BRIEF REPORT

Poly-Tobacco Use Among HIV-Positive Smokers: Implications for Smoking Cessation Efforts

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ABSTRACT

Introduction: Poly-tobacco use is defined as cigarette and other tobacco consumption with either product used daily or non-daily. While concurrent use of different types of tobacco has been documented within the general population, less is known about poly-tobacco use among HIV-positive smokers and its impact on smoking cessation efforts.

Objective: To characterize the profile of poly-tobacco users (PTU) in a sample of HIV-positive smokers participating in a cessation program.

Methods: The study sample consisted of 474 HIV-positive smokers enrolled in a 2-group randomized controlled trial of cigarette smoking cessation comparing a cell phone-based intervention to usual care. Prevalence was determined, and risk factors for poly-tobacco use were evaluated using logistic regression.

Results: In this cohort of HIV-positive cigarette smokers, 21.6% of participants were PTU, with cigars (73.4%) the most common tobacco product consumed. Among PTU, 73.5% used other form(s) of tobacco some days, and 26.5% use them every day. Perceived discrimination and unemployment were significantly associated with poly-tobacco use after adjusting for other demographic, behavioral, and psychosocial factors. Analysis showed that participants in the cell phone group (vs. usual care) were more likely to report 24-hr abstinence, both among monocigarette users (16.6% vs. 6.3%, $p < .001$) and PTU (18.5% vs. 0%, $p < .001$).

Conclusion: Poly-tobacco use prevalence among adult HIV-positive smokers was considerably higher than in the general population. Special attention must be placed on concurrent use of cigarettes and cigars among HIV-positive smokers. Because PTU are a unique population less likely to succeed in brief smoking cessation interventions, effective cessation programs are needed.

INTRODUCTION

It is well established that tobacco use is the single most preventable cause of disease, disability, and death in the United States (Center for Disease Control and Prevention [CDC], 2011). Mounting evidence suggests that smoking increases the risk of cardiovascular disease, respiratory disease, lung and other cancers, secondhand smoke exposure, and other diseases (CDC, 2008). In addition to cigarette smoking, the negative consequences associated with smokeless tobacco (dip, snuff, and chewing tobacco), cigars, and pipes include increased risk of lung, larynx, esophageal, and oral cancers (CDC, 2011), cardiovascular disease (Katsiki, Papadopoulou, Fachantidou, & Mikhailidis, 2013), respiratory disease (Schivo, Avdalovic, & Murin, 2013), immune dysfunction, perinatal mortality, pre-term birth, reduced sperm viability (Willis, Popovech, Gany,

& Zelikoff, 2012), dental caries, teeth loss, gingival recession (Kallischnigg, Weitkunat, & Lee, 2008), among others.

Poly-tobacco use, dual use, and multitobacco use are various terms utilized in the scientific literature to define cigarette smoking with the concurrent consumption of other tobacco products (Bombard, Pederson, Nelson, & Malarcher, 2007; Klesges et al., 2011). However, much of the emphasis in the literature has been on describing concurrent cigarette and smokeless tobacco use (dual use) (Klesges et al., 2011).

While the adverse effects of individual tobacco product use are well documented, a growing body of literature suggests the need to examine multiple utilization of tobacco products among smokers because (a) concurrent use of products may increase the risk of tobacco-attributable death and disease relative to use of either product alone (Wetter et al., 2002), (b) concurrent tobacco use increases risk of nicotine exposure and possibly

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nicotine addiction (Bombard et al., 2007), and (c) poly-tobacco use may create unique challenges for smoking cessation efforts (Bombard et al., 2007; Wetter et al., 2002). Wetter et al. (2002) found that among smokers enrolled in a cancer prevention work-site trial, concomitant users were significantly less likely to quit using tobacco over the course of 4 years compared to those who only used cigarettes or smokeless tobacco (11% tobacco cessation for concomitant users vs. 16% for smokers, and 20% for smokeless tobacco users). In previous studies, poly-tobacco use has been found to be associated with lower educational achievement, lower income, White race, living in nonmetropolitan areas, alcohol use, and high-risk behaviors among adults (Klesges et al., 2011; Lando, Haddock, Klesges, Talcott, & Jensen, 1999; Mumford, Levy, Gitchell, & Blackman, 2005). This highlights the importance of exploring poly-tobacco use especially among high-risk populations. In this article, we have chosen the term poly-tobacco use as cigarette and other tobacco consumption with either product used daily or nondaily.

Previous studies have shown that smoking is highly prevalent among people living with HIV/AIDS (PLWHA), with estimates ranging from 50% to 70% (Burkhalter, Springer, Chhabra, Ostroff, & Rapkin, 2005; Gritz, Vidrine, Lazez, Amick, & Arduino, 2004; Mamary, Bahrs, & Martinez, 2002; Webb, Vanable, Carey, & Blair, 2007). Additionally, PLWHA suffer disproportionately from adverse health outcomes related to smoking and are less likely to succeed in smoking cessation programs (Crothers et al., 2009; Feldman et al., 2006; Turner et al., 2001). While overlapping use of various types of tobacco has been documented within the general population, little is known about the occurrence of poly-tobacco use among PLWHA and its impact on smoking cessation efforts.

Using secondary data from a randomized controlled trial designed for HIV-positive smokers, the current study expands on the limited literature related to poly-tobacco use among PLWHA. The overall aims of this study are to (a) assess the prevalence of poly-tobacco use among HIV-positive smokers, (b) determine the sociodemographic and behavioral risk factors associated with poly-tobacco use, and (c) compare abstinence rates of poly-tobacco users (PTU) versus monocigarette users (MCU) at 3 months after initiating a smoking cessation intervention.

METHODS

Study Population

This study is a secondary analysis of data collected during a smoking cessation trial for HIV-positive smokers. The study took place at a large HIV outpatient clinic that serves a predominantly low income, ethnically diverse patient population, representative of the HIV-positive population in Houston, TX. Four hundred seventy-four individuals (≥ 18 years of age) were enrolled in two different smoking cessation interventions: (a) *usual care*, in which participants received brief provider advice to quit, self-help written materials, and access to nicotine replacement therapy and (b) *cell phone-based intervention*, in which participants received all usual-care components plus a prepaid cell phone, by which proactive counseling was delivered over a period of 12 weeks. Details of the design and methods of this trial have been published elsewhere (Vidrine, Marks, Arduino, & Gritz, 2012). This study was approved by

the Institutional Review Boards of The University of Texas MD Anderson Cancer Center and The University of Texas Health Science Center at Houston.

Main Outcome: Poly-Tobacco Use

The sample of HIV-positive smokers was stratified into PTU and MCU. All participants smoking cigarettes in addition to consuming any other tobacco product (either every day or some days) were classified as PTU, while MCU were those HIV-positive individuals smoking cigarettes only.

Psychosocial Scales

Alcohol Use Disorders Identification Test

The Alcohol Use Disorders Identification Test (AUDIT) is a 10-item screening tool (scale 0–4) developed by the World Health Organization to assess risky, hazardous, and harmful drinking (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). A score of 8 or higher indicates harmful or hazardous alcohol consumption.

Perceived Stress Scale

This 10-item questionnaire evaluates the degree to which situations in one's life are appraised as stressful (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988). A maximum score of 40 indicates the highest level of stress.

Self-Efficacy Scale

This nine-item measure (scale 0–4) assesses the level of confidence an individual has to abstain from smoking in a variety of situations (Velicer, Diclemente, Rossi, & Prochaska, 1990). Higher scores indicate higher levels of smoking self-efficacy.

State-Trait Anxiety Inventory

State-Trait Anxiety Inventory (STAI) is a psychological inventory and includes 40 questions on a self-report basis. In this study, we used the State component, a 20-item instrument (scale 20–80), which measures the level of anxiety an individual experiences at a given point in time (Spielberger, Gorsuch, & Lushene, 1970). Higher scores indicate greater levels of anxiety.

Center for Epidemiological Studies Depression Scale

This self-report measure (scale 0–60) identifies current depressive symptoms related to major or clinical depression (Radloff, 1977). A score of 16 or higher has been used as the cutoff point for indicating high depressive symptoms.

Perceived Discrimination Scale

This nine-item instrument (scale 1–4) was developed by Williams, Yan, Jackson, and Anderson (1997) to assess participant's perceptions of discrimination. Higher scores indicate greater perceived discrimination.

Physical Health Summary Score of the Medical Outcomes Study HIV Health Survey

The Medical Outcomes Study HIV Health Survey (MOS-HIV) survey is a 35-item questionnaire that measures quality of life among PLWHA by "asking a series of questions about specific aspects of functioning and well-being" (Wu, Hays, Kelly, Malitz, & Bozzette, 1997). The MOS-HIV has two summary

scores for mental and physical health (scale 0–100), with higher scores indicating better health and mental status.

Interpersonal Support Evaluation List

The Interpersonal Support Evaluation List-12 is a shortened version of the general population scale (40 items) designed to measure the self-perceived availability of social support (i.e., assistance or help from others). This self-administered questionnaire measures three subscales—tangible, appraisal, and belonging—with four items each (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). Higher scores indicate more social support.

Exploratory Analyses: Comparison of Smoking Abstinence Among PTU and MCU

Using an intent-to-treat (ITT) approach, the 24-hr abstinence rate, biochemically verified by expired CO, was calculated for both groups (PTU vs. MCU) at 3 months after initiating the smoking cessation interventions, in both usual care and cell phone-based intervention groups. In ITT approach, all participants are analyzed according to the groups to which they are randomized (usual care or cell phone-based intervention), and those participants lost to follow-up ($n = 124$), rather than being dropped from analyses, were coded as smokers.

Statistical Analyses

Poly-tobacco use prevalence was defined as the proportion of HIV-positive individuals who reported smoking cigarettes in addition to consuming any other tobacco product. In order to identify statistical differences between PTU and MCU, categorical variables were compared using the chi-square test or Fisher's exact test, when appropriate.

We assessed the consumption prevalence of each tobacco product used by our study population, along with the prevalence of cigarette smoking with concurrent use of one, two, or more than three tobacco products. To assess the impact of the associated factors on poly-tobacco use, we performed multivariate logistic regression analysis with all factors simultaneously included in the same model. The following independent variables were included in the model: work status, mode of HIV transmission, hazardous drinking (AUDIT), perceived stress, smoking self-efficacy, anxiety (STAI), depression (Center for Epidemiological Studies Depression Scale), perceived discrimination, mental health functional status (MOS-HIV MHS), physical health functional status (MOS-HIV PHS), and social support (ISEL). Finally, we performed a conditional logistic regression analysis with backward stepwise procedures based on the maximum partial likelihood estimates to construct a final best fit logistic regression model to identify the predictors of risk for poly-tobacco use among all factors. In the backward stepwise method, the significance level was set at $p < .05$ for entering an explanatory variable into the model. We estimated odds ratios (ORs) and 95% CIs. All statistical tests were considered to be significant at an alpha level of .05 on a two-tailed test.

We assessed model calibration using the Hosmer-Lemeshow goodness-of-fit test, which assesses whether the predicted probabilities match the observed probabilities. In this analysis, $p > .05$ was taken to indicate a well calibrated model. To address the issue of multicollinearity, we assessed tolerance and variance inflation factor (VIF) in our logistic

regression model. Variables with a tolerance value less than 0.2 were not included in the regression equation and were investigated further. Values of VIF exceeding 5.0 were regarded as an indication of multicollinearity. Finally, a $2 \times 2 \times 2$ multilayered chi-square exploratory analysis was used to assess 24-hr abstinence prevalence among HIV-positive smokers participating in the two different cessation interventions (usual care vs. cell phone-based intervention) stratified by type of tobacco use (MCU and PTU). All tests of hypotheses were two-tailed and p values less than .05 were considered significant.

Statistical Package for Social Sciences Software (SPSS 18 for Windows; SPSS Inc.) was used to conduct all statistical analyses.

RESULTS

Demographics and Behavioral Characteristics

The study sample consisted primarily of men (70.2%) with a mean age of 45 ± 8.1 years. African Americans represented more than three quarters of the sample (76.1%), followed by Whites (12.5%), and other races/ethnicities (11.4%). Self-identified HIV risk factors were as follows: 45.4% heterosexual, 25.3% men having sex with men, and 17.2% injecting drug users. The HIV risk for 12.1% of the sample was not identified. Only 21.1% of the participants reported working and more than half (52%) indicated living with someone who smokes.

Poly-Tobacco Use Among HIV-Positive Smokers

The overall prevalence of poly-tobacco use was 21.6%. Among those 102 individuals who reported poly-tobacco use, 73.5% used other forms of tobacco some days and 26.5% used them every day. Besides cigarettes, cigars (73.4%) were the most common tobacco product being consumed by PTU. More than one third (34.0%) of HIV-positive smokers in our study sample reported using at least two tobacco products other than cigarettes.

Risk Factors for Poly-Tobacco Use

In our sample, PTU were more likely to report injecting drugs than MCU (26.5% vs. 14.6%, $p < .01$). Additionally, PTU were less likely to be working compared to MCU (10.8% vs. 24.0%, $p < .01$). One third of PTU (33.3%) and more than half of the MCU (52.0%) reported living in a smoke-free home ($p < .01$). Compared to MCU, PTU reported lower scores on the physical and mental health subscales of the MOS-HIV survey and higher levels of alcohol consumption. In addition, PTU had higher levels of stress, higher levels of anxiety, higher levels of depression, higher levels of perceived discrimination, lower smoking self-efficacy scores, and lower scores on social support compared to MCU. For all of these factors, the differences were statistically significant (see Table 1).

From the initial full logistic regression model for poly-tobacco use, a reduced model was developed retaining only the significant predictor variables: work status and perceived discrimination. HIV-positive smokers who were PTU were more likely than those who only smoked cigarettes to be unemployed (adj OR 3.61, 95% CI = 1.221–10.644) and to report higher levels of perceived discrimination (adj OR 1.11, 95% CI = 1.048–1.166) (Table 2). For this multivariate analysis, the p value for Hosmer and Lemeshow goodness-of-fit test was

Table 1. Sociodemographic and Clinical Factors Among HIV-Positive Smokers Stratified by Type of Tobacco Use

Characteristics	All patients	Monocigarettes users	Poly-tobacco users ^a	<i>p</i> value
Mean age, <i>y</i> (<i>SD</i>)	473 (100.0) 44.8±8.07	371 (78.4) 44.9±8.11	102 (21.6) 44.7±7.80	.767
Gender				
Female	141 (29.8)	116 (31.3)	25 (24.5)	.186
Male	332 (70.2)	255 (68.7)	77 (75.5)	
Race/ethnicity				
White	59 (12.5)	48 (12.9)	11 (10.8)	.190
African American	360 (76.1)	276 (74.4)	84 (82.4)	
Other ^b	54 (11.4)	47 (12.7)	7 (6.9)	
HIV transmission risk category				
MSM	119 (25.3)	102 (27.6)	17 (16.7)	.0012
Heterosexual	214 (45.4)	166 (45.0)	48 (47.1)	
IVDU	81 (17.2)	54 (14.6)	27 (26.5)	
Other	57 (12.1)	47 (12.7)	10 (9.8)	
Educational level				
Less than high school	181 (38.3)	147 (39.6)	34 (33.3)	.425
High school or equivalent	180 (38.1)	136 (36.7)	44 (43.1)	
More than high school	112 (23.6)	88 (23.7)	24 (23.5)	
Current working status				
Not working	371 (78.4)	282 (76.0)	91 (89.2)	.004
Working ^c	100 (21.1)	89 (24.0)	11 (10.8)	
Relationship status				
Single/divorced/separated/widowed	389 (82.2)	304 (81.9)	85 (83.3)	.744
Married/living with sig.	84 (17.8)	67 (18.1)	17 (16.7)	
Number of cigarettes per day at baseline (<i>SD</i>)	19.2±11.54	19.0±11.62	19.7±11.28	.618
FTND score	5.77±2.27	5.71±2.27	6.06±2.21	.169
Other smokers at home				
Yes	246 (52.0)	178 (48.0)	68 (66.7)	.001
No	227 (48.0)	193 (52.0)	34 (33.3)	
Hazardous drinking (AUDIT)	6.0±8.21	5.5±7.62	7.6±9.96	.054
Perceived stress (PSS)	44.8±18.87	43.7±19.34	48.8±16.66	.015
Self-efficacy	25.4±8.77	25.8±8.89	23.9±8.21	.050
Anxiety (STAI)	43.3±13.39	42.5±13.42	46.2±13.00	.015
Depression (CES-D)	21.7±11.31	20.8±11.23	25.0±11.10	.001
Perceived discrimination	10.0±5.55	9.4±5.39	12.5±5.48	.000
Physical health score (PHS/MOS-HIV)	40.0±10.83	40.7±10.83	37.6±10.56	.011
Mental health score (MHS/MOS-HIV)	42.1±11.23	43.1±11.58	38.7±9.20	.000
Social support (ISEL)	34.1±7.58	34.8±7.59	31.9±7.20	.001

Note. AUDIT = Alcohol Use Disorders Identification Test; CES-D = Centers for Epidemiologic Studies Depression scale; FTND = Fagerström Test for Nicotine Dependence; ISEL = Interpersonal Support Evaluation List; IVDU = intravenous drug use; MHS/MOS-HIV = Mental Health Survey of the Medical Outcomes Study HIV Health Survey; MSM = men who have sex with men; PHS/MOS-HIV = Physical Health Survey of the Medical Outcomes Study HIV Health Survey; PSS = Perceived Stress Scale; STAI = State-Trait Anxiety Inventory.

^aCurrent poly-tobacco users were identified if use of tobacco products was “every day or some days.”

^bOther races/ethnicities: Hispanic/Latino, Asian/Pacific Islander, and American Indian/Alaska.

^cIncludes full-time and part-time employment.

greater than .05, which indicates the model fit the data at an acceptable level. The tolerance and VIF were examined for each variable, all of which were greater than 0.2 and less than 5.0, respectively, indicating no concerns with multicollinearity in the final model.

Smoking Abstinence Prevalence Among PTU and Monotobacco Users According to the Type of Smoking Cessation Intervention

At the 3-month follow-up, participants in the cell phone-based intervention group were more likely to report 24-hr abstinence

than participants in the usual-care group, both among MCU (16.6% vs. 6.3%, $p < .001$) and PTU (18.5% vs. 0%, $p < .001$). Of note, no PTU in the usual-care condition had successfully quit.

DISCUSSION

In the United States, more deaths are caused each year by tobacco use than by HIV, illegal drug use, alcohol use, motor vehicle injuries, suicides, and murders combined (CDC, 2008; Mokdad, Marks, Stroup, & Gerberding, 2004). PLWHA are two to three times more likely to smoke than the U.S. national

Table 2. Final Multivariable Conditional Logistic Regression Model for Poly-Tobacco Use^a Among HIV-Positive Smokers

Independent variable	Bivariate analyses	Multivariate analyses		
	Crude OR ^b	Adj OR ^b	95% CI	<i>p</i> value
Current working status				
Not working	2.61	3.61	1.221–10.644	<.05
Working (ref.)	1.00	1.00		
Perceived discrimination	1.11	1.11	1.048–1.166	<.01

Note. ^aModel: poly-tobacco user (PTU) vs. monocigarette users (MCU).

^bOdds ratios (OR), significant association ($p < .05$); CI = confidence intervals.

average (Burkhalter et al., 2005; Gritz et al., 2004; Mamary et al., 2002; Webb et al., 2007). Given this excessive use of tobacco, HIV-positive smokers have an increased mortality rate compared to HIV-positive nonsmokers (Rahmanian et al., 2011). On the other hand, a new landscape of tobacco use patterns has emerged in the United States due to the growing diversity of tobacco products, more restrictive antitobacco regulations, and the varying price increase of tobacco products (Rath, Villanti, Abrams, & Vallone, 2012). In our study sample, consisting of 474 HIV-positive smokers, 21.6% were PTU. This poly-tobacco use prevalence is considerably higher than the prevalence reported by Bombard et al. (2007) (3.4%) in a sample of more than 50,000 adult smokers from the general population in 10 states and the prevalence reported in 2008 by Olmsted et al. among U.S. active duty military personnel, which ranged from 3.1% to 6.0% (Olmsted, Bray, Reyes-Guzman, Williams, & Kruger, 2011). A lower prevalence has also documented from the 2008 Behavioral Risk Factor Surveillance System (BRFSS), in which the prevalence of poly-tobacco use among adults from 13 States ranged from 1.0% to 3.7% (CDC, 2010). Of note, the 2009 and 2010 versions of the BRFSS survey did not include the optional module “Other Tobacco Products.” Therefore, poly-tobacco prevalence estimates from the 2008 BRFSS are the most recent data available. Emerging evidence suggests that there is an additive effect resulting from using more than one type of tobacco product (Accortt, Waterbor, Beall, & Howard, 2002; Chao et al., 2002; Teo et al., 2006), which consequently may increase the likelihood of premature death due to a tobacco-related illness among PLWHA.

Seventy-three percent of the HIV-positive cigarette smokers in our sample concurrently used cigars. This result was not unexpected since the use of non-cigarette tobacco products has dramatically increased since 2009, when taxation was raised on cigarettes and not on other forms of tobacco (Family Smoking Prevention and Tobacco Control Act. Public Law No. 111-31, 2009). Consequently, non-cigarette tobacco products, especially cigars, have become a less expensive alternative for lower socioeconomic groups, who can buy cigars individually or in small quantities at relatively low prices (Cullen et al., 2011; Public Health Law Center, 2012).

Although in the univariate and bivariate analyses there were differences in the relative importance of many of the psychosocial factors, the logistic regression model was consistent in finding unemployment and high levels of perceived discrimination as the most important risk factors for poly-tobacco use among HIV-positive smokers in our sample. As reported in a previous study, “unemployment may play a significant

part in establishing life-long patterns of hazardous behavior” (Montgomery, Cook, Bartley, & Wadsworth, 1998) such as smoking. Unfortunately, PLWHA are less likely to maintain employment, mostly due to work-related discrimination and/or disease advancement (Dray-Spira, Gueguen, & Lert, 2008). In addition, individuals who report discriminatory treatment are more likely to engage in unhealthy behaviors such as smoking, alcohol abuse, and drug use (Crawford et al., 2012; Purnell et al., 2012). To our knowledge, our study is the first to evaluate the association of unemployment and perceived discrimination among PLWHA who report poly-tobacco use.

Our findings should be interpreted with caution because data were not collected specifically for the purpose of this study. An important limitation is the possibility of underestimating the prevalence of cigar use in our sample due to the lack of a uniform definition of this tobacco product (sometimes called cigar, large cigar, filtered cigar, little cigar or cigarillo, or blunt) (Golub, Johnson, & Dunlap, 2005; Nasim, Blank, Berry, & Eissenberg, 2012; Terchek, Larkin, Male, & Frank, 2009). “Cigars that are about the size of cigarettes are changing the way cigars are smoked and how *cigar* is defined.” (American Cancer Society, 2012).

As our exploratory findings showed, poly-tobacco use among PLWHA may pose a risk to the success of tobacco control efforts based on brief interventions. Perhaps, different types of cell phone-based interventions such as interactive text messaging and smartphone applications tailored to quit stage and multiple times per day contact could prove to be more effective in helping PTU quit. Hence, future directions for research should include identifying HIV-positive individuals who are PTU in order to offer them the most intensive smoking cessation treatment. Additionally, future qualitative work may provide an in-depth understanding of the patterns of tobacco product utilization among HIV-positive individuals who are PTU to inform future intervention development.

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DECLARATION OF INTERESTS

None declared.

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