

Prevalence, Harm Perceptions, and Reasons for Using Noncombustible Tobacco Products Among Current and Former Smokers

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The use of noncombustible tobacco products has increased rapidly in recent years¹⁻³ and may continue to rise in response to restrictions such as smoke-free indoor air laws and rising cigarette taxes.⁴⁻⁸ Noncombustible tobacco products can be grouped into 2 broad categories— aerosolized products such as e-cigarettes, or more accurately termed electronic nicotine delivery systems (ENDS), which deliver nicotine primarily through vapor inhalation that mimics smoking a traditional cigarette,⁹ and smokeless tobacco products such as chew, dip, or snuff; snus; and dissolvables, which deliver nicotine via oral mucosal absorption.¹⁰ These products are marketed to appeal to unique target audiences,^{9,11-13} such as smokers and young adults, and vary in levels of harmful constituents.⁹

Noncombustible tobacco products are a critical part of the tobacco industry's strategy to navigate the changing tobacco product landscape. Phillip Morris^{14,15} and RJ Reynolds¹⁶ have announced their intent to develop and market noncombustible tobacco products as part of a shift to reduced harm products.¹⁷ In some cases, noncombustible tobacco products have been used to expand the appeal of established cigarette brands to a broader spectrum of consumers, as with RJ Reynolds's Camel Snus product.¹⁸ Most ENDS are marketed and sold independently; however, this is changing with Lorillard's acquisition of blu eCigs in 2012^{19,20} and the recent launches of RJ Reynolds's Vuse digital vapor cigarettes^{21,22} and Altria's MarkTen e-cigarettes.²³

Noncombustible tobacco product awareness and prevalence vary by product. In 2010, approximately 40% of adults reported awareness of e-cigarettes,^{24,25} rising to nearly 60% in 2011²⁵; awareness approached 75% among current and former smokers in 2010 to 2011.²⁶ Between 1.8% and 3.4% of the adult general population has tried an e-cigarette,^{24,25,27,28}

Objectives. We provided estimates of noncombustible tobacco product (electronic nicotine delivery systems [ENDS]; snus; chewing tobacco, dip, or snuff; and dissolvables) use among current and former smokers and examined harm perceptions of noncombustible tobacco products and reasons for their use.

Methods. We assessed awareness of, prevalence of, purchase of, harm perceptions of, and reasons for using noncombustible tobacco products among 1487 current and former smokers from 8 US designated market areas. We used adjusted logistic regression to identify correlates of noncombustible tobacco product use.

Results. Of the sample, 96% were aware of at least 1 noncombustible tobacco product, but only 33% had used and 21% had purchased one. Noncombustible tobacco product use was associated with being male, non-Hispanic White, younger, and more nicotine dependent. Respondents used noncombustible tobacco products to cut down or quit cigarettes, but only snus was associated with a higher likelihood of making a quit attempt. Users of noncombustible tobacco products, particularly ENDS, were most likely to endorse the product as less harmful than cigarettes.

Conclusions. Smokers may use noncombustible tobacco products to cut down or quit smoking. However, noncombustible tobacco product use was not associated with a reduction in cigarettes per day or cessation. (*Am J Public Health.* 2014; 104:1437-1444. doi:10.2105/AJPH.2013.301804)

including up to 21.2% of current smokers.^{25,26} More than 40% of adults have heard of snus,²⁹ 5% have tried the product,²⁹ and 1.4% are current users.³⁰ Awareness of dissolvables is low (10%), and use is even lower (0.5%).²⁹ Noncombustible tobacco product use is highest among young adults^{26,31} and smokers.^{24,27,28}

Although use of noncombustible tobacco products could potentially reduce harm associated with smoking if they replace cigarettes,^{32,33} some studies suggest that current smokers who use noncombustible tobacco products do not reduce combustible use and may delay cessation.^{12,34-37} For example, a study by Wetter et al.³⁸ found that dual users of smokeless tobacco products and cigarettes were less likely to quit than were either smokeless tobacco product or cigarette users alone. This is of concern given the rising rates of dual use; a recent study reported that 30% of young adults who smoke cigarettes use at

least 1 other tobacco product.³¹ Dual use is more prevalent among men,^{39,40} those of lower socioeconomic status,^{39,41} and youths and young adults.^{35,41,42}

Studies show that most users (65%–85%) perceive ENDS as less harmful than cigarettes,^{24,26,43} and 40% to 50% perceive snus and dissolvables as equally harmful as cigarettes.²⁹ Few studies have examined reasons for use; one study of visitors to ENDS and smoking cessation Web sites found that nearly 85% used ENDS because they believed that they were less toxic than tobacco; other responses included use of ENDS to deal with cravings or withdrawal, to quit smoking, and to save money.⁴³ Focus group research has shown that adults associate snus and dissolvables with historic images of chewing tobacco,^{34,44} express skepticism that the products are safer than cigarettes,³⁴ do not view them as substitutes for cigarettes,^{34,44} and

express concern about the user's lack of control of nicotine ingestion relative to cigarettes.⁴⁴ By contrast, young adults expressed positive perceptions of snus, dissolvables, and ENDS, in part because of a willingness to experiment with new products and because they are available in flavors.⁴⁵

With the ever-changing tobacco marketplace and the tobacco companies' commitment to the development and promotion of noncombustible tobacco products, surveillance is critical. This study built on previous research to provide current estimates of noncombustible tobacco product use among current and former smokers and examined harm perceptions of noncombustible tobacco products and reasons for their use.

METHODS

We used data from the third follow-up of a cohort of current and former adult smokers, recruited at ages 18 to 49 years. The cohort was developed to evaluate the effectiveness of Legacy's EX smoking cessation campaign among current smokers. The sample was randomly selected from 8 US designated market areas, regions identified by the largest city and extending outward, where the population receives similar media offerings. The designated market areas were selected to ensure variability on key factors thought to influence cessation outcomes, including location, strength of tobacco control policy, racial/ethnic composition, and smoking prevalence. They are Birmingham, Alabama; Columbus, Ohio; Fort Smith and Fayetteville, Arkansas; Houston, Texas; Kansas City, Missouri; Phoenix and Prescott, Arizona; Pittsburgh, Pennsylvania; and Portland, Oregon.

The baseline survey was conducted from February 5 through April 15, 2008 ($n = 5616$ current smokers), the first follow-up was from August 23 to October 19, 2008 ($n = 4067$ current and former smokers), and the second follow-up was from January 7 to April 3, 2010 ($n = 3658$ current and former smokers). Respondents from the second follow-up were contacted by telephone up to 35 times for the third follow-up, which occurred between June 16 and September 30, 2011, among 1487 respondents via a computer-assisted telephone interview. This was the only survey to contain

extended questions on noncombustible tobacco product use. The attrition was likely a result of the time elapsed between the second and the third follow-up (14–21 months). When comparing characteristics of the baseline cohort with those of respondents who completed the third follow-up, several differences emerged. Respondents at the third follow-up were more likely than the baseline sample to be non-Hispanic White (79.0% vs 71.9%), less likely to be non-Hispanic Black or Hispanic (9.7% vs 12.2% and 4.4% vs 8.5%, respectively), and more likely to have had at least some college education (45.7% vs 39.5%). Details of the survey design are presented elsewhere.⁴⁶

Measures

Awareness, use, and purchase of noncombustible tobacco products were assessed with the question, "Please indicate whether you have ever heard of these products, if you have ever tried them and if you have ever purchased them. [Allow multiple responses]" Products included ENDS; dissolvables; chew, dip, or snuff (assessed in 1 question); and snus, each presented with brand names to increase validity of responses. Respondents could choose multiple options from the following choices: (1) heard of; (2) tried; (3) purchased; (4) never heard of, tried, or purchased (for those to whom options 1, 2, and 3 were not applicable); (5) refused; and (6) don't know.

Respondents who reported trying or purchasing a noncombustible tobacco product were asked (for each product used):

We're interested in the reasons why you use these alternative tobacco products. Have you ever used these products when you've been in places where you can't smoke regular cigarettes, as a way to help you cut down on cigarette smoking, or as a way to help you quit?

Respondents were able to choose multiple reasons for use and allowed the options of some other reason, refused, or don't know.

Respondents who reported trying or purchasing ENDS ($n = 241$) also were asked: "How much do the following reasons influence your use of e-cigarettes?" Reasons included (1) e-cigarettes are less harmful; (2) no lingering odor; (3) feels like I'm smoking a regular cigarette; (4) costs less than cigarettes; (5) can avoid smoking bans; and (6) doesn't bother other people. Response options were (1) not at

all, (2) somewhat, (3) a lot, (4) refused, and (5) don't know.

Harm perceptions of noncombustible tobacco products were assessed by asking:

Compared to regular-strength cigarettes, do you think that the following products are a lot less harmful to a person's health, a little less harmful, about the same, a little more harmful, or a lot more harmful to health?

Demographic variables included gender, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), education (less than high school, high school or general equivalency diploma, some college or technical college, a college degree or higher), employment status (employed, unemployed, not in the workforce), and baseline age because updated information on age was not re-collected at the third follow-up. Perceived health status was measured by the question, "In general, would you say your health is . . .," with response options of excellent, very good, good, fair, or poor.

Smoking status was defined as follows: current smokers represented those who reported smoking "every day" or "some days." Those who answered "not at all" were classified as former smokers. Among current smokers, additional variables assessed included number of cigarettes per day, time to first cigarette in the morning (a measure of dependence used in the Fagerström Test for Nicotine Dependence),⁴⁷ motivation to quit (on a 1–10 scale), and past-year quit attempts (1 = 1 or more quit attempts, 0 = no quit attempts).

Data Analysis

We calculated frequencies for current versus former cigarette smokers. If no statistically significant differences were detected at $P < .05$, the groups were collapsed. We tabulated frequencies of awareness, use, and purchase of noncombustible tobacco products, both by individual product and in total ("any noncombustible tobacco product"). We tabulated demographic characteristics across 3 groups: (1) the total sample; (2) ever dual users of cigarettes and any noncombustible tobacco product; and (3) cigarette-only smokers. We used the χ^2 test to obtain an overall P value; if the overall test was significant, comparisons were made at each level of the demographic variable. Reasons for use of specific

noncombustible tobacco products were tabulated among any individual who had endorsed using that product. We calculated harm perceptions of noncombustible tobacco products among the entire sample as well as by awareness and use. We examined *P* values for statistical significance. Bonferroni adjusted *P* values were also presented when examining harm perceptions.

We conducted weighted logistic regression analyses to examine correlates of noncombustible tobacco product use. Dependent variables were ever use of any noncombustible tobacco product, ENDS, snus, and chew, dip, or snuff. We did not examine use of dissolvables because of the low sample size of users, which is likely related to the fact that they were available in only select test markets at the time of the study. Independent variables included demographics, current smoking status, and perceived health status, which was included because individuals might be more likely to use noncombustible tobacco products if they perceive that they are not in good health and believe that noncombustible tobacco products are less harmful. Regression analyses among current smokers included additional tobacco use covariates mentioned earlier: nicotine dependence (time to first cigarette), motivation to quit, number of cigarettes per day, and past-year quit attempts. All analyses were conducted with Stata version 12.1 (StataCorp LP, College Station, TX). Unweighted estimates were presented for all frequency data.

RESULTS

Of the 1487 respondents, 1270 were current and 217 were former smokers. Almost the entire sample (96.2%) had heard of a noncombustible tobacco product, with awareness highest for chew, snuff, or dip (89.2%) and ENDS (81.8%), followed by snus (65.9%) and dissolvables (36.0%). A smaller percentage (33.6%) indicated using (“ever trying”) any noncombustible tobacco product, with rates highest for chew, snuff, or dip (19.0%) and ENDS (14.9%), followed by snus (11.6%) and dissolvables (3.5%). Only 21.3% of the sample had ever purchased a noncombustible tobacco product, with patterns of rates similar to those for awareness: chew, dip, or snuff (11.7%); ENDS (8.6%); snus (5.3%); and dissolvables

(1.4%). Among individuals who indicated purchasing a product, some did not endorse trying the product; rates were 15.8% for ENDS; 28.6% for dissolvables; 14.4% for chew, dip, or snuff; 10.1% for snus; and 11.7% for little cigars and cigarillos. No statistically significant differences were seen in awareness, use, or purchase by smoking status.

As compared with ever cigarette-only smokers, smokers who also had used noncombustible tobacco products (dual users) were more likely to be male (66.8% vs 30.2%), younger (15.8% vs 7.8%), and employed (72.0% vs 64.2%) (Table 1). When analysis was restricted to current smokers only (*n* = 1270), dual users smoked on average more cigarettes per day as compared with cigarette-only smokers (17.1 vs 15.0) and were more likely to have made a past-year quit attempt (49.7% vs 37.9%; Table 1). The percentage of respondents (current smokers) reporting past-year quit attempts varied by product use, ranging from 48.9% of chew, dip, or snuff users to 53.4% of ENDS users to 57.5% of snus users.

Reasons for using noncombustible tobacco products are shown in Table 2. Among ENDS users, 55.3% indicated using them to either cut down or quit smoking, and 38.1% reported using them in places where they could not smoke. Many cited use of dissolvables; chew, snuff, or dip; and snus in smoke-free areas (38.5%, 41.1%, and 37.7%, respectively). Many cited “some other reason” for using these products, but further information on these reasons was not available. We found no statistically significant differences by smoking status.

Additional reasons for using ENDS specifically (data not shown) included that the experience at least somewhat “feels like I’m smoking a regular cigarette” (62.8%), with former smokers more likely than current smokers to endorse this reason “a lot” (35.5% vs 16.8%). Other common reasons indicated as at least “somewhat” a reason were the lower cost than cigarettes (59.6%), that it was less bothersome to other people (69.6%), and that it had “no lingering odor” (61.7%). ENDS were also used to at least “somewhat” avoid smoking bans (69.0%), with former smokers more likely than current smokers to cite this as a reason for use (92.6% vs 65.4%).

Harm perceptions of noncombustible tobacco products by product use are shown in Table 3. Respondents who were only aware of a product but had not tried it were much more likely than those who had tried a noncombustible tobacco product to respond that they “didn’t know” or refused to answer the question. Respondents who had tried noncombustible tobacco products were more likely than were those just aware of the products to perceive them as less harmful than cigarettes (*P* < .001 for all products). For example, 38.4% of the respondents who had tried snus said that it was “less harmful” than cigarettes as compared with only 12.3% of those who were only aware of but had not tried the product (*P* < .01). Respondents who had tried noncombustible tobacco products also were more likely than cigarette-only smokers to perceive products as less harmful than cigarettes (*P* < .001 for all products). ENDS were the only product viewed as “less harmful” than cigarettes by most respondents regardless of whether they had tried or used a product.

Overall, we found few statistically significant correlates of noncombustible tobacco product use (Table 4). Respondents who were male (vs female) and younger (vs older) were more likely to use any noncombustible tobacco product. These same findings applied to use of snus; chew, dip, or snuff; and ENDS. Some differences were identified by race/ethnicity; non-Hispanic Black participants were less likely than non-Hispanic White participants to use snus (odds ratio [OR] = 0.07; 95% confidence interval [CI] = 0.02, 0.32) and chew, dip, or snuff (OR = 0.32; 95% CI = 0.12, 0.86). Hispanic participants were less likely than non-Hispanic White participants to use ENDS (OR = 0.23; 95% CI = 0.07, 0.80) and snus (OR = 0.14; 95% CI = 0.03, 0.71). Otherwise, we found no statistically significant differences in use by education level, employment status, perceived health status, or smoking status.

Among current smokers only (data not shown), the same demographic correlates remained statistically significant. Additionally, increased dependence was associated with any noncombustible tobacco product use as compared with no noncombustible tobacco product use (OR = 2.06; 95% CI = 1.23, 3.44; *P* = .01) as well as e-cigarette use as compared with no ENDS use (OR = 2.25; 95% CI = 1.16,

TABLE 1—Demographic and Baseline Smoking Characteristics by Ever Use of Noncombustible Tobacco Products Among Current and Former Smokers (Unweighted): 8 US Designated Market Areas, 2011

Characteristic	Total Sample, ^a % (No.) or Mean ±SE	Cigarette + Any Noncombustible Tobacco Product, % (No.) or Mean ±SE	Cigarette Smokers Only, % (No.) or Mean ±SE	P
Current and former smokers				
Overall		33.6 (500)	51.4 (765)	
Gender				< .01
Male	44.9 (667)	66.8 (334)	30.2 (231)	
Female	55.1 (820)	33.2 (166)	69.8 (534)	
Age, y				
18–24	11.0 (164)	15.8 (79)	7.8 (60)	< .01
25–39	34.4 (512)	36.4 (182)	32.9 (252)	.21
40–49	54.5 (811)	47.8 (239)	59.2 (453)	< .01
Race				.06
Non-Hispanic White	79.0 (1175)	83.4 (417)	79.2 (606)	
Non-Hispanic Black	9.7 (144)	5.4 (27)	9.5 (73)	
Hispanic	4.4 (31)	4.0 (20)	4.4 (34)	
Other	6.9 (103)	7.2 (36)	6.8 (52)	
Education				.89
< high school	14.2 (211)	14.4 (72)	14.2 (109)	
High school/general equivalency diploma	40.1 (597)	40.8 (204)	39.5 (302)	
Some college/technical college	32.6 (485)	31.4 (157)	33.5 (256)	
≥ college	13.0 (194)	13.4 (67)	12.8 (98)	
Employment status				
Employed	66.2 (985)	72.0 (360)	64.1 (490)	.01
Unemployed	7.7 (114)	6.0 (30)	7.7 (59)	.24
Not in the workforce	26.0 (386)	22.0 (110)	28.0 (214)	.02
Perceived health status				.93
Excellent/very good/good	74.2 (1103)	74.0 (370)	74.1 (567)	
Fair/poor	25.6 (380)	25.4 (127)	25.8 (197)	
Smoking characteristics among current smokers				
Cigarettes/d	15.8 ±0.31	17.07 ±0.58	15.0 ±0.43	.01
Motivation to quit	6.94 ±0.09	6.94 ±0.14	6.88 ±0.12	.77
Time to first cigarette, min				.19
≤ 30	66.0 (834)	67.1 (284)	63.4 (416)	
> 30	34.0 (430)	32.6 (138)	36.6 (240)	
Past-year quit attempt				< .01
Yes	43.3 (427)	49.7 (170)	37.9 (192)	
No	56.7 (559)	50.3 (172)	62.1 (315)	

Note. The 8 US designated market areas were Birmingham, AL; Columbus, OH; Fort Smith and Fayetteville, AR; Houston, TX; Kansas City, MO; Phoenix and Prescott, AZ; Pittsburgh, PA; and Portland, OR. The sample sizes for current and former smokers were: total sample, n = 1487; cigarette and any noncombustible tobacco product, n = 500; and cigarette smokers only, n = 765. The sample sizes for current smokers only were: total sample, n = 1270; cigarette and any noncombustible tobacco product, n = 423; and cigarette smokers only, n = 661. Percentages may not add to 100% because of rounding.

^aThe total sample includes an additional 222 respondents who smoked cigarettes in addition to at least 1 combustible tobacco product (e.g., little cigars). These 222 respondents were included in total but not included in either “Cigarette + Any Noncombustible Tobacco Products” or “Cigarette Smokers Only” groups.

^bThe total sample includes an additional 186 respondents who smoked cigarettes in addition to at least 1 combustible tobacco product (e.g., little cigars). These 186 respondents were included in total but not included in either “Cigarette + Any Noncombustible Tobacco Products” or “Cigarette Smokers Only” groups.

4.37; *P* = .02). There was a borderline statistically significant effect of using snus as compared with not using snus (OR = 2.29; 95% CI = 1.00, 5.22; *P* = .05) and chew, dip, or snuff use as compared with no chew, dip, or snuff use (OR = 1.94; 95% CI = 0.98, 3.86; *P* = .06) on dependence. Use of snus, in comparison with no use of snus, was associated with a higher likelihood of making a past-year quit attempt (OR = 2.92; 95% CI = 1.43, 5.97; *P* < .01). None of the other products, including ENDS, were statistically significantly associated with quit attempts. Noncombustible tobacco product use overall also was not associated with quit attempts. When the number of cigarettes smoked per day was analyzed, ENDS use was significantly associated with more cigarettes smoked per day (*b* = 2.39; 95% CI = 0.32, 4.45; *P* = .02). Use of other products did not show this same association.

DISCUSSION

Despite high awareness of noncombustible tobacco products, a minority of the sample reported use or purchase of a product, a finding consistent with a recent study of smokers.⁴⁰ Respondents who were younger, male, and non-Hispanic White were more likely to use noncombustible tobacco products, factors consistent with data reported in other recent studies.^{35,36,39–41}

Although noncombustible tobacco products are often promoted for use in smoke-free areas, fewer than half of users cited this as a reason for use. Many indicated using noncombustible tobacco products to either cut down or quit cigarettes. ENDS use, in particular, was indicated for these reasons, which is in agreement with results of prior studies.^{48,49} Lower cost and similarity to smoking regular cigarettes were other reasons cited for using ENDS, which could serve to drive consumer demand and increase their use as a cessation aid. However, in contrast to the evidence that ENDS promote cessation or reduction of cigarettes smoked,^{43,50,51} ENDS users showed no increased likelihood of making a quit attempt, and ENDS use, in fact, was significantly associated with increased number of cigarettes smoked. This calls into question the helpfulness of ENDS in either reducing harmful combustible use or aiding cessation efforts. Snus, by

TABLE 2—Reasons for Use of Noncombustible Tobacco Products Among Current and Former Smokers: 8 US Designated Market Areas, 2011

Product	Use in Places Where I Cannot Smoke, % (No.)	Use as a Way to Cut Down on Cigarette Smoking, % (No.)	Use as a Way to Help Me Quit Cigarettes, % (No.)	Some Other Reason, % (No.)
e-Cigarettes or electronic nicotine delivery systems (n = 226)	38.1 (86)	35.8 (81)	45.6 (103)	27.0 (61)
Dissolvables (n = 52)	38.5 (20)	19.2 (10)	23.1 (12)	32.7 (17)
Chew, snuff, or dip (n = 285)	41.1 (117)	21.1 (60)	18.2 (52)	41.4 (118)
Snus (n = 175)	37.7 (66)	22.9 (40)	13.7 (24)	41.1 (72)

Note. Categories are not mutually exclusive (unweighted). The 8 US designated market areas were Birmingham, AL; Columbus, OH; Fort Smith and Fayetteville, AR; Houston, TX; Kansas City, MO; Phoenix and Prescott, AZ; Pittsburgh, PA; and Portland, OR.

contrast, was associated with increased quitting and, like ENDS, is also promoted for cessation.^{52,53} Reasons for the discrepancy between the reported reasons for using ENDS (as a quit aide) and actual use are unknown but may reflect the higher levels

of dependence among ENDS users, which could hinder smoking reduction or cessation efforts.^{54,55}

Similar to other studies,^{24,26,29,40,56} harm perceptions of noncombustible tobacco products varied. Users of all noncombustible tobacco

products were more likely than nonusers to perceive the products as less harmful than cigarettes, but only ENDS were perceived by the majority of all groups as less harmful. This may reflect the marketing efforts of the ENDS industry to promote the product as a less harmful alternative to cigarettes.^{57,58} Although ENDS and other noncombustible tobacco products are considered less harmful on an individual-level basis,^{32,33} it is unclear how noncombustible tobacco products will influence population-level health. Part of this assessment will depend on how individuals use these products—specifically, whether noncombustible tobacco products replace combustible tobacco product use or whether they are simply used as a supplemental product.

The tobacco control community is divided in the views of noncombustible tobacco products.^{59–61} Some advocate their use for harm reduction,^{52,53,62} whereas others are concerned about their overall effect on tobacco use

TABLE 3—Harm Perceptions of Noncombustible Tobacco Products According to Awareness and Use Among Current and Former Smokers (Unweighted): 8 US Designated Market Areas, 2011

Product	Aware of the Product Only (a), ^a % (No.)	Aware of and Tried the Product (b), % (No.)	Cigarette-Only Smokers (n = 765) (c), % (No.)	Adjusted P ^b (a) vs (b)	Adjusted P ^b (b) vs (c)
Electronic nicotine delivery systems	(1012)	(221)			
Don't know/refused	21.2 (215)	6.3 (14)	22.7 (174)	< .01	< .01
Less harmful	65.4 (662)	79.2 (175)	61.6 (471)	< .01	< .01
About the same	10.3 (104)	10.4 (23)	11.9 (91)	> .99	> .99
More harmful	3.1 (31)	4.1 (9)	3.8 (29)	> .99	> .99
Snus	(836)	(172)			
Don't know/refused	17.6 (147)	2.9 (5)	29.0 (222)	< .01	< .01
Less harmful	12.3 (103)	38.4 (66)	10.8 (83)	< .01	< .01
About the same	47.5 (397)	47.7 (82)	42.1 (322)	> .99	.73
More harmful	22.6 (189)	11.0 (19)	18.0 (138)	< .01	.11
Chewing tobacco, snuff, dip	(1083)	(282)			
Don't know/refused	4.0 (43)	1.4 (4)	4.7 (36)	.14	.06
Less harmful	9.7 (105)	19.9 (56)	9.9 (76)	< .01	< .01
About the same	48.2 (522)	51.1 (144)	49.5 (379)	> .99	> .99
More harmful	38.1 (413)	27.7 (78)	35.8 (274)	< .01	.05
Dissolvables	(489)	(51)			
Don't know/refused	31.5 (154)	21.6 (11)	45.4 (347)	.57	< .01
Less harmful	17.0 (83)	41.2 (21)	14.0 (107)	< .01	< .01
About the same	38.2 (187)	29.4 (15)	31.4 (240)	.86	> .99
More harmful	13.3 (65)	7.8 (4)	9.3 (71)	> .99	> .99

Note. The 8 US designated market areas were Birmingham, AL; Columbus, OH; Fort Smith and Fayetteville, AR; Houston, TX; Kansas City, MO; Phoenix and Prescott, AZ; Pittsburgh, PA; and Portland, OR.
^aThe sample size specified for each product represents the number of people in the total sample (n = 1487) who indicated awareness of that product but who had not yet tried it. Respondents who had tried other tobacco products (other than the specified noncombustible tobacco product) could be included in the product-specific sample. Percentages may not add to 100% because of rounding.
^bP values were adjusted by Bonferroni's method for multiple comparison.

TABLE 4—Correlates of Noncombustible Tobacco Product Ever Use in Current and Former Smokers: 8 US Designated Market Areas

Characteristic	Any Noncombustible Tobacco Product Use		Electronic Nicotine Delivery System Use		Snus Use		Chew, Dip, or Snuff Use	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Gender								
Male	5.09 (3.49, 7.44)	< .01	2.16 (1.38, 3.39)	< .01	16.28 (7.51, 35.29)	< .01	24.33 (13.19, 44.90)	< .01
Female (Ref)	1.00		1.00		1.00		1.00	
Age, y								
18–24	2.28 (1.35, 3.73)	< .01	2.35 (1.30, 4.26)	.01	3.42 (1.74, 6.72)	< .01	2.61 (1.43, 4.77)	< .01
25–39	1.42 (0.98, 2.07)	.06	1.26 (0.79, 2.02)	.33	2.08 (1.17, 3.68)	.01	1.75 (1.07, 2.86)	.03
40–49 (Ref)	1.00		1.00		1.00		1.00	
Race								
Non-Hispanic White (Ref)	1.00		1.00		1.00		1.00	
Non-Hispanic Black,	0.49 (0.22, 1.08)	.08	0.48 (0.19, 1.21)	.12	0.07 (0.02, 0.32)	< .01	0.32 (0.12, 0.86)	.02
Hispanic	0.57 (0.26, 1.23)	.15	0.23 (0.07, 0.80)	.02	0.14 (0.03, 0.71)	.02	0.80 (0.31, 2.07)	.64
Other	1.22 (0.55, 2.75)	.62	1.03 (0.36, 2.92)	.95	0.66 (0.20, 2.12)	.48	1.34 (0.45, 3.97)	.6
Education								
< high school	0.98 (0.60, 1.61)	.94	1.05 (0.56, 1.97)	.87	0.93 (0.44, 1.99)	.86	1.17 (0.64, 2.12)	.62
High school or general equivalency diploma (Ref)	1.00		1.00		1.00		1.00	
Some college or technical college	0.87 (0.57, 1.34)	.52	0.95 (0.55, 1.64)	.86	0.60 (0.30, 1.19)	.14	0.80 (0.45, 1.43)	.45
≥ college	1.13 (0.63, 2.02)	.69	1.23 (0.65, 2.32)	.52	0.75 (0.34, 1.68)	.49	0.76 (0.30, 1.96)	.58
Employment status								
Employed (Ref)	1.00		1.00		1.00		1.00	
Unemployed	0.75 (0.38, 1.48)	.4	0.84 (0.34, 2.05)	.7	1.28 (0.54, 3.06)	.58	0.54 (0.25, 1.19)	.13
Not in the workforce	0.96 (0.59, 1.56)	.87	0.66 (0.36, 1.24)	.2	1.17 (0.54, 2.52)	.69	1.69 (0.92, 3.11)	.09
Perceived health status								
Excellent/very good/good	0.71 (0.44, 1.15)	.17	0.64 (0.36, 1.14)	.13	0.94 (0.47, 1.86)	.86	1.06 (0.61, 1.84)	.84
Fair/poor (Ref)	1.00		1.00		1.00		1.00	
Smoking status								
Current	0.94 (0.58, 1.54)	.82	1.25 (0.64, 2.42)	.42	0.54 (0.26, 1.13)	.1	0.73 (0.38, 1.38)	.33
Former (Ref)	1.00		1.00		1.00		1.00	

Note. CI = confidence interval; OR = odds ratio. All variables in the first column are included in each of the respective models. Indicators for the 8 designated market areas (Birmingham, AL; Columbus, OH; Fort Smith and Fayetteville, AR; Houston, TX; Kansas City, MO; Phoenix and Prescott, AZ; Pittsburgh, PA; and Portland, OR) from which the sample was pulled were included in the regressions but not shown here.

patterns and population-level health.⁵⁹ Non-combustible tobacco products have the potential to reduce harm,⁶³ and studies suggest that they can promote cessation^{64–68}; however, this evidence derives mainly from studies of snus in Scandinavia and may not generalize to the United States or other countries. Additionally, these studies were not controlled clinical trials, so unequivocal claims for the use of snus as a cessation aid cannot yet be made. Noncombustible tobacco products convey some level of harm,^{59,69,70} so they are not without risks. Additionally, they may promote dual use^{31,35,71–73} and negatively affect quit intentions, attempts, or success.^{38,72,74}

Data from this study showed that noncombustible tobacco product users did not smoke fewer cigarettes and, with the exception of snus, did not increase the probability of a quit attempt. This suggests that noncombustible tobacco products did not reduce harm in this population. This was a cross-sectional study, however, and to fully understand the influence of noncombustible tobacco products on the overall burden of tobacco use in the United States, longitudinal data are necessary. This is particularly critical as the tobacco industry invests further resources into the development and marketing of noncombustible tobacco products and acquires a greater share of the

ENDS business. ENDS sales are expected to reach \$1 billion in 2013^{1,2,75} and “could surpass traditional cigs in the next decade.”⁷⁵ Some speculate that ENDS could be a means for the industry to normalize nicotine use and extend their product range,⁷⁶ which was alluded to in a recent statement by a Reynolds American Inc. representative regarding their plans to make “significant investments to expand product innovations and brand-equity building.”⁷⁷

This study had several limitations. First, data presented here were cross-sectional, so causal effects could not be determined. Second, the cohort was derived from 8 designated market

areas and is not generalizable to the US population. Third, differential attrition occurred over time with regard to race/ethnicity, age, and education. There were few differences by these variables in weighted data, however. It is possible that frustrated smokers who have tried to quit, including through use of non-combustible tobacco products, and who did not remain nonsmokers were more likely to drop out. Differential loss of this group may have resulted in an underestimation of the use of noncombustible tobacco products. Fourth, most respondents in this sample were current smokers; the small number of former smokers had quit within the 3-year study period and may be not be representative of longer-term former smokers. This may explain the lack of differences between the smoking groups. Finally, no information was gathered on patterns of current use of noncombustible tobacco products, such as frequency of use, how the products were used, or when the respondents started using. A comprehensive picture of the respondent's tobacco use profile, therefore, could not be constructed.

Despite these limitations, this study provides important data on the prevalence, harm perceptions, and reasons for using noncombustible tobacco products among a sample of current and former smokers. As further progress is made in developing and marketing new and optimized noncombustible tobacco products, continued surveillance of use will be essential. In particular, longitudinal data will allow us to understand tobacco use trajectories over time, especially the initiation of noncombustible tobacco product use and whether smokers are using noncombustible tobacco products instead of, or in addition to, other combustible products. Efforts to understand how noncombustible tobacco product use affects smoking cessation and the degree to which these products do or do not contribute to one's overall tobacco use profile and health are particularly critical. ■

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Contributors

A. Richardson conceptualized the idea, drew up the analytic plan, oversaw data collection, interpreted results, and wrote the article. J. Pearson helped with drafting and editing the article. H. Xiao completed the data analysis. C. Stalgaitis helped with drafting the article and references. D. Vallone provided input on drafts of the article.

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Human Participant Protection

Copernicus institutional review board approved this research.

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