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Smoking Dependence across the Levels of Cigarette Smoking in a Multiethnic Sample

Taneisha S. Scheuermann, PhD^{1,*}, Nicole L. Nollen, PhD¹, Lisa Sanderson Cox, PhD¹, Lorraine R. Reitzel, PhD², Carla J. Berg, PhD³, Hongfei Guo, PhD⁴, Ken Resnicow, PhD⁵, and Jasjit S. Ahluwalia, MD, MPH, MS⁶

¹Department of Preventive Medicine and Public Health, University of Kansas School of Medicine, Kansas City, KS

²College of Education, Department of Educational Psychology, University of Houston, Houston, TX

³Department of Behavioral Sciences and Health Education, Emory University School of Public Health, Atlanta, GA

⁴Division of Biostatistics, School of Public Health, University of Minnesota, Minneapolis, MN

⁵Department of Health Behavior & Health Education, University of Michigan, School of Public Health, Ann Arbor, MI

⁶Department of Medicine and Center for Health Equity, University of Minnesota Medical School, Minneapolis, MN

Abstract

Objectives—The Brief Wisconsin Inventory of Smoking Dependence Motives (WISDM) is a multi-dimensional smoking dependence measure that assesses Primary Dependence Motives (PDM; e.g., core dependence marked by tolerance, craving) and Secondary Dependence Motives (SDM; e.g., auxiliary dependence motives such as cognitive enhancement, weight control). However, the relationship between PDM, SDM, and smoking level remains unclear. Thus, we examined these scales across smoking levels in a diverse sample of smokers.

Methods—Participants were 2,376 African American, Latino, and non-Hispanic White smokers recruited using an online panel research company. The sample included 297 native nondaily

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Corresponding author at: Department of Preventive Medicine and Public Health, University of Kansas Medical Center, 3901 Rainbow Boulevard, Kansas City, Kansas 66160, USA. tscheuermann@kumc.edu.

Contributors

Drs. Ahluwalia and Scheuermann wrote the protocol for the study. All authors participated in the conceptualization of the manuscript. Drs. Guo and Scheuermann conducted the statistical analyses. Dr. Scheuermann wrote the first draft of the manuscript and all authors contributed to, and have approved the final manuscript.

Conflict of Interests

Authors have no conflicts of interest pertaining to this research.

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smokers (never smoked daily), 297 converted nondaily smoker (previously smoked daily for six months), 578 light daily smokers (10 cigarettes per day [cpd]), and 597 moderate to heavy daily smokers (>10 cpd).

Results—Results of a multinomial logistic regression showed that for each unit increase in SDM, after controlling for PDM, the odds of being a native nondaily, converted nondaily or light smoker vs. moderate to heavy smoker increased by 29% to 56% ($p < 0.001$). In the model, higher PDM scores were associated with lower odds of being a native nondaily, converted nondaily, or light smoker vs. a moderate to heavy daily smoker ($p < 0.001$).

Conclusion—Nondaily and light smokers endorse higher secondary dependence motives relative to their primary dependence motives. Smoking cessation trials for nondaily and light smokers might address these secondary motives within the context of counseling intervention to enhance abstinence.

Keywords

Smoking dependence; nondaily smoking; daily smoking

1. Introduction

Approximately 22% of current U.S. cigarette smokers are classified as nondaily smokers, smoking on “some days” of the month, and 22% of daily current smokers are classified as light daily smokers (Centers for Disease Control and Prevention [CDC], 2012). Among current smokers, the proportion of nondaily smokers has more than doubled from 9.3% in 1994 (Johnston, O’Malley, Bachman, & Schulenberg, 2007), and light smoking has increased from 16.4% among daily smokers in 2005 (CDC, 2012). In fact, nondaily and light smokers account for 66% of African American smokers, 76% of Latino smokers, and 40% of White smokers (Trinidad et al., 2009). Consequently, understanding how smoking motives among nondaily and light smokers differ from those of heavier smokers will inform interventions to address this emerging smoking population.

Nondaily smokers consistently exhibit less dependence than daily smokers (Shiffman, Ferguson, Dunbar, & Scholl, 2012). However, widely used dependence measures such as the Fagerstöm Test of Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerström, 1991) may not capture variations in lower levels of smoking dependence among nondaily and light smokers (Etter, Duc, & Perneger, 1999; Shiffman, Ferguson et al., 2012). Other measures such as the Wisconsin Inventory of Smoking Dependence Motives (WISDM) (Piper et al., 2004), which assesses core dependence and accessory motivations for smoking, might offer a more nuanced assessment of dependence among nondaily and light smokers.

The WISDM is a promising instrument for providing detailed assessment of smoking dependence motives and has been used in diverse samples of smokers (Bronars et al., 2014; Businelle et al., 2009; Ma, Ling, & Payne, 2012; Piper et al., 2008; Reitzel et al., 2009). Piper and colleagues identified two distinct dimensions underlying the WISDM scales using latent profile analysis and factor analysis: Primary Dependence Motives (PDM) and Secondary Dependence Motives (SDM) (Piper et al., 2008). PDM is comprised of the

Automaticity, Craving, Loss of Control, and Tolerance subscales, identified as core features that are predictive of nicotine dependence criteria. SDM is comprised of the remaining subscales of Affiliative Attachment (emotional attachment to cigarette use), Cognitive Enhancement, Cue Exposure/Associative Processes, Affective Enhancement (smoking to improve mood), Social/ Environmental Goads (social stimuli or contexts promoting smoking), Taste, and Weight Control, and represents more accessory motivations for smoking that are not necessary for nicotine dependence among heavy smokers with marked loss of control over smoking but provide supplemental information.

Three studies have examined the association between the WISDM scales and smoking level. Piasecki and colleagues found that although both PDM and SDM were independently associated with daily vs. nondaily smoking among 33 daily and 17 nondaily college student smokers (Piasecki, Piper, Baker, & Hunt-Carter, 2011), the associations of SDM and daily smoking were not significant in models that also included PDM. Similarly, Shiffman et al. found that PDM were more accurate than SDM in discriminating between daily and nondaily smoking in a sample of 217 nondaily and 197 daily smokers (Shiffman, Ferguson et al., 2012). They also found that PDM were more accurate than SDM in discriminating between converted nondaily (nondaily smokers who previously smoked daily for at least six months) and native nondaily smokers (nondaily smokers who never smoked daily for six months). In a second study with an overlapping sample, Shiffman et al. examined the profiles of WISDM dependence motives among 252 nondaily and 218 daily smokers (Shiffman, Dunbar, Scholl, & Tindle, 2012). Using raw scores, daily smokers scored higher than nondaily smokers, and converted nondaily smokers scored higher than native nondaily smokers on all subscales. When the profiles were standardized using mean scores, SDM subscales were higher among nondaily vs. daily smokers. This latter finding was unexpected in light of the previous findings that SDM did not uniquely explain variance in daily vs. nondaily smoking (Piasecki et al., 2011).

To elucidate these findings, the current study will examine the unique associations between smoking dependence and smoking level across nondaily and daily smoking in a large, multi-ethnic sample. We will extend the previous work by investigating whether there are ethnic differences in the associations between PDM, SDM, and smoking level, and conduct additional analyses using a continuous indicator of smoking level because definitions of light and nondaily smoking have been inconsistent in the literature (Husten, 2009). Following previous findings (Shiffman et al., 2012), we hypothesized that PDM would be positively associated with smoking level (native nondaily, converted nondaily, light daily [1-10 cpd], and moderate to heavy daily smokers [>11 cpd]), and SDM would be negatively associated with smoking level after controlling for PDM. Secondly, we examined the association between WISDM PDM and WISDM SDM using total number of cigarettes as a continuous indicator of smoking level. We also examined whether the associations between WISDM PDM, WISDM SDM, and smoking level differed by race and ethnicity.

2. Materials and methods

2.1. Participants

Smokers were recruited using an online panel survey company, Survey Sampling International (SSI). SSI maintains an opt-in online panel that is closely monitored for sample consistency and quality control (SSI, 2013). The SSI panel consists of approximately 1.5 million people in the U.S. who enrolled in the panel and are interested in completing online surveys. Eligible participants spoke English and self-identified as African American, White, or Latino. We were interested in stable smokers who were not recent smoking initiators. Eligibility criteria included being 25 years old and older, smoking at least 100 cigarettes in their lifetime, for at least one year, and at their current rate (i.e., daily or nondaily) for at least 6 months. Individuals who participated in any smoking cessation treatment in the past 30 days, or who were currently pregnant or breast-feeding were excluded from the study.

Quota sampling was used to obtain equal numbers of daily smokers and nondaily smokers for each racial/ethnic group to yield a total sample of approximately 2,400 smokers. Nondaily smokers smoked at least one cigarette during 4 to 24 days in the past 30 days; persons who smoked three or fewer days out of the past 30 days were excluded from the study in order to sample nondaily smokers who were smoking the equivalent of at least once a week (Shiffman, Tindle, et al., 2012). Daily smokers smoked on 25 to 30 of the past 30 days (Evans et al., 1992), representing a common criterion for smoking most days of the month (Ahluwalia et al., 2006; Cox et al., 2012). Daily smokers were further subdivided to obtain equal samples of light daily smokers (≤ 10 cpd) and moderate to heavy daily smokers (>10 cpd; Businelle et al., 2009; Reitzel et al., 2009). Nondaily smokers who indicated that they had smoked daily for six months or longer were categorized as “converted nondaily smokers” and those who reported that they had not smoked daily for a six month period were categorized as “native nondaily smokers.”

2.2. Procedures

All procedures were approved by the University of Minnesota Institutional Review Board. SSI used existing panelist information (e.g., race and ethnicity) to identify potential participants from a randomly selected subsample of the panel. These SSI panelists received email invitations directing them to the study. Potential participants were presented with an informed consent page, screened for eligibility, then eligible participants were directed to the survey. In addition to the eligibility criteria, if the quota for a particular ethnic group or smoking level was met these participants were no longer recruited into the study. Participants received SSI's standard incentives that include entry into a quarterly drawing for \$12,500 available to the entire panel of 1.5 million and points that could be redeemed for cash. Additional detail on participant recruitment is provided elsewhere (Kendzor et al., 2014).

2.3. Measures

2.3.1. Demographic Variables—Participants were asked to report their age, race and ethnicity, gender, education level completed, relationship status, and monthly household income.

2.3.2. Smoking Behaviors—Participants reported the number of days they smoked in the past month, average cpd in the past 7 days, and whether they typically smoked mentholated or non-mentholated cigarettes. Total cigarettes in a month were estimated by multiplying number of days smoked in the past 30 days by cpd. Participants were asked whether they had ever smoked daily for at least six months and length of time smoking cigarettes (reported in years).

2.3.3. Smoking Dependence—The Brief WISDM is a 37-item measure consisting of 11 subscales (Smith et al., 2010). Using Smith and colleagues' scoring (Smith et al., 2010), the 11 subscales were used to calculate Primary Dependence Motives (PDM) and Secondary Dependence Motives (SDM). PDM summary scale was computed by averaging scores on the Automaticity, Craving, Loss of Control, and Tolerance subscales. The Secondary Dependence Motives summary scale was calculated using the average of the Affiliative Attachment, Cognitive Enhancement, Cue Exposure/Associative Processes, Affective Enhancement, Social/ Environmental Goads, Taste, and Weight Control subscales. Internal consistency reliabilities for the WISDM Total, PDM, and SDM scales were excellent for the total sample and across racial and ethnic groups in the current study. Cronbach's alpha was 0.95 for Total WISDM (alphas ranged from 0.93 for Whites to 0.96 for Latinos), 0.94 for WISDM PDM (0.93 for African Americans to 0.95 for Latinos), and 0.90 for WISDM SDM (0.88 for Whites to 0.93 for Latinos).

Smoking dependence was also assessed using the single-item of time to first cigarette after waking taken from the Fagerström Test for Nicotine Dependence (Baker et al., 2007; Heatherton et al., 1991). Response options were “0-5 minutes”, “6-15 minutes”, “16-30 minutes”, “31-60 minutes”, and “61+ minutes”. These responses were dichotomized into “30 minutes” and “> 30 minutes”, with 30 minutes to first cigarette after waking indicating greater smoking dependence (Baker et al., 2007).

2.4. Data Analysis

Participants' demographics and smoking characteristics were summarized using descriptive statistics. Continuous variables were analyzed using Analysis of Variance (ANOVA) with Bonferonni adjusted post-hoc comparisons and categorical variables were analyzed using chi-square tests. We conducted preliminary analyses to determine whether we would replicate differences in WISDM subscale scores by smoking level and history found in previous studies (Shiffman et al., 2012; Shiffman, Ferguson et al., 2012) and reported the ratio of WISDM SDM to WISDM PDM scores for each group. We used ANOVA to compare means, and Bonferonni adjusted post-hoc comparisons were used to examine differences between pairs.

Finally, to examine whether SDM would be independently associated with smoking level and history (native nondaily, converted nondaily, light daily, and moderate to heavy daily smoking) after controlling for PDM, we used a multinomial logistic regression included covariates of age, gender, race, and use of menthol cigarettes. The model was adjusted for these characteristics because previous research indicates that gender and race are associated with WISDM scores (Piper et al., 2008) and age and use of menthol cigarettes are associated

with other measures of smoking dependence (Fagan et al., 2010; Fidler, Shahab, & West, 2011). Interaction terms between race and the WISDM PDM and WISDM SDM were also included in the model. We also assessed the associations between smoking level, PDM, and SDM with total cigarettes smoked in a month as the dependent variable to present the data across the full spectrum of smoking levels. Specifically, a Poisson Regression analysis was conducted with gender, menthol use, and race entered as factors and PDM, and SDM as covariates. The model was specified with race \times WISDM PDM and race \times WISDM SDM interaction terms. The Poisson regression was corrected for over dispersion due to the larger value for the variance in total cigarettes smoked in a month relative to the mean. All analyses were conducted using SPSS 20.0 for Windows (SPSS Inc., Chicago, IL, USA). The level of statistical significance for all analyses was 0.05.

3. Results

3.1. Preliminary Analyses

Participant characteristics are presented in Table 1. Overall, 1,382 (58.2%) participants were female, and 794 (33.4%) were African American, 786 (33.1%) were Latino, and 796 (33.5%) were White.

There were statistically significant mean differences on the Brief WISDM Total [$F(3, 2372) = 175.17.05, p < 0.001$], WISDM PDM [$F(3, 2372) = 266.45, p < 0.001$], WISDM SDM [$F(3, 2372) = 106.18, p < 0.001$], and the 11 WISDM subscales by smoking levels (all $ps < 0.001$). Post-hoc analyses showed that there were statistically significant differences by smoking level on WISDM Total, PDM, SDM and 9 of the 11 subscales with scores increasing for native nondaily smokers to converted nondaily smokers to light daily to moderate to heavy daily smokers (ps ranged from 0.03 to < 0.001). The ratio of SDM to PDM scores increased incrementally across the four smoking levels from native nondaily smokers to moderate to heavy daily smokers ($p < 0.001$). Converted nondaily smokers and light smokers scores on Social/Environmental Goals and Weight Control were similar ($p > 0.05$). These results are presented in Table 2.

3.2. Multivariate Analysis of the Associations between Primary Dependence Motives, Secondary Dependence Motives, and Smoking Level

Multinomial logistic regression was used to assess the associations between WISDM PDM, SDM and smoking level (native nondaily, converted nondaily, light daily, and moderate to heavy daily). Adjusting for the covariates of age, gender, and menthol use, there were no significant interactions between race and either WISDM PDM (χ^2 change [df = 6] = 6.11, $p = 0.41$) or WISDM SDM (χ^2 change [df = 6] = 7.00, $p = 0.32$). To create the final model, we conducted a multinomial logistic regression using forced-entry including variables in the following order (control variables entered first): age, gender, race, and use of menthol cigarettes, PDM, and SDM. Adjusted odds ratios for the multinomial logistic regression are presented in Table 3. As hypothesized, both PDM and SDM were associated with smoking level. For each unit increase in PDM, the odds of being a native nondaily smoker versus a moderate to heavy daily smoker decreased by 79% (Adjusted Odds Ratio [AOR] = 0.21, 95% confidence interval [CI] 0.17-0.25, $p < 0.001$), the odds of being a converted nondaily

smoker versus a moderate to heavy daily smoker decreased by 68% (AOR = 0.32, 95% CI 0.28-0.37, $p < 0.001$) and the odds of being a light daily smoker versus a moderate to heavy daily smoker decreased by 52% (AOR = 0.48, 95% CI 0.42-0.56, $p < 0.001$). Also as hypothesized, after controlling for the effects of PDM, each unit increase in SDM increased the odds of being a native nondaily smoker versus a moderate to heavy daily smoker by 56% (AOR = 1.56, 95% CI 1.26-1.93, $p < 0.001$), the odds of being a converted nondaily versus a moderate to heavy daily smoker by 51% (AOR = 1.51, 95% CI 1.30-1.76, $p < 0.001$), and the odds of being a light daily smokers versus a moderate to heavy smoker by 29% (AOR = 1.29, 95% CI 1.11-1.49, $p < 0.001$). The logistic regression model was also conducted with each of the remaining smoking levels as the reference group (results not shown). While the overall pattern of results was consistent, there were nonsignificant odds ratios for WISDM PDM for being a native nondaily smoker versus a converted nondaily smoker ($p = 0.72$), and for being a native nondaily smoker versus a light daily smoker ($p = 0.06$).

In the overdispersed Poisson Regression model for estimated total number of cigarettes in the past month, none of the race by WISDM scale interaction terms was significant. Regression coefficients for the covariates in the model were 0.01 for age (SE=0.001, $p < 0.001$), - 0.03 for male gender (SE = 0.04, $p = 0.36$), - 0.18 for menthol use (SE = 0.04, $p < 0.001$), - 0.04 for African American race (SE = 0.05, $p = 0.39$) and -0.06 for Latino ethnicity (SE= 0.04, $p = 0.18$). PDM was positively associated with total cigarette consumption in the past month (regression coefficient = 0.39, SE= 0.02, $p < 0.001$) and SDM was negatively associated with total cigarette consumption (regression coefficient = -0.10, SE= 0.02, $p < 0.001$).

4. Discussion

This is the first study to explore smoking dependence using the Brief WISDM among nondaily and daily smokers including large samples of Latino, African American and White participants. We found that Secondary Dependence Motives (SDM) distinguish between smoking levels even after accounting for Primary Dependence Motives (PDM). Smokers with lower levels of overall cigarette use endorsed higher SDM when controlled for the variance accounted for by PDM. This finding has important implications for better understanding motivations for smoking beyond traditional indicators of smoking dependence.

As hypothesized, both PDM and SDM were associated with smoking level. After controlling for PDM, SDM was associated with smoking level but *higher* scores were associated with being a nondaily or light smoker versus a moderate to heavy smoker. Thus, heavier smokers' dependence was characterized by automaticity, loss of control, and tolerance motives and lighter smokers had stronger accessory or instrumental motivators. The findings utilizing nondaily and daily smoking levels were consistent with estimated total cigarette consumption across the past month. Similar to the current findings using total cigarettes per month, Piper and colleagues found that after controlling for PDM, SDM was negatively associated with cpd (Piper et al., 2008). In light of the present results, Piasecki et al.'s findings that SDM was no longer associated with daily versus nondaily smoking after controlling for PDM (Piasecki et al., 2011) have not been replicated. Thus, the unique

variance contributed by SDM may be important in driving nondaily and light smokers' cigarette use relative to cigarette use among heavier smokers.

SDM may play a significant role in maintaining smoking among light and nondaily smokers. SDM represents instrumental motivations that are more influenced by psychological and environmental contexts for smoking than the compulsive aspects of smoking dependence related to cravings, automaticity, and loss of control over smoking. Given nondaily smokers' periodic abstinence for days at a time and light smokers' lower levels of daily cigarette consumption, accessory or instrumental motivators appear to be key factors that maintain their cigarette use over time relative to heavier smokers. The results of this study strongly indicate that research on effective tobacco use treatment for light and nondaily smokers should address accessory motivations such as social situations and cognitive and affective effects of smoking in addition to addressing traditionally defined nicotine dependence.

We found an increase in scores on the WISDM Total, PDM, SDM, and subscales from native nondaily smokers, to converted nondaily smokers, followed by light smokers, then moderate to heavy daily smokers. Differences between native nondaily smokers and converted nondaily smokers on the WISDM and using time to first cigarette as a proxy for nicotine dependence support previous findings (Shiffman, Ferguson et al., 2012; Shiffman, Tindle, et al., 2012). While we found that lighter smokers had higher SDM scores relative to PDM, the magnitude of differences in smoking dependence between groups was greater for PDM indicating its importance in distinguishing between the smoking levels. Interestingly, the distinctions used in the current study between light daily smokers and moderate to heavy daily smokers revealed that converted nondaily smokers are very similar to light smokers on at least two motivations: social or environmental-related motives and weight control. Recall that the current study included only nondaily smokers who could be considered relatively stable at that smoking rate. The fact that these converted nondaily smokers consistently reported higher smoking dependence motivations than native nondaily smokers is an important consideration for future intervention research.

The average cpd of daily smokers in the US is currently 15 (Centers for Disease Control and Prevention, 2012); given the context of national smoking level interventions should address motivations most relevant to these smoker characteristics. Thus, although PDM can be considered the fundamental drivers of smoking dependence, secondary motivations for smoking should be examined as it relates to promoting smoking cessation. Prospective studies are needed to assess the prediction of both PDM and SDM on smoking cessation among nondaily and light smokers in particular. Additionally, further research is needed to determine which smoking motivations represent effective targets for intervention.

Nondaily and light smokers endorsed multiple smoking dependence motives, which are manifested in ways that traditional treatments may not adequately address. Treatment studies for nondaily smokers and light smokers are sparse. Only two published pilot trials target nondaily smokers (Berg & Schauer, 2012; Schane, Prochaska, & Glantz, 2013) and there are only two randomized placebo-controlled trials that have been conducted in light smokers (Ahluwalia et al., 2006; Cox et al., 2012). Both clinical trials with light smokers found lower than expected quit rates for light smokers using nicotine replacement gum

(Ahluwalia et al., 2006) and bupropion (Cox et al., 2012). One plausible explanation for lower quit rates with light smokers is that the interventions (medications and educational counseling) did not sufficiently address secondary dependence motives that may be more salient for these smokers than for heavier smokers.

One important strength of this study is the oversampling of African Americans and Latinos who have a high prevalence of nondaily and light daily smoking. As a result of this sampling strategy, we were able to examine interactions between race and smoking dependence, and conclude that the associations between PDM, DSM and smoking level are reasonably consistent for African Americans, Latinos, and Whites. However, the sampling methodology also presents limitations. First, participants in this sample belonged to an online survey panel and are not necessarily representative of the national population of smokers. Second, the survey was self-administered in English and therefore the Latino sample was restricted to those who are proficient in reading English. Finally, all variables were self-reported and participants' responses may be subject to social desirability and other forms of bias. Despite these limitations, the online panel is comprised of a large number of individuals across the country thus enabling generalizability beyond single geographic regions. Additionally, the use of both categorizations of smokers (Businelle et al., 2009, Piasecki et al., 2011, Shiffman et al., 2012) and total cigarette consumption suggest that the findings are not an artifact of the smoking level cut-points utilized in this study.

In conclusion, this study adds to the growing body of literature suggesting that secondary motivations for smoking are especially important for nondaily and light smokers relative to heavier smokers. These findings are consistent when examined using cigarette consumption and categorical smoking levels. Although PDM for smoking are considered fundamental to smoking dependence and are related to heaviness of smoking, SDM contribute to lighter smoking above and beyond these primary motives. Therefore, in addition to pharmacotherapy that targets cravings and withdrawal, smoking cessation intervention trials for nondaily and light smokers should investigate whether interventions that address secondary or auxiliary motivations for smoking are more effective for these groups.

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Highlights

- The WISDM offers a detailed assessment of dependence across smoking levels.
- After controlling for PDM, SDM is negatively associated with smoking level.
- There were no significant race interactions.

Table 1

Participant Characteristics

| Variable | Total (N=2376) | Nondaily Smokers | | Daily Smokers | | P Values |
|--|-----------------|------------------------------|--------------------------------|-------------------------------|--|----------|
| | | Native ^d (n= 297) | Converted ^b (n=904) | Light ^c (n=578) | Moderate to Heavy ^d (n=597) | |
| | | <i>N (%) or Mean (SD)</i> | | | | |
| Race/ethnicity (%) | | | | | | |
| African American | 794 (33.4%) | 106 (35.69%) | 295 (32.6%) | 193 (33.4%) | 200 (33.5%) | 0.96 |
| Latino | 786 (33.1%) | 100 (33.67%) | 300 (33.19%) | 190 (32.9%) | 196 (32.8%) | |
| White | 796 (33.5%) | 91 (30.64%) | 309 (34.18%) | 195 (33.7%) | 201 (33.7%) | |
| Gender (%) | | | | | | |
| Female | 1382 (58.2%) | 162 (54.55%) | 508 (56.19%) | 371 (64.2%) ^{a,b,d} | 341 (57.1%) | <0.01 |
| Age (SD) | 42.97 (12.44) | 39.81 (12.24) | 41.9 (12.37) | 43.71(12.57) ^{a,b} | 45.45(12.01) ^{a,b} | <0.001 |
| Highest education level (%) < High school graduate | 81 (3.4%) | 9 (3.03%) | 29 (3.21%) | 16 (2.8%) | 27 (4.5%) | 0.36 |
| Household income/month (%) < \$1800 | 841 (37.0%) | 105 (36.97%) | 314 (36.98%) | 228 (41.0%) ^d | 194 (33.2%) | 0.06 |
| Days smoked/30 days (SD) | 21.99 (8.68) | 13.11 (5.91) | 14.99 (5.85) ^a | 29.43 (1.46) | 29.80 (0.88) | <0.001 |
| CPD on days smoked (SD) | 9.71 (8.62) | 4.25 (3.86) | 5.78 (5.58) ^a | 7.41 (2.72) ^{a,b} | 20.60 (8.49) ^{a,b,c} | <0.001 |
| Total cigarettes/30 days (SD) | 249.00 (265.42) | 60.30 (72.15) | 89.03(101.15) ^a | 219.02 (82.51) ^{a,b} | 614.15 (255.07) ^{a,b,c} | <0.001 |
| Time to first cigarette (%) 30 minutes | 1349 (56.8%) | 71 (23.91%) | 389 (43.03%) ^a | 367(63.5%) ^{a,b} | 522(87.4%) ^{a,b,c} | <0.001 |
| Smoke menthol cigarettes (%) Yes | 1360 (57.2%) | 174 (58.59%) ^d | 543 (60.07%) | 331 (57.3%) | 312 (52.3%) | 0.03 |
| Years smoked cigarettes (SD) | 19.41 (16.0) | 12.86 (10.49) | 17.03 (12.69) ^a | 21.16 (13.21) ^{a,b} | 24.56 (12.83) ^{a,b,c} | <0.001 |
| Years as nondaily smoker (SD) | -- | 10.01 (9.51) | 11.92 (11.70) ^a | -- | -- | 0.01 |
| Years as daily smoker (SD) | 21.12 (13.29) | -- | -- | 15.58 (13.43) | 23.03 (12.88) ^c | <0.001 |

Note. CPD = cigarettes smoker per day. Superscripts were as follows:

^a native nondaily smoker;

^b converted nondaily smoker;

^c light daily smoker;

^d moderate to heavy daily smoker.

Superscripts indicate statistically significant differences between groups at $p < 0.05$. For each pair of differences, the superscript representing the group with the smaller mean or lower proportion appears in the column of the other group.

Table 2
WISDM Primary Dependence Motives (PDM) and Secondary Dependence Motives (SDM) Subscales and Total Score

| WISDM Scales | Nondaily Smokers | | | Daily Smokers | | P Values |
|------------------------------------|------------------------------|--------------------------------|------------------------------|--|--------|----------|
| | Native ^a (n= 297) | Converted ^b (n=904) | Light ^c (n=578) | Moderate to Heavy ^d (n=597) | | |
| | <i>Mean (SD)</i> | | | | | |
| WISDM PDM | 2.53 (1.37) | 3.42 (1.75) ^a | 4.10 (1.51) ^{a,b} | 5.26 (1.29) ^{a,b,c} | <0.001 | |
| Automaticity | 2.83 (1.64) | 3.66 (1.92) ^a | 4.23 (1.86) ^{a,b} | 5.35(1.59) ^{a,b,c} | <0.001 | |
| Craving | 2.74 (1.53) | 3.64 (1.79) ^a | 4.39 (1.66) ^{a,b} | 5.40 (1.41) ^{a,b,c} | <0.001 | |
| Loss of Control | 2.37 (1.49) | 3.24 (1.89) ^a | 3.94 (1.73) ^{a,b} | 5.08 (1.54) ^{a,b,c} | <0.001 | |
| Tolerance | 2.18 (1.43) | 3.14 (1.94) ^a | 3.83 (1.70) ^{a,b} | 5.22 (1.40) ^{a,b,c} | <0.001 | |
| WISDM SDM | 3.03 (1.31) | 3.66 (1.54) ^a | 4.03 (1.32) ^{a,b} | 4.65(1.30) ^{a,b,c} | <0.001 | |
| Affective Enhancement | 3.04 (1.67) | 3.75 (1.84) ^a | 4.25 (1.72) ^{a,b} | 5.02 (1.61) ^{a,b,c} | <0.001 | |
| Affiliative Attachment | 2.42 (1.57) | 3.16 (1.96) ^a | 3.49 (1.91) ^{a,b} | 4.38 (1.87) ^{a,b,c} | <0.001 | |
| Cognitive Enhancement | 2.95 (1.75) | 3.57 (1.91) ^a | 4.00 (1.84) ^{a,b} | 4.82 (1.68) ^{a,b,c} | <0.001 | |
| Cue Exposure/Associative Processes | 3.13 (1.58) | 3.83 (1.73) ^a | 4.18 (1.63) ^{a,b} | 4.84 (1.54) ^{a,b,c} | <0.001 | |
| Social/Environmental Goals | 3.49 (1.87) | 3.86 (1.95) ^a | 4.07 (1.90) ^a | 4.53 (1.96) ^{a,b,c} | <0.001 | |
| Taste | 3.63 (1.66) | 4.19 (1.76) ^a | 4.82 (1.57) ^{a,b} | 5.21(1.56) ^{a,b,c} | <0.001 | |
| Weight Control | 2.54 (1.65) | 3.24 (1.96) ^a | 3.37 (1.92) ^a | 3.75(1.92) ^{a,b,c} | <0.001 | |
| WISDM Total | 31.94 (14.09) | 39.87 (17.08) ^a | 45.35 (14.37) ^{a,b} | 54.26 (13.13) ^{a,b,c} | <0.001 | |
| WISDM SDM: WISDM PDM Ratio | 1.34 (0.53) | 1.19 (0.43) ^a | 1.05 (0.32) ^{a,b} | 0.90 (0.21) ^{a,b,c} | <0.001 | |

Note. Superscripts were as follows:

^a native nondaily smokers;

^b converted nondaily smokers;

^c light daily smoker;

^d moderate to heavy daily smokers.

Superscripts indicate statistically significant differences between groups at $p < 0.05$. For each pair of differences, the superscript representing the group with the smaller mean or lower proportion appears in the column of the other group.

Multinomial Logistic Regression Model Comparing Native Nondaily Smokers, Converted Nondaily Smokers, Light Daily Smokers to Moderate to Heavy Daily Smoker on WISDM Primary Dependence (PDM) and WISDM Secondary Dependence Motives (SDM)

Table 3

| Variable | Native Nondaily Smokers | | | Converted Nondaily Smokers | | | Light Daily Smokers | | | Moderate to Heavy Daily Smokers | | |
|-----------|-------------------------|-----------|----------|----------------------------|-----------|----------|---------------------|-----------|----------|---------------------------------|--------|----------|
| | AOR | 95% CI | P Values | AOR | 95% CI | P Values | AOR | 95% CI | P Values | AOR | 95% CI | P Values |
| WISDM PDM | 0.21 | 0.17-0.25 | <0.001 | 0.32 | 0.28-0.37 | <0.001 | 0.48 | 0.42-0.56 | <0.001 | | | Ref |
| WISDM SDM | 1.56 | 1.26-1.93 | <0.001 | 1.51 | 1.30-1.76 | <0.001 | 1.29 | 1.11-1.49 | <0.001 | | | Ref |

Note. Moderate to heavy daily smoker was the reference group in the analysis. The model was adjusted for sex, age, race, and use of mentholated cigarettes. AOR: adjusted odds ratio; CI: confidence interval. Odds ratios (OR) for the covariates in the model were as follows: ORs for age ranged from 0.95 for native nondaily smokers to 0.98 for light smokers vs. moderate to heavy smokers ($ps < 0.01$), ORs for males vs. females ranged from 0.75 for light daily smokers to 1.47 ($ps < 0.05$) for native nondaily smokers vs. moderate to heavy smokers, the ORs for African Americans vs. Whites and Latinos vs. Whites were nonsignificant ($ps > 0.05$), and the ORs for menthol use ranged from 1.56 for light daily smokers to 2.00 ($ps < 0.01$) for converted nondaily smokers vs. moderate to heavy smokers.