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## Association between Smoking Cessation and Weight Gain in Treatment-Seeking African Americans

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### Abstract

**Introduction**—Research has shown that African Americans gain more than average weight after smoking cessation. However, African Americans have been underrepresented in post-cessation weight gain research. The current study examined 1) the pattern of weight gain and 2) the association between smoking status and weight gain in a sample of African Americans seeking smoking cessation treatment.

**Methods**—Data were drawn from a randomized controlled trial testing the efficacy of a 4-week culturally specific smoking cessation cognitive behavioral therapy (CBT) intervention among African American smokers (N=342). Weight was measured and self-reported smoking status was biochemically verified at baseline, end of counseling, 3-, 6-, and 12-month follow-ups. Random effects multilevel modeling was used to examine weight gain over twelve months post CBT, and a fully unconditional model tested the pattern of weight gain over time. Smoking status was

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### Contributors

MT conceptualized the current study, performed statistical analyses, and wrote the first draft of this manuscript. MH was Principal Investigator on the grant and contributed to the drafting and editing of this manuscript. KO, KR, ND, and MA were Co-investigators on the grant and contributed to editing and review of the manuscript. All authors contributed to and have approved the final manuscript.

### Conflict of Interest

The authors have no conflicts of interest to disclose. All authors verify adherence to appropriate ethical standards while conducting this research. The research was approved by University of Miami's Institutional Review Board, and all study personnel completed appropriate ethical training.

included as a time-varying factor to examine its effect on weight gain, controlling for potential confounding variables.

**Results**—Weight significantly increased among those who remained abstinent over 12 months post CBT [average gain of seven lbs. (three kg)]. Controlling for covariates, abstinence was predictive of the rate of weight gain for those with high weight concern.

**Conclusions**—Weight gain among African American abstainers was comparable to the average post-cessation weight gain observed among the general population. It is possible that exposure to CBT (culturally specific or standard) may have mitigated excessive weight gain. Future research should assess predictors of weight gain in African American smokers to inform future smoking cessation interventions and help elucidate factors that contribute to tobacco- and obesity-related health disparities.

### Keywords

post-cessation weight gain; smoking cessation; weight concern; African American smokers; ethnic minority health; health disparities

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## INTRODUCTION

African Americans experience the highest rates of tobacco-related morbidity and mortality of all racial/ethnic groups (1). This group also has a higher rate of obesity (49.5%) and being overweight (76.7%) than whites [34.3% and 66.7%, respectively (2)]. African American smokers have been found to gain excessive weight, or greater than the average four to 10 pounds [lbs.; 1.8-4.5 kilograms (kg)], after smoking cessation (3, 4), which may contribute to these disparities. The purpose of this study was to examine the association between smoking status and weight gain among African Americans enrolled in a smoking cessation intervention.

The benefits of quitting smoking outweigh the effects of weight gain (5); however, post-cessation weight gain remains a pertinent concern among smokers. Approximately 80% of smokers report weight gain within the first three months post cessation (6). Post-cessation weight gain contributes to short-term smoking relapse (7, 8) and increased risk of chronic conditions (9-11). Given the prevalence of overweight among African Americans, post-cessation weight gain may be particularly detrimental. Further, African Americans also have more difficulty losing weight (12, 13) and demonstrate a lower resting metabolic rate compared to whites (12, 14). Therefore, it is imperative to consider post-cessation weight gain in this population during smoking cessation treatment.

### Smoking and weight gain in African Americans

Research examining the association between weight gain and race/ethnicity among smokers has been mixed. Williamson et al. (1991) was among the first to report that African Americans who quit smoking were more likely to gain excessive weight than those categorized as non-African American. Klesges et al. (1998) examined smoking status and weight change among African American (n=237) and white (n=448) former smokers over a seven year period. Adjusting for age, energy intake, alcohol intake, and physical activity,

African Americans gained more weight and were twice as likely to gain excessive weight compared to whites [28 lbs. (12.5kg) and 21 lbs. (9.7kg), respectively].

In contrast, Vander Weg et al. (2001) found no differences in weight and energy balance following cessation between African Americans (n=25) and whites (n=70) over two weeks (15). Additionally, O'Hara et al. (1998) examined post-cessation weight gain among adult smokers (N= 5,887) who received either 12-week behavioral smoking intervention plus nicotine gum or assessment only; the effect of race/ethnicity on weight gain over five years was not significant. However, African Americans represented only 4% of the sample, and the proportion of African American quitters was even lower (2% males, 4% females). To date, research on African Americans and the pattern of post-cessation weight gain is scant.

### Factors associated with post-cessation weight gain

Many factors have been examined as predictors of post-cessation weight gain in the general population of smokers. A history of smoking greater than 15 cigarettes per day (CPD), greater nicotine dependence, lower socioeconomic status (SES), younger age (<55 years old), decreased physical activity, and baseline BMI are positively associated with weight gain within one year of abstinence (4, 16, 17). Of the few studies that examined smokers receiving a behavioral smoking cessation intervention, age, baseline BMI, and sex predicted weight gain over one year in abstainers (18-20), and no significant differences in race/ethnicity were observed or reported.

Weight concern, a well-established reason for smoking initiation and maintenance (21), has been widely studied among smokers and identified as a barrier to smoking cessation (22, 23). Concern about weight gain also is associated with post-cessation weight gain, particularly among females (24, 25). Previous research demonstrated that African American smokers, particularly females, are weight-concerned (26-28), and this psychological concern about weight predicts actual weight gain (24, 25). In a sample consisting of 40% African Americans receiving cognitive behavioral therapy (CBT) for smoking cessation, Borrelli and Mermelstein (1998) found weight concern positively predicted weight gain at the end of treatment and at the 3-month follow-up. Thus, weight concern may have an influence on post-cessation weight gain in this population.

### The current study

The purpose of the study was to examine 1) the pattern of weight gain among treatment-seeking African American smokers and abstainers over 12 months post CBT and 2) the association between smoking status and weight gain controlling for potential confounders. We expected a) an overall increase (i.e., significantly greater than zero pounds) in weight over the 12-month follow-up period, b) among abstainers, participants would demonstrate an increase in weight over the 12-month follow-up period, and c) among continued smokers, participants would demonstrate no change in weight over the 12-month follow-up period. We also hypothesized that smoking status would predict weight gain, such that abstinence would be associated with greater weight gain over the 12-month follow-up period.

## MATERIALS AND METHODS

### Participants

Data were drawn from a randomized controlled trial testing the efficacy of a culturally specific smoking cessation intervention among African Americans (29). Participants were recruited via flyers, word-of-mouth, the public transit system, internet ads, doctors' offices, and community organizations. Eligibility criteria included: 1) self-identified as African American, 2) smoked at least five cigarettes per day, 3) age 18-65, 4) motivated to quit smoking (>5 on a scale from 1 to 10), 5) spoke and read fifth to sixth grade level English, and 6) had access to transportation. Participants were ineligible if they 1) were involved in another smoking cessation or drug treatment program, 2) reported serious mental illness, 3) reported contraindications to transdermal nicotine patch (TNP) use, 4) did not have permanent contact information, and 5) reported current illicit drug use. Participants provided informed consent and were compensated up to \$300 for participation through the 12-month follow-up. The study was approved by the University of Miami's Institutional Review Board.

### Interventions and procedures

Details about methods, collected measures, and results are published elsewhere (30). Participants ( $N=342$ ) were randomized into either a standard CBT smoking cessation intervention condition or CBT targeted to African American culture. Both conditions included an orientation session and an 8-session, 4-week group intervention administered by trained tobacco counselors. All participants received psychoeducation and were taught strategies for coping with urges to smoke, general weight control, stress management, and relapse prevention. Participants also were given eight weeks of TNP, including 21mg for the first four weeks, 14mg for two weeks, and 7mg for two weeks.

Participants completed follow-up assessments either in-person or via telephone at 3-, 6-, and 12- months post CBT. At baseline, the end of counseling (session eight), and all follow-up assessments, questionnaires were administered and weight and carbon monoxide (CO) levels were measured.

### Measures

**Weight**—Weight was measured in pounds using a digital scale, and height was self-reported. Weight was measured at each CBT session and follow-up assessments at the same time each day (e.g., afternoon, early evening). Participants wore light clothing and shoes when weighed. Weight was recorded to the nearest whole number.

**Smoking status**—Smoking status was self-reported and biochemically confirmed at each CBT session and follow-up assessment; participants were classified as either smoking or abstinent. Continuous abstinence was assessed at the end of counseling (abstinence for previous two weeks), and 3-, 6-, and 12-month follow-ups (abstinence for previous four weeks; 28-day continuous abstinence), using the timeline follow-back method (TLFB) (31).

**Covariates**—At baseline, information on demographics, average number of cigarettes smoked per day (CPD), and weight concern was collected. Demographic variables (sex, age in years, and education level) were self-reported. Education level was reported on a Likert scale [0-*Elementary School*, 1-*Junior High School*, 2-*Partial High School*, 3-*High School*, 4-*Business or Technical Training*, 5-*Some College (no degree)*, 6-*University Degree, Bachelor level or equivalent*, 7-*Post-graduate Degree*] and examined as a continuous variable. Baseline BMI was calculated using height and weight measurements [(lbs.)/(in)<sup>2</sup> × 703] (32). Weight concern was assessed using a single-item question “If you stopped smoking cigarettes today, how concerned would you be that you might start smoking again because of any weight gain?” Participants responded on an ordinal scale indicating either 0 (*not at all concerned*), 1 (*somewhat concerned*), or 2 (*very concerned*).

At each CBT session, TNP use was visually confirmed by interventionists and self-reported at 3-month follow up. Adherence to TNP was recorded as “yes” if the patch was applied and remained on the skin for the entire day and since the previous session, using the TLFB method. The frequency of days used was totaled and examined as a continuous variable in the analysis.

### Data Analyses

Chi-squared and t-tests examined differences in covariates and weight between intervention conditions (Table 1). Participants in the culturally specific condition were significantly more likely to report 28-day continuous abstinence at 3-month follow-up compared to the standard condition; no other intervention effects were observed. Thus, intervention conditions were collapsed, and intervention group was included as a covariate in the model. Baseline descriptive statistics were obtained, and data were examined for normality. Variables also were examined for multicollinearity using variance inflation factor (VIF), with no significant intercorrelations observed. Correlations between covariates and weight at baseline, end of counseling, 3-, 6-, and 12-months post CBT were examined. Variables that were significantly correlated with weight were included as control variables in the multilevel model analyses. Alpha was set at a *p* level of 0.05.

Analyses were conducted using PROC MIXED in SAS 9.3 statistical software (SAS Institute, Inc. Cary, NC). Random effects (mixed effects) multilevel modeling, using restricted maximum likelihood estimation, examined the pattern of weight gain and tested the association between smoking status on weight gain. To account for individual differences in weight gain over time, both intercept and slope were included as random effects. In the multilevel model, level 1 modeled individual weight gain and level 2 tested the variability in weight gain. This method used all available information and weighted estimates in cases of missing data; therefore, if a participant was missing measurements at a specific time point, the entire case was not removed from analyses (33.).

### Pattern of weight gain

To address each aim, a series of models was analyzed. First, a fully unconditional level 1 model was specified using five time points (baseline, end of counseling, 3-, 6-, and 12-month follow-up assessments) to examine the average baseline weight (intercept), the rate of

weight gain (linear slope), and the quadratic rate of change (quadratic slope) over 12 months post CBT. The effect of time (months that have passed since baseline assessment) was tested in level 1, and the variances in the intercept and slopes were represented in level 2. Results of this analysis indicated the average baseline weight of the sample, the rate of weight gain (i.e., increases, decreases, or remains steady), and the change in the rate of weight gain (i.e., whether the rate speeds up or slows down over time). A fully unconditional model was specified first for the entire sample. The sample then was stratified by smoking status: a) abstainers (i.e., participants who were abstinent at all follow-up periods over 12 months) and b) continued smokers (i.e., participants who did not meet criteria for 28-day continuous abstinence on at least one occasion over the 12-month follow-up period), and a fully unconditional model was specified for each group separately.

$$\text{Level 1: } Weight_{it} = \pi_{0i} + \pi_{1i}(Time_{it}) + \pi_{2i}(Time_{it}^2) + e_{it}$$

$$\text{Level 2: } \pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Definition of terms:  $\beta_{00}$ = average baseline weight (intercept);  $\beta_{10}$ = average rate of weight gain (slope);  $\beta_{20}$ =average quadratic rate of change (quadratic slope);  $r_{0i}$ =error component of intercept;  $r_{1i}$ =error component of slope;  $r_{2i}$ =error component of quadratic slope;  $e_{it}$ =overall random error.

Next, demographics and covariates were included to examine their associations with both baseline weight and rate of weight gain. Sex (0=Male, 1=Female), age (continuous), education level (continuous), weight concern [0=Not concerned, 1=Somewhat concerned, 2=Very concerned (dummy coded)], intervention condition (0=Standard, 1=Culturally Specific), TNP use (continuous), BMI (continuous), and CPD (continuous) were added to level 2 of the model. Nonsignificant variables were excluded from further analyses.

**Smoking status and weight gain**—To examine smoking status as a predictor of weight gain, smoking status (0=Smoking, 1=Abstinent) was added to level 1 of the model as a time-varying covariate, which accounted for changes in smoking status over time. Time-varying covariates may have multiple types of variances, including within-person, between-person, and/or an interaction of within- and between-person (34). It has been recommended that both the within-person and between-person variances are considered when assessing time-varying predictors (34). The level 1 effect of time-varying smoking status demonstrated the within-person effect of smoking on weight gain. To control for the between-person variance, the effect of the percentage of time reporting abstinence was added as a continuous variable to level 2. Between-person smoking status was calculated by averaging how often each participant reported abstinence across all assessments (i.e., 0-80%) (34). Results of this analysis indicated the effect of abstinence on weight gain over time, holding constant the effects of covariates.

## RESULTS

Overall participant demographics and baseline comparisons between the intervention conditions are found in Table 1. Approximately, 80% of the sample had data on weight at the 3-month follow-up, 79% at 6-month follow-up, and 78% at 12-month follow-up. At the end of counseling, 17% had achieved continuous abstinence for the previous two weeks, including 19% of the culturally specific group and 15% of the standard condition.

### Pattern of weight gain

All results of weight will be presented in pounds (lbs.). In the overall sample, weight significantly increased at a rate of .62 lbs. per month ( $p<.01$ ); among abstainers ( $n=79$ ; 23% of sample), weight increased at rate of 1.2 lbs. per month ( $p<.0001$ ; Table 2). The quadratic effect of time was inversely associated with weight for the overall sample ( $p<.001$ ) and abstainers ( $p<.05$ ), indicating that the rate of weight gain decelerated over the 12-month follow-up for both groups. The overall average weight gain was approximately 0.91 lbs. Abstainers gained an approximate average weight of 7.26 lbs. over the course of the one-year study, with most of the weight gain occurring within the first six months of follow-up. The linear effect of time (i.e., the average rate of weight gain per one month increase in time) was not significant in the sample of continued smokers, indicating no significant weight gain during the study.

### Factors associated with weight gain

**Control variables**—Age, TNP use, CPD were not significantly associated with the weight outcome and were excluded from further analyses. We also excluded the “Somewhat [weight] concerned” category because this variable was not associated with weight gain ( $p>0.5$ ), and reduced model fit (AIC 9950.7 compared to AIC 9939.6); therefore, we collapsed weight concern into a dichotomous variable of weight concern (0=Somewhat concerned or Not concerned, 1=Very concerned). Sex negatively predicted baseline weight, indicating that the mean weight for females was 23.27 lbs. less than for males ( $p<.0001$ ). Baseline BMI was positively related to baseline weight ( $\beta=193.31$ ,  $SE=6.85$ ,  $p<.0001$ ). Due to the high correlation between continuous BMI and weight, BMI was coded into a dichotomous variable signifying obesity status of a BMI  $\geq 30$  (0=Not obese, 1=Obese) and included in further analyses. Participants reporting high weight concern weighed on average 11.74 lbs. more at baseline compared to those who were somewhat or not concerned ( $p<.01$ ). No other variables were significantly associated with the rate of weight gain.

**Smoking status and weight gain**—Controlling for the effects of demographics, obesity, weight concern, and intervention condition, smoking status significantly predicted weight gain over the 12-month follow-up (Table 3). There was a positive trend between within-person smoking status and weight, such that a participant weighed more over time with reported abstinence ( $p=.069$ ). The association between weight and between-person smoking status was moderated by intervention condition and weight concern. Among participants in the culturally specific CBT condition, the rate of weight gain increased by 1.38 lbs. each month as a function of the percentage of biochemically-confirmed abstinence ( $p<.01$ ). In addition, among those with much weight concern, the rate of weight gain increased as the

percentage of biochemically-confirmed abstinence increased ( $p<.01$ ). The simple effect of weight concern was also significant ( $p<.05$ ), indicating that those who did not report considerable weight concern weighed less than those who reported considerable concern over time, irrespective of smoking status.

## DISCUSSION

Overall, participants gained weight over the 12-month follow-up period. After stratification by smoking status, the rate of weight gain was significantly greater among participants who reported 12-month continuous abstinence. For the full sample, the percentage of time abstinent was predictive of the rate of weight gain over time for participants in the culturally specific condition, or who reported high weight concern at baseline.

### Weight gain in African American smokers

The average weight gain in this sample was minimal. However, among abstainers only, post-cessation weight gain within the 12-month follow-up period averaged seven lbs. The results are consistent with previous research indicating that smokers gained an average of four to 10 lbs. after quitting (6, 35, 36). Consistent with findings in the general population of smokers, most of the weight gained occurred during the first six months of follow-up (6). However, in this sample of African American smokers, we did not observe excessive, or more than average, weight gain after cessation, as documented in previous literature (3, 4). These contrasting findings may be a function of the variation in study designs and analyses. Previous studies in this racial group included population-based surveys (3, 4, 15), while we tested associations following an intensive smoking cessation intervention. The current study was the first, to our knowledge, to examine weight in African American smokers enrolled in a CBT efficacy trial. While causality cannot be inferred from this study, it is possible that exposure to group CBT (in either a culturally specific or standard format) in combination with TNP helped participants better manage their post-cessation weight. For example, one session of CBT focused entirely on post-cessation weight gain and discussed strategies to reduce weight gain (e.g., increasing physical activity, decreasing high fat consumption, not replacing cigarettes with food). This would be consistent with previous research, which demonstrated a reduction in post-cessation weight gain at six months following weight control interventions or education (37-40). Moreover, CBT has been found to have a positive effect on cessation outcomes in African American smoking samples (41), as well as NRT treatment, which has been shown to delay or reduce weight gain after quitting (38). Considering the limited current research on African Americans and post-cessation weight gain, our findings begin to fill a gap in the literature and have implications for future research.

### Smoking dynamics and weight gain

We also found an association between smoking status and the individual rate of weight gain over time. The current study extends the literature by examining correlates of both within- and between-person smoking status and weight. Smokers tend to make multiple quit attempts before sustaining long-term abstinence (42), thus, the prevalence of lapsing or relapsing during post-treatment follow-up may be substantial. For example, approximately



50% of smokers in evidence-based CBT relapsed over the next 12 months (43). Our analytic approach considered the dynamics tobacco smoking and cessation, specifically, how time-varying abstinence may be related to weight status. We found no association between abstinence and weight at any single time point; however, participants with more periods of abstinence gained significantly more weight.

### **Moderators of smoking and weight gain**

The rate of weight gain was highest among weight-concerned participants who were abstinent for more periods during the 12-month follow-up. Findings are mixed on the association between weight concern and smoking outcomes (8, 22-24, 44). For example, weight concern has been linked to greater difficulty sustaining abstinence in samples of primarily white smokers (44). A previous study focused on African American female smokers found a positive association between quit attempts and weight concern (45), which is in line with the current findings. Thus, weight control interventions among treatment-seeking African American smokers with high weight concerns are needed. A multiple behavior change approach might be useful here, as the high motivation of this subgroup of smokers may be harnessed to minimize weight gain. Potential moderators of the association between weight concern and cessation, such as social support and intention to quit (45), may contribute to our understanding of this association and also should be examined in future research.

In addition, the rate of weight gain was highest among participants in the culturally specific CBT group who were abstinent for more periods during follow-up. This condition included discussions of weight gain specifically among African Americans and offered culturally appropriate strategies for increasing physical activity and healthy eating. This was an unexpected finding that requires additional investigation. We hypothesize that the effect of intervention condition may simply be attributable to the significantly higher quit rates within the culturally specific group overall (30), but cannot confirm this in the current analysis.

### **Strengths and limitations**

The current study included a large sample of African American smokers enrolled in a smoking cessation trial, who have been underrepresented in post-cessation weight gain research. The prospective study design allowed for examination of predictive versus cross-sectional associations, and use of rigorous, longitudinal data modeling to delineate associations between the predictors on the rate of weight gain. Findings also were strengthened by the use of objective measures of weight and smoking status throughout the intervention and at each follow-up. However, this was a secondary analysis, so analyses were limited by the available dataset, which did not include details on diet/eating habits and physical activity. We also are unable to generalize findings to non-treatment-seeking African American smokers or compare findings to other racial/ethnic groups.

### **Conclusions and future directions**

This study is the first, to our knowledge, to examine weight gain among treatment-seeking African American smokers enrolled in a CBT efficacy trial. The weight gain of African Americans in this sample was comparable to the average four to 10 lbs. documented in

previous literature. Findings are in contrast to research suggesting that African Americans gain excessive weight post-cessation, and this may be due to the observational design of previous research. Placing the current findings into the context of the extant literature, it appears that exposure of intensive group CBT (delivered in either culturally specific or standard formats) combined with TNP may have attenuated excessive weight gain. Future research including an inactive control condition is necessary to demonstrate whether a causal association exists. Additionally, longitudinal studies that include racially and ethnically diverse samples are important for making direct comparisons of weight gain across groups. Given the disproportionate burden of chronic illnesses and obesity-related cancer experienced by African Americans, it is important to understand and address the distinctive factors that are related to weight gain among treatment-seeking smokers, and to address health disparities.

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### Highlights

- Previous research showed that African Americans gain excessive weight after smoking cessation.
- We found that African American smokers gained the average 4-10 lbs (1.8-4.5 kg) reported in literature.
- Abstainers gained weight particularly if they had high pre-treatment weight concern.
- Exposure to cognitive-behavioral therapy may mitigate excessive weight gain.

**Table 1**

Sample Characteristics

Characteristic	Total (N=342)	Standard (n=173)	Culturally Specific (n=167)	Possible Range	Observed Range	* p
Age, years, M (SD)	49.50 (9.07)	49.52 (8.73)	49.48 (9.44)	18—	(20-67)	ns
Sex (%)						
Male	57	52	61	—		
Female	43	48	39	—		
Education level (%)						ns
Less than high school	19	17	20	—		
High school	50	51	48	—		
Greater than high school	31	32	32	—		
Smoking Status, 28-day continuous abstinence (%)						
3 months post CBT	31	26	37	—		p<.05
6 months post CBT	29	28	31	—		Ns
12 months post CBT	27	25	28	—		Ns
Weight concern (%)						Ns
No concern	41	40	42	—		
Some concern	36	39	33	—		
Much concern	23	21	25	—		
Cigarettes per day, M (SD)	18.08 (10.81)	17.87 (10.03)	18.29 (11.54)	0—	(1.0-60.0)	Ns
Transdermal nicotine patch use, total days, M (SD)	21.67 (6.44)	21.19 (6.44)	22.20 (6.41)	(0-25)	(0-25)	
Weight in pounds, M (SD)						
Baseline	192.79 (46.10)	197.08 (46.21)	188.30 (45.70)	—	(93.0-354.0)	Ns
3 months post CBT	196.68 (47.19)	200.10 (47.43)	193.50 (46.91)	—	(89.0-358.9)	Ns
6 months post CBT	195.45 (47.47)	198.10 (46.05)	193.20 (48.67)	—	(87.4-365.4)	Ns
12 months post CBT	195.56 (46.96)	199.04 (45.06)	192.46 (48.37)	—	(97.6-378.8)	Ns
Baseline BMI, M (SD)	29.69 (7.28)	30.55 (7.34)	28.86 (7.13)	—	(16.6-58.9)	
Obesity (%)						p<.05
Obese (BMI>=30)	42	45	39	—		

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Characteristic	Total (N=342)	Standard (n=173)	Culturally Specific (n=167)	Possible Range	Observed Range	* p
Not obese (BMI<30)	58	55	61	—		

\*  $\chi^2$  or t-test comparing each variable by intervention condition

CBT=cognitive-behavioral therapy

Initial Weight and Rate of Weight Gain in African American Treatment-Seeking Smokers: Results of Full Unconditional Models

Table 2

Model Results						
Fixed Effect	Estimate*	Standard Error	DF	t Value	p	
<b>Overall Sample (N=342)</b>						
Intercept	192.87	2.4904	341	77.45	<.0001	
Time (months)	0.6185	0.1912	951	3.23	0.0013	
Time (months <sup>2</sup> )	-0.04526	0.01286	951	-3.52	0.0005	
<b>Abstainers (n=79)</b>						
Intercept	204.59	4.9443	78	41.38	<.0001	
Time (months)	1.2317	0.3562	234	3.46	0.0006	
Time (months <sup>2</sup> )	-0.05134	0.02374	234	-2.16	0.0316	
<b>Continued Smokers (n=263)</b>						
Intercept	189.35	2.8477	262	66.49	<.0001	
Time (months)	0.4231	0.2243	715	1.89	0.0597	
Time (months <sup>2</sup> )	-0.04329	0.01525	715	-2.84	0.0046	

\* Average baseline weight in pounds (lbs.) or average rate of weight gain per one month increase



**Table 3** Association between Smoking Status and Weight over Twelve Months Post CBT among Treatment-seeking Smokers

Model Results						
Fixed Effect	Estimate*	Standard Error	DF	t Value	p	
<b>Factors Associated with Baseline Weight</b>						
Intercept	162.75	5.1925	333	31.34	<.0001	
Smoking status (between)	2.6848	5.2183	333	0.51	0.6072	
Sex (female)	-23.2569	3.4758	333	-6.69	<.0001	
Education level	2.2454	1.2552	333	1.79	0.0745	
Obesity	69.1617	3.5086	333	19.71	<.0001	
Weight concern (much)	11.7413	4.0412	333	2.91	0.0039	
<b>Predictors of Change in Weight Over Time</b>						
Time (Months)	0.5811	0.2545	934	2.28	0.0226	
Time (Months <sup>2</sup> )	-0.04483	0.01294	934	-3.47	0.0006	
Smoking status (within)	0.7747	0.4252	934	1.82	0.0688	
Smoking status (between)	-0.3155	0.3839	934	-0.82	0.4114	
Weight concern (much)	-0.5223	0.2611	934	-2.00	0.0458	
Intervention condition	-0.2533	0.2360	934	-1.07	0.2834	
Smoking status (between) × weight concern (much)	1.7071	0.5681	934	3.01	0.0027	
Smoking status (between) × intervention condition	1.3795	0.4857	934	2.84	0.0046	

\* Average differences in baseline weight in pounds (lbs.) or rate of weight gain per one-unit change in the predictor variable (if continuous) or between groups (if categorical)