Real-Time Craving Differences between Black and White Smokers

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Abstract

Black and White smokers may experience aspects of nicotine dependence, including craving, differently. This study used a naturalistic technique, ecological momentary assessment (EMA), to explore differences in craving, mood, expectancy, and smoking enjoyment between Black and White smokers. Participants carried personal digital assistants (PDAs) programmed to obtain multiple daily assessments. Black smokers reported higher craving after smoking and at random assessment times and higher cigarette enjoyment. No differences were found in mood or expectancy. Racial differences in psychological factors related to smoking are explored in the contexts of genetic, sociological, and psychophysiological distinctions. Implications for practice and research are discussed.

INTRODUCTION

Smoking patterns and health consequences have been shown to vary widely between Black and White smokers. For example, smoking prevalence is lower among Blacks (19.8%) than Whites (21.4%),[1] Blacks smoke fewer cigarettes per day,[2,3] Blacks have reported equal or higher desire to quit smoking,[2,4] but the prevalence of cessation is higher among Whites (51.0%) than among Blacks (37.3%).[5] Blacks experience more serious smoking-related health consequences, such as a 50% higher likelihood of developing lung cancer compared to Whites.[6] These findings suggest that Blacks may experience some aspects of nicotine dependence (eg, smoking patterns, craving) differently from White smokers.

One key aspect of nicotine dependence is nicotine craving. For the cigarette smoker, the experience of craving is a complex phenomenon, and a significant factor responsible for maintaining smoking behavior and initiating relapse during quit attempts. Smokers commonly report craving as a motivation to maintain regular smoking patterns, and they

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anticipate craving as the most difficult aspect of quitting.[7],[8] Craving is one of the dominant symptoms experienced during nicotine withdrawal and is associated with smokers' failures to succeed in quit attempts.[9–11]

Although many laboratory studies have easily captured the craving response by subjecting smokers to the presentation of cigarette-related stimuli, which produces robust craving responses,[12] more recent work has focused on the craving response as it happens in the smokers' daily lives. These naturalistic studies use ecological momentary assessment (EMA),[13],[14] collecting mood and craving ratings with handheld computers, or personal digital assistants (PDAs), from smokers in their day-to-day lives. These studies have investigated the temporal relationship between craving, mood, and smoking. For example, Shiffman et al.[15] used EMA to study the psychological antecedents of cigarette smoking. Smokers used a handheld computer to complete craving ratings immediately before smoking and at random times of day. The researchers found that smoking increased with higher craving ratings; that is, smokers reported higher craving before smoking than at random times of day. More recent studies by Shiffman and colleagues have shown similar results. [16],[17] This finding helps confirm the commonly held belief that craving is at least partially responsible for motivating smoking behavior in everyday settings. However, this technique has yet to be explored to make direct comparisons between Black and White smokers.

Considerable controversy exists surrounding the terms "race" and "ethnicity." Hunt and Carlson[18] reviewed the definitions of race and ethnicity for their study on group differences in intelligence. Race is used more often to describe biological factors, whereas ethnicity usually refers to cultural practices, including language and social customs. For the purpose of this study, self-identified race was used to classify smokers as Black or White because a biological approach is more appropriate to examine group differences within the context of smoking-related health disparities. Moreover, as Hunt and Carlson point out, racial self-identification is a "surprisingly reliable guide to genetic composition" reflected in racial differences.[18]

Given the discrepancies between Black and White smokers, psychologists and other mental health care providers have been active in developing cessation programs targeted at Black smokers. These racially specific interventions frequently place smoking cessation within the context of culturally relevant values, communication patterns, familial roles, unique stressors, and historical factors; however, results of the effectiveness of such programs have been mixed.[19] Understanding racial differences in the experience of craving could improve tailored efforts in smoking cessation programs for Black smokers.

The present study used EMA technology to explore possible racial craving differences both before and immediately after smoking, and at random times of day. Along with self-reported craving, other factors commonly believed to influence smoking behavior–negative and positive mood, expectancy that smoking will improve mood, and smoking enjoyment–were also explored for potential ethnic differences. Comparing the experiences of Black and White smokers could offer greater insight into factors that may subtly influence the psychological and physiological aspects of nicotine dependence for these disparate groups. For example, if Blacks report higher levels of craving compared to Whites, this may help

explain Blacks' relatively poor smoking cessation rates compared to Whites. Gaining a greater understanding of differences in craving between Blacks and Whites could be critical in developing more targeted cessation materials focusing on the role of race and craving in smoking behavior.

METHOD

Participants

Non-treatment-seeking smokers ($N = 68$, 39 Blacks, 29 Whites, by racial self-report) were recruited from the Houston metropolitan area through newspaper and radio advertisements, as part of a larger laboratory study. There were no differences between Black and White smokers on socioeconomic status as measured by level of education. In this sample 21% reported having a high school degree or below, 64% reported having some college experience, 13% reported having a bachelor's degree, and 2% reported having a master's degree or higher. This study assessed smoking status by saliva cotinine analysis when participants were in a non-deprived state before entry into the study. Table 1 shows descriptive data for each race. Blacks were slightly older than Whites, but were otherwise not significantly different.

EMA Apparatus and Programming

Participants carried a Cassiopeia Pocket PC personal digital assistant (PDA, Casio Model E-125, Casio Computer Co., Ltd., Tokyo, Japan), which has a touch-sensitive color screen and a silo for a stylus. Native Pocket PC programming (calendar, date book, address book, etc.) was blocked, and a specialized EMA program was put in its place. Participants were instructed to access the PDA before smoking each cigarette throughout the day and night, and to answer questions if they appeared on the screen. They were also instructed to respond to PDA alarms that would occur periodically throughout the day and answer any questions that appeared on the PDA screen. These alarms occurred both randomly and, at times, 20 minutes post-cigarette.

Each day was tailored to the participant, based on their typical wake up and bedtime, by dividing the day into three epochs roughly corresponding to morning, afternoon, and evening. The program was designed to randomly obtain one of each type of assessment (before, after, random) during each epoch to gain a representative sample of smoking throughout the day.

EMA Questionnaires

Craving self-report was derived as a composite score from three questions, "I have a craving for a cigarette," "I really need a cigarette," and "I want a cigarette." *Negative mood* was assessed as a composite score from four questions, "I feel bored," "I feel sad," "I feel anxious," and "I feel angry." *Positive mood* was assessed as a composite score from three questions, "I feel happy," "I feel relaxed," and "I feel enthusiastic." A single *expectancy* item, "Smoking will improve my mood or make me feel better," was included, as well as a *smoking enjoyment* assessment made of two questions, "I enjoyed my last cigarette," and

"My last cigarette was pleasurable." All assessments used a five-point scale with anchor points of "Strongly Disagree" (=1), to "Strongly Agree" (=5).

PDA programming was designed to obtain craving assessments at least nine times per day, three immediately before smoking, three at 20 minutes after a smoked cigarette, and three not associated with smoking, randomly placed 20 minutes or more from any previous reported smoking. Participants were not informed of the study's specific goal to examine craving and mood ratings before and after smoking. Very few participants' individual cigarette recordings ($n \sim 1$, per day) were assessed both before and after smoking. That is, the vast majority of assessments associated with a single smoking occurrence were requested either before smoking or after, but not both. Moreover, to decrease participant burden, the majority of recorded cigarettes required no assessment at all.

Statistical Approach

The primary analytic strategy used involved a mixed model approach to examine the effects of the dependent variables (eg, craving, mood) across assessment types. The mixed model approach provides a generalization to the classic linear regression model, using restricted maximum likelihood functions instead of least squares to estimate effects.[20] The mixed model approach is well suited for analysis of repeated measures data in that it allows for more specific estimation of the correlation structure of the residuals, and more efficiently handles unbalanced designs and missing data, without excluding participants or imputing values.[21,22] Due to the repeated nature of EMA data (ie, temporally sequential data collected from the same individual), the residuals may be both homoscedastic and auto correlated.[23] Thus, to allow for heteroscedastic variance over time, a first-order autoregressive error structure was added to the model. Changes in model deviance were compared to a chi-square distribution, between the model with and without an autoregressive error structure, to examine whether adding an autoregressive error structure yielded significant improvement in model fit. An initial analysis was conducted without covariates in the model. Baseline levels of cotinine, Fagerstrom Test of Nicotine Dependence (FTND), age, cigarettes per day, and sex were then entered into the model for a second analysis. Because there was no change in results due to the covariates, the results of the initial analysis are reported here. The computer program PROC MIXED (SAS Institute Inc, Cary, NC) was used to estimate and test the models.

RESULTS

Because the focus of the present study is on differences between Black and White smokers, findings for the group as a whole are reported elsewhere. The following analyses examine only ethnic differences.

Participants provided a total of 6,782 assessments over an average of 10.37 days (SD = 3.98). Participants reported a daily average of 2.54 before-smoking assessments (SD = .73), 2.0 after-smoking assessments (SD = .65), and 2.14 random assessments (SD = .59). Participants responded 81% of after assessments prompts and 75% of random assessment prompts.

There was a main effect of race on craving ($F(1, 66) = 9.94$, $p < .01$), with Blacks reporting higher overall craving than Whites. There was also an assessment time X race interaction for craving ($F(2, 131) = 28.64$, $p < .01$). Follow-up analyses revealed no significant difference in craving between Blacks and Whites before smoking, but Blacks had significantly higher craving both after smoking ($t(131) = 2.98$, $p < .01$) and at random ($t(131) = 4.65$, $p < .01$). (See Fig. 1.)

There was a main effect of race on enjoyment ($F(1,66) = 7.66$, $p < .01$), in which Blacks reported higher enjoyment than Whites at each assessment time. There was no assessment time X enjoyment interaction. There were no effects of race on expectancy, negative or positive mood.

DISCUSSION

In general, Blacks reported higher levels of craving than Whites when assessed throughout the day. The lack of craving differences between Black and White smokers immediately before smoking is consistent with the baseline smoking characteristics of this sample. That is, contrary to previous research, Blacks in this study did not smoke significantly fewer cigarettes than Whites, nor were there any significant differences from Whites on a biochemical measure of recent smoking (saliva cotinine level). However, Blacks' higher levels of craving both after smoking and at random times suggests that, overall, Black smokers may find craving a more pervasive problem than Whites do. For instance, in this case Black smokers did not experience as much relief from craving as White smokers. This also suggests smoking cessation interventions with Black smokers should have a strong emphasis on craving assessment (pre-quit) and an equally strong emphasis on craving control (post-quit).

Racial craving differences may arise from complex factors, operating from the basic biological genetic level to socioeconomic characteristics. Erblich et al.[24] found a significant effect of two polymorphisms on smoking cue-induced craving reactions in a Black population. Black smokers carrying either the DRD2 A1 allele or the SLC6A3 dopamine transporter gene (9-repeat) had stronger cue-induced craving reactions than noncarriers. Carriers of both receptor and transporter polymorphisms exhibited the highest cue-induced craving, reaching levels that were almost five times higher than carriers of neither variant. Although Erblich et al.[24] did not explore these polymorphisms among White smokers, their study does suggest a genetic basis for differences in craving cue reactions among Black smokers because previous research has indicated that the DRD2 A1 allele is more common in Blacks.[25] In the case of the present study, the Black participants could have had a disproportionately higher frequency of this polymorphism. However, future naturalistic studies will have to genotype participants to test such a hypothesis.

There are a number of additional potential explanations for the results found here. For example, craving differences could also be due, in part, to social or demographic factors. Considerable research has found a greater density of tobacco outlets and tobacco advertising in predominately minority neighborhoods.[26,27] This suggests that Blacks, compared to Whites, are exposed more often to tobacco images and advertising that is specifically

targeted at them, representing greater exposure to cigarette cues. Moreover, social cognitive theory[28] posits that such advertising is more salient to Blacks than White advertisements are to Whites. Laboratory evidence suggests that this higher exposure would evoke an increase in the overall level of craving in their daily lives.

Another potential factor may be chronic race-based discrimination and frequent exposure to stressful life events. Chronic race-based discrimination and frequent exposure to stressful life events appear to result in changes in brain functioning and psychophysiological responses in a "race–discrimination–health pathway" wherein stress challenge loads are related to negative health outcomes.[29] In two studies, Black adults' appraisal of stressful discrimination predicted smoking better than education, gender, income, or age.[30] The amygdala and the anterior cingulate cortex are brain structures activated by social stressors, and these are being studied in relation to social exclusion (eg, reference [30]). Differential experiences of craving, in such a light, could be related to differences at the molecular level, created in response to race-based patterns of experience.

The principal dependent variables of interest in this study were craving and mood. Questions involving expectancy and cigarette enjoyment were included as exploratory items. The two-item ad hoc enjoyment assessment scale did produce a higher cigarette enjoyment rating among Blacks compared to Whites. Although considerable research reports on expectancy and smoking, scant research exists on smoker's enjoyment of their smoking. The racial difference in enjoyment found here needs replication and further study to determine what role, if any, it plays in nicotine dependence among Blacks. No racial differences were found on measures of negative mood or positive mood. These null findings indicate that there are few differences between Whites and Blacks on basic emotional self-report measures related to smoking, thus suggesting that what differences do exist may be more subtle and perhaps related to more complex causal chains.

These findings have important practice and research implications, particularly for those attempting to provide racially specific smoking cessation. Environmental factors related to social and demographic issues and the stress of facing chronic race-based discrimination may have a stronger impact on Black smokers' levels and patterns of craving. Seeking to better understand and inform Black consumers of the potential effects of their unique social and physical environments will help Black smokers begin to address these issues on a personal and community level. It is important to explore environmental factors with Black clients and empower them to recognize and address their reactions to these cues and stresses through provision of appropriate coping skills.

It is essential that more research be conducted in the area of craving and race differences in order to gain a greater understanding of this phenomenon and the social and environmental factors that affect smokers. Psychologists and other mental health professionals are well positioned to conduct research exploring diverse, often unexplored populations of smokers and are ethically bound to reduce the disparities that exist in smoking research with, and our understanding of, underrepresented populations of smokers.

Unfortunately, a dearth of research investigates psychological and physiological aspects in Blacks' smoking behavior. Further exploration of Black smokers is needed to gain a more complete picture of how race contributes to nicotine dependence. Research on the association of genetic differences, race-based experiential differences, and smoking behavior may help guide the development of cessation treatments for Blacks that incorporate findings on the psychological and biological aspects of craving.

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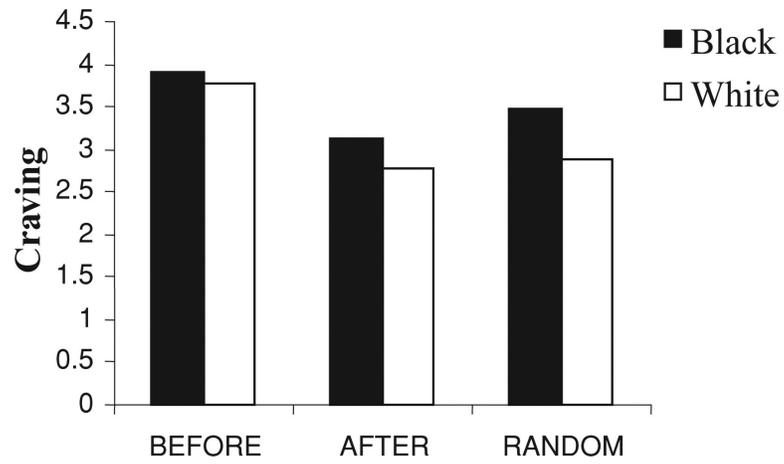
FIGURE 1.
Means by race at each assessment time. Note: Standard error values are so small (range = .
08, .15) that error bars were omitted because they lack visual utility.

TABLE 1

Characteristics of black and white smokers ($n = 68$)

Characteristics	Black $n = 39$		White $n = 29$	
	M	**SD**	**M**	**SD**
Age	44.9[*]	8.6	39.4[*]	10.7
Cigarettes per day	21.1	10.5	21.7	5.5
Years smoked	23.6	8.6	20 8	9.7
Age began smoking	18.9	5.0	17.3	5.7
Baseline CO level	21.9	8.4	26.2	9.9
Cotinine level	238.2	160.8	210.7	126.6
Fagerstrom Tolerance Score	5.3	1.9	5.6	1.6

[*] $p < .05$.