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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

be >35 years of age, belong to a white racial background, and have lower educational attainment compared to former smokers across income levels (Table 1).

3.1. Other tobacco use among male current and former smokers

3.1.1. Ever use of other tobacco

Ever use of cigars was lower among current smokers than among former smokers for those living below 100% of the FPL (58.11% versus 65.47%, $p < 0.008$) and for those living at $\geq 200\%$ of the FPL (72.00% versus 80.13%, $p < 0.001$), whereas it did not differ for those living at 100%–199% of the FPL (61.49% versus 63.09%, $p = 0.5$). Ever use of snuff did not differ between current (prevalence range 28.34%–37.93%) and former smokers (prevalence range 25.22%–40.16%) for any income level. Ever use of chewing tobacco did not differ between current and former smokers, except for those living at $\geq 200\%$ of the FPL where use was lower among current smokers (35.27% versus 38.26%, $p < 0.007$).

3.1.2. Dual and poly-use of other tobacco

Among male current cigarette smokers, 60.59% reported no other tobacco use in the past year, 30.05% were dual users (i.e. cigarettes and cigars, or cigarettes and smokeless tobacco), and 9.33% used both cigars and some form of smokeless tobacco (Fig. 1A). Current smokers living below 100% of the FPL were slightly but significantly more likely to report no other tobacco use compared to those in the highest income group (61.07% versus 59.72%, $p < 0.01$) (Table 2). A third (33.01%) of the former cigarette smokers reported using some other form of tobacco in the past year, with 19.32% reporting cigar use only, 5.83% reporting snuff use only, 1.47% reporting chewing tobacco use only, and 6.38% reporting poly-use (Fig. 1B). Former smokers living below 100% FPL were considerably more likely to be completely abstinent from tobacco compared to those in the highest income group (73.05% versus 64.02%, $p < 0.001$) (Table 2).

3.1.3. Past year, past 30 days, and daily use of other tobacco

Current male smokers had a higher prevalence of past-year and past 30-day cigar use than former smokers, irrespective of income level (Table 2). The prevalence of daily use of cigars did not differ significantly between current and former smokers except for those living below the 100% of the FPL where use was higher among current cigarette smokers (1.79% versus 0.26%, $p < 0.001$). Use of snuff in the past year did not differ between current and former cigarette smokers, except for those living below 100% of the FPL where use was higher among current cigarette smokers (11.19% versus 7.73%, $p < 0.02$). Daily use of snuff was lower for current smokers compared to former smokers for those in the higher income categories, whereas it did not differ for individuals in the lowest income category. There were no differences in past-year and past 30-day chewing tobacco use between current and former smokers across income levels. Current smokers had lower rates of daily use of chewing tobacco than former smokers across all income levels.

3.2. Multivariate models of the association of smoking status with other tobacco use

The significantly higher prevalence of past-year cigar use among current smokers compared to former smokers persisted in multivariate logistic regression models that adjusted for demographic factors (adjusted odds ratio (AOR) 1.69, 95% CI 1.50–1.92) (Table 3). Higher income, older age, and belonging to a racial/ethnic minority were associated with lower odds of cigar use in the past year, whereas higher educational attainment was associated with higher odds of cigar use. The association of past-year cigar use with smoking status differed by income level (p -value for interaction < 0.001). While still significant, the difference in cigar use between current and former

Table 1 Sample characteristics of male current and former smokers by income level (National Survey on Drug Use and Health, 2006–2011, N = 54,239).

	<100% FPL			100%–199% FPL			$\geq 200\%$ FPL			p-Value ^c
	% ^a	Current N = 9075 % ^b	Former N = 1083 % ^b	% ^a	Current N = 11846 % ^b	Former N = 1465 % ^b	% ^a	Current N = 26410 % ^b	Former N = 4211 % ^b	
Age										
18–25	33.23	31.99	45.63	25.05	24.68	28.15	20.02	19.79	21.51	<0.007
26–34	19.43	19.26	21.10	23.22	23.49	20.94	23.03	22.73	24.94	
35–49	26.27	26.86	20.46	26.84	27.39	22.21	29.55	29.59	29.22	
≥ 50	21.06	21.89	12.81	24.89	24.44	28.71	27.41	27.88	24.33	
Race/ethnicity										
White	52.60	53.16	47.11	58.09	58.98	50.70	74.99	74.97	75.14	<0.01
Hispanic	22.16	21.47	28.87	22.04	20.99	30.78	11.62	11.33	13.49	
African American	18.92	19.18	16.33	14.17	14.42	12.04	8.24	8.53	6.32	
Asian/PI/Mixed/Other	6.32	6.18	7.67	5.70	5.61	6.47	5.15	5.16	5.04	
Education										
Less than high school	42.43	43.87	27.97	32.02	32.22	30.30	12.62	13.29	8.22	<0.001
High school	30.84	30.78	31.50	39.96	40.59	34.63	35.29	36.31	28.70	
Some college	19.95	19.32	26.26	20.28	19.63	25.77	27.79	27.60	29.02	
College graduate	6.78	6.02	14.27	7.74	7.56	9.29	24.29	22.81	34.06	
Ever used cigars	58.79	58.11	65.47	61.67	61.49	63.09	73.08	72.00	80.13	<0.001
Ever used snuff	28.05	28.34	25.22	29.79	29.66	30.89	38.23	37.93	40.16	0.07
Ever chewed tobacco	26.11	26.22	24.94	29.19	29.53	26.44	35.67	35.27	38.26	<0.007

^a Total weighted population proportion.
^b Weighted proportion for current or former smokers.
^c p-Value represents difference in proportions between current and former smokers.

smokers was higher among the lower income groups compared to the higher income groups (Table 4).

Current smokers were more likely to use snuff in the past year compared to former smokers in the adjusted model (AOR 1.14, 95% CI 1.01–1.28) (Table 3). Higher income level was associated with higher odds of snuff use in the past year (AOR 1.22, 95% CI 1.09–1.35), and older age, belonging to a racial/ethnic minority, and a higher educational attainment were associated with lower odds. The association of smoking status and past-year snuff use differed by income level (p-value for interaction < 0.001). When estimated separately within income levels, current smokers had higher odds of snuff use compared to former smokers for those living below 100% of the FPL (AOR 1.85, 95% CI 1.28–2.68), whereas use did not differ by smoking status among higher income levels (Table 4).

There was no association between the use of chewing tobacco in the past year and smoking status. Older age, belonging to a racial/ethnic minority, and having a higher educational attainment were associated with lower odds of chewing tobacco use. The association of chewing tobacco use and smoking status did not vary by income level (p-value for interaction 0.2).

4. Discussion

In this nationally representative sample of U.S. adults, we found high rates of use of other forms of tobacco among both male current and former smokers, with cigar use being the most common form of other

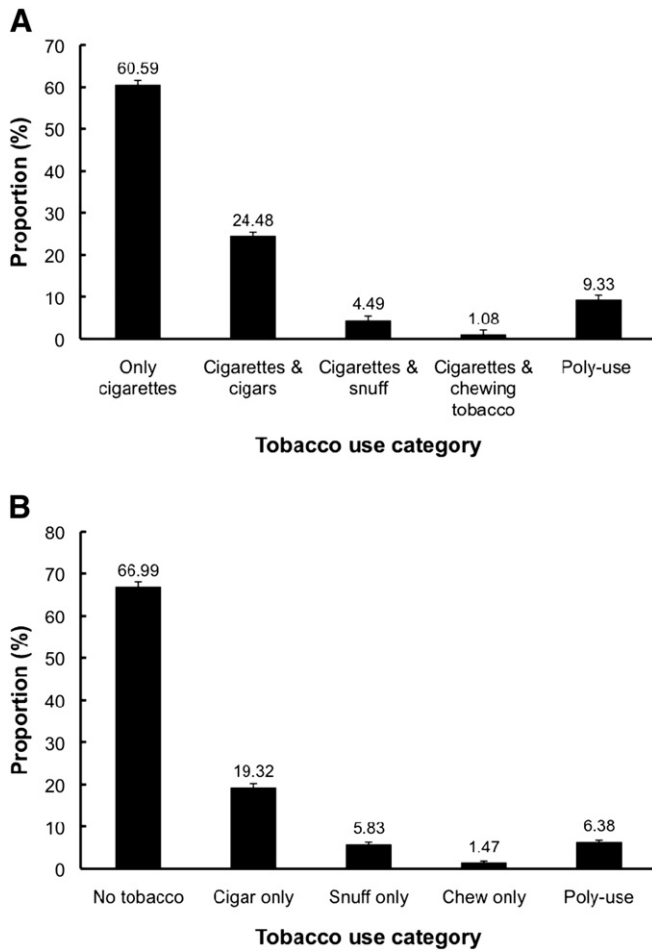


Fig. 1. A: Other tobacco use in the past year among male current cigarette smokers (National Survey on Drug Use and Health, 2006–2011, N = 47,331). B: Other tobacco use in the past year among male former cigarette smokers (National Survey on Drug Use and Health, 2006–2011, N = 6908).

Table 2
Other tobacco use among male current and former smokers by income level (National Survey on Drug Use and Health, 2006–2011, N = 54,239).

	<100% FPL			100%–199% FPL			≥200% FPL		
	Current N = 9075 ^a	Former N = 1083 ^a	p-Value ^b	Current N = 11846 ^a	Former N = 1465 ^a	p-Value ^b	Current N = 26410 ^a	Former N = 4211 ^a	p-Value ^b
No tobacco use	NA	73.05	–	NA	74.49	–	NA	64.02	–
Only cigarettes	61.07	NA	–	63.47	NA	–	59.72	NA	–
Cigar use									
Past year	33.21	19.51	<0.001	29.73	16.24	<0.001	32.26	26.29	<0.001
Past 30-day use	20.11	10.89	<0.001	16.43	9.22	<0.001	16.08	14.39	<0.05
Daily use	1.79	0.26	<0.001	1.71	0.63	0.04	1.21	1.26	0.9
Only cigars ^c	NA	16.45	–	NA	12.40	–	NA	21.69	–
Snuff use									
Past year	11.19	7.73	<0.02	10.74	10.79	0.9	13.74	12.60	0.2
Past 30-day use	7.04	5.27	0.13	7.26	9.23	<0.02	9.57	10.57	0.2
Daily use	2.25	2.83	0.4	2.71	5.57	<0.001	3.59	6.62	<0.001
Only snuff ^c	NA	4.39	–	NA	4.78	–	NA	6.38	–
Chewing tobacco									
Past year	8.03	5.85	0.06	8.36	7.82	0.7	8.69	7.39	0.09
Past 30-day use	3.32	3.37	0.9	3.51	4.58	0.3	3.35	3.35	0.9
Daily use	0.52	1.45	<0.03	0.67	2.87	<0.001	0.57	1.02	<0.01
Only chewing tobacco ^c	NA	1.99	–	NA	2.07	–	NA	1.21	–

^a Weighted proportion.

^b p-Value represents difference in proportions between current and former smokers.

^c Former smokers who only reported using cigars, snuff, or chewing tobacco in the past year.

Table 3
Adjusted odds ratio of past-year use of other tobacco by smoking status (current vs. former), income level, and demographic factors (National Survey on Drug Use and Health, 2006–2011).

	Cigar use ^a	Snuff use ^a	Chewing tobacco use ^a
	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Smoking status			
Former smoker (ref)	1	1	1
Current smoker	1.69 (1.50–1.92) ^{***}	1.14 (1.01–1.28) [*]	1.15 (0.95–1.38)
Income level			
<100% FPL (ref)	1	1	1
100%–199% FPL	0.87 (0.79–0.96) ^{**}	0.99 (0.89–1.11)	1.09 (0.92–1.31)
≥200% FPL	0.96 (0.89–1.05)	1.22 (1.09–1.35) ^{**}	1.04 (0.91–1.19)
Age			
18–25 years (ref)	1	1	1
26–34 years	0.58 (0.54–0.63) ^{***}	0.65 (0.59–0.71) ^{***}	0.66 (0.58–0.74) ^{***}
35–49 years	0.36 (0.33–0.39) ^{***}	0.36 (0.32–0.39) ^{***}	0.39 (0.33–0.47) ^{***}
≥50 years	0.25 (0.23–0.28) ^{***}	0.12 (0.09–0.15) ^{***}	0.19 (0.15–0.25) ^{***}
Race/ethnicity			
White (ref)	1	1	1
Non-white	0.77 (0.71–0.83) ^{***}	0.23 (0.20–0.25) ^{***}	0.24 (0.20–0.28) ^{***}
Education			
<High school (ref)	1	1	1
High school	1.15 (1.06–1.24) ^{**}	1.18 (1.06–1.33) ^{**}	1.03 (0.87–1.21)
Some college	1.39 (1.28–1.24) ^{***}	1.02 (0.91–1.14)	0.81 (0.69–0.95) [*]
College	1.67 (1.49–1.86) ^{***}	0.83 (0.74–0.95) ^{**}	0.64 (0.53–0.76) ^{***}

*** p < 0.001.

** p < 0.005.

* p < 0.05.

^a Models were fit separately for each product type (cigar, snuff, chewing tobacco), and include all variables shown.

tobacco used. Consistent with our hypothesis, use of other tobacco in the past year was higher among current smokers although rates among former smokers were much higher than previous estimates (Zhu et al., 2009). Among former smokers, rates of other tobacco use appeared to be higher among individuals with higher incomes. Our results showed that dual cigarette and cigar smokers and cigarette and smokeless tobacco users tended to be individuals with lower incomes, and these results are consistent with those observed in other studies (Backinger et al., 2008; McClave-Regan & Berkowitz, 2011; Mushtaq et al., 2012; Rath et al., 2012; Richardson et al., 2012; Tomar et al., 2010).

Several factors could explain the higher rates of dual use among lower income populations. Previous studies have shown that cigar smokers perceive cigars to be a safe alternative or addition to cigarettes (Malone, Yerger, & Pearson, 2001; Nyman, Taylor, & Biener, 2002), and this perception may be more common among lower income individuals for some types of cigars. The large excise tax differential between cigars and cigarettes that made some cigars cheaper than cigarettes (Delnevo, Hrywna, Foulds, & Steinberg, 2004; Government Accountability Office, 2012) may provide an alternative or additional source of combustible tobacco to lower income smokers. The tobacco industry has created newer, smaller cigars that are similar in appearance to cigarettes (Delnevo & Hrywna, 2007). This in combination with the increased marketing and availability of cigars to cigarette smokers (King, Dube,

& Tynan, 2013) may have increased accessibility to lower income populations. Future studies need to obtain information on usage patterns of cigars using finer categorization of cigar types.

Similarly, the lower taxes of smokeless tobacco products compared to cigarettes and the ability to use smokeless tobacco where smoking is prohibited may make it a convenient alternative tobacco product among lower income populations (McClave-Regan & Berkowitz, 2011). As lower income individuals tend to have higher rates of smoking, the higher rates of dual use among lower income populations raise the concern that these individuals may have higher levels of nicotine dependence.

Some studies have suggested that use of other tobacco, particularly smokeless forms of tobacco, may aid in smoking cessation (Rodu & Cole, 2009). While it is possible that the higher rates of dual use among current smokers could suggest that these individuals are using other tobacco as a way to quit cigarette smoking, our results do not support this hypothesis. If smokeless forms of tobacco were adopted as smoking cessation aids, we argue that rates of ever use and current use of smokeless tobacco would be higher among former smokers than current smokers. However, ever use of smokeless tobacco did not differ significantly between current and former smokers. Depending on the income level or the type of smokeless tobacco used, rates of past-year use were either lower among former smokers compared to

Table 4
Adjusted odds ratio comparing past-year use of tobacco between male current and former cigarette smokers, estimated separately within income levels (National Survey on Drug Use and Health, 2006–2011).

	Cigar use ^{a,c,d}	Snuff use ^{a,c,d}	Chewing tobacco use ^{b,c,d}
	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
<100% FPL	2.57 (1.91–3.46) ^{***}	1.85 (1.28–2.68) ^{**}	1.51 (0.98–2.30)
100%–199% FPL	2.35 (1.81–3.03) ^{***}	0.90 (0.70–1.16)	0.96 (0.61–1.52)
≥200% FPL	1.48 (1.28–1.69) ^{***}	1.13 (0.97–1.30)	1.19 (0.96–1.48)

*** p < 0.001.

** p < 0.005.

^a p-Value for interaction of smoking status and income level < 0.001.

^b p-Value for interaction of smoking status and income level income level 0.2.

^c Models were fit separately for each product type (cigar, snuff, chewing tobacco), and adjusted for age, race/ethnicity, and education.

^d Reference group: Former smokers.

current smokers or similar between the two groups. Our results support those from a previous study that showed a lack of an increase in the prevalence of smokeless tobacco use over 5 years despite population declines in cigarette smoking during the same time period (Tomar, 2010). Consistent with the hypothesis that smokeless tobacco is being used as an aid to quit cigarette smoking, daily use of smokeless tobacco was higher among former smokers than current smokers. However, the very low rates of daily use observed in our study indicate that this is not a significant smoking cessation aid for the more than 40% of smokers who attempt to quit each year.

We found that use of smokeless tobacco was higher for current and former smokers with higher incomes. This may reflect differential exposures to smoke-free norms across income levels. Compared to smokers with higher incomes, those with lower incomes are less likely to have a smoke-free home (Mills, Messer, Gilpin, & Pierce, 2009) and are less exposed to smoking cessation programs in the workplace (Barbeau, Krieger, & Soobader, 2004). This may mitigate the desire to find a nicotine substitute. Snuff may also be perceived to be a more “acceptable” alternative to cigarettes than chewing tobacco, as the spitting that accompanies the latter is more proscribed by social norms among higher income smokers (Mejia & Ling, 2009).

Our study had several limitations. We were unable to assess temporal associations or infer causality from these cross-sectional data. We relied on self-reports of income, cigarette smoking, and other tobacco use, resulting in a potential for misclassification bias. While we anticipate this bias to be non-differential, it is possible that income level influenced self-reports of tobacco use behaviors. We used past-year use of other tobacco in our multivariable logistic regression analysis to increase power, minimizing our ability to differentiate between episodic and regular use of other tobacco. However, our results with past 30-day use were qualitatively similar across income levels. By pooling data from the 2006 through 2011 surveys, we were unable to assess yearly fluctuations in the estimates of tobacco use by income level during the study time period.

5. Conclusions

Our findings suggest that patterns of tobacco use may be influenced in complex ways by income level. The high rates of dual use among lower income current cigarette smokers suggest that we may be underestimating nicotine dependence by considering only cigarette consumption. Future work should focus on understanding the motivations for use of other tobacco among current and former smokers, and developing nicotine dependence measures that account for the concurrent use of other tobacco. To the extent that smokers use other tobacco products to quit cigarette smoking, examining whether these products are associated with increased success in smoking cessation will be important. Our results highlight the need for clinical and public health interventions to increase awareness of the addictiveness of these products and their potential to influence smoking cessation among low-income populations.

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Contributors

M. Vijayaraghavan participated in the study conception, design, analysis, interpretation of data, drafting and revision of the manuscript. J. P. Pierce participated in the study conception, interpretation of data, and revision of the manuscript. M. White participated in the analysis, interpretation of data, and revision of the manuscript. K. Messer participated in study conception, design, analysis, interpretation of data, and revision of the manuscript. All authors approved the final version of the manuscript.

Conflict of Interest

The authors have no conflicts of interest to report.

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