



Differential use of other tobacco products among current and former cigarette smokers by income level



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HIGHLIGHTS

- A third of the current and former cigarette smokers used other forms of tobacco.
- Use of other forms of tobacco among current and former smokers varied by income.
- Other tobacco use was more common among lower income current than former smokers.
- Nicotine dependence may be underestimated among lower income current smokers.
- Many higher income former smokers use other tobacco after quitting cigarette smoking.

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ABSTRACT

With the declining sales of cigarettes, the tobacco industry has been promoting other forms of combustible and smokeless tobacco to current and former cigarette smokers. Exposure to the promotion of tobacco products has been shown to vary by income level. We combined the 2006 through 2011 National Surveys on Drug Use and Health to compare the prevalence and patterns of other tobacco use (cigar, snuff, and chewing tobacco) between current and former cigarette smokers by income level. Other tobacco use was minimal among females and among male non-smokers. Approximately a third of both current and former male cigarette smokers reported past-year other tobacco use. Overall, current smokers were more likely than former smokers to have used cigars (adjusted odds ratio (AOR) 1.69, 95% CI 1.50–1.92) or snuff (AOR 1.14, 95% CI 1.01–1.28) in the past year. The association of smoking status with other tobacco use differed by income level (interaction term p -value < 0.001). Among lower income groups, current smokers were more likely to use cigars and snuff compared to former smokers. Among the highest income group, former smokers were just as likely to use smokeless tobacco as current smokers. The differing patterns of use of other tobacco between current and former smokers by income level highlight a need for studies to understand the motivations for the use of these products and their role in smoking cessation.

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1. Introduction

As cigarette sales have declined, the tobacco industry has increased advertising and marketing of other forms of combustible (e.g. cigars, roll-your-own tobacco, and pipe tobacco) (Wenger, Malone, & Bero, 2001) and smokeless tobacco (e.g. snuff or chewing tobacco) as a way to retain profits among cigarette smokers (Carpenter, Connolly, Ayo-Yusuf, & Wayne, 2009; Mejia & Ling, 2009). Between 2000 and 2011 cigarette consumption decreased by 32.8%, whereas consumption of combustible tobacco products such as cigars increased by 123.1% (Centers for Disease Control & Prevention, 2012). Unlike cigar use, smokeless tobacco use has remained stable in the last decade (Tomar,

2010). Tobacco industry advertising has promoted the use of smokeless tobacco as an alternative to cigarette smoking in areas where smoking is prohibited (Mejia & Ling, 2009). Loose leaf chewing tobacco and moist snuff are the most common forms of smokeless tobacco (Maxwell, 2010).

Concurrent use of cigarettes and other tobacco products is common among certain populations, including young men, those with low incomes and low educational attainment (Backinger et al., 2008; McClave-Regan & Berkowitz, 2011; Mushtaq, Williams, & Beebe, 2012; Rath, Villanti, Abrams, & Vallone, 2012; Richardson, Xiao, & Vallone, 2012; Tomar, Alpert, & Connolly, 2010). Although dual cigarette and cigar smokers may be more likely to make quit attempts, they appear to be less successful at quitting smoking compared to cigarette only smokers (Richardson et al., 2012). While some studies have suggested that switching from cigarettes to smokeless tobacco may provide a means for smoking cessation (Rodu & Phillips, 2008), others have

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shown that dual cigarette and smokeless users have less desire to stop smoking (McClave-Regan & Berkowitz, 2011) and are less likely to quit tobacco use (Wetter et al., 2002). Among recent former smokers, other tobacco may be used to maintain nicotine dependence after a quit attempt (Mumford, Levy, Gitchell, & Blackman, 2005), and may potentially contribute to relapse to smoking (Zhu et al., 2009).

Several studies have examined the differential use of other tobacco by income level among current smokers. In nationally representative samples of current smokers, use of other tobacco was higher among those with annual incomes less than \$20,000 compared to those with higher incomes (Backinger et al., 2008; McClave-Regan & Berkowitz, 2011). Given that other tobacco use may contribute to relapse, it is also important to study use among former smokers by income level. The differential exposure to marketing and availability of other tobacco products to low income populations may lead to differing use patterns with income level (Apollonio & Malone, 2005). Tobacco industry marketing strategies include distributing discount coupons for cigarettes with food stamps and discount offers at point-of-sale, offering free cigarettes to service providers that serve populations disproportionately affected by tobacco use, and creating product advertisements that are directed toward low-income populations (Apollonio & Malone, 2005; Brown-Johnson, England, Glantz, & Ling, 2014; John, Cheney, & Azad, 2009). Such strategies have been shown to be associated with increased tobacco use among low-income populations (Cornelius et al., 2014; Lee, Turner, Burns, & Lee, 2007).

In this study, we investigated whether trends in other tobacco use (cigars, snuff, chewing tobacco) varied by income level in the 2006 through 2011 National Surveys on Drug Use and Health prior to combining these surveys to identify differences in other tobacco use by smoking status (current or former smokers) and income level. After verifying previous reports of low rates of other tobacco use among women (Backinger et al., 2008; Mushtaq et al., 2012) and never smokers, we focused our analysis on male ever smokers. Given that the marketing of tobacco products has been shown to target low-income populations, we hypothesized that rates of other tobacco use would be higher among current and former smokers with lower incomes compared to those with higher incomes.

2. Methods

2.1. Data source

The National Survey on Drug Use and Health (NSDUH) is a yearly, national household survey designed to obtain information on the use of alcohol, tobacco, and other substances among the non-institutionalized population aged ≥ 12 years (Substance Abuse & Mental Health Services Administration, 2011). The NSDUH survey is sponsored by the Center of Behavioral Health Statistics and Quality within the Substance Abuse and Mental Health Services Administration (SAMHSA) (Substance Abuse & Mental Health Services Administration, 2011). The survey uses a stratified, multistage area probability sampling design, which oversamples youth and young adults so that each state's sample is distributed equally among three age groups (12–17 years, 18–25 years, and 26 years or older). The samples are weighted to represent the demographics of the national population. Since 1999, the interview has been conducted using computer-assisted interviewing technology, using a combination of interviewer-administered computer-assisted personal interviewing (CAPI) and audio computer-assisted self-interviewing technology (ACASI) (Substance Abuse & Mental Health Services Administration, 2001). Since 2002, respondents were provided a monetary incentive of \$30, which was associated with an increase in survey response rates. The weighted adult response rate was 66.0% in 2006, 65.0% in 2007, 65.3% in 2008, 75.6% in 2009, 74.6% in 2010, and 74.4% in 2011. Preliminary analysis showed some yearly fluctuations in the estimates of tobacco use, particularly for those living below 100% of the FPL; however, there were no major differences in usage trends over this time

period (data not shown, but available upon request). Therefore, we combined data from survey years 2006 through 2011 to create a pooled sample in order to increase statistical power for sub-group analyses. The combined sample contained 243,221 respondents, aged ≥ 18 years, for whom we had self-reported income and tobacco use information. Of these, our analysis was restricted to 54,239 male current and former cigarette smokers.

2.2. Tobacco use measures

Respondents reported tobacco use using ACASI technology. Use of each tobacco product (cigarettes, cigars, snuff, and chewing tobacco) was assessed separately. Respondents were asked whether they had ever smoked at least 100 cigarettes in their lifetime; those who responded affirmatively were classified as ever smokers. Respondents were asked, "How long has it been since you last smoked part or all of a cigarette?" We categorized current smokers as those who responded smoking any time during the past year. Former smokers were those who reported smoking 'more than 12 months ago, but within the past 3 years'. Similar questions assessed ever and past-year use of cigars, snuff, and chewing tobacco. We also examined use of other tobacco in the past 30 days and daily use in the past 30 days. Participants who responded that their last use was 'within the past 30 days' were categorized as past 30-day users, and those who responded using the product for all 30 days in the past month were categorized as daily users.

2.3. Income and other covariates

The NSDUH survey used self-reported income and household size to categorize participants into three income groups relative to the federal poverty level (FPL): $<100\%$ of the FPL, 100% – 199% of the FPL, and $\geq 200\%$ of the FPL. We included as demographic covariates age group (18–25 years, 26–34 years, 35–49 years, ≥ 50 years), gender, race/ethnicity (Non-Hispanic white, Hispanic/Latino, Non-Hispanic black, and Asian/Pacific Islander/Mixed/Other), and education (less than high school, high school, some college, and college graduate).

2.4. Statistical analysis

All estimates and standard errors were weighted using sampling weights provided by SAMHSA, which adjust for survey non-response and unequal selection probabilities in the sampling design (Substance Abuse & Mental Health Services Administration, 2011). We compared sample characteristics and the prevalence of other tobacco use and reported weighted proportions (PROC SURVEYFREQ for categorical variables and PROC SURVEYMEANS for continuous variables). Using multivariable logistic regression, we examined the association of smoking status and past-year use of other tobacco and assessed interactions with income. We ran separate models for past-year cigar use, past-year snuff use, and past-year chewing tobacco use, and adjusted for income, age, race/ethnicity (white versus non-white), and education. We conducted all analyses using SAS 9.3 (SAS Institute, Cary, NC).

3. Results

Women were low users of smokeless tobacco products and usage was highest among current smokers (snuff = 1.2% among current smokers and 0.6% among former smokers; chewing tobacco = 0.7% among current smokers and 0.3% among former smokers). Past-year cigar use was more common at 11.9% for current smokers and 5.9% for former smokers, although these were less than one third of the level of equivalent males. Past-year usage rates were also low among male never smokers (cigars = $<8\%$; snuff = $<4\%$; and chewing tobacco = $<3\%$) and did not vary by income level. Accordingly, we investigated our hypotheses among the 54,329 male ever smokers surveyed over the 5-year period. Male current smokers were more likely to

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