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Polytobacco Use of Cigarettes, Cigars, Chewing Tobacco, and Snuff Among US Adults

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Abstract

Introduction: Tobacco use prevalence has been commonly estimated on a product by product basis and the extent of polytobacco use among current users of each tobacco product is not well understood. This study aimed to examine the prevalence, trends, and correlates of polytobacco use among current users of cigarettes, cigars, chewing tobacco, and snuff in US adults aged ≥18.
Methods: We used pooled data from the 1998, 2000, 2005, and 2010 Cancer Control Supplements of the National Health Interview Survey (N = 123 399 adults). Multivariate logistic regression models were estimated to determine significant factors associated with polytobacco use.
Results: In 2010, the prevalence of polytobacco use was 8.6% among current cigarette smokers, 50.3% among current cigar users, 54.8% among current chewing tobacco users, and 42.5% among current snuff users. After controlling for other covariates, gender and race/ethnicity did not show consistent associations with poly-use across these four groups of current tobacco users; however, a positive association of young adulthood, less than high school education, and binge drinking with poly-use was consistently found among all these groups.
Conclusions: Polytobacco use is extremely popular among current users of non-cigarette tobacco products. Polytobacco use patterns differ across sociodemographic subpopulations, and the gender and racial/ethnic profiles in poly-users vary across different groups of current tobacco users. Tobacco control strategies need to consider the interrelationships in the use of different tobacco products and the diverse profiles of poly-users in order to develop tailored tobacco prevention and intervention policies to further reduce the burden of tobacco use.

Introduction

The pattern of tobacco use in the United States is changing. While cigarette consumption continues to decline, the consumption of other tobacco products has increased recently. During 2000–2007, US cigarette sales declined by 18%, whereas large cigar sales increased by 37% and little cigar sales increased by 115%.[1] Sales of moist snuff products increased by 65.6 % between 2005 and 2011.[2] In addition, consuming two or more tobacco products—referred to as polytobacco use and also known as multiple tobacco product use, concurrent tobacco use, and concomitant tobacco use—has become increasingly common.[3–5] According to the 2012 National Survey on Drug Use and Health data, 10.1% of young adults aged 18–25 and 3.7% of adults aged ≥26 were current polytobacco users.[3]

Cigarette smoking negatively affects nearly every organ of the body.[3,6] The use of other tobacco products is also associated with negative health effects. Cigar use is known to be associated with an increased risk of lung cancer, cancers of the lip and upper aerodigestive tract, and coronary heart disease.[7,8] Smokeless tobacco (SLT)

use has been linked to oral and pharyngeal cancers, bladder and pancreatic cancer, oral leukoplakia, periodontal disease, and hypercholesterolemia.[9–12] Because different tobacco products have potentially different levels of addiction and toxicity,[3] polytobacco use may be associated with increased risks of nicotine dependence,[13] adverse health effects,[14] and healthcare utilization compared with exclusive use of a single tobacco product. To evaluate the potential effects of polytobacco use on population health and health-related economic burden, it is crucial to understand the pattern of poly-use and the demographic profile of poly-users.

The prevalence of tobacco use has been commonly estimated on a product by product basis in population-level surveillance studies,[15–18] and the extent of polytobacco use among current users of each tobacco product, especially non-cigarette product, is not well understood. In the literature of polytobacco use among US adults, except few recent studies which examined lifetime polytobacco use,[4,19–21] most studies examined current polytobacco use at either the population level or tobacco users' level. At the population level, some studies estimated the prevalence of current polytobacco use among special populations such as the Lumbee American Indians in North Carolina (4.8%),[22] Air Force recruits (1.3%–3.3%),[5,23] active duty military personnel (11.5%),[24] college students (7.4%),[25] young adults aged 18–34 (7.0%),[26] and cancer prevention trial participants (3.7%),[27] while others estimated the prevalence of current polytobacco use among the general population of all adults (ranging from 0.3%–1.6%[28–31] to 2.5%–3.4%[32,33] and up to 10.6%[34]), of all men (0.6%–1.6%),[28,35–37] and of all women (0.3%).[36] At the tobacco users' level, the vast majority of studies estimated the prevalence of current polytobacco use among current cigarette smokers (ranging from 2.3%–8.5%[13,16,29,31,35,36] to 8.7%–16.3%[16,32,38] and up to 26.4%–46.5%[34]), and relatively few studies estimated the prevalence of current polytobacco use among current users of all tobacco products combined (9.9%–12.1% of those aged ≥26 and 21.4%–24.6% of those aged 18–25),[39] among male current snuff users (15.0%–19.2% of daily snuff users and 38.9%–44.7% of nondaily snuff users),[13,37] and among current SLT users (25.0%–42.4%).[30,31,35,36] There is a lack of studies that examine polytobacco use among current cigar users, even though it has been shown that cigars were the most prevalent product concurrently used among current cigarette smokers,[29] and one-half of all polytobacco users consumed both cigarettes and cigars.[3]

Given the increasing use of non-cigarette tobacco products, the popularity of polytobacco use, and the limited research examining polytobacco use among non-cigarette tobacco users, this study aims to assess the prevalence, trends, and correlates of polytobacco use separately among current cigarette smokers as well as three groups of non-cigarette tobacco users—current cigar users, current chewing tobacco users, and current snuff users—using a large-scale nationally representative survey of the US adult population. Because different tobacco product users may have different profiles, the profile of poly-users among current users of one specific tobacco product may differ from the profile of poly-users among current users of other tobacco products. The results of this study offer a deeper understanding of the complex matrix of alternative product use and insight into tobacco users who may be at a greatest risk of polytobacco use.

Methods

Data Source

The analyses for this study were based on National Health Interview Survey (NHIS) data. The NHIS is an annual nationally representative in-person survey of approximately 35 000 households in the US civilian noninstitutionalized population. Blacks, Hispanics, and Asians are over sampled. For each family in the NHIS, one adult aged ≥18 was randomly selected to participate in an adult core survey which contains detailed questions about health conditions, cigarette smoking history, and other risk behaviors including alcohol drinking. Since 1987, a Cancer Control Supplement has been periodically administered to the same participants in the adult core survey to respond to questions about their knowledge, attitudes, and practices concerning cancer-related health behaviors, and the use of tobacco products including cigarettes, cigars, pipes, bidis, chewing tobacco, and snuff. The most recent Cancer Control Supplements were conducted in 1998, 2000, 2005 and 2010. We pooled the adult core and Cancer Control Supplement data from these 4 years to obtain a total sample of 123 399 adults aged ≥18.

Outcome Variables

We examined the use of four tobacco products: cigarettes, cigars, chewing tobacco, and snuff. We did not examine the use of pipes or bidis because they were not included in every year of the Cancer Control Supplement and the sample size of these users was small.

Current Cigarette Smoking

According to the two NHIS questions: "Have you smoked at least 100 cigarettes in your entire life?" and "Do you now smoke cigarettes every day, some days, or not at all?", we classified respondents who answered "yes" to the first question and "every day" or "some days" to the second question as current cigarette smokers.

Current Cigar Use

According to the two questions: "Have you smoked at least 50 cigars in your entire life?" and "Do you now smoke a cigar every day, some days, or not at all?", we classified respondents who answered "yes" to the first question and "every day" or "some days" to the second question as current cigar users.

Current Chewing Tobacco Use

According to the two questions: "Have you used chewing tobacco (such as Redman, Levi Garrett, or Beech-Nut) at least 20 times in your entire life?" and "Do you now use chewing tobacco every day, some days, or not at all?", we classified respondents who answered "yes" to the first question and "every day" or "some days" to the second question as current chewing tobacco users.

Current Snuff Use

According to the two questions: "Have you used snuff (such as Skoal, Skoal Bandits, or Copenhagen) at least 20 times in your entire life?" and "Do you now use chewing tobacco every day, some days, or not at all?", we classified respondents who answered "yes" to the first question and "every day" or "some days" to the second question as current snuff users.

Polytobacco Use

We defined polytobacco use as currently using two or more tobacco products. In contrast, exclusive tobacco use refers to the use of only one tobacco product. We assessed polytobacco use separately for each of the four different samples—current cigarette smokers, current cigar users, current chewing tobacco users, and current snuff users.

Covariates

Covariates in our analyses included survey year, sociodemographic characteristics, and other health-risk behaviors. Sociodemographic variables included gender, age (18–24, 25–44, 45–64, and ≥65), race/ethnicity (Hispanics, non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, and non-Hispanic Others), education (less than high school education [no diploma], high school graduate [including General Education Diploma], some college, and college graduate), family income level (poor, low, middle, high, and unknown), and census region of residence (Northeast, Midwest, South, and West). Non-Hispanic Others included non-Hispanic respondents who are American Indian or Alaska Native, Native Hawaiian or Pacific Islander, multiracial, or other races. If a respondent's family income level was less than 100% of the federal poverty line, they were classified as the poor. Those who reported family income at 100%–199%, 200%–399%, and at least 400% of the federal poverty line were classified as the low, middle, and high income, respectively. Those who did not report family income were not excluded from our analyses but were classified as a separate "unknown" group because nearly 20% of respondents fell into this group (Table 1).

Alcohol drinking has been identified as an important risk factor for tobacco use[23,40] and polytobacco use[5,23,27,36]; therefore, we included binge drinking as a covariate. Respondents who have had at least 12 drinks of any type of alcoholic beverage in their lifetime and who answered "at least one day" to the NHIS question: "In the past year, on how many days did you have 5 or more drinks of any alcoholic beverage?" were defined as binge drinkers.[41] Current cigarette smoking status (current smokers, former smokers, and never smokers) was also included as a covariate in the analyses that examined current cigar use, current chewing tobacco use, and current snuff use. Former smokers are those who have smoked at least 100 cigarettes in their lifetime but do not smoke cigarettes now. Never smokers are those who have never smoked or have not smoked 100 cigarettes in their lifetime. Likewise, whether or not someone was a current user of other tobacco products (cigar, chewing tobacco, or snuff) was included as a covariate in the analysis that examined current cigarette smoking.

Statistical Analysis

We first estimated the prevalence of current tobacco use for each tobacco product among all US adults and the subpopulations stratified by each covariate. For each product, the bivariate analysis chi-square test was used to determine if there was any difference in the prevalence of current tobacco use across all subgroups of each covariate, and multivariate logistic regression analysis was used to determine significant factors associated with current tobacco use. We then estimated the prevalence of polytobacco use among current users of each tobacco product. Multivariate logistic regression analysis was used to identify significant factors associated with polytobacco use among current users of each tobacco product.

All analyses were estimated with the NHIS sampling weights that adjust for nonresponse and unequal probabilities of sample selection. Analyses were performed using SAS version 9.3 procedures—PROC SURVEYFREQ and PROC SURVEYLOGISTIC—that correct for the complex survey design in the NHIS to produce accurate standard errors and confidence intervals (SAS Institute, Cary, NC). For each multivariate logistic regression analysis, the adjusted odds ratio and 95% confidence interval between the covariate and outcome variables were calculated. We considered estimates to be statistically significant if the *P* value from a two-tailed test was less than .05.

Study Sample

Excluding the 5583 cases (ie, 4.5% of all NHIS eligible adult respondents) with missing values for current use of cigarettes, cigars, chewing tobacco, or snuff resulted in a sample size of 117 816 adults for estimating the prevalence of current tobacco use. The sample size for multivariate regression analyses on current tobacco use is 114 780 after excluding another 3036 respondents with missing values for education (N = 762) and binge drinking status (N = 2356).

Results

Among the 117 816 sampled adults, slightly more than half were women, nearly 40% were between ages 25–44, more than 70% were non-Hispanic white, 16.6% had less than a high school degree, 9.6% reported poor income, 18.9% did not report family income, and 35.9% lived in the South (Table 1). By other health-risk behaviors, 20.5% of adults self-reported being binge drinkers, 21.8% were current cigarette smokers, 22.1% were former smokers, and 4.6% were current users of other tobacco products.

Prevalence of Current Tobacco Use

Table 1 also shows the prevalence of current tobacco use for each covariate. The prevalence of current cigarette smoking decreased from 24.1% in 1998 to 19.3% in 2010. There were no significant temporal trends in the prevalence of current cigar use or current chewing tobacco use over the study period of 1998–2010. Prevalence of current snuff use was 1.8% in 1998, dropped to 1.3% in 2000, and increased to 2.0% in 2010. The bivariate analyses show that the prevalence of current tobacco use differed significantly by all sociodemographic characteristics for every tobacco product except for cigars by education level. Binge drinkers reported higher prevalence of current tobacco use than non-binge drinkers for every product. Additionally, the prevalence of current cigarette smoking was much higher among current users of other tobacco products compared to nonusers of these products (36.4% vs. 21.1%). The prevalence of current cigar use, current chewing tobacco use, and current snuff use varied by cigarette smoking status (5.2%, 1.5%, and 2.2%, respectively, among current smokers; and 1.2%, 0.9%, and 1.3%, respectively, among never smokers). During the study period, the vast majority (81.2%) of current cigarette smokers consumed cigarettes every day, 60.8% of current snuff users consumed snuff daily, and 44.3% of current chewing tobacco users consumed chewing tobacco daily, whereas only 16.9% of current cigar users consumed cigars daily (data not shown).

Factors Associated With Current Tobacco Use

The multivariate logistic regression results in Table 2 show that, compared to 1998, US adults were significantly less likely to be current cigarette smokers in 2005 and 2010, but more likely to be current snuff users in 2010. Men were more likely to be current tobacco users than women for all products with the adjusted odds ratio being greatest for chewing tobacco (24.0) followed by snuff (14.1), cigars (12.5), and cigarettes (1.1). Moreover, compared with the respective reference groups, the odds of being a current cigarette smoker was significantly higher among adults aged 25–64, those living in the Midwest and South, and binge drinkers; however, it was significantly lower among the oldest group, Hispanics, non-Hispanic blacks, Non-Hispanic Asians,

Table 1. Distribution of Study Sample and Prevalence of Current Tobacco Use by Year, Sociodemographic Characteristics, and Other Health-Risk Behaviors among US Adults (*N* = 117 816)

	Study sample		Prevalence							
			Cigarettes		Cigars		Chewing tobacco		Snuff	
	N	Column %	Row %	*P*	Row %	*P*	Row %	*P*	Row %	*P*
All	117 816	100.0	21.8		2.4		1.2		1.7	
Year				<.001		.194		.238		<.001
1998	31 740	23.9	24.1		2.5		1.2		1.8	
2000	31 097	24.0	23.3		2.3		1.3		1.3	
2005	29 650	25.5	20.9		2.2		1.1		1.5	
2010	25 329	26.5	19.3		2.5		1.1		2.0	
Sociodemographics										
Gender				<.001		<.001		<.001		<.001
Men	51 358	48.0	24.3		4.6		2.3		3.3	
Women	66 458	52.0	19.5		0.3		0.1		0.2	
Age				<.001		<.001		<.001		<.001
18–24	12 128	13.1	24.6		2.2		1.7		2.4	
25–44	46 143	38.8	25.2		2.6		1.3		2.3	
45–64	36 602	31.8	22.7		2.8		0.8		1.1	
≥65	22 943	16.4	9.7		1.1		1.1		0.8	
Race/ethnicity				<.001		<.001		<.001		<.001
Non-Hispanic white	75 847	72.3	23.0		2.7		1.4		2.1	
Hispanic	20 255	11.9	16.2		1.5		0.2		0.3	
Non-Hispanic black	16 722	11.3	22.3		2.1		0.6		0.6	
Non-Hispanic Asian	3726	3.3	12.1		0.5		0.2		0.2	
Non-Hispanic Others	1266	1.1	29.4		2.4		2.3		2.9	
Education				<.001		.860		<.001		<.001
Less than HS	23 008	16.6	28.2		2.3		2.0		0.4	
HS graduate	33 418	29.0	27.8		2.4		1.3		2.2	
Some college	33 132	28.8	22.2		2.4		1.1		2.0	
College graduate	27 496	25.0	10.2		2.4		0.6		1.7	
Unknown	762	0.6	21.6	…	1.6	…	0.5	…	1.0	…
Family income				<.001		<.001		.038		<.001
Poor	15 180	9.6	30.2		2.6		1.2		1.7	
Low	19 495	14.5	27.3		2.2		1.4		1.9	
Middle	28 969	25.4	23.8		2.2		1.2		2.0	
High	31 883	31.6	16.2		2.9		1.0		1.6	
Unknown	22 289	18.9	20.0		1.8		1.1		1.1	
Region				<.001		.001		<.001		<.001
Northeast	20 864	18.5	20.4		2.2		0.5		0.8	
Midwest	27 181	24.8	24.4		2.7		1.3		1.9	
South	42 807	35.9	23.1		2.4		1.6		2.3	
West	26 964	20.8	17.8		2.1		0.9		1.0	
Other health-risk behaviors										
Binge drinking status				<.001		<.001		<.001		<.001
No	92 858	77.5	17.3		1.4		0.8		1.0	
Yes	22 602	20.5	37.1		5.8		2.5		4.1	
Unknown	2356	2.0	40.9	…	4.2	…	2.2	…	2.2	…
Other tobacco use[a]				<.001						
Not current users	113 174	95.4	21.1		…		…		…	
Current users	4642	4.6	36.4		…		…		…	
Cigarette smoking status						<.001		<.001		<.001
Current smokers	25 866	21.8	…		5.2		1.5		2.2	
Former smokers	25 966	22.1	…		2.5		1.5		2.2	
Never smokers	65 984	56.1	…		1.2		0.9		1.3	

HS = high school; *N* = unweighted sample size. All the percentages are estimated from the weighted analysis. *P* values are based on chi-square statistics from bivariate analyses. Ellipsis indicates not included in the bivariate analysis.

[a]Whether or not being a current cigar user, or current chewing tobacco user, or current snuff user.

those with at least a high school degree, those who lived above the poverty line or did not report income, and those living in the West. Current cigar use was significantly more likely among adults aged 45–64 and binge drinkers but was less likely among Hispanics, non-Hispanic Asians, and those with at least low income or who did not report income. For the chewing tobacco model and snuff

Table 2. Characteristics Associated With Current Cigarette Smoking, Cigar Use, Chewing Tobacco Use, and Snuff Use Among US Adults (*N* = 114 780): Multivariate Logistic Regression Analysis

	Current cigarette smokers (*N* = 24 818)		Current cigar users (*N* = 2410)		Current chewing tobacco users (*N* = 1099)		Current snuff users (*N* = 1513)	
	N	*AOR* (95% CI)	*N*	*AOR* (95% CI)	*N*	*AOR* (95% CI)	*N*	*AOR* (95% CI)
Year								
1998	7309	REF	677	REF	330		468	REF
2000	6932	0.99 (0.95–1.04)	597	0.96 (0.84–1.08)	316	1.06 (0.88–1.27)	315	**0.73 (0.63–0.85)**
2005	5894	**0.88 (0.84–0.93)**	576	0.98 (0.86–1.12)	234	0.93 (0.75–1.16)	346	0.93 (0.78–1.12)
2010	4683	**0.79 (0.75–0.83)**	560	1.07 (0.93–1.23)	219	1.04 (0.83–1.31)	384	**1.30 (1.08–1.56)**
Gender								
Men	12 175	**1.08 (1.04–1.12)**	2209	**12.53 (10.53–14.91)**	1037	**23.99 (19.49–32.91)**	1369	**14.06 (11.38–17.36)**
Women	12 643	REF	201	REF	62	REF	144	REF
Age								
18–24	2904	REF	246	REF	158	REF	221	REF
25–44	11 219	**1.41 (1.32–1.50)**	1027	1.18 (0.98–1.42)	480	0.92 (0.72–1.18)	795	1.12 (0.91–1.39)
45–64	8430	**1.36 (1.27–1.45)**	910	**1.42 (1.17–1.71)**	256	**0.59 (0.45–0.78)**	328	**0.51 (0.39–0.66)**
≥65	2265	**0.40 (0.37–0.43)**	227	0.83 (0.65–1.07)	205	**0.67 (0.50–0.90)**	169	**0.34 (0.25–0.46)**
Race/ethnicity								
Non-Hispanic white	17 032	REF	1783	REF	932	REF	1310	REF
Hispanic	3307	**0.40 (0.37–0.42)**	252	**0.57 (0.47–0.69)**	33	**0.07 (0.04–0.11)**	50	**0.08 (0.06–0.12)**
Non-Hispanic black	3689	**0.74 (0.70–0.78)**	325	0.94 (0.81–1.09)	100	**0.34 (0.26–0.43)**	118	**0.22 (0.17–0.29)**
Non-Hispanic Asian	435	**0.64 (0.55–0.73)**	19	**0.20 (0.11–0.37)**	8	**0.18 (0.09–0.38)**	8	**0.15 (0.06–0.37)**
Non-Hispanic Others	355	1.16 (0.98–1.36)	31	0.91 (0.59–1.42)	26	1.48 (0.96–2.29)	27	1.36 (0.84–2.20)
Education								
Less than HS	5703	REF	405	REF	333	REF	343	REF
HS graduate	8718	**0.79 (0.75–0.84)**	700	0.98 (0.84–1.16)	330	**0.48 (0.38–0.60)**	500	**0.63 (0.53–0.75)**
Some college	7399	**0.55 (0.52–0.59)**	720	1.03 (0.87–1.22)	289	**0.40 (0.32–0.50)**	450	**0.48 (0.40–0.58)**
College graduate	2998	**0.23 (0.21–0.24)**	585	1.17 (0.98–1.39)	147	**0.20 (0.16–0.26)**	220	**0.25 (0.20–0.32)**
Family income								
Poor	4247	REF	303	REF	136	REF	190	REF
Low	4840	**0.89 (0.83–0.95)**	311	**0.78 (0.65–0.95)**	209	1.10 (0.86–1.41)	250	0.99 (0.79–1.25)
Middle	6635	**0.69 (0.65–0.74)**	348	**0.68 (0.57–0.80)**	314	0.94 (0.73–1.21)	469	0.93 (0.74–1.16)
High	5174	**0.47 (0.44–0.51)**	580	**0.84 (0.71–0.98)**	278	0.86 (0.67–1.10)	434	0.82 (0.64–1.05)
Unknown	3922	**0.63 (0.59–0.68)**	868	**0.72 (0.60–0.86)**	162	1.10 (0.78–1.56)	170	0.78 (0.55–1.12)
Region								
Northeast	4154	REF	404	REF	78	REF	110	REF
Midwest	6403	**1.08 (1.02–1.14)**	633	1.04 (0.88–1.22)	292	**2.26 (1.69–3.01)**	419	**2.13 (1.61–2.82)**
South	9432	**1.13 (1.07–1.20)**	878	1.02 (0.88–1.18)	557	**3.61 (2.76–4.72)**	767	**3.61 (2.75–4.73)**
West	4829	**0.89 (0.84–0.95)**	495	0.96 (0.81–1.14)	172	**2.08 (1.49–2.90)**	217	**1.51 (1.13–2.01)**
Binge drinking status								
No	16 158	REF	1180	REF	625	REF	767	REF
Yes	8660	**2.73 (2.61–2.86)**	1230	**2.27 (2.05–2.52)**	474	**2.13 (1.79–2.53)**	146	**2.37 (2.06–2.72)**
Other tobacco use[a]								
Not current users	23 183	REF	…	…	…	…	…	…
Current users	1635	**1.28 (1.18–1.40)**	…	…	…	…	…	…
Cigarette smoking status								
Current smokers	…	…	1158	**3.15 (2.78–3.58)**	301	**0.80 (0.65–0.99)**	410	**0.78 (0.65–0.93)**
Former smokers	…	…	575	**1.63 (1.42–1.88)**	344	1.17 (0.97–1.40)	443	**1.39 (1.19–1.62)**
Never smokers	…	…	677	REF	454	REF	660	REF

AOR = adjusted odds ratio; CI = confidence interval; HS = high school; *N* = unweighted sample size of adults who are current cigarette smokers, current cigar users, current chewing tobacco users, and current snuff users, respectively. Ellipsis indicates not included in the model. Statistically significant *AOR* results are noted in bold.

[a]Whether or not being a current cigar user, or current chewing tobacco user, or current snuff user.

model, compared with the reference groups, the odds of being a current user were significantly higher among adults residing in the Midwest, South, and West, and binge drinkers, but was significantly lower among adults aged ≥45, Hispanics, non-Hispanic blacks, Non-Hispanic Asians, and those with at least a high school degree.

There was a significant association between current cigarette smoking and current use of other tobacco products. The odds of being a current smoker were 28% higher among current users of other tobacco products compared to non-users of these products. On the other hand, compared with never smokers, current smokers had 215% higher odds of being a current cigar user, 20% lower odds of being a current chewing tobacco user, and 22% lower odds of being a current snuff user. Former smokers had 63% higher odds of being a current cigar user and 39% higher odds of being a current snuff user than never smokers.

Prevalence of Polytobacco Use

Table 3 shows that in 2010, only 8.6% of current cigarette smokers were polytobacco users, whereas a large percentage of current cigar users, current chewing tobacco users, and current snuff users were polytobacco users—50.3%, 54.8%, and 42.5%, respectively. The prevalence of polytobacco use fluctuated over time during 1998–2010 in the range of 6.8%–8.6% among cigarette smokers, 50.1%–53.9% among cigar users, 47.4%–57.4% among chewing tobacco users, and 42.1%–47.4% among snuff users. It also varied widely across different subgroups stratified by sociodemographic characteristics and other health-risk behaviors.

Figure 1 shows the patterns of product combination among poly-users over time. Among current cigar users, the proportion of poly-users who concurrently used cigarettes only was 78.7% in 2010, and another 12.3% of poly-users concurrently used both cigarettes and other forms of non-cigarette tobacco products. Among current chewing tobacco users, the proportion of poly-users who concurrently used cigarettes only increased from 19.2% in 1998 to 37.2% in 2000 and then declined continuously to 19.1% in 2010, and the proportion of poly-users who concurrently used both cigarettes and other forms of non-cigarette tobacco products fluctuated in the range of 22.2%–36.8%; in 2010, more than half of poly-users concurrently used only other forms of non-cigarette tobacco products. Of the poly-users among current snuff users, more than one-third concurrently used cigarettes only, 23.5%–30.0% concurrently used both cigarettes and other forms of non-cigarette tobacco products, and 30.2%–40.6% concurrently used only other forms of non-cigarette tobacco products.

Factors Associated With Polytobacco Use

After controlling for other covariates, the prevalence of poly-use among current chewing tobacco users in 2000 and 2005 was significantly lower compared to 1998 (Table 3). The prevalence of poly-use among current cigarette smokers was significantly higher in 2010 compared to 2000 ($P < .01$; data not shown). There was no statistically significant temporal trend in the prevalence of poly-use among current cigar users and among current snuff users. Among current cigarette smokers, polytobacco use was significantly more likely among men, those residing in the South, and binge drinkers, but was significantly less likely among those aged ≥45, Hispanics, non-Hispanic blacks, non-Hispanic Asians, high school graduates, and those with at least middle income, compared to the respective reference groups. Among current cigar users, polytobacco use was significantly more likely among those residing in the South and binge drinkers but was significantly less likely among men, the oldest group, Hispanics, non-Hispanic blacks, those with at least a high school degree, and those with at least middle income or who did not report income. Among current chewing tobacco users, polytobacco use was significantly more likely among non-Hispanic Asians and binge drinkers; however, it was significantly less likely among those aged ≥25, high school graduates, and college graduates. Among current snuff users, polytobacco use was significantly more likely among men, non-Hispanic blacks, and binge drinkers, but was significantly less likely among adults aged ≥25, college graduates, and the high income group.

Discussion

The present study extends previous studies on polytobacco use in US adults by examining the prevalence and correlates of current polytobacco use among four major groups of tobacco product users. To compare our results with the literature of poly-use among current tobacco users,[13,16,29–32,34–39] it is worth pointing out that previous poly-use prevalence estimates varied widely depending on types of tobacco products examined, frequency of tobacco use (daily vs. non-daily), and gender. In the literature, dual use of cigarettes with SLT (chewing tobacco and snuff)[16,30,31,35,36] and dual use of cigarettes with snuff[13,37] were the most commonly examined poly-use combinations. These dual-use studies showed that 15.0%–19.2% of male daily snuff users and 38.9%–44.7% of male nondaily snuff users concurrently used cigarettes,[13,37] that dual-use prevalence among current SLT users was 25.0%–33.0% for men,[30,35,36] 42.4% for women,[36] and 41.3% for both genders,[31] and that dual-use prevalence among current cigarette smokers was 4.4%–8.5%% for men,[35,36] 2.3% for women,[36] and 6.1% for both genders.[31] We examined four types of tobacco products and our poly-use prevalence estimates are generally greater than those from the above-mentioned dual-use studies.[13,30,31,35,36,37] Compared with another study[29] which examined poly-use of cigarettes, cigars, chewing tobacco, snuff, and pipes using data from the 1995–2002 Tobacco Use Supplements to the Current Population Survey, our estimate of poly-use prevalence among current cigarette smokers in 1998 (7.4%) is almost identical to theirs (7.9%). Conversely, our estimates are lower than those from three studies that examined other combinations of polytobacco use.[32,34,38] For example, Lee and colleagues used the 2012 National Adult Tobacco Survey data and estimated that 46.5% of male and 26.4% of female current cigarette smokers concurrently used cigars, cigarillos, little cigars, e-cigarettes, hookah/water pipe, chewing tobacco, snuff, dip, and snus.[34] Their high estimates of poly-use prevalence were likely due to including more types of tobacco products.

Only a few studies have examined the sociodemographic characteristics of poly-users among current tobacco users.[29,34–36,38] Our study found that gender and race/ethnicity did not play a consistent role in predicting polytobacco use across the four groups of current tobacco users. On the one hand, men were merely 8% more likely to be current cigarette smokers but were more than 12 times as likely to be current cigars users, nearly 24 times as likely to be current chewing tobacco users, and 14 times as likely to be current snuff users as women (Table 2). On the other hand, male cigarette smokers were 11 times as likely as female cigarette smokers to be poly-users, male current cigar users were 43% less likely than female current cigar users to be poly-users, and male snuff users were three times as likely as female snuff users to be poly-users (Table 3). Compared to non-Hispanic whites, racial/ethnic minorities were in general less likely to be current users for all four types of tobacco products, and less likely to be poly-users among current cigarette smokers and current cigar users. Nonetheless, compared to non-Hispanic whites, non-Hispanic Asians were more likely to be poly-users among current

Table 3. Prevalence of Polytobacco Use and Characteristics Associated With Polytobacco Users Among Current Cigarette Smokers, Current Cigar Users, Current Chewing Tobacco Users, and Current Snuff Users: Multivariate Logistic Regression Analysis

	Polytobacco use among cigarette smokers (N = 24 818)		Polytobacco use among cigar users (N = 2410)		Polytobacco use among chewing tobacco users (N = 1099)		Polytobacco use among snuff users (N = 1513)	
	%Poly	*AOR* (95% CI)	%Poly	*AOR* (95% CI)	%Poly	*AOR* (95% CI)	%Poly	*AOR* (95% CI)
All	7.6	…	51.1	…	51.9	…	44.7	…
Year								
1998	7.4	REF	53.9	REF	57.4	REF	47.4	REF
2000	6.8	0.93 (0.79–1.09)	51.7	0.92 (0.71–1.19)	47.4	**0.67 (0.48–0.93)**	42.1	0.84 (0.60–1.18)
2005	7.7	1.05 (0.90–1.24)	50.1	0.85 (0.65–1.11)	47.8	**0.71 (0.51–0.99)**	47.0	0.95 (0.69–1.30)
2010	8.6	1.18 (0.99–1.40)	50.3	0.89 (0.68–1.18)	54.8	1.00 (0.70–1.42)	42.5	0.82 (0.63–1.06)
Gender								
Men	13.2	**11.22 (9.12–13.81)**	50.1	**0.57 (0.40–0.82)**	52.3	1.03 (0.57–1.85)	46.1	**3.16 (1.98–5.04)**
Women	1.2	REF	70.3	REF	43.6	REF	24.6	REF
Age								
18–24	10.1	REF	66.7	REF	70.3	REF	65.7	REF
25–44	8.1	0.89 (0.72–1.10)	56.9	1.11 (0.81–1.53)	54.3	**0.63 (0.42–0.93)**	41.9	**0.46 (0.33–0.65)**
45–64	6.6	**0.75 (0.60–0.93)**	46.1	0.82 (0.59–1.15)	49.0	**0.51 (0.31–0.83)**	39.7	**0.46 (0.31–0.68)**
≥65	3.6	**0.48 (0.35–0.67)**	25.5	**0.24 (0.15–0.37)**	26.3	**0.15 (0.08–0.26)**	26.8	**0.23 (0.14–0.39)**
Race/ethnicity								
Non-Hispanic white	8.2	REF	51.0	REF	51.9	REF	44.4	REF
Hispanic	5.9	**0.46 (0.37–0.58)**	56.7	**0.62 (0.44–0.87)**	56.5	1.11 (0.62–2.00)	55.9	1.62 (0.88–3.00)
Non-Hispanic black	5.5	**0.57 (0.47–0.70)**	50.1	**0.44 (0.33–0.58)**	42.6	0.82 (0.52–1.28)	37.8	**1.66 (1.07–2.57)**
Non-Hispanic Asian	1.7	**0.14 (0.07–0.31)**	31.3	0.55 (0.18–1.65)	59.1	**1.88 (1.21–2.91)**	16.1	0.25 (0.04–1.39)
Non-Hispanic Others	9.8	1.16 (0.75–1.81)	75.8	1.41 (0.59–3.37)	72.3	1.78 (0.77–4.14)	66.4	1.79 (0.75–4.31)
Education								
Less than HS	8.6	REF	75.1	REF	52.1	REF	48.6	REF
HS graduate	7.4	**0.83 (0.69–0.99)**	60.3	**0.50 (0.38–0.67)**	49.0	**0.61 (0.39–0.94)**	46.6	0.76 (0.54–1.07)
Some college	7.4	0.83 (0.69–1.01)	51.4	**0.34 (0.25–0.46)**	60.4	0.92 (0.58–1.46)	46.0	0.75 (0.52–1.06)
College graduate	7.0	0.84 (0.66–1.06)	26.8	**0.14 (0.10–0.19)**	40.2	**0.45 (0.26–0.75)**	32.0	**0.51 (0.33–0.80)**
Family income								
Poor	8.0	REF	73.2	REF	51.4	REF	50.5	REF
Low	8.0	0.86 (0.70–1.07)	67.0	0.85 (0.62–1.16)	53.4	1.35 (0.88–2.08)	50.9	0.89 (0.58–1.37)
Middle	7.6	**0.77 (0.64–0.93)**	56.5	**0.63 (0.47–0.84)**	55.3	1.38 (0.87–2.17)	46.2	0.75 (0.51–1.10)
High	7.6	**0.72 (0.58–0.88)**	36.7	**0.37 (0.28–0.49)**	48.1	0.93 (0.59–1.47)	35.9	**0.50 (0.33–0.75)**
Unknown	6.7	0.81 (0.62–1.06)	52.7	**0.64 (0.45–0.91)**	51.4	1.09 (0.64–1.87)	50.1	0.83 (0.53–1.30)
Region								
Northeast	5.7	REF	41.2	REF	50.1	REF	45.7	REF
Midwest	7.2	1.16 (0.94–1.42)	49.1	1.19 (0.88–1.61)	55.1	1.21 (0.66–2.21)	48.5	1.30 (0.90–1.88)
South	8.9	**1.60 (1.32–1.95)**	59.5	**2.01 (1.52–2.66)**	51.6	1.41 (0.77–2.58)	42.2	0.96 (0.68–1.37)
West	7.1	1.16 (0.93–1.46)	49.5	1.33 (0.95–1.85)	48.3	0.76 (0.40–1.45)	46.1	1.16 (0.79–1.71)
Binge drinking status								
No	4.9	REF	45.9	REF	45.0	REF	39.0	REF
Yes	12.3	**1.85 (1.62–2.11)**	56.5	**1.61 (1.31–1.99)**	60.3	**1.49 (1.15–1.94)**	50.1	**1.35 (1.05–1.73)**

AOR = adjusted odds ratio; CI = confidence interval; HS = high school; %Poly = prevalence of polytobacco use. Ellipsis indicates not included in the model. Statistically significant *AOR* results are noted in bold. The sample sizes by subgroups of current cigarette smokers, current cigar users, current chewing tobacco users, and current snuff users are the same as those shown in the sample size columns of Table 2.

chewing tobacco users, and non-Hispanic blacks were more likely to be poly-users among current snuff users. Our findings regarding the gender and racial/ethnic profile of poly-users among current cigarette smokers are consistent with previous studies,[29,34,35,38] especially one reporting that male current smokers were 13 times as likely as female smokers to be dual users,[29] but are different from a study reporting that non-Hispanic black current smokers were more likely to be dual users than non-Hispanic white current smokers.[38] Our findings regarding the racial/ethnic profile of poly-users among current chewing tobacco and snuff users are partially consistent with a previous study which analyzed polytobacco use separately by gender and found that white male SLT users were less likely to be poly-users than all racial/ethnic minority male SLT users except American Indians/Alaska Natives, whereas white female SLT users were more likely to be poly-users than racial/ethnic minority female SLT users.[36]

In addition, our study found that young adulthood, less than high school education, living below the poverty level (except among chewing tobacco users), binge drinking, and living in the South (only among cigarette smokers and cigar users) were positively associated with polytobacco use among all four groups of current tobacco users. Our findings are consistent with previous studies reporting that among current cigarette smokers, poly-use was associated with

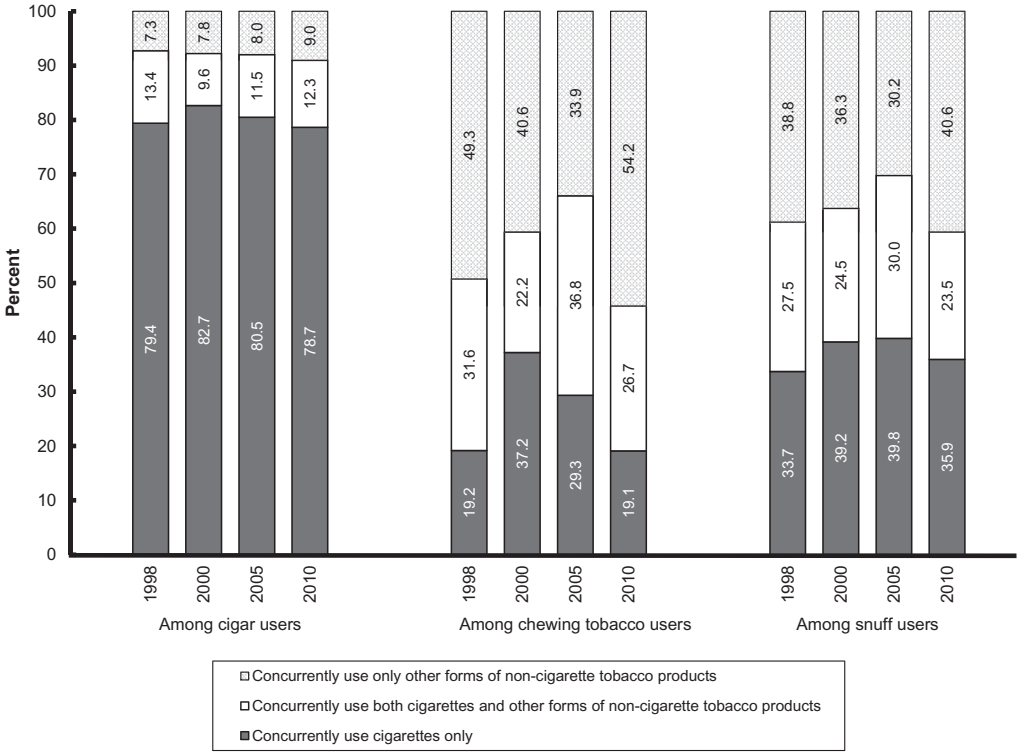

Figure 1. Patterns of product combination among poly-users within current cigar users, current chewing tobacco users, and current snuff users over time.

younger age,[29,34,36,38] low income,[29] low education,[35,36] and heavy alcohol drinking,[36] as well as previous studies reporting that among current SLT users, the risk of poly-use increased with low education,[35] low income,[36] and heavy alcohol drinking.[36]

This study, to our knowledge, is the first study to assess polytobacco use among current cigar users. While only 16.9% of current cigar users consumed cigars on a daily basis, more than half of current cigar users were polytobacco users, and overwhelming 90% of these poly-users concurrently smoked cigarettes. This study also found a significantly negative association of former cigarette smoking with current cigar use and snuff use, suggesting that some of the decline in cigarette consumption might be offset by cigar use or other forms of tobacco use. Longitudinal studies of tobacco use trajectories are warranted to investigate the initiation and transition of various tobacco use behaviors and understand the impact of polytobacco use on quitting behaviors.[13,27] Future research is also needed to understand the underlying reasons for engaging in polytobacco use especially among female cigar users, non-Hispanic Asian chewing tobacco users, and non-Hispanic black snuff users.

Our estimates of current tobacco use prevalence among adults in 2010 are comparable with those from a study based on the 2009–2010 National Adult Tobacco Survey data (19.5% for cigarettes, 6.6% for cigars, and 3.4% for chewing tobacco, snuff, and dip) except that our estimate for current cigar use (2.5%) is lower than theirs.[42] One possible reason is that we defined current cigar use by requiring a minimum lifetime usage of 50 cigars while their study defined current cigar users as those who answered "yes" to the question: "Have you ever tried smoking cigars, cigarillos, or very small cigars that look like cigarettes in your entire life, even one or two puffs?" and who reported smoking these products on at least one day during the past 30 days. Omitting the lifetime thresholds to define current tobacco users could yield higher current prevalence estimates.[17,43] Indeed, another study used the 2012–2013 National Adult Tobacco Survey data to defined current cigar users as those who answered "yes" to the question: "Have you smoked cigars, cigarillos, or little filtered cigars at least 50 times in your entire life?" and who reported smoking these products every day or some days now, and their estimate of current cigar use prevalence was 2.0%,[17] which is close to our estimate.

This study is subject to some limitations. First, due to lack of data availability, we could not examine new and emerging tobacco products, such as e-cigarettes, hookah, and dissolvables. Excluding such products may underestimate the prevalence of polytobacco use.[34] Second, this study was based on cross-sectional data from a large nationally representative survey but 2010 was the most recent year of available data. The patterns of tobacco use might have changed after 2010 due to the Family Smoking Prevention and Tobacco Control Act which became law on June 22, 2009 to grant the Food and Drug Administration the authority to regulate tobacco products. For example, under the Family Smoking Prevention and Tobacco Control Act, cigarettes with characterizing flavors other than menthol are banned by the Food and Drug Administration, but flavored cigars and SLT are not prohibited; therefore, use of flavored cigars and SLT might become more prevalent after 2010.[38] Third, the sample size of certain subgroups, such as non-Hispanic Asian current chewing tobacco users, snuff users, and cigar users, was small and the results for these subgroups should be interpreted with caution.

In conclusion, our results show that polytobacco use is extremely common among current users of non-cigarette tobacco products. Polytobacco use patterns not only differ across sociodemographic subpopulations, but also the gender and racial/ethnic profiles in poly-users vary across different groups of current tobacco users. Accordingly, focusing policy efforts on cigarette smokers is clearly not an adequate strategy for addressing the tobacco epidemic.

Tobacco control strategies need to consider the interrelationships in the use of different tobacco products and the diverse profiles of poly-users in order to develop tailored tobacco prevention and intervention policies that can further reduce the burden of tobacco use. Consideration of polytobacco use should be part of Food and Drug Administration's tobacco product regulation.

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Declaration of Interests

None declared.

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