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The association between lifetime polytobacco use and intention to quit among HIV-positive cigarette smokers

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Abstract

Background: This secondary analysis aims to describe, over time, the relationship between HIV disease progression and intention to quit cigarette smoking among current monocigarette users with and without a lifetime history of polytobacco use.

Methods: Participants completed a baseline assessment at the time of HIV care initiation and four follow-up assessments (3, 6, 9, and 12-months). Assessments included biochemically verified smoking status and audio computer-assisted self-interviews assessing psychosocial, substance use, and clinical variables known to influence smoking behaviors. Using linear and generalized linear fixed-effects models, we modeled the covariance structure for the repeated outcome measures (intention to quit and 7-day point prevalence smoking abstinence) across the study time points and included a three-way interaction term to examine the effects of disease stage and tobacco product use.

Results: Participants (N = 357) were 73.1% male, 67.3% black/African American, and had a mean (SD) age of 38.7 (10.6) years. At baseline, lifetime polytobacco users reported significantly worse HIV-related symptoms and burdens, illness perception, social support, and nicotine dependence. Intention to quit, but not smoking abstinence, was predicted by a three-way interaction between time from HIV care initiation, disease progression, and tobacco product use ($p = .04$). Overall, progressive HIV was associated with greater intention to quit smoking cigarettes. However, the relationship differed over time between the two tobacco product groups.

Conclusion: Future studies should consider tailoring the timing of cessation interventions upon disease stage and lifetime history of polytobacco use.

Keywords

Tobacco; Smoking cessation; Polytobacco use; HIV/AIDS; Disease progression

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Contributors

All authors of this manuscript have directly participated in the design and/or execution of the study, and all have read and approved the final version submitted.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.drugalcdep.2018.05.007>.

Conflict of interest

No conflict declared.

1. Introduction

With the advent of antiretroviral (ARV) therapy, the effects of HIV pose a much smaller threat to mortality (Hessol et al., 2000; Lloyd-Smith et al., 2006). Scholars now attribute the majority of deaths among people living with HIV/AIDS (PLWH) to health risk behaviors, such as smoking (Helleberg et al., 2015). Among those adhering to ARV, the negative impact of smoking upon life expectancy is two times greater than HIV-related factors (Reddy et al., 2016). This is of major concern as nearly 54% of PLWH are reported to smoke cigarettes in the United States compared to 19% in the general population (Park et al., 2016; Mdodo et al., 2015; Pacek et al., 2014). Recent work also reveals a disproportionate prevalence of polytobacco use among PLWH in comparison to the broader population, yet minimal literature is available on HIV-positive polytobacco users (Pacek et al., 2016a,b).

Polytobacco users, defined by concurrent use of multiple tobacco products, face unique challenges and complex risks in reaching cessation in comparison to monocigarette users: those who have only used cigarettes in their lifetime (Klesges et al., 2011; Mumford et al., 2005; Teo et al., 2006). Increased risks associated with cigarette smoking patterns of polytobacco users, such as not quitting and increased consumption, may additively affect morbidity and mortality among PLWH (Vidrine, 2009; Bombard et al., 2007; Wetter et al., 2002). Although multiple studies indicate the impact of cigarette smoking upon mortality are greatly reduced when cessation is reached early in life, little literature addresses cessation interventions in the early years of HIV (Helleberg et al., 2015, 2014). Collectively, the literature discussing early cessation interventions among PLWH and heightened cessation barriers among polytobacco users emphasizes the need to characterize polytobacco users at the time of HIV diagnosis (Pool et al., 2016; Pacek and Cioe, 2015).

PLWH face barriers to cigarette smoking cessation. Characteristics of populations affected by HIV infection (e.g., substance users and gay and bisexual men) may partially explain the high cigarette smoking relapse rate of PLWH (Richter and Arnsten, 2006). Smoking populations predisposed for HIV and HIV-positive smokers often report demographic (education, race/ethnicity, work status) and psychosocial characteristics (e.g., depression, nicotine dependence, and low social support) associated with cigarette smoking and relapse (Gruskin et al., 2007; Reynolds, 2009). Despite these characteristics, HIV-positive smokers are receptive to quitting smoking and motivated (Lauder et al., 2006; Wilhelm et al., 2006). In fact, intention to quit smoking may increase upon the onset of HIV or an advancement in disease progression. Our previous work (Vidrine et al., 2017) observed increased intention to quit and abstinence among HIV-positive cigarette smokers with advanced disease stage, in comparison to those with no advanced HIV, at three and six-month post-diagnosis follow-ups. This research suggests that events/stages of HIV may serve as a teachable moment, defined as an event that can prompt individuals to adopt risk-reducing behaviors. Cessation interventions tailored to the teachable moment model may promote successful cessation among PLWH (Vidrine et al., 2017).

In comparison to HIV-positive monocigarette users, or cigarette-only users, HIV-positive polytobacco users have greater difficulty in reaching cigarette smoking cessation, even when intensive treatment is provided (Tamí-Maury et al., 2013). Moreover, the prevalence of risk

factors associated with cigarette smoking is elevated among HIV-positive polytobacco users compared to HIV-positive monocigarette users (Pacek et al., 2016a,b). Although our previous work describes the role of disease progression and markers of cessation, no known research utilizes a teachable moment model to describe the relationship between disease progression and cessation among newly diagnosed HIV-positive polytobacco users.

To address this gap, this secondary analysis aims to examine the relationship between HIV disease status, lifetime history of tobacco product use (monocigarette or polytobacco users) and cigarette smoking outcomes (intention to quit and 7-day smoking abstinence), over a one-year time period. It was hypothesized that the interaction of lifetime tobacco product use, disease status, and time from HIV diagnosis would predict intention to quit smoking cigarettes and 7-day point prevalence smoking abstinence. In concordance with our past work, we expected advanced disease status to elevate intention to quit smoking cigarettes and cessation rates. Furthermore, we expected intention to quit, and cessation rates among HIV-positive polytobacco users would trend downward from the initiation of care. Lastly, our post-hoc explorative analysis was hypothesized to demonstrate that patterns of intention to quit smoking cigarettes among lifetime polytobacco users will be distinctly unique from that of HIV-positive monocigarette users.

2. Methods

The parent study, Project STATE, explored the potential of HIV-related events to serve as teachable moments for cigarette smoking cessation. In the parent study, 378 HIV-positive cigarette smokers were recruited from Thomas Street Health Center (TSHC), a large, safety net HIV clinic in Houston, Texas. New TSHC patients who were initiating HIV care (confirmed via electronic medical record review) were recruited if the following criteria were met: 1) smoked 100 or more cigarettes in their lifetime; 2) smoked every day or most days; 3) spoke English or Spanish; and 4) deemed eligible by their physician. Infectious disease physicians at TSHC could exclude individuals on the premise that the study may exacerbate existing medical or psychiatric conditions. Eligible participants provided written consent for the study. For each visit completed, participants received a \$25 gift card. The University of Texas MD Anderson Cancer Center Institutional Review Board and The University of Texas Health Science Center at Houston Committee for the Protection of Human Subjects approved all study-related activities and provided oversight. Additional details about the study have been previously published (Vidrine et al., 2014a,b).

During baseline assessments, participants completed audio computer-assisted self-interviews (ACASI) and biochemical breath verification of carbon monoxide levels. The ACASI contained programmed logic checks and skip patterns.

Follow-up assessments coincided with clinic appointments at 3, 6, 9, and 12-months after baseline. Follow-up assessments replicated the baseline assessment, except for the shortening of the ACASI to reduce unnecessary repetition. Procedures to reduce attrition included: 1) reminder phone calls/text messages, 2) offering follow-up assessments on different days/times, and 3) obtaining the contact information of at least three friends/relatives.

3. Measures

3.1. Dependent variables

Outcomes of interest include intention to quit smoking cigarettes and 7-day point prevalence smoking abstinence. Intention to quit smoking cigarettes was determined by the following item, “*Do you plan to quit smoking?*” Responses are structured on a 7-point scale, ranging from definitely no to definitely yes. Responses approaching seven demonstrate a greater intention to quit smoking cigarettes (Sutton, 1998). The determination of 7-day smoking abstinence was based on the Society for Research on Nicotine and Tobacco recommendations (SRNT Subcommittee on Biochemical Verification, 2002). Participants who reported not smoking cigarettes (not even a single puff) in the past 7-days and provided an expired carbon monoxide level of less than 7 ppm were considered abstinent.

3.2. Independent variables

Predictors of interest include time from HIV care initiation, HIV disease progression, and tobacco product use. Time from HIV care initiation was estimated by time point of assessment (e.g., time of treatment initiation, 3-months post-initiation, 6-months post-initiation, 9-months post-initiation, and 12-months post-initiation). Participants’ CD4 counts and HIV-related illnesses were extracted from electronic health records after every time point of assessment. Advanced disease was defined by the CDC disease staging system, which states advanced HIV to occur with the emergence of an HIV-related illness or a CD4 cell count drop below 200 cells/ul (Center for Disease Control and Prevention, 2014). The following item was used to determine lifetime tobacco product use, “*Have you ever used forms of tobacco other than cigarettes?*”. Participants who responded “*Yes*” and had used other tobacco products > 5 times were classified as lifetime polytobacco users, while participants who responded “*No*” were classified as lifetime monocigarette users. To characterize the specific tobacco products used in addition to combustible cigarettes, lifetime polytobacco users were asked “*What other forms of tobacco do you use?*”.

3.3. Covariates

Covariates of interest include demographic, substance use, and psychosocial variables. Demographic variables include items on age, sex, employment, race/ethnicity, education, and route of HIV transmission. Substance use variables include alcohol dependence and nicotine dependence. Alcohol dependence was assessed with the Alcohol Use Disorder Identification Test (Babor et al., 1989). Nicotine Dependence was assessed with the 6-item Fagerstrom Test for Nicotine Dependence (Heatherton et al., 1991). Psychosocial variables include depressive symptoms, affect, illness perception, and social support. Depressive symptoms were assessed with the Center for Epidemiologic Studies Depression scale (Raldoff, 1977). Affect was assessed with the Positive Affect and Negative Affect Scale (Watson et al., 1988). Social support was assessed with the 12-item Interpersonal Support Evaluation List (Cohen et al., 1985).

3.4. Statistical analysis

Descriptive and bivariate analysis characterized and assessed differences based on lifetime polytobacco use history. To assess the associations between HIV disease status (advanced vs. not-advanced), tobacco use and intention to quit smoking at each time point, unadjusted linear regression was used. Similarly, unadjusted logistic regression evaluated the associations between disease status and smoking abstinence at each follow-up time point. Linear and generalized linear fixed-effects models in the MIXED and GLIMMIX procedures in SAS 9.4 (SAS Institute, North Carolina) examined the relationship between HIV status, tobacco use and intention to quit across the study time points and model the covariance structure for the repeated outcome measures. We introduced a three-way interaction term to allow the effect of HIV disease status to vary across the time points differently depending on lifetime polytobacco use status and accounted for demographic and psychosocial variables, identified as follows (Fitzmaurice et al., 2011). Each covariate was assessed in univariate models and then associated variables ($\alpha = 0.2$) were included in a multivariable model which was reduced to the final model using backward selection. This final model included those covariates found to be significantly associated with the smoking outcome ($\alpha = 0.05$) or to alter the main relationship of interest by more than 20% when excluded. This final model was used to evaluate the associations between disease status, lifetime polytobacco use, and intention to quit smoking by obtaining the difference between the adjusted mean (least square mean estimate) in those with advanced HIV disease and those with stable HIV disease in monocigarette and polytobacco users at each time point. The same analyses were then repeated wherein 7-day smoking abstinence replaced intention to quit as the outcome variable.

Missing rates for intention to quit and 7-day smoking abstinence ranged from roughly 25% to 53% throughout the duration of the study. Additionally, the proportion of missingness was unbalanced across participants with advanced vs. not advanced HIV, which has the potential to result in an overestimation of the effect of disease status on smoking-related outcomes (Blankers et al., 2016). Multiple methods were employed to reduce the nonresponse bias in our analysis, including analysis of available data, intention to treat (in which missing 7-day smoking abstinence values are coded as smoking), and sequential multiple imputation (SMI; Rubin, 1987; Raghunathan et al., 2001; Zhu and Raghunathan, 2015). Our primary approach was SMI. First, for each item with missing data, we identified covariates which significantly predicted the variable or its missingness. Identified covariates were then assessed for collinearity and then stepwise regression was used to identify the set of covariates to be included in the SMI for each variable. Linear regression models were used to impute intention to quit, with values restricted between 1 and 7, and then the imputed values were rounded to integers. Seven-day smoking abstinence rates were imputed using logistic regression models. We generated 40 imputed values for each missing item, then used Rubin's rule to combine the parameter estimates which takes into account both the within- and between-imputation variance (Rubin, 1987).

4. Results

4.1. Sample characteristics

Of the 504 eligible individuals, 403 (74.6%) consented to participate in the study. Of the 403 participants, 25 dropped out at baseline. Due to limited information pertaining to polytobacco use, 22 participants were excluded from this secondary analysis. This resulted in a final sample size of 357 participants. Participation rates were 76% (288), 58% (220), 52% (197), and 61% (229) at 3, 6, 9, and 12-month follow-ups (See Supplemental Table 1). Rates of ARV non-adherence was reasonably low throughout the 12-month follow-up period, ranging from approximately 13% at month 3 to 16.5% at month 12 (Chesney et al., 2000). Participants ($n = 357$) were primarily male (71.4%; $n = 255$), Black (67.5%; $n = 241$), single/not living with a significant other (82.0%; $n = 294$) and reported a mean age of 38.7 (± 10.5) years. The sample predominantly reported a high school education or less (71.2%; $n = 269$) and not working (80.4%; $n = 304$). Most participants reported acquiring HIV through either heterosexual (42.6%; $n = 152$) or homosexual (39.8%; $n = 142$) contact. On average, participants reported starting smoking cigarettes at the age of 18.2 (± 12.2), smoking for the past 16.4 (± 10.6) years, and a nicotine dependence of 4.2 (± 2.4). The majority of the sample reported living with a smoker (55.2%).

Of the sample, 26.0% ($n = 93$) reported lifetime polytobacco use. Of polytobacco users, 57.9% ($n = 53$) preferred using cigars as their other tobacco product of choice. Cigarillos and electronic cigarettes were equally preferred among polytobacco users (13.0%; $n = 12$). Lastly, snuff and chew were preferred by 9.7% ($n = 9$) and 4.3% ($n = 4$) of polytobacco users. Polytobacco users significantly differed from monocigarette users in HIV-related symptoms/burdens, illness perception, social support, illicit drug use and nicotine and alcohol dependence ($p < 0.05$; See Table 1).

4.2. Analyses results

The relationship between advanced HIV disease status, tobacco use status, and intention to quit smoking cigarettes over time is depicted in Fig. 1. In general, the figure indicates that regardless of disease status, intention to quit increased between baseline and 3-months and subsequently decreased at 6-month follow up. An overall Type III test of fixed effects examining the 3-way interaction of time, disease status, and tobacco product use significantly predicted intention to quit smoking cigarettes ($p = .04$). Results from the SMI single time point unadjusted and longitudinal adjusted models for HIV disease status and the intention to quit outcome are provided in Tables 2 (pairwise comparisons) and Table 3 (parameter estimates). We did not observe un-adjusted or adjusted differences in intention to quit by disease status at the time of study enrollment nor the 12-month follow-up in either tobacco use group. However, significant unadjusted and adjusted differences between the two tobacco groups were observed at the other time points. Single time point unadjusted results comparing monocigarette users with advanced HIV vs. monocigarette users without advanced HIV trended towards significance at 3-months ($p = .0813$) and reached significance at the 9-month follow up ($p = .0072$). Unadjusted results comparing intention to quit among lifetime polytobacco users with and without advanced HIV suggested polytobacco users with advanced HIV, versus polytobacco users without advanced HIV,

maintained significantly higher levels of intention to quit at both 3 and 6-month follow-ups ($p = .0494$; $p = .0153$). Results from the longitudinal adjusted model analyses then accounted for FTND score ($p < .0196$) and positive affect score ($p = .0419$). Between monocigarette users with and without advanced HIV, differences in mean intention to quit only trended toward significance at the 3-month follow up ($p = .0675$). However, significant differences between monocigarette users with and without advanced HIV were found at the 9-month follow-ups ($p = .0051$). Polytobacco users with and without advanced HIV differed significantly at the 6-month follow-up ($p = .0335$). Similar results are observed when the longitudinal adjusted model analyses are done on available data (data not shown).

The trends in 7-day smoking abstinence over the 12-month follow-up window indicated that cessation rates were low (36.2% of monocigarette users; 13.1% of polytobacco users) but followed a similar trend as our measure of intention to quit. Due to an overall non-significant Type III test of fixed effects examining the 3-way interaction of time, disease status, and tobacco product use ($p = .4123$), no other analyses were conducted.

5. Discussion

A mounting body of evidence supports the need for efficacious smoking cessation treatment for PLWH (Vidrine, 2009; Pacek and Cioe, 2015). Cigarette smoking cessation interventions among PLWH continue to build importance as the association of smoking, and adverse outcomes of mortality and morbidity strengthen. Although attention to polytobacco use among this population has risen, few studies examine the role that polytobacco use may have on smoking behaviors at the time of HIV diagnosis (Pacek et al., 2016a,b; Tamí Maury et al., 2013). To date, most cessation treatment efforts for PLWH have taken a uniform approach rather than addressing treatment based on polytobacco use or HIV disease-related variables (Pool et al., 2016). Findings from this study indicate that participants with a history of polytobacco use display a unique pattern of intention to quit during the first 12-months of HIV-related treatment.

Furthermore, this secondary analysis supports and builds upon our previous findings suggesting that disease status impacts smoking behaviors (Vidrine et al., 2017). Variables known to modulate the relationship between disease status and smoking behaviors, such as symptom burden and nicotine dependence, may underlie this relationship. Thus, our findings suggest that the initiation of HIV treatment and events related to disease progression may serve as a teachable moment for promoting cigarette smoking cessation among various tobacco product users.

Key in the differentiation of polytobacco users from monocigarette users is the characterization of these individuals. Previous work among the general population indicates that lifetime polytobacco users report lower levels of education, more risk-taking/seeking behaviors, and greater nicotine dependence in comparison to monocigarette users (Creamer et al., 2016; Cooper et al., 2016; Loukas et al., 2016). Polytobacco users have been theorized to be at increased risk for tobacco-attributable death and disease, nicotine exposure and addiction, and may face unique barriers to smoking cessation (Vidrine, 2009; Bombard et al., 2007; Wetter et al., 2002). Our results further substantiate these postulations. At baseline,

lifetime polytobacco users reported significantly worse HIV-related symptoms and burdens, illness perception, social support, and nicotine dependence. Furthermore, increased level of nicotine dependence, a variable essential in the characterization of polytobacco use, was significantly associated with intention to quit across all time points. This data suggests HIV-positive polytobacco users be more vulnerable to health-related implications, such as the psychophysiological demands of addressing HIV-infection or nicotine dependence.

Previous works examining the relationship of nicotine dependence, smoking cessation, and HIV-related symptom burden may explain the unique trend of intention to quit among our advanced HIV-positive polytobacco users. Our group's previous work found HIV-related symptom burden to increase with the length of abstinence among HIV-positive smokers and poorer abstinence outcomes (Vidrine, 2009; Singer and Thames, 2016). In the current study, advanced HIV disease among participants with a history of polytobacco use initially demonstrated increased intention to quit smoking cigarettes followed by a striking decrease over time. These findings suggest a synergistic relationship may exist between polytobacco use and HIV status, such that HIV-positive smokers with a history of polytobacco use may face an increased risk of failed smoking cessation, secondary seroconversion, immunosuppression, and exposure to tobacco-specific nitrosamines. Conversely, it seems reasonable to expect characteristics of lifetime polytobacco users, previously reported as a motivation and anxiety (Tavolacci et al., 2016): mechanisms theorized to decrease cessation efforts (Pawlina et al., 2015), may explain the decreased intention to quit among those coping with an advanced HIV diagnosis (Maurer et al., 2008; Pumar et al., 2014). Initial levels of intention to quit among those with advanced disease status may be greater than those without advanced disease status due to the negative perception and added burden of coping with an AIDS diagnosis (Reynolds, 2009). Further-more, it seems that the increased nicotine dependence, fundamental in the characterization of polytobacco users, moderates one's intention to quit, such that advanced HIV-positive polytobacco users have a more pronounced change in intention to quit over time. These data may partially explain the low rates of cigarette smoking cessation found among polytobacco users who have long lived with HIV, as our HIV-positive polytobacco users trend suggests the intention to quit to continue to decrease after the first 6-months of an HIV diagnosis (e.g., Tamí-Maury et al., 2013). Thus, it may be of importance to tailor cigarette smoking cessation interventions for PLWH by lifetime history of tobacco product use.

Temporal differences in intention to quit between monocigarette and polytobacco users corroborate with previous work documenting a rebound effect (Montoya et al., 2016). Specifically, substance use may exacerbate patterns in risk reduction, such that hypervigilant risk reduction appears early in diagnosis among PLWH, but then declines over the first year of diagnosis (Gorbach et al., 2011; Heijman et al., 2012). After ARV therapy initiation (typically occurring at the 3-month visit for our study), the saliency of symptoms related to AIDS may diminish and differentially effect positive affect of tobacco product users. Moreover, tobacco use and HIV-infection are both thought to catalyze a cascade of inflammatory mechanisms associated with changes in depression, affect, anhedonia, decision-making, and HIV-associated neurocognitive disorders (Woods et al., 2009; Kooij et al., 2016; Soontornniyomkij et al., 2016). Thus, the inflammatory effects of HIV and

tobacco use before and after ARV initiation may also differentially alter cognitive processes necessary for intention to quit.

The results of the current study should be interpreted in light of several limitations. The high order of our main interaction was not powered appropriately for the small rate of point prevalence abstinence observed in our sample, as well as our exploratory post-hoc analysis. While inadequate sample size may partially explain incongruences between intention to quit and 7-day point prevalence, previous literature also report inconsistent associations (Soulakova et al., 2017). The Health Behavior model may provide a strong informational basis for altering nicotine dependence, but dependence is often deeply ingrained and difficult to modify (Quinton and Brunton, 2017). Future intervention research should explore the role that implicit automatic processes may have in successful smoking cessation. We suggest future works to replicate these important findings among a larger intervention-based sample designed to examine abstinence and high order interactions at each time point. The secondary nature of this analysis limited our operational definitions of lifetime polytobacco use. We expect future works to examine the effects of current polytobacco use upon one's intention to quit smoking cigarettes to corroborate or strengthen our findings among current polytobacco users. Regardless, the effects of lifetime polytobacco use may be representative of other individual-level factors, such as genetic pre-disposition for sensation seeking, and should be interpreted with caution due to its static and correlational nature. As a caveat, intention to quit smoking variables do not represent behaviors and patterns of use among various users. Our intention to quit findings can only be attributed to monocigarette users' intention to quit smoking cigarettes. It is possible that current smokers with a history of polytobacco use may have reported upon their intention to cut down on smoking other tobacco products. However, this is unlikely as an intention to quit and smoking abstinence trended similarly. Lastly, while we provided robust methods to handle missing data, our data may be biased by potential non-ignorable missingness.

Findings from this study suggest that initiating HIV care as a teachable moment may differentially impact smoking cessation efforts across tobacco users. The addition of a binary lifetime polytobacco use item to current 5 A's practices has clear clinical implications, as it quickly communicates the patient's need for additional and intensified smoking cessation resources during the limited time window in which interventions may be optimized (HIV Provider Smoking Cessation Handbook, 2012).

Furthermore, given the low success among polytobacco cessation trials for PLWH, future HIV-positive polytobacco users research should integrate smoking cessation interventions at 3–6 months post-HIV care initiation. Similarly, efforts among groups at risk for HIV (LGBTQ; racial and ethnic minorities) should further emphasize polytobacco prevention efforts. Future efforts should also attempt to parse out the possible bidirectional relationship of HIV-associated neurocognitive disorders and nicotine withdrawal.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.

Intention to quit smoking at each assessment time point by HIV disease status.

Note: * $p < .05$

** Advanced HIV disease defined as CD4+ T-lymphocyte counts of < 200 cells/ μ l or an HIV-related illness

Table 1

Bivariate analysis of groups stratified by disease status and tobacco product use at baseline.

	Non-advanced HIV Monocigarette Users N=120	Non-advanced HIV Polytobacco Users N=42	Advanced HIV Monocigarette Users N=144	Advanced HIV Polytobacco Users N=51	p-value
Age (M, SD)	39.6 (± 10.3)	39.0 (± 11.2)	39.8 (± 10.2)	39.1 (± 10.4)	.7647
Gender (% male)	65.0% (78)	71.4% (30)	74.3% (107)	78.4% (40)	.2367
Ethnicity					.7207
% Black	68.3% (82)	76.2% (32)	70.1% (101)	72.6% (37)	
% White	18.3% (22)	21.4% (9)	19.4% (28)	15.7% (8)	
% Hispanic	12.5% (15)	2.4% (1)	9.0% (13)	9.8% (5)	
% Other	.8% (1)	0% (0)	1.3% (2)	2.0% (1)	
Education (% , N)					.6525
No high school diploma/GED	32.5% (39)	35.7% (15)	35.4% (51)	43.1% (22)	
High school diploma/GED	42.5% (51)	42.9% (18)	41.0% (59)	27.5% (14)	
Some college	25.0% (30)	21.4% (9)	23.6% (34)	29.4% (15)	
Employment					.1796
Working full/parttime	15.8% (19)	23.8% (10)	16.0% (23)	2.0% (1)	
Not working because of my health	46.7% (56)	47.6% (20)	49.3% (71)	58.8% (30)	
Not working for reasons unrelated to my health	29.2% (45)	28.6% (12)	34.7% (50)	39.2% (20)	
HIV transmission					.2538
Homosexual	37.5% (45)	40.5% (17)	36.8% (53)	31.4% (16)	
Heterosexual	41.7% (50)	40.5% (17)	41.7% (60)	49.0% (25)	
Intravenous drug use	9.2% (11)	7.1% (3)	8.3% (12)	15.7% (8)	
Age began smoking	19.0 (± 10.6)	19.1 (± 16.8)	18.3 (± 5.5)	17.1 (± 5.4)	.6427
Years of smoking	15.5 (± 9.9)	17.6 (± 11.5)	15.8 (± 10.8)	17.5 (± 10.6)	.5371
Fagerstrom Test for Nicotine Dependence					
Composite score	4.2 (± 2.4)	5.6 (± 2.4)	4.0 (± 2.4)	4.6 (± 2.5)	.0031
Alcohol Use Disorders Identification Test (% , N)					
Hazardous use	20.0% (24)	35.7 (15)	22.9% (33)	31.4% (16)	.1306
Interpersonal Support Evaluation List					

	Non-advanced HIV Monocigarette Users N=120	Non-advanced HIV Polytobacco Users N=42	Advanced HIV Monocigarette Users N=144	Advanced HIV Polytobacco Users N=51	p-value
Composite score	35.1 ($\pm$ 8.3)	34.0 ($\pm$ 8.7)	35.5 ($\pm$ 7.6)	32.4 ($\pm$ 7.4)	.0912
Positive and Negative Affect Schedule					
Positive Affect	32.2 ($\pm$ 10.7)	30.6 ($\pm$ 9.1)	29.9 ($\pm$ 10.7)	31.2 ($\pm$ 9.7)	.3327
Negative Affect	20.5 ($\pm$ 10.6)	23.1 ($\pm$ 9.1)	21.5 ($\pm$ 9.9)	21.2 ($\pm$ 10.5)	.5673
Center for Epidemiological Studies Depression					
CESD 16 cut off(%, N)	60.8% (73)	81.0% (34)	69.4% (100)	70.6% (36)	.0949
HIV Symptom Index (M, SD)					
Symptom Count	11.0 ($\pm$ 5.7)	14.3 ($\pm$ 5.1)	12.0 ($\pm$ 6.2)	14.0 ($\pm$ 5.4)	.0013

Table 2

Relationship between HIV status, tobacco use status, and intention to quit - pairwise comparisons estimated through least square mean in adjusted linear regression at each time point.

Tobacco Use	Pairwise comparison	Estimate	Lower CL	Upper CL	P-value
Monocigarette User	Baseline	0.0226	−0.4173	0.4625	0.9199
	3-month visit	0.3827	−0.0276	0.793	0.0675
	6-month visit	0.3701	−0.1213	0.8616	0.1398
	9-month visit	0.6789	0.2042	1.1535	0.0051
	12-month visit	0.231	−0.2669	0.7289	0.3629
Polytobacco User	Baseline	0.1405	−0.616	0.897	0.7159
	3-month visit	0.5622	−0.1543	1.2788	0.124
	6-month visit	0.9083	0.0711	1.7455	0.0335
	9-month visit	0.1293	−0.7078	0.9664	0.762
	12-month visit	−0.3412	−1.1106	0.4283	0.3847

Table 3

Relationship between HIV status, tobacco use status, and intention to quit - parameter estimates estimated in longitudinal, repeated measures analysis adjusting for covariates.

Parameter	Estimate	Lower CL	Upper CL	P-value
Intercept	5.2063	4.6400	5.7726	< .0001
HIV Status	0.1089	- 0.2754	0.4932	0.5786
3-month visit (referent of Baseline)	0.3374	- 0.0076	0.6825	0.0553
6-month visit (referent of Baseline)	0.1046	- 0.2683	0.4775	0.5820
9-month visit (referent of Baseline)	0.0063	- 0.3444	0.3569	0.9721
12-month visit (referent of Baseline)	0.1970	- 0.1485	0.5425	0.2636
Interaction HIV Status, 3-month visit	0.2391	- 0.2508	0.7290	0.3386
Interaction HIV Status, 6-month visit	0.1716	- 0.3814	0.7245	0.5429
Interaction HIV Status, 9-month visit	0.3505	- 0.1717	0.8727	0.1882
Interaction HIV Status, 12-month visit	0.1466	- 0.3883	0.6815	0.5909
Tobacco Status	- 0.3055	- 0.9077	0.2967	0.3201
Interaction HIV and Tobacco Status	0.0694	- 0.6974	0.8362	0.8591
Interaction Tobacco Status, 3-month visit	0.1261	- 0.5558	0.8081	0.7169
Interaction Tobacco Status, 6-month visit	0.2270	- 0.4801	0.9342	0.5290
Interaction Tobacco Status, 9-month visit	0.3729	- 0.3009	1.0468	0.2779
Interaction Tobacco Status, 12-month visit	0.2925	- 0.3856	0.9707	0.3977
Three-way interaction, 3-month visit	0.1091	- 0.8667	1.0849	0.8265
Three-way interaction, 6-month visit	0.3965	- 0.6932	1.4861	0.4756
Three-way interaction, 9-month visit	- 0.5587	- 1.5866	0.4693	0.2867
Three-way interaction, 12-month visit	- 0.8757	- 1.9053	0.1538	0.0954
FTND	- 0.1159	- 0.1704	- 0.0614	< .0001
Positive Affect	0.0133	0.0004	0.0262	0.0434