0.04	4.23	1.05	1.0	1.09
	IHAS	0.48	1.61	1.62	0.77	3.39
	(Constant)	-1.4	6.57	0.25		

Note. Dependent variable, nicotine dependence; Key: IHAS, internalized HIV/AIDS stigma.

Appendix E

Supplemental Table 5

Sequential Logistic Regression Analysis of Motivation to Quit Smoking as a Function of IHAS Controlling for Years Since HIV Diagnosis (n = 131)

Block	Variables	B	Wald X^2-test	Odds Ratio	95% Confidence Interval for Odds Ratio	
					Lower	Upper
Block 1	Years since HIV diagnosis	0.02	1.2	1.02	0.98	1.07
	(Constant)	-1.27	6.8	0.28		
Block 2	Years since HIV diagnosis	0.03	1.25	1.03	0.98	1.07
	IHAS	0.09	0.05	1.09	0.51	2.34
	(Constant)	-1.33	5.6	0.27		

Note. Dependent variable, motivation to quit smoking; Key: IHAS, internalized HIV/AIDS stigma.

Appendix F

Results of Analysis Using Continuous Variables

Preliminary Analyses

Participant recruitment and study sample. From 3/22/2017 through 4/19/2018, a total of 445 patients in the CPL waiting room were approached by RAs and asked if they wanted to participate in the study. 147 of the 445 CPL patients approached did not complete the study questionnaire ad reason's for study non-completion at this stage of recruitment included a) being not interested in study participation (N = 128) b) being non-English speaking (N = 41); and c) declining to participate after being read the consent form (N = 7). Additionally, after completing the consent form, three patients started to fill out the study packet but did not complete the packet for reasons including, lacking the time to complete the packet, walking away with the packet and not returning it, and being HIV negative. Please note, at this stage of study recruitment, some CPL patients did not complete the study for more than one reason (ex. some patients were both not interested in study participation and non-english speaking). In total, 298 patients completed the questionnaire. Of the 298 patients who completed the questionnaire, eleven were then excluded from the final analysis due to errors in reporting (i.e., disclosing they were HIV negative after completing the questionnaire, not reporting smoking status, leaving significant and essential information blank, or being non-English speaking). In total, 287 participants completed the questionnaire and were included in the final analysis.

Skewness and kurtosis. Descriptive statistics (e.g., means, medians, ranges, frequencies, skewness and kurtosis) and scatter plots were generated for every potential covariate and primary variable to evaluate if variables were normally distributed. For continuous variables, among the entire sample (N = 287), none were significantly skewed or kurtotic and parametric tests were conducted. Among the current cigarette smokers only sample (N = 145), BMI was non-normally distributed, with skewness of 1.75 (SE = 0.21) and kurtosis of 4.52 (SE = 0.43). Additionally, cigarettes smoked per day (CPD) was non-normally distributed among current smokers, with skewness of 3.55 (SE = 0.21) and kurtosis of 21.2 (SE = 0.41). Therefore, non-parametric tests were used when analyzing BMI and CPD.

Demographics, substance use and HIV characteristics among the full sample. Among the 287 participants, 43.9% were female (N = 126), the mean age was 50.6 years old, 55% of participants identified as Latino/a (N = 132), 52.9% of the sample identified as Black/African-American (N = 146), 57% of the sample reported being single (N = 163), the highest level of education completed was 9^{th}-11^{th} grade for 25.9% of the sample (N = 74), 72% of the sample identified as heterosexual (N = 204). With regards to HIV/AIDS related information, based on self report, the average years since HIV diagnosis was 19.8 years and 45% of the sample self-reported being diagnosed with AIDS (N = 126). With regards to substance use, more than half of the sample reported lifetime use of alcohol (71.4%) and marijuana (57.5%).

Demographics, substance use and HIV characteristics by smoking status. BMI was significantly higher among non-smokers ($p < 0.01$). Additionally, the amount of participants who self reported having and AIDs diagnoses was significantly higher among current

smokers compared to non-smokers ($p = 0.03$). With regard to substance use, the amount of participants who self reported having current use of marijuana ($p < 0.01$), cocaine ($p < 0.01$), and heroin ($p = 0.03$) was significantly higher among current smokers than non-smokers. No other variables varied significantly smoking status.

Cigarette Smoking Characteristics of Current Smokers. Regarding the smoking behaviors among the 145 participants who reported current cigarette smoking: the average number of days per week participants reported smoking cigarettes was 5.8 (SD = 1.2, range 1-7) and the average number of cigarettes smoked per day was 7.6 (SD = 7.1; range 0.5-60.0). 92.6 % (n = 125) of current smokers reporting smoking at least 100 cigarettes in their lifetime. The average level of nicotine dependence was 3.9 (SD = 2.6, range 0-10), indicating mild dependence. Participants reported a moderate level of motivation to quit smoking and were in the contemplation stage (contemplation ladder, M = 6.1, SD = 1.9, range 1-8) and desire to quit smoking (M = 6.6, SD = 2.8). Participants had average score on confidence in their ability to quit was 6 (SD = 2.6, range, 1-10).

IHAS characteristics by smoking status. Regarding the item level frequency data for the IARSS Scale by smoking status, χ^2 tests were computed between individual IARSS items and smoking status (current smoker versus non-current smoker). The number of participants within each smoking status did not differ significantly for items one through four. However, for item five, "I sometimes feel worthless because I am HIV positive," current smokers were significantly more likely to answer yes to the item compared to non-current smokers , χ^2 (1, N = 287) = 6.73, $p < 0.01$. Additionally, for item six, "I hide my HIV status from others,"

non-current smokers were significantly more likely to answer yes to the item compared to current smokers χ^2 (1, N = 287) = 4.28, p = 0.04.

Primary Aim 1. To examine the relationship between IHAS and smoking status among PLWHA.

A direct logistic regression analysis was performed to assess the ability of the IHAS level (IARSS total score) to predict smoking status (current cigarette smoker versus non current cigarette smoker). After listwise deletion of three cases with missing values on IARRS total score, 284 of 287 participants were included in the analysis, with 143 current cigarette smokers, and 141 non-current cigarette smokers. Omnibus Tests of Model Coefficients showed no significant improvement over the baseline model X^2 (1, N = 284) 0.37, p=0.54. However, the Hosmer-Lemeshow Goodness of Fit Test showed support for the model X^2 (5, N = 284) 5.38, p = 0.37. Cox & Snell R Square (0.001) and the Nagelkerke R Square (0.002) values suggested that between 0.1% and 0.2% of the variability was explained by the model. On the basis of IARSS total score alone correction classification rates were 61.5% for current cigarette smokers and 39.7% for non-current cigarette smokers; the overall correct classification rate was 50.7%. According to the Wald Criterion IARRS total score did not significantly predict smoking status X^2 (1, N = 284) =0.37, p = 0.54.

A sequential logistic regression was then run to assess the ability of the IHAS level (IARSS total score) to predict smoking status (current cigarette smoker versus non current cigarette smoker) controlling for the influence of relevant covariates that were significantly correlated with IARSS score for the total sample determined from the preliminary analysis. Due to limitations in missing data, this analysis was not fully powered to detect a significant

effect.

Block one included relevant covariates of age, and years since HIV diagnosis, current marijuana use and lifetime cocaine use. Initially, ethnicity was found to be significantly related to IARSS total score, however, multicollinearity was found between the variables of ethnicity and lifetime cocaine use using chi-square tests ($p = 0.01$) therefore ethnicity was dropped from analysis. Block two included the addition of the independent variable of interest, IARSS total score. After listwise deletion of participants missing values for IARRS total score (missing N=3), age (missing N = 1), years since HIV diagnosis (missing N = 24), lifetime cocaine use (missing N = 1), and current marijuana use (missing N = 2), the total sample included in the analysis consisted of 258 participants.

In block 1, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model X^2 (4, N=258) 015.53, p<.01. The Hosmer-Lemeshow Goodness of Fit Test showed support for the model X^2 (8, N=258) =9.75, p=0.28. Cox & Snell R Square (0.06) and the Nagelkerke R Square (0.08) values suggested that between 6% and 8% of the variability was explained by the block 1 model. After the addition IARSS total score in block two, the Omnibus Tests of Model Coefficients showed significant improvement over the baseline model X^2 (5, N=258) 15.974 p<0.01. However, there was no significant improvement over block 1 X^2 (1, N=258) =0.45, p=0.5. Hosmer-Lemeshow Goodness of Fit Test showed support for the model X^2 (8, N=258) 7.81, p=0.45. Cox & Snell R Square (0.06) and the Nagelkerke R Square (0.08) values remained the same and suggested that between 6% and 8% of the variability was explained by the Block 2 model.

In block one, which included the four covariates, correction classification rates were

55.0% for current cigarette smokers, 63.6% for non-current cigarette smokers, and 59.3% for the overall correct classification rate. After controlling for the covariates in Block 2, with the addition of IARSS total score, correction classification rates slightly improved and were 56.6% for current cigarette smokers and 65.1% for non-current cigarette smokers; the overall correct classification rate was 60.9%.

In the block one model, according to the Wald criterion, age significantly predicted smoking status X^2 (1, N=258) 4.3, p = 0.04, B = -0.03, OR = 0.97, 95% CI = 0.95 -0.998. For a one-unit increase in age, the odds of someone being a current smoker decreased by 0.97. Additionally, current marijuana use significantly predicted smoking status X^2 (1, N=258) 5.11, p=0.02., B=0.71, OR=2.04, 95% CI= 1.2 – 3.77. The odds of a person being a current cigarette smoker was 2.04 times higher for someone who reported current marijuana use than for a person who reported no current marijuana use. No other variables significantly predicted smoking status in block one. In block two, after the addition of IARSS total score, according to the Wald Criterion IARRS total score did not significantly predict smoking status X^2 (1, N=258) = 0.45, p=0.5. Age and current marijuana use significantly predicted smoking status (ago, X^2 (1, N=258) 4.4, p = 0.04, B=-0.03, OR=0.97, 95% CI= 0.94 -0.998; Current marijuana use, X^2 (1, N=258) 4.63, p = 0.03., B=0.68, OR=1.98, 95% CI= 1.06 – 3.68.). For a one-unit increase in age, the odds of someone being a current smoker decreased by 0.97. Additionally, the odds of a person being a current cigarette smoker was 1.98 times higher for someone who reported current marijuana use than for a person who reported no current marijuana use. No other variables significantly predicted smoking status in the final model.

Primary Aim 2: To examine the relationship between IHAS and ND.

A direct linear regression was conducted to determine if internalized stigma score using IARRS total score, significantly predicted nicotine dependence, using the FTND total score. The independent variable of IARSS total score was entered into the model explaining 0.1% of the variance of nicotine dependence $F(1, 138) = 0.18$, $p = 0.67$. IARSS score did not make a significant contribution to the variance in nicotine dependence ($\beta = 0.04$, $p = 0.67$).

A hierarchical regression was conducted to determine if internalized stigma score using IARRS total score, significantly predicted nicotine dependence, after controlling the influence of relevant covariates that were significantly correlated with IARSS score for the current cigarette smokers. Block one of this analysis included the covariates of age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use. Block 2 included the addition of IARRS total score.

The covariates of age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use were entered into the model at block 1, explaining 24% of the variance of nicotine dependence $F(5, 99) = 6.4$, $p < .001$. After entry of IARSS total score into the model at block 2, the total variance explained by the model as a whole was 25%, $F(6, 98) = 5.3$, $p<.001$. IARSS total score explained an additional 0.1% of the variance in nicotine dependence, after controlling for age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use R^2 change =0.001, F change (6, 98) =0.12, p=0.73. IARSS score did not his is a make a significant contribution to the variance in nicotine dependence. In the final model, only smoking days per week ($\beta = 0.45$, $p<.001$) and years since HIV diagnosis ($\beta = 0.27$, p=0.01) were statistically significant.

Independent-samples t-tests were conducted to compare the FTND scores for smokers who answered yes versus smokers who answered no, to the six individual IARSS items, which were in binary (yes/no) format. For item five, "I sometimes feel worthless because I am HIV positive," there was a significant difference in scores for smokers who answered yes (M = 4.64, SD = 2.45) and smokers who answered no, to the item [M=3.59, SD=2.61; t (140)=-2.29, p = 0.02. The magnitude of the differences in the means was small to moderate (eta squared=0.04). Participants who answered yes to item five had significantly higher levels of nicotine dependence than those who answered no to the item. There were no significant differences in FTND scores for smokers who answered yes versus no for any of the additional IARSS items.

Primary Aim 3: To examine the relationship between internalized HIV/AIDS stigma and motivation to quit.

A direct linear regression was conducted to determine if internalized stigma score using IARRS total score, significantly predicted motivation to quit smoking, using the Contemplation Ladder score. The independent variable of IARSS total score was entered into the model explaining <0.01% of the variance of motivation to quit $F(1, 141) = 0.001$, $p = 0.97$. IARSS score did not make a significant contribution to the variance in motivation to quit smoking ($\beta = 0.08$, p=0.97).

A hierarchical regression was conducted to determine if internalized stigma score using IARRS total score, significantly predicted motivation to quit smoking, after controlling the influence of relevant covariates that were significantly correlated with IARSS score for the current cigarette smokers. Block one of this analysis included the covariates of age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use.

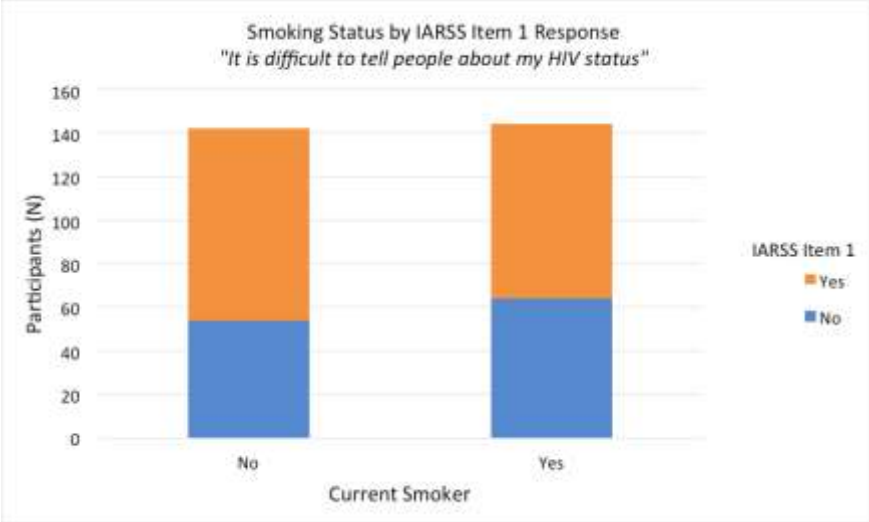
Block 2 included the addition of IARRS total score.

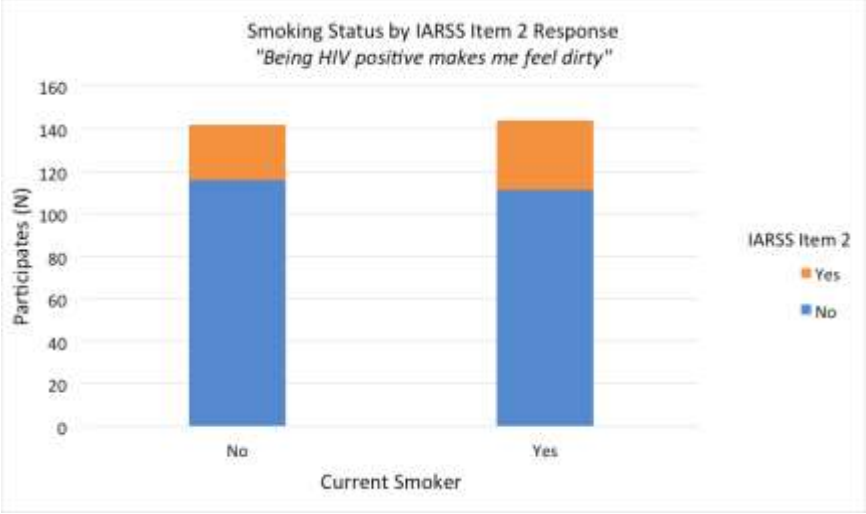
The covariates of age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use were entered into the model at block 1, explaining 14.6% of the variance of nicotine dependence $F(5, 99) = 3.38$, $p < 0.01$. After entry of IARSS total score into the model at block 2, the total variance explained by the model as a whole was 15.7%, $F(6, 98) = 3.05$, $p < 0.1$. IARSS total score explained an additional 1.1% of the variance in motivation to quit, after controlling for age, ethnicity, years since HIV diagnosis, smoking days per week, and current marijuana use R^2 change =0.001, F change (6, 98) = 1.13, p = 0.25. IARSS score did not his is a make a significant contribution to the variance in motivation to quit. In the final model, only smoking days per week ($\beta = -0.37$, $p < .001$) and ethnicity ($\beta = 0.2$, $p = 0.045$) were statistically significant.

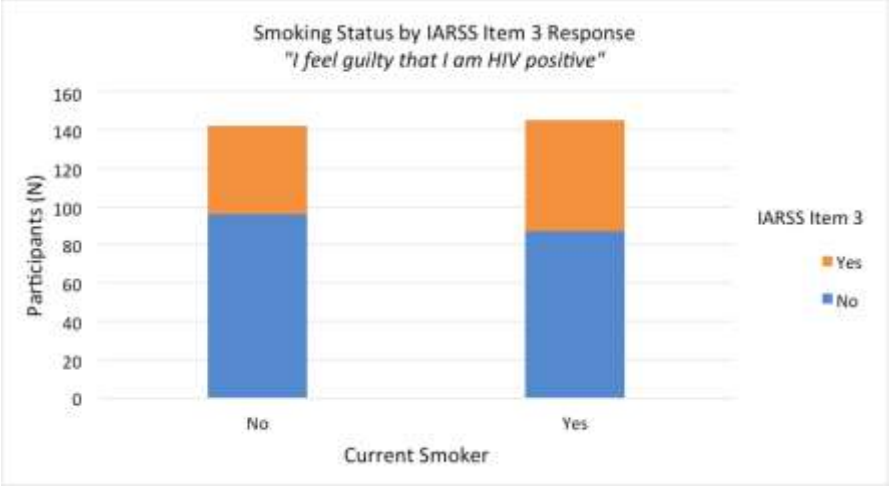
Independent-samples t-tests were conducted to compare the Contemplation Ladder scores for smokers who answered yes versus smokers who answered no, to the six individual IARSS items. There was no significant difference in scores for smokers who answered yes versus no for any of the IARSS items.

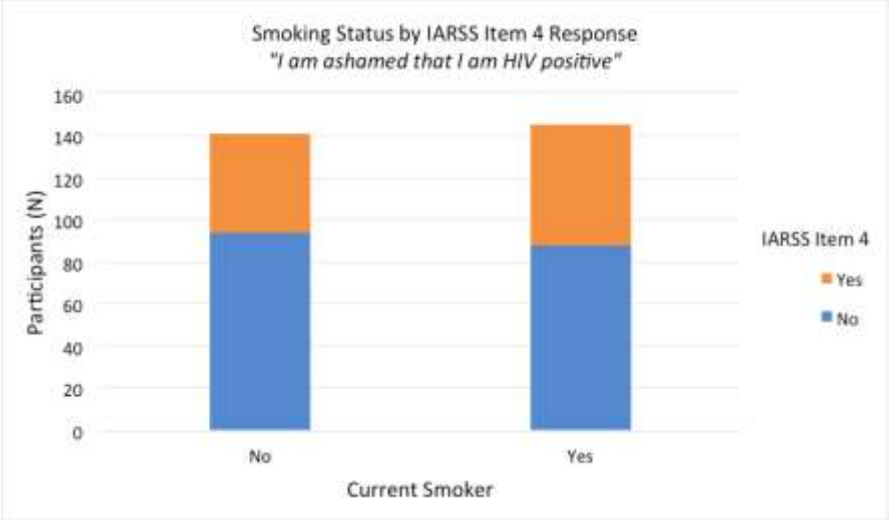
APPENDIX G

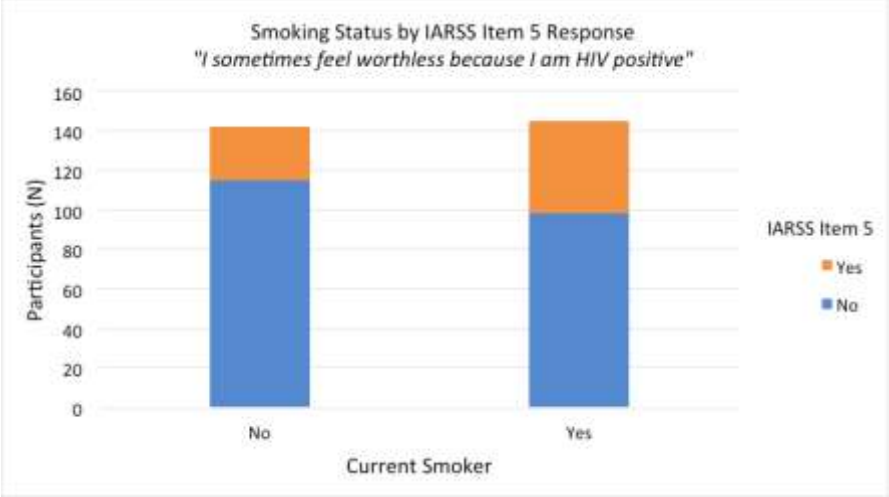
Bar Graphs Representing Individual IARSS Item Responses by Smoking Status

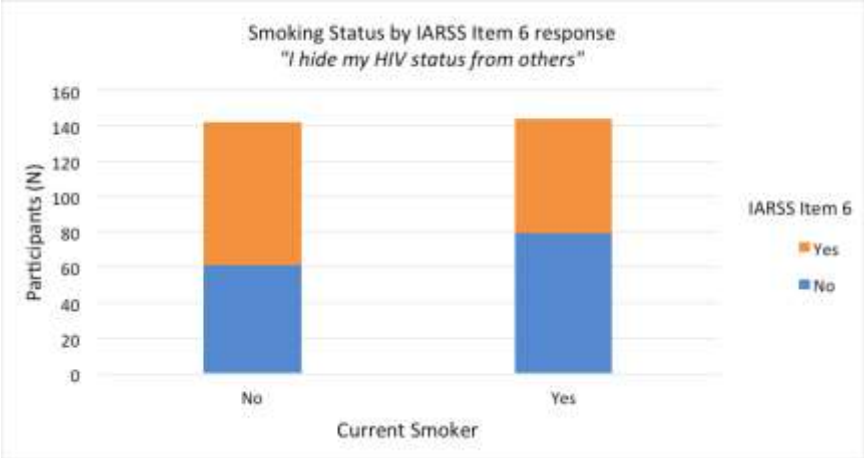





Smoking Status by IARSS Item 3 Response
"I feel guilty that I am HIV positive"
Participants (N)
160
140
120
100
80
60
40
20
0
No
Yes
Current Smoker
IARSS Item 3
Yes
No


Smoking Status by IARSS Item 4 Response
"I am ashamed that I am HIV positive"
Participants (N)
160
140
120
100
80
60
40
20
0
No
Yes
Current Smoker
IARSS Item 4
Yes
No


Smoking Status by IARSS Item 5 Response
"I sometimes feel worthless because I am HIV positive"
Participants (N)
160
140
120
100
80
60
40
20
0
No
Yes
Current Smoker
IARSS Item 5
Yes
No


Smoking Status by IARSS Item 6 response
"I hide my HIV status from others"
Participants (N)
160
140
120
100
80
60
40
20
0
No
Yes
Current Smoker
IARSS Item 6
Yes
No