

## Brief report

# Do Socioeconomic Risk Factors for Cigarette Smoking Extend to Smokeless Tobacco Use?

Thomas J. White PhD<sup>1,2</sup>, Ryan Redner PhD<sup>1,2</sup>, Janice Y. Bunn PhD<sup>3</sup>,  
Stephen T. Higgins PhD<sup>1,2,4</sup>

<sup>1</sup>Vermont Center on Behavior and Health, University of Vermont, Burlington, VT; <sup>2</sup>Department of Psychiatry, University of Vermont, Burlington, VT; <sup>3</sup>Department of Medical Biostatistics, University of Vermont, Burlington, VT; <sup>4</sup>Department of Psychology, University of Vermont, Burlington, VT

Corresponding Author: Stephen T. Higgins, PhD, Vermont Center on Behavior and Health, University of Vermont, UHC Campus, Rm 3100B Old Hall, 1 S. Prospect Street, Burlington, VT 05401, USA. Telephone: 802-656-9614; Fax: 802-656-9628; E-mail: [Stephen.Higgins@uvm.edu](mailto:Stephen.Higgins@uvm.edu)

## Abstract

**Introduction:** Individuals with lower socioeconomic status (SES) are at increased risk for cigarette smoking. Less research has been conducted characterizing the relationship between SES and risk of using of other tobacco products. The present study examined SES as a risk factor for smokeless tobacco (ST) use in a US nationally representative sample, utilizing data from the 2012 National Survey on Drug Use and Health.

**Methods:** Odds were generated for current cigarette smoking and ST use among adults ( $\geq 18$  years) based on SES markers (educational attainment, income, blue-collar employment, and unemployment) after controlling for the influence of demographics and other substance dependence.

**Results:** Odds of current cigarette smoking increased as a graded, inverse function of educational attainment as well as lower income and being unemployed. Odds of current ST use also increased as a function of lower educational attainment, although not in the linear manner seen with cigarette smoking. Odds of ST use but not cigarette smoking also increased with blue-collar employment. In contrast to patterns seen with cigarette smoking, ST use did not change in relation to income or unemployment.

**Conclusions:** Markers of SES are significantly associated with odds of cigarette smoking and ST use, but which indicators are predictive and the shape of their relationship to use differs across the two tobacco products.

## Introduction

Cigarette smoking prevalence is unevenly distributed in the US population, with persons of lower socioeconomic status (SES) being especially vulnerable.<sup>1–4</sup> Less is known about the relation of these risk factors to use of other tobacco products, including smokeless tobacco (ST). Recent prevalence estimates of ST use in the United States suggest higher rates among those with less than a college education.<sup>5</sup> Others note that ST use varies widely among working adults based on industry,<sup>6</sup> that lower-income smokers are more likely to be dual users of cigarettes and ST,<sup>7</sup> and that ST sales are negatively associated with local median income.<sup>8</sup>

Understanding vulnerabilities to use of ST and other noncombustible tobacco products has become more important as cigarette manufacturers have increased marketing of noncombustible tobacco products.<sup>9,10</sup> Products recently introduced in the United States include snus,<sup>11</sup> dissolvable tobacco products,<sup>12</sup> and electronic nicotine delivery systems.<sup>13</sup> The current report, and our prior reports on substance use disorders and depression,<sup>14,15</sup> focus on more long-standing ST products. The ST market is overwhelmingly comprised of two products, moist snuff (81% of the ST market) and loose-leaf chewing tobacco (18% of the ST market).<sup>16,17</sup> Prevalence of current use of these products in the US population of adults was estimated

at 3.2% as of 2011.<sup>14,15</sup> Modified forms of moist snuff (eg, snus) also represent a small but growing segment of the market.<sup>18–20</sup> Along with increases in availability of different types of ST products, the prevalence of ST use in the United States may be increasing.<sup>10,20</sup> That possibility warrants monitoring as ST use is linked to numerous adverse health outcomes.<sup>21</sup> Conversely, noncombustible products should also be monitored because their use could have positive health impacts as a form of harm reduction if they were to replace combustible products.<sup>22,23</sup> The present study examined the extent to which SES vulnerabilities to cigarette smoking extend to ST use.

## Methods

### Data Source

Data were obtained from the 2012 National Survey on Drug Use and Health (NSDUH), the most recent at the time this study was conducted. A detailed description of survey procedures has been provided previously.<sup>24</sup> Briefly, respondents age 12 and older ( $N = 55\,268$ ) were selected from the civilian noninstitutionalized population. They completed computer- and audio-assisted structured interviews. Individuals in active military duty, residential drug treatment, prison, or homeless without residence were excluded. The weighted interview response rate was 73.0%. The current study was restricted to respondents aged at least 18 years ( $N = 37\,869$ ; 17 756 males and 20 113 females), that is, those legally able to purchase tobacco products.

### SES Predictors

Four SES variables were examined: educational attainment, household income, industry, and current unemployment. Educational attainment was classified into four levels (<high school, high school, some college, and college graduate). Household income was categorized into four levels (<\$20 000, \$20 000–49 999, \$50 000–74 999, and  $\geq$ \$75 000). Industry was dichotomized into blue-collar (agriculture, forestry, fishing, hunting, mining, construction, manufacturing, transportation, and wholesale trade) versus all other categories. Unemployment was dichotomized into “unemployed and seeking work in the past 7 days” versus all other categories.

### Other Potential Predictors

Four demographic characteristics (age, sex, marital status, and race) that often predict use of tobacco were examined. Age was coded into six categories (18–25, 26–29, 30–34, 35–49, 50–64, and  $\geq$ 65) and considered a categorical variable. Sex was dichotomized (male/female). Marital status was dichotomized (currently married vs. all other categories). Race was measured with multiple nominal categories. Other variables known to be significant predictors of cigarette smoking and ST use,<sup>14,15</sup> including past-year *DSM-IV*<sup>25</sup> diagnoses of Major Depressive Disorder (MDD) and substance dependence were also examined. Cigarette use was included as a covariate in the ST model because many ST users also smoke cigarettes.<sup>26</sup>

### Dependent Variables

The two dependent variables examined were smoking at least once in the past 30 days (current cigarette use), and ST use in the past 30 days (ie, current ST use). It is common to define current smokers as those having smoked more than 100 cigarettes in their lifetime. However, the NSDUH does not include a lifetime measure of ST use. To keep definitions comparable across products, current users of both products were defined as those reporting use in the past 30 days.

## Statistical Methods

Descriptive statistics were used to describe the sample, which is weighted to be representative of the US population. Simple logistic regression was used to estimate the odds of past 30-day cigarette and ST use based on educational attainment, household income, industry, and unemployment, and other covariates (age, sex, marital status, race, MDD, and alcohol, marijuana, cocaine and heroin dependence).

Multiple regression analyses were also conducted separately to predict cigarette and ST use. In the first step of the multiple regression analyses for each model, all four SES variables were entered together. The ST model was also adjusted for current cigarette use. In the second step, nonsignificant SES predictors were removed, and all other potential predictors were added. In subsequent steps, nonsignificant variables were removed from each model until only significant associations remained.

Statistical software STATA version 13.1 was used for all analyses. The complex sampling design was taken into account by using survey weights. The 2012 NSDUH provided weighting, stratum, and probability sampling unit variables, and standard errors were computed using the jackknife repeated replication method. Odds ratios and 95% confidence intervals are reported. Statistical significance was defined as  $P < .05$ .

## Results

### Prevalence of Cigarette Smoking and ST Use

Prevalence of current cigarette smoking and current ST use in the general population of adults were estimated at 23.8% (26.7% among males, 21.1% among females) and 3.7% (7.1% among males, 0.5% among females), respectively (Table 1). Among current cigarette smokers, 5.7% reported current ST use; among current ST users, 37.2% reported current cigarette use.

### Modeling Predictors of Cigarette Smoking

Results from simple logistic regressions are shown in Table 2. Odds of current cigarette smoking increased as a graded, inverse function of educational attainment and household income, and were increased among persons employed in blue-collar industries and the unemployed. The odds of current cigarette smoking also increased in relation to being younger, male, unmarried, having a past-year diagnosis of MDD, and being dependent on alcohol, marijuana, cocaine, or heroin. Compared to non-Hispanic whites, odds of current cigarette smoking were lower among those who identified as Hispanic or Asian, and increased among those who identified as Native American or Multiracial.

When the four SES variables were considered together in a multiple regression model, all remained significant ( $P < .0001$ ; Table 2). In the second step where the other significant predictors of cigarette smoking from simple logistic regressions (employment in blue collar industry, age, sex, race, marital status, MDD, and alcohol/marijuana/cocaine/heroin dependence) were entered, all remained significant and included in the final model except for blue-collar industry.

### Modeling Predictors of ST Use

Odds of ST use were negatively associated with educational attainment, although only one comparison (college graduates vs. the <high school reference group) achieved significance (Table 2). Working in a blue-collar industry was significantly associated with ST use, while household income and current unemployment were not. Younger

**Table 1.** Sociodemographics and Substance Use Characteristics in the 2012 National Survey of Drug Use and Health (NSDUH), ≥18 Years, Weighted Sample (Unweighted N = 37 869)

Variable	% (WSE)	Unweighted N
<b>Education</b>		
<High school	14.5 (0.32)	5941
High school	29.7 (0.39)	12 374
Some college	26.4 (0.39)	11 146
College graduate	29.4 (0.40)	8408
<b>Household income</b>		
<\$20 000	18.9 (0.35)	9873
\$20 000–\$49 999	32.9 (0.48)	13 087
\$50 000–74 999	16.6 (0.35)	5746
≥\$75 000	31.6 (0.57)	9163
Blue-collar industry	27.5 (0.45)	6057
Unemployed	5.0 (0.17)	3045
<b>Sociodemographics</b>		
Male	48.1 (0.44)	17 756
Married	52.6 (0.50)	13 101
<b>Age</b>		
18–25	14.7 (0.21)	18 615
26–29	7.4 (0.22)	2628
30–34	8.3 (0.27)	2864
35–49	25.9 (0.41)	7391
50–64	25.9 (0.50)	3923
≥65	17.8 (0.43)	2448
<b>Race</b>		
Non-Hispanic white	66.3 (0.53)	23 476
Black/African American	11.6 (0.37)	4825
Hispanic	14.8 (0.36)	6119
Asian	4.9 (0.24)	1571
Hawaiian/Pacific Islander	0.4 (0.07)	230
Native American/Alaska Native	0.6 (0.06)	536
Multiracial	1.4 (0.13)	1112
<b>Mental health</b>		
Major depression	6.9 (0.21)	3112
<b>Substance dependence</b>		
Alcohol	3.4 (0.12)	1857
Marijuana	1.0 (0.06)	804
Cocaine	0.3 (0.04)	136
Heroin	0.2 (0.03)	129
<b>Tobacco use</b>		
Cigarettes	23.8 (0.37)	11 260
Smokeless tobacco (ST)	3.7 (0.16)	1868

WSE = weighted standard error.

age, male sex, and being a current cigarette smoker were each associated with increased odds of ST use in simple logistic regressions, while marital status was not. Compared to non-Hispanic whites, individuals who identified as black, Hispanic, Asian or Multiracial were less likely to use ST, and Native Americans more likely. MDD was not associated with ST use in simple logistic regression. Dependence on alcohol, marijuana, and heroin were associated with ST use; cocaine dependence was not.

In the first step of the multiple regression model, educational attainment and working in a blue-collar industry (SES variables significant in simple logistic regressions) were considered together. Both remained significant predictors of ST use. In the second step, age, sex, race, dependence on alcohol, marijuana, heroin, and being a current cigarette smoker (variables significant in simple logistic regressions) were included in the model along with educational attainment and working in a blue-collar industry. All except marijuana dependence

and being a current cigarette smoker remained significant and were retained in the final model (Table 2).

Additional analyses were conducted using (1) participants who were at least 26 years of age to better ensure that respondents had a chance to complete their education, and (2) using the more conventional definition of “current smoker” as those having smoked at least 100 cigarettes in one’s lifetime and smoked in the past month. Only minor changes were observed compared to the results shown in Table 2. Increasing the lower age limit from 18 to 26 eliminated heroin dependence as a predictor of cigarette smoking and ST use, and retained current smoking as a predictor of ST use. Additionally, being black no longer was related to lower risk of ST use. Changing the definition of current smoker resulted in the retention of current smoking status as a predictor of ST use.

## Discussion

The current study extends the literature on SES and risk of tobacco use by examining the extent to which relations observed with cigarette smoking extend to ST use. Lower educational attainment was associated with increased odds of cigarette smoking and ST use establishing a clear association between SES status and risk of engaging in both forms of tobacco use. It seems likely that these patterns of tobacco use contribute to at least some of the SES disparities seen in oral cancers and other tobacco-related illnesses, especially among men.<sup>27,28</sup> The relationship between educational attainment and risk was graded and linear with cigarette smoking. With ST use, the relation was flatter with the only significant difference in odds of use being between college graduates and those with less than a high school education. As a general rule of thumb, educational attainment gradients in relation to the odds of engaging in health-related risk behaviors become increasingly well defined as knowledge regarding the potential risks involved are diffused into the general population.<sup>29–31</sup> The flatter functions seen with ST use may reflect a lack of clarity within the general population about the risks involved with ST use.<sup>32,33</sup>

Two robust predictors of cigarette smoking (lower household income and unemployment) did not predict ST use in the present study. It is not entirely clear why these vulnerabilities did not extend from cigarette smoking to ST use, although ST use is highly associated with being non-Hispanic white and male, each of which are characteristics associated with higher employment rates in the United States.<sup>34</sup> Association with employment in a blue-collar industry predicted ST use but not cigarette smoking after controlling for potential confounds, although it predicted both forms of tobacco use at the univariate level or when examining only the SES predictors together in multiple regression models. Whether this is a reliable difference will need to be determined in future studies.

Several public health implications merit mention. First, this study further confirms the vulnerability of lower-SES populations to cigarette smoking and ST use. Second, it suggests that regarding ST use, particular care should be taken to promote health and safety messages regarding use among male non-Hispanic whites and blue-collar workers. Third, the relationship between ST use and alcohol dependence suggests that this population may benefit from stronger health and safety messages regarding ST products in addition to cigarettes. Information on the relative risks of combustible and smokeless products may also be an important element of such messaging.<sup>35</sup>

There are at least two limitations to the present study that merit mention. First, the current data set is observational, and as such it is

**Table 2.** Simple and Multiple Logistic Regressions of Socioeconomic Characteristics and Sociodemographic Variables Predicting Current Cigarette Smoking or Smokeless Tobacco (ST) Use

Variable	Cigarette use						ST use					
	Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% CI	P	AOR	95% CI	P	OR	95% CI	P	AOR	95% CI	P
Educational attainment			<.0001			<.0001			<.0001			<.0001
High school graduate	0.86	(0.77, 0.97)		0.80	(0.70, 0.91)		0.99	(0.75, 1.32)		0.83	(0.61, 1.13)	
Some college	0.69	(0.61, 0.77)		0.62	(0.55, 0.71)		0.89	(0.68, 1.16)		0.82	(0.62, 1.07)	
College graduate	0.27	(0.24, 0.31)		0.28	(0.24, 0.32)		0.53	(0.41, 0.68)		0.50	(0.38, 0.64)	
Household income			<.0001			<.0001			.81			
\$20 000–\$49 999	0.70	(0.64, 0.77)		0.85	(0.76, 0.95)		1.01	(0.75, 1.36)				
\$50 000–74 999	0.44	(0.39, 0.50)		0.57	(0.49, 0.66)		1.13	(0.82, 1.54)				
≥\$75 000	0.35	(0.31, 0.40)		0.57	(0.49, 0.67)		1.03	(0.77, 1.37)				
Blue-collar industry	1.31	(1.20, 1.42)	<.0001				3.69	(3.21, 4.24)	<.0001	1.93	(1.62, 2.29)	<.0001
Unemployment	2.27	(2.01, 2.55)	<.0001	1.36	(1.19, 1.55)	<.0001	1.05	(0.77, 1.43)	.76			
Sociodemographics												
Age			<.0001			<.0001			<.0001			<.0001
18–25	4.41	(3.59, 5.43)		3.47	(2.78, 4.32)		3.47	(2.21, 5.43)		3.37	(2.15, 5.26)	
26–29	4.82	(3.88, 5.99)		5.97	(4.76, 7.50)		3.37	(2.01, 5.64)		3.18	(1.89, 5.35)	
30–34	4.43	(3.59, 5.47)		6.18	(4.89, 7.81)		2.50	(1.55, 4.04)		2.50	(1.50, 4.16)	
35–49	3.33	(2.67, 4.14)		4.72	(3.74, 5.95)		2.98	(1.85, 4.80)		2.77	(1.70, 4.52)	
50–64	2.53	(2.00, 3.20)		3.29	(2.55, 4.24)		1.37	(0.76, 2.46)		1.10	(0.61, 1.98)	
Sex (male)	1.36	(1.26, 1.46)	<.0001	1.32	(1.23, 1.43)	<.0001	15.62	(9.60, 25.41)	<.0001	12.88	(7.77, 21.35)	<.0001
Marital status	0.43	(0.39, 0.47)	<.0001	0.56	(0.50, 0.62)	<.0001	0.86	(0.73, 1.01)	.06			
Race			<.0001			<.0001			<.0001			<.0001
Black/African American	0.99	(0.88, 1.11)		0.57	(0.50, 0.66)		0.45	(0.27, 0.75)		0.42	(0.24, 0.72)	
Hispanic	0.69	(0.61, 0.77)		0.37	(0.32, 0.42)		0.26	(0.16, 0.39)		0.16	(0.10, 0.25)	
Asian	0.33	(0.25, 0.44)		0.38	(0.28, 0.52)		0.09	(0.04, 0.19)		0.09	(0.04, 0.20)	
Hawaiian/Pacific Islander	1.15	(0.58, 2.29)		0.75	(0.37, 1.53)		1.15	(0.36, 3.65)		1.21	(0.37, 3.98)	
Native American	2.05	(1.40, 3.01)		1.15	(0.76, 1.72)		1.97	(1.26, 3.07)		1.71	(1.08, 2.72)	
Multiracial	1.99	(1.52, 2.60)		1.51	(1.06, 2.14)		0.52	(0.31, 0.88)		0.47	(0.29, 0.77)	
Mental health												
Major depression	1.76	(1.55, 1.99)	<.0001	1.42	(1.24, 1.63)	<.0001	0.89	(0.66, 1.19)	.42			
Substance dependence												
Alcohol	3.99	(3.45, 4.63)	<.0001	2.56	(2.17, 3.02)	<.0001	2.79	(2.11, 3.69)	<.0001	1.70	(1.29, 2.26)	<.01
Marijuana	6.26	(4.86, 8.05)	<.0001	3.25	(2.42, 4.37)	<.0001	1.75	(1.27, 2.41)	<.01			
Cocaine	11.85	(6.41, 21.89)	<.0001	2.63	(1.14, 6.09)	.02	1.69	(0.67, 4.26)	.26			
Heroin	23.61	(7.97, 69.88)	<.0001	5.56	(1.70, 18.12)	<.01	6.21	(3.23, 11.94)	<.0001	2.14	(1.15, 4.00)	.02
Cigarette use							1.95	(1.66, 2.28)	<.0001			

AOR = adjusted odds ratio; CI = confidence interval; OR = odds ratio; PI = Pacific Islander. Data are from the 2012 National Survey of Drug Use and Health (NSDUH), ≥18 years, weighted sample (unweighted N = 37 869). The reference category for educational attainment is <high school. The reference category for household income is <\$20 000. The reference category for age is ≥65. The reference category for race is non-Hispanic white.

important to acknowledge the possible influence of unobserved variables. We attempted to control for potential confounders, but other possible influences cannot be ruled out. Second, the data collected in the NSDUH is self-report, and thus may be biased in the direction of underreporting. The validity of self-reported cigarette smoking has been relatively well studied, but that is less the case with ST use although some evidence on the topic is available.<sup>36</sup> These limitations notwithstanding, the present study provides new knowledge regarding commonalities as well as some substantive differences in the relation of SES and risk for cigarette smoking and ST use.

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## Declaration of Interests

None declared.

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