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The Role of BMI Change on Smoking Abstinence in a Sample of HIV-Infected Smokers

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Abstract

The prevalence of cigarette smoking among persons living with HIV/AIDS (PLWHA) is approximately 40%, significantly higher than that of the general population. Identifying predictors of successful smoking cessation for PLWHA is necessary to alleviate the morbidity and mortality associated with smoking in this population. Weight gain has been associated with smoking relapse in the general population, but has not been studied among PLWHA. Data from 474 PLWHA enrolled in a smoking cessation randomized clinical trial were analyzed to examine the effect of BMI change, from baseline to 3-month follow-up, on smoking outcomes using multiple logistic regression. The odds of 7-day smoking abstinence at 3-month follow-up were 4.22 (95% CI=1.65, 10.82) times higher for participants classified as BMI decrease and 4.22 (95% CI=1.62, 11.01) times higher for participants classified as BMI increase as compared to participants with a minimal increase or decrease in BMI. In this sample, both weight gain and loss following smoking

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cessation were significantly associated with abstinence at 3-month follow-up among HIV-infected smokers. Further research and a better understanding of predictors of abstinence will encourage more tailored interventions, with the potential to reduce morbidity and mortality.

Keywords

HIV; smoking cessation; BMI; body image; obesity

Introduction

The estimated prevalence of smoking among people living with HIV/AIDS (PLWHA) is approximately 40% (Mdodo et al., 2015)as compared to 15% (Centers for Disease Control and Prevention, 2015)in the general population. Helleberg et al. (Helleberg et al., 2013) reported that the excess number of years of life lost due to HIV and smoking was 12.3 years for HIV-infected smokers as compared to HIV-infected non-smokers. Few randomized controlled trials have examined the effectiveness of smoking cessation programs tailored for PLWHA. Results from existing trials indicate that cessation rates, particularly long-term, are low and adherence is suboptimal (Gritz et al., 2013; Lloyd-Richardson et al., 2009; Matthews, Conrad, Kuhns, Vargas, & King, 2013; Moadel et al., 2012). A better understanding of the factors associated with cessation treatment efficacy could help improve low cessation rates and increase adherence to the prescribed intervention.

In the general population, weight gain following smoking cessation has been associated with decreased motivation and a lower number of quit attempts (Klesges, Meyers, Klesges, & La Vasque, 1989; Meyers et al., 1997; Ward, Klesges, Zbikowski, Bliss, & Garvey, 1997). Greater weight gain post-cessation has also been associated with African-American race and low socioeconomic status (Swan & Carmelli, 1995; Williamson et al., 1991), both of which are overrepresented characteristics of PLWHA in the United States.

Existing literature has shown that PLWHA are receptive to smoking cessation interventions (Vidrine, 2009; Vidrine, Marks, Arduino, & Gritz, 2012), but these studies have not focused on weight gain as a predictor of relapse. The current study attempts to assess this relationship.

Methods

Recruitment and Follow-Up

The parent study, which was a two-group randomized controlled trial, compared a Cell Phone Intervention (CPI) for smoking cessation to Usual Care (UC) (Gritz et al., 2013; Vidrine et al., 2012). Current smokers were recruited from a county clinic in Houston, TX that provides comprehensive care to underserved PLWHA. Weight change was not specifically addressed in either study group. Structured follow-up assessments and expired CO levels were conducted at 3, 6 and 12 months post-enrollment. In the current study, only baseline and 3-month follow-up data were used.

BMI Change

BMI change was calculated using height and weight information taken from the clinic's electronic medical record system (EMR). Data were recorded from participant appointments closest to the dates, either preceding or following, that participants completed the baseline and 3-month assessments. Carry forward methodology was used for participants who did not have BMI data in the EMR at 3-months. For these participants, the 3-month BMI was coded the same as the baseline BMI and the overall BMI change was coded as "0" This methodology has been used in other randomized controlled trials, including those focusing on HIV and weight loss (Fairclough, Thijs, Huang, Finnern, & Wu, 2008; Lane, 2008; Ware, 2003).

Smoking Abstinence

The primary outcome was 7-day smoking abstinence which was biochemically verified with expired CO level. An intent-to-treat approach was used, with participants who did not complete the 3-month follow-up coded as smoking (Matthews et al., 2013; Moadel et al., 2012).

Co-variables

Demographic co-variables of interest included age, self-reported sex and racial/ethnic affiliation. The Fagerstrom Test of Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) and Center for Epidemiologic Studies Depression Scale scores (Lewinsohn, Seeley, Roberts, & Allen, 1997; Radloff, 1977) were also considered. A variable quantifying the number of days elapsed between the baseline and 3-month BMI measurements was included as a log exposure variable in all models.

Statistical Analyses

Descriptive statistics were calculated for the socio-demographic and smoking variables. Multiple logistic regression models were used to compare the association between BMI change and smoking abstinence at 3-months. BMI change was analyzed by quartiles in order to identify if larger magnitudes of BMI change, either increased or decreased, were associated with smoking abstinence. Odds ratios (ORs) and 95% confidence intervals (CIs) were used to measure the strength and precision of the associations. Finally, chi-square and t-tests were used to test for differences at baseline in important covariates between the full sample and a complete case sample excluding participants with missing data at 3-months.

Results

A total of 474 participants were enrolled in the parent treatment trial (Gritz et al., 2013; Vidrine et al., 2012). See Table 1 for baseline socio-demographic and smoking characteristics of participants. No statistically significant differences in socio-demographic variables were observed between participants in the full sample and complete case sample.

At baseline, the mean (SD) BMI in the sample was 26.22 (5.97) units. The percentage of patients classified as wasting (BMI <18.5) and overweight or obese (BMI >25) were 3.5% and 50.0%, respectively. The mean (SD) time elapsed between collection of baseline and 3-

month BMI data was 94.43 (26.63) days. Table 2 presents the results from multiple regression models of smoking outcomes at the 3-month follow-up. To facilitate comparisons, BMI change was categorized in quartiles: BMI decrease, minimal BMI decrease, minimal BMI increase and BMI increase. Because the intent of this analysis was to investigate the association of a larger magnitude of BMI change and smoking abstinence, the minimal BMI decrease and minimal BMI increase quartiles were combined into a single minimal change referent group. Participants in both the BMI increase and decrease groups (vs. the minimal change group) were significantly more likely to report 7-day abstinence.

The odds of 7-day smoking abstinence at 3-month follow-up were 4.22 (95% CI=1.65, 10.82) times higher for participants classified as BMI decrease (Range: −4.91≤BMI change< −0.41) as compared to participants with a minimal increase or decrease in BMI The odds of 7-day smoking abstinence for participants classified as BMI increase (Range: 0.81≤BMI change<7.82 units) were 4.22 (95% CI=1.62, 11.01) times higher as compared to participants with a minimal increase or decrease in BMI.

Discussion

In the general population, concerns about weight gain have been associated with decreased motivation to quit (Meyers et al., 1997; Pomerleau & Kurth, 1996), and post-cessation weight gain has been observed among successful quitters (Swan & Carmelli, 1995; Williamson et al., 1991). In this sample of HIV-infected smokers, larger magnitude of BMI change, either positive or negative, versus minimal BMI change was significantly associated with 7-day smoking abstinence at 3-months. The partially contrary nature of the results in this sample to smoking behaviors observed in the general population may be related to different perceptions of weight gain among minorities and PLWHA (Clark, Niccolai, Kissinger, Peterson, & Bouvier, 1999; Fingeret, Vidrine, Arduino, & Gritz, 2007).

Clark et al. (Clark et al., 1999) found that HIV-infected African-American women were more likely than non-infected African-American women to be satisfied with their weight, have the desire to be bigger, believe that weight gain would protect against sickness and that they would not be perceived as sick if they gained weight. Sharma et al.(Sharma, Howard, Schoenbaum, Buono, & Webber, 2006; Sharma et al., 2007) found that among overweight, HIV-infected men, only 26.0% perceived themselves as too heavy; among overweight, HIV-infected women, 52.4% women believed their weight was “just right.” It is possible that in our sample, weight gain was not associated with poorer abstinence outcomes because participants perceived themselves as being at a healthy weight even if their BMI classified them as overweight or obese.

Missing data is a limitation of this study. However, we believe the data were missing at random because no significant differences were seen between participants that had complete BMI and smoking data as compared to those that were analyzed with carry forward and intent to treat methodology. Although the average time elapsed between baseline and 3-month BMI collection was approximately 3-months (Mean=94.43 days), the time elapsed ranged from 20–308 days giving participants differing amounts of follow-up time. In addition, although the CPI intervention did not specifically cover weight change, it is

possible that some participants brought it up on their own with their counselor. Results from the parent study indicated that the treatment group had a significant effect on smoking abstinence (Gritz et al., 2013; Vidrine et al., 2012), but from this analysis we cannot identify the effect of BMI change on smoking outcomes without the compounded effect of treatment group.

To our knowledge, this is the first analysis of the association between BMI change and smoking outcomes in a sample of HIV-infected smokers. Smoking is a major contributor to morbidity and mortality in this population (Crothers et al., 2005; Helleberg et al., 2013; Lifson et al., 2010). As people live longer with HIV/AIDS, obesity is becoming another factor contributing to the burden of chronic disease (Amorosa et al., 2005; Shor-Posner et al., 2000). In this sample, both large increases and decreases in BMI were associated with smoking abstinence. Weight gain and loss may serve as potential teachable moments for smoking cessation. A better understanding of how weight gain/loss following smoking cessation affects prolonged abstinence may inform the development of more effective treatment approaches in the future, which may ultimately minimize the adverse health outcomes associated with both smoking and obesity.

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Table 1

Baseline Characteristics of Study Participants (n=474)

Characteristic, n (%)	
Age, mean (SD)	44.8 (8.1)
Male	332 (70.0)
Race/ethnicity	
White	59 (12.4)
Black/African American	361 (76.2)
Latino/Hispanic	43 (9.1)
Other	11 (2.3)
HIV Transmission	
Male homosexual contact	119 (25.1)
Heterosexual contact	215 (45.4)
Injection drug use	81 (17.1)
Other	57 (12.0)
Years of formal education, mean (SD)	10.9 (2.6)
Depression (CES-D[1] score) ≥ 16	319 (67.3)
Cigarettes smoked per day, mean (SD)	19.2 (11.6)
Nicotine dependence (FTND[2]), mean (SD)	5.78 (2.3)
Body mass index, mean (SD)	26.2 (6.0)
Current diagnosis of a co-morbid condition	291 (61.4)

[1] Centers for Epidemiologic Studies Depression scale; scores ≥16 indicate clinical depression

[2] Fagerstrom Test for Nicotine Dependence

Table 2

BMI Change as a Predictor of Smoking Abstinence at 3-month Follow-up[1,2]

Quartile		*OR (95% CI)*	*P-Value*
BMI Decrease[3]			
	7-day	4.22 (1.65, 10.82)	0.003
BMI Increase[4]			
	7-day	4.22 (1.62, 11.01)	0.003

[1] Models adjusted for treatment group, age, sex, race, nicotine dependence, depression

[2] Models compared to minimal BMI decrease and minimal BMI increase as referent (Range: −0.41≤ BMI change<0.81 units).

[3] BMI change <−0.41 units

[4] BMI change >0.81 units