



## Smoking dependence across the levels of cigarette smoking in a multiethnic sample



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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.

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### 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 2376 African American, Latino, and non-Hispanic White smokers recruited using an online panel research company. The sample included 297 native nondaily smokers (never smoked daily), 297 converted nondaily smoker (previously smoked daily for  $\geq$  six months), 578 light daily smokers ( $\leq$  10 cigarettes per day [cpd]), and 597 moderate to heavy daily smokers ( $>$  10 cpd).

**Methods:** 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% ( $ps < 0.001$ ). 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 ( $ps < 0.001$ ).

**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.

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### 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 & Prevention., 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 (Centers for Disease Control & Prevention., 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.

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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, Dunbar, Scholl, & Tindle, 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, Li, & 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 goods (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, Dunbar, & Scholl, 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, Ferguson, Dunbar, & Scholl, 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 the WISDM PDM and WISDM SDM using the total number of cigarettes as a continuous indicator of

smoking level. We also examined whether the associations between the 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 2400 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 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 on 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 ( $\leq 10$  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

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