

Use of Conventional and Novel Smokeless Tobacco Products Among US Adolescents



WHAT'S KNOWN ON THIS SUBJECT: Despite declines in cigarette smoking, smokeless tobacco use among youth has remained unchanged in the United States. Modified or novel smokeless tobacco products are being increasingly promoted to youth in the United States as an alternative to smoking.



WHAT THIS STUDY ADDS: Among US students in grades 6 through 12, 5.0% used snuff or chewing or dipping tobacco, whereas 2.2% used snus or dissolvable tobacco products. Approximately two-thirds of smokeless tobacco users concurrently smoked combustible tobacco; risk perception of all tobacco products was protective of smokeless tobacco use.

abstract



OBJECTIVES: To assess the prevalence and correlates of use of conventional and novel smokeless tobacco products among a national sample of US middle and high school students.

METHODS: Data from the 2011 National Youth Tobacco Survey were analyzed to determine national estimates of current use of conventional (“chewing tobacco”, “snuff,” or “dip”), novel (“snus” and “dissolvable tobacco products”), and any smokeless tobacco products (novel and/or conventional products) within the past 30 days.

RESULTS: The overall prevalence of current use of any smokeless tobacco product was 5.6% ($n = 960$). Among all students, 5.0% used chewing tobacco, snuff, or dip; 1.9% used snus; and 0.3% used dissolvable tobacco products. Among users of any smokeless tobacco, 64.0% used only conventional products, 26.8% were concurrent users of novel plus conventional products, whereas 9.2% exclusively used novel products. Approximately 72.1% of current any smokeless tobacco users concurrently smoked combustible tobacco products, and only 40.1% expressed an intention to quit all tobacco use. Regression analyses indicated that peer (adjusted odds ratio [aOR]: 9.56; 95% confidence interval [CI]: 7.14–12.80) and household (aOR: 3.32; 95% CI: 2.23–4.95) smokeless tobacco use were associated with smokeless tobacco use, whereas believing that all forms of tobacco are harmful was protective (aOR: 0.55; 95% CI: 0.38–0.79).

CONCLUSIONS: Conventional smokeless tobacco products remain the predominant form of smokeless tobacco use. Most users of novel smokeless tobacco products also concurrently smoked combustible tobacco products. Smokeless tobacco use was associated with lower perception of harm from all tobacco products and protobacco social influences, indicating the need to change youth perceptions about the use of all tobacco products and to engage pediatricians in tobacco use prevention and cessation interventions. *Pediatrics* 2013;132:e578–e586

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KEY WORDS

smokeless, adolescents, smoking, tobacco, cigarette, harm reduction, addiction

ABBREVIATIONS

aOR—adjusted odds ratio

CI—confidence interval

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Conventional smokeless tobacco products such as dry snuff, moist snuff, plug/twist, and loose-leaf chewing tobacco have evolved greatly over the years to enhance their social acceptability, appeal, and ease of use. Moreover, the increased proliferation of state and local laws prohibiting tobacco smoking in indoor public areas and workplaces has prompted the tobacco industry to promote smokeless tobacco as an alternative for smokers to access nicotine in situations in which smoking is not allowed.^{1,2} Whereas cigarette smoking has been on the decline, smokeless tobacco use among US youth has remained stable in recent years,³ and a substantial number of new or modified smokeless tobacco products have entered the US market.⁴ Swedish-style snus and dissolvable tobacco products are novel smokeless tobacco products introduced into the US market in 2006 and 2008, respectively.^{5,6} Both novel smokeless tobacco products differ from conventional smokeless tobacco products in that they are lower in tobacco-specific nitrosamines and do not require spitting.⁶ More so, their design allows for their discreet use.^{6,7} Whereas some have argued that these low-nitrosamine novel smokeless tobacco products may confer relatively lower risk of tobacco-related disease compared with cigarettes,^{8,9} this assumption of harm reduction may only hold true at a population level if these novel smokeless tobacco products are used exclusively by large numbers of adolescents who would have otherwise been smoking.

Despite these potential population-level effects, little nationwide data are available regarding the behavioral characteristics of smokeless tobacco use among US youth. Hence, this study assessed the patterns of use of conventional and novel smokeless tobacco products among US middle and high

school students by using data from the 2011 National Youth Tobacco Survey.¹⁰

METHODS

Study Sample/Population

The National Youth Tobacco Survey is a biennial, nationally representative survey of US middle and high school students.¹⁰ In the 2011 survey, 18 866 students from 178 schools (school response rate = 83.2%; student participation rate = 87.4%) completed a self-administered questionnaire in a classroom setting, yielding an overall response rate of 72.7%. This current study was conducted with the use of publicly available, deidentified data and was institutional review board exempted as nonhuman subject research.

Measures/Definitions

Smokeless Tobacco Use

Current smokeless tobacco use was defined as a response other than “0 days” to the question “During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip?” or responses of “snus” or “dissolvable tobacco products” to the question “During the past 30 days, which of the following tobacco products did you use on at least 1 day?”

Snus products such as Camel or Marlboro snus and dissolvable tobacco products such as Ariva, Stonewall, Camel orbs, Camel sticks, or Camel strips were categorized as novel smokeless tobacco products, whereas chewing tobacco, snuff, or dip products were regarded as conventional smokeless tobacco products.

Combustible and Other Tobacco Products

Current use of any combustible tobacco product was defined as use of at least 1 of the following tobacco products on ≥ 1 days during the past 30 days:

cigarettes (including flavored cigarettes and roll-your-own cigarettes), cigars (including clove cigars and flavored little cigars), bidis (small, hand-rolled cigarettes), kreteks (clove cigarettes), pipes, and water pipes/hookahs.

Current use of electronic cigarettes and other unspecified “new tobacco products” on ≥ 1 days during the past 30 days was also assessed.

Quit Intentions

An intention to quit among current tobacco users was defined as any response other than “I am not thinking about quitting the use of all tobacco” to the question “Are you seriously thinking about quitting the use of all tobacco?”

Access to Smokeless Tobacco

Access to smokeless tobacco was assessed with the question “During the past 30 days, how did you get your own chewing tobacco, snuff, or dip?” A response of “I bought it myself” was categorized as a purchase, whereas a response of “I took it from a store or another person” was categorized as stealing. Responses of “I had someone else buy it for me,” “I borrowed or bummed it,” or “Someone gave it to me without my asking” were merged together as having obtained smokeless tobacco through someone else.

Point of purchase of smokeless tobacco was assessed by using the question “During the past 30 days, where did you buy your own chewing tobacco, snuff, or dip?” Responses of “a gas station,” “a convenience store,” “a grocery store,” or “a drugstore” were merged as having bought smokeless tobacco from a retail store. Purchases through a vending machine were assessed separately, as were Internet/mail purchases.

Ease of access to tobacco products was assessed with the question “How easy would it be for you to get tobacco

products if you wanted some?" Responses of "very easy" or "somewhat easy" were grouped together as a perceived ease of access (versus "not easy at all").

Perception of Harm From All Tobacco Products

The perception that all tobacco products are harmful was defined with the question "How strongly do you agree with the statement 'All tobacco products are dangerous?'" Responses of "strongly agree" or "agree" were grouped together as a positive perception of harm, whereas responses of "disagree" or "strongly disagree" were categorized together to identify respondents who did not perceive that all tobacco products are harmful.

Exposure to Health Warning Labels

Exposure to health warning labels on smokeless tobacco products was assessed with the question "During the past 30 days, how often did you see a warning label on a smokeless tobacco product?" Among respondents who saw a smokeless tobacco product during the past 30 days, responses of "sometimes," "most of the time," and "always" were categorized as having seen a warning label, whereas responses of "never" or "rarely" were categorized together to identify unexposed respondents.

Exposure and Receptivity to Tobacco Promotional Activities

Exposure to advertisements on a billboard or a retail store was assessed with the question "During the past 30 days, how often did you see an ad for cigarettes or smokeless tobacco that was outdoors on a billboard or could be seen from outside a store?" Students who responded "sometimes," "most of the time," or "always" were categorized as being exposed to protobacco advertisements on a billboard or at a store, whereas responses of

"never" or "rarely" were categorized together to identify unexposed respondents. Receptivity to tobacco promotional activities was assessed with 2 questions: "During the past 12 months, did you buy or receive anything that has a tobacco company name or picture on it?" (with "yes" as a positive response indicating receptivity to tobacco promotional activities) and "How likely is it that you would ever use or wear something that has a tobacco company name or picture on it?" Responses of "very likely" or "somewhat likely" to the latter question categorized the adolescent as receptive of tobacco promotional activities, whereas responses of "very unlikely" or "somewhat unlikely" were categorized together to identify unreceptive respondents.

Peer and Household Protobacco Influences

Protobacco peer influence was assessed with the following questions: "How many of your 4 closest friends use chewing tobacco, snuff, or dip?" and "How many of your 4 closest friends smoke cigarettes?" Students who reported having at least 1 friend who used smokeless tobacco or at least 1 friend who smoked cigarettes were categorized as being exposed to pro-smokeless tobacco and prosmoking peer influences, respectively.

Students who had at least 1 household member who used smokeless tobacco products were categorized as having a pro-smokeless tobacco household influence, whereas those who had at least 1 household member who smoked any combustible tobacco product were categorized as having a prosmoking household influence.

Sociodemographic Factors

Sociodemographic characteristics assessed included the respondents' age (9–11, 12–14, 15–17, or ≥ 18 years), gender (girl or boy), race/ethnicity (His-

panic, non-Hispanic white, non-Hispanic black, non-Hispanic Asian, or non-Hispanic American Indian/Alaska Native), and school level (middle or high).

Statistical Analysis

National estimates of current use of smokeless tobacco products were calculated overall and stratified by sociodemographic characteristics and are presented as percentages with 95% confidence intervals (CIs). Within-group comparison of estimates was performed by using χ^2 statistics; estimates with a relative SE of $\geq 40\%$ were not reported. Logistic regression was performed to assess the role of perception of harm from all tobacco products and social influences on smokeless tobacco use, adjusting for the following: gender, race/ethnicity, and school level; current use of other smoked tobacco products; and receptivity toward tobacco promotional activities ($P < .05$).

Finally, a decomposition analysis was conducted to assess how much of the male-female difference in smokeless tobacco use was attributable to gender differences in covariates such as sociodemographic characteristics (age and race/ethnicity), perception of harm from all tobacco products, current use of combustible tobacco products, as well as proximal (protobacco peer and household influences) and environmental (exposure and receptivity to tobacco advertisements) factors. In the decomposition analysis, current smokeless tobacco use was the outcome variable, gender was the group variable, and all other covariates were decomposed iteratively. An adaptation of the Blinder-Oaxaca decomposition analysis for nonlinear regression models was used because of the binary outcome.¹¹ All analyses were weighted to account for the complex survey design and were performed with Stata version 11 (StataCorp, College Station, TX).

RESULTS

Study Participants

In total, 49.0% of all students were girls and 43.3% were in middle school. Participants' race/ethnic composition was as follows: non-Hispanic white (60.2%), non-Hispanic black (14.8%), non-Hispanic Asian (3.5%), Hispanic (20.2%), and non-Hispanic American Indian/Alaska Native (0.8%).

Prevalence

The overall prevalence of current any smokeless tobacco product use was 5.6%. By specific smokeless tobacco products, 5.0% of all students used chewing tobacco, snuff, or dip; 1.9% used snus; and 0.3% used dissolvable tobacco products.

As depicted in Table 1, the prevalence of current smokeless tobacco use increased with age and was lowest among respondents aged 9 to 11 years (2.2%; 95% CI: 0.9%–3.6%) and highest among those aged ≥ 18 years (10.8%; 95% CI: 8.1%–13.5%). The prevalence of current smokeless tobacco use was significantly higher among boys (9.0%; 95% CI: 7.2%–10.7%) compared with girls (2.0%; 95% CI: 1.7%–2.4%) and higher among high school students (7.7%; 95% CI: 6.2%–9.3%) compared with middle school students (2.6%; 95% CI: 2.1%–3.1%). By race/ethnicity, the prevalence of current smokeless tobacco use was lowest among non-Hispanic blacks (2.2%; 95% CI: 1.1%–3.4%), whereas non-Hispanic whites (6.7%; 95% CI: 5.3%–8.1%) and non-Hispanic American Indian/Alaska Natives (7.4%; 95% CI: 3.3%–11.6%) had the highest prevalence of smokeless tobacco use.

Concurrent Tobacco Use

Among current smokeless tobacco users, the majority reported use of conventional smokeless tobacco products (64.0%; $n = 617$), whereas 26.8%

TABLE 1 Prevalence and Pattern of Current Use of Smokeless Tobacco Products Among All US Middle and High School Students by Type of Smokeless Tobacco Product and Sociodemographic Characteristics, 2011 National Youth Tobacco Survey

Characteristic	Using Any Smokeless Tobacco Product ^a ($n = 960$)	Using Snuff or Chewing or Dipping Tobacco Products ($n = 838$)		Using Dissolvable Tobacco Products ($n = 65$)	Combining Use of Snus or Dissolvable Tobacco Products Plus Snuff or Chewing or Dipping Tobacco Products ($n = 221$)		Combining Use of Any Smokeless Tobacco Product Plus Combustible Tobacco Products ^b ($n = 686$)
		Using Snuff or Chewing or Dipping Tobacco Products ($n = 838$)	Using Snus ($n = 313$)		Using Dissolvable Tobacco Products ($n = 65$)	Dissolvable Tobacco Products Plus Snuff or Chewing or Dipping Tobacco Products ($n = 221$)	
Overall	5.6 (4.6–6.6)	5.0 (4.1–6.0)	1.9 (1.5–2.4)	0.3 (0.2–0.4)	1.5 (1.1–1.9)	4.0 (3.3–4.7)	
Age, y							
9–11	2.2 (0.9–3.6)	1.9 (0.7–3.2)	1.0 (0.2–1.8)	—	0.8 (0.1–1.5)	2.0 (0.7–3.3)	
12–14	2.8 (2.3–3.4)	2.4 (1.9–2.9)	0.9 (0.6–1.2)	0.2 (0.1–0.3)	0.6 (0.3–0.9)	2.0 (1.5–2.4)	
15–17	7.5 (5.9–9.0)	6.9 (5.4–8.4)	2.7 (2.0–3.4)	0.3 (0.1–0.4)	2.2 (1.6–2.9)	5.4 (4.3–6.5)	
≥ 18	10.8 (8.1–13.5)	10.1 (7.4–12.7)	3.6 (2.3–4.9)	0.6 (0.1–1.2)	3.2 (1.9–4.4)	7.8 (5.7–10.0)	
Gender							
Female	2.0 (1.7–2.4)	1.6 (1.2–1.9)	0.7 (0.5–0.9)	0.2 (0.1–0.3)	0.3 (0.2–0.5)	1.6 (1.3–2.0)	
Male	9.0 (7.2–10.7)	8.4 (6.8–10.1)	3.2 (2.3–4.0)	0.4 (0.3–0.6)	2.7 (2.0–3.5)	6.3 (5.2–7.5)	
School level							
Middle school (grades 6–8)	2.6 (2.1–3.1)	2.2 (1.7–2.6)	0.8 (0.6–1.1)	0.2 (0.1–0.4)	0.4 (0.3–0.6)	1.9 (1.4–2.3)	
High school (grades 9–12)	7.7 (6.2–9.3)	7.2 (5.6–8.7)	2.8 (2.1–3.5)	0.4 (0.2–0.5)	2.4 (1.7–3.0)	5.6 (4.5–6.7)	
Race/ethnicity							
White, non-Hispanic	6.7 (5.3–8.1)	6.2 (4.8–7.6)	2.5 (1.8–3.2)	0.2 (0.1–0.3)	2.0 (1.4–2.6)	4.6 (3.6–5.6)	
Black, non-Hispanic	2.2 (1.1–3.4)	2.2 (1.0–3.3)	0.6 (0.2–1.0)	—	0.5 (0.2–0.9)	1.6 (0.6–2.5)	
Asian, non-Hispanic	2.6 (0.9–4.4)	2.1 (0.6–3.5)	—	—	—	2.2 (0.6–3.9)	
Hispanic	5.0 (4.3–5.7)	4.1 (3.4–4.8)	1.5 (1.3–1.8)	0.5 (0.3–0.8)	0.9 (0.6–1.3)	4.1 (3.5–4.6)	
AI/AN, non-Hispanic	7.4 (3.3–11.6)	6.8 (2.6–11.1)	3.3 (0.8–5.7)	—	—	5.1 (3.4–6.8)	

Data are presented as percentages (95% CI). All data were weighted to account for the complex survey design. AI/AN, American Indian or Alaska Native; —, estimate not reported because relative SE was $\geq 40\%$.

^a Any smokeless tobacco use was defined as use of at least 1 of the following tobacco products on ≥ 1 day during the past 30 days: snus, dissolvable tobacco products, snuff, or chewing or dipping tobacco.

^b Current use of any combustible tobacco product was defined as use of at least 1 of the following tobacco products on ≥ 1 day during the past 30 days: cigarettes (including flavored cigarettes and roll-your-own cigarettes), cigars (including clove cigars and flavored little cigars), bidis, kreteks, pipes, and waterpipes/hookahs.

TABLE 2 Concurrent Use Pattern of Smokeless Tobacco With Other Tobacco Products, Perceptions, Social Influences, and Adjusted Effect of Characteristics on Current Any Smokeless Tobacco Use, 2011 National Youth Tobacco Survey

Characteristic	Proportion of Students, % (95% CI)					Adjusted Effect on Smokeless Tobacco Use, aOR ^b (95% CI)
	Nonusers of Any Smokeless Tobacco Product (n = 17 589)	Snus or Dissolvable Tobacco Product Users Only (n = 114)	Snuff or Chewing or Dipping Tobacco Users Only (n = 617)	Combined Users of Snus or Dissolvable Tobacco Products Plus Snuff or Chewing or Dipping Tobacco (n = 221)	Users of Any Smokeless Tobacco Product ^a (n = 960)	
Concurrent use of other tobacco products						
Current smoking of any combustible tobacco ^c	13.0 (11.6–14.4)	80.5 (70.6–90.4)	65.2 (59.1–71.4)	82.3 (76.9–87.7)	72.1 (67.4–76.8)	5.91 (4.36–7.99)* (Ref = nonsmokers)
Current use of electronic cigarettes	0.6 (0.4–0.8)	8.6 (2.6–14.5)	3.9 (1.9–6.0)	19.2 (12.7–25.7)	8.5 (5.9–11.0)	2.95 (1.62–5.37)* (Ref = nonusers)
Current use of other “new tobacco products” not specified	1.2 (0.9–1.4)	—	15.6 (11.1–20.2)	20.0 (13.2–26.9)	16.3 (12.5–20.2)	4.11 (2.47–6.87)* (Ref = nonusers)
Beliefs, attitudes, and perceptions						
Self-report that it would be easy or somewhat easy to get tobacco	60.6 (57.9–63.4)	93.7 (88.1–99.3)	92.6 (89.0–96.1)	97.1 (94.6–99.6)	93.9 (91.5–96.2)	2.22 (1.35–3.63)* (Ref = not easy)
Belief that all tobacco products are harmful	91.6 (90.8–92.4)	67.6 (57.7–77.4)	67.9 (63.0–72.8)	64.6 (57.6–71.6)	67.0 (63.3–70.7)	0.55 (0.38–0.79)* (Ref = not harmful)
Exposure to smokeless tobacco health warning labels	47.9 (45.1–50.8)	64.0 (50.0–78.0)	75.7 (70.8–80.7)	86.3 (81.1–91.5)	78.1 (74.0–82.2)	2.68 (1.93–3.74)* (Ref = never or rarely)
Saw warning label on smokeless tobacco products in past 30 days ^d						
Exposure and receptivity to tobacco advertisement	51.5 (49.3–53.7)	68.7 (55.8–81.5)	69.9 (64.5–75.3)	73.3 (66.3–80.2)	70.8 (66.5–75.1)	1.24 (0.93–1.65) (Ref = never or rarely)
Exposure to tobacco advertisements at billboard or store	16.0 (14.9–17.2)	56.9 (46.9–66.9)	57.8 (53.3–62.2)	64.2 (55.2–73.2)	59.4 (55.6–63.3)	1.68 (1.26–2.25)* (Ref = not likely)
Likely to use or wear something with tobacco company name or picture	10.5 (9.7–11.3)	39.2 (29.9–48.6)	41.1 (35.7–46.5)	52.1 (43.9–60.2)	44.0 (39.8–48.1)	1.41 (1.01–1.99)* (Ref = no purchase/receipt)
Bought or received something with tobacco company name/picture in past 12 months						
Protobacco influences						
One or more close friends smokes cigarettes	29.7 (27.4–31.9)	73.2 (63.6–82.7)	74.5 (70.0–78.9)	85.3 (79.4–91.2)	77.4 (74.3–80.5)	0.82 (0.59–1.12) (Ref = none)
One or more close friends uses smokeless tobacco	12.9 (11.0–14.8)	41.9 (30.0–53.7)	79.2 (75.0–83.4)	91.6 (87.4–95.9)	79.2 (76.2–82.3)	9.56 (7.14–12.80)* (Ref = none)

TABLE 2 Continued

Characteristic	Proportion of Students, % (95% CI)					Adjusted Effect on Smokeless Tobacco Use, aOR ^b (95% CI)
	Nonusers of Any Smokeless Tobacco Product (n = 17 589)	Snus or Dissolvable Tobacco Product Users Only (n = 114)	Snuff or Chewing or Dipping Tobacco Users Only (n = 617)	Combined Users of Snus or Dissolvable Tobacco Products Plus Snuff or Chewing or Dipping Tobacco (n = 221)	Users of Any Smokeless Tobacco Product ^a (n = 960)	
One or more persons in household smokes any combustible tobacco	35.6 (32.9–38.2)	49.4 (40.5–58.4)	54.8 (49.2–60.4)	65.7 (57.7–73.8)	57.3 (52.4–62.1)	0.96 (0.73–1.27) (Ref = none)
One or more persons in household uses smokeless tobacco	7.1 (5.6–8.6)	10.9 (3.3–18.5)	34.9 (28.0–41.8)	45.5 (38.1–52.9)	35.6 (30.5–40.7)	3.32 (2.23–4.95)* (Ref = none)

All data were weighted to account for the complex survey design. Ref. referent category; —, estimate not reported because relative SE was $\geq 40\%$.

^a Any smokeless tobacco use was defined as use of at least 1 of the following tobacco products on ≥ 1 days during the past 30 days: snus, dissolvable tobacco products, or snuff or chewing or dipping tobacco.

^b Adjusted for age, gender, race/ethnicity, school level, current use of smoked tobacco products, receptivity toward protobacco advertisements (as measured by buying or receiving an item with a tobacco name or picture), and protobacco peer and household influences.

^c Current use of any combustible tobacco product was defined as use of at least 1 of the following tobacco products on ≥ 1 days during the past 30 days: cigarettes (including flavored cigarettes and roll-your-own cigarettes), cigars (including clove cigars and flavored little cigars), bidis, kreteks, pipes, and waterpipes/hookahs.

^d Among students who reported seeing a smokeless tobacco product within the past 30 days.

* Significant at $P < .05$.

($n = 221$) reported combined use of conventional plus novel products such as snus or dissolvable tobacco products, and only 9.2% ($n = 114$) reported using only novel smokeless tobacco products. About 72.1% of smokeless tobacco users also smoked combustible tobacco products. Also, 80.5% of users of snus or dissolvable tobacco products also smoked combustible tobacco products.

Factors Associated With Smokeless Tobacco Use

Of the covariates assessed, perceiving that all tobacco products are harmful was the only protective factor against smokeless tobacco use (adjusted odds ratio [aOR]: 0.55; 95% CI: 0.38–0.79), whereas a pro-smokeless tobacco peer (aOR: 9.56; 95% CI: 7.14–12.80) and household environment (aOR: 3.32; 95% CI: 2.23–4.95) were associated with significantly higher odds of smokeless tobacco use. However, cigarette smoking by either peers or household members was not significantly associated with current smokeless tobacco use (Table 2).

Access and Intention to Quit

Slightly more than half (53.9%) of current users of snuff or chewing or dipping tobacco reported that they obtained smokeless tobacco from someone else, 32.2% reported purchasing it, 3.6% reported stealing from a store or someone else, and 10.3% obtained it through other ways not specified. Among those who did purchase smokeless tobacco within the past 30 days, 70.2% reported that they bought it from a retail store, 4.0% purchased over the Internet/mail, 3.5% purchased from a vending machine, whereas 22.3% reported that they purchased it through some other way not specified. Moreover, 93.9% of smokeless tobacco users felt it would be easy to get tobacco if they wanted to.

An intention to quit all tobacco use was reported by 40.1% of smokeless tobacco users, with those combining the use of conventional plus novel smokeless tobacco products reporting significantly lower quit intention rates compared with those who used only novel smokeless tobacco products (34.2% vs 57.7%; $P < .05$).

Exposure to Health Warning Labels

The prevalence of self-reported exposure to warning labels on smokeless tobacco products was lowest among respondents who used novel smokeless tobacco products only (64.0%; 95% CI: 50.0%–78.0%) and highest among combined users of novel plus conventional smokeless tobacco products (86.3%; 95% CI: 81.1%–91.5%). Even after controlling for potential confounders, exposure to warning labels on smokeless tobacco products was not protective against smokeless tobacco use (aOR = 2.68; 95% CI: 1.93–3.74; Table 2).

Explaining Gender Differences

Only 2.0% of the male-female difference in smokeless tobacco use was explained by gender differences in sociodemographic characteristics such as age and race/ethnicity. Similarly,

gender differences in household members' use of tobacco products explained only 1.9% of the male-female gap in smokeless tobacco use (Table 3). In contrast, gender differences in the use of combustible tobacco products (with higher use among boys) explained 17.0% of the male-female difference in smokeless tobacco use, whereas gender differences in protobacco peer relationships (with boys having more close friends who used smokeless tobacco and cigarettes) further explained 19.1% of the male-female gap in smokeless tobacco use. In addition, some of the male-female difference in smokeless tobacco use was explained by gender differences in exposure and receptivity to tobacco promotional activities (10.7%) and differential perception that all tobacco products are harmful (6.5%).

DISCUSSION

Our results indicate that the overall prevalence of smokeless tobacco use among US youth was 5.6%, which substantially differed by gender, age, and race/ethnicity. Moreover, this study identified that the majority of smokeless tobacco users used snuff or chewing or dipping smokeless tobacco products, alone or in combination with novel

smokeless tobacco products such as snus or dissolvable tobacco products. Most smokeless tobacco users also smoked combustible tobacco products, and ~4 of 5 users of snus or dissolvable tobacco products concurrently smoked combustible tobacco products.

These findings are generally at odds with the recent positions in favor of novel smokeless tobacco products as a means of harm reduction. Whereas novel smokeless tobacco products such as snus or dissolvable tobacco products contain lower levels of tobacco-specific nitrosamines compared with combustible tobacco products or conventional smokeless tobacco products,⁶ the dual-use patterns found in this study suggest that any harm reduction that might be associated with these low-nitrosamine novel products may be negated by the finding that they are often used concurrently with high-nitrosamine conventional smokeless tobacco products and/or with combustible tobacco products. The increased popularity and use of high-nitrosamine moist snuff in recent years further complicates the argument of harm reduction with smokeless tobacco products.⁴ Thus, whereas the evidence is suggestive that switching from cigarettes to novel smokeless tobacco products might reduce individual risk, promotion of snus or dissolvable tobacco products at a population level may not have benefits and might even cause harm from dual use with combustible and/or conventional smokeless tobacco products.^{6,12,13} The American Academy of Pediatrics has thus called for the regulation of novel smokeless tobacco products to prevent potential harm to children and adolescents.¹⁴

The relatively higher prevalence of smokeless tobacco use among boys and non-Hispanic whites found in our study is consistent with reports in the literature.^{15–18} In addition, the important

TABLE 3 Assessment of Male-Female Differences in Smokeless Tobacco Use, 2011 National Youth Tobacco Survey

Characteristic	Male-Female Gap in Smokeless Tobacco Use Explained by Gender Difference in Observed Characteristics, % (95% CI)	P
Use of cigarette or smokeless tobacco by ≥ 1 close friend	19.11 (15.39–22.84)	<.001
Use of cigarette or smokeless tobacco by ≥ 1 household member	1.92 (0.0–4.09)	.081
Exposure and receptivity to tobacco advertisements	10.72 (7.05–14.38)	<.001
Current use of any combustible tobacco products ^a	16.89 (12.93–20.85)	<.001
Perception that all tobacco products are harmful	6.50 (4.01–8.99)	<.001
Sociodemographic characteristics ^b	2.00 (0.73–3.24)	.002

All data were weighted to account for the complex survey design.

^a Current use of any combustible tobacco product was defined as use of at least 1 of the following tobacco products on ≥ 1 days during the past 30 days: cigarettes (including flavored cigarettes and roll-your-own cigarettes), cigars (including clove cigars and flavored little cigars), bidis, kreteks, pipes, and waterpipes/hookahs.

^b Sociodemographic characteristics assessed included age and race/ethnicity.

role of current use of combustible tobacco products and pro-smokeless tobacco peer influence on smokeless tobacco use was further shown by the fact that most of the gender difference in smokeless tobacco use was explained by these factors.

Although we found that harm perception of all tobacco products was protective of smokeless tobacco use, the fact that exposure to health warning labels was not protective of smokeless tobacco use suggests the need for more effective warning labels on smokeless tobacco products. Strikingly, we noted that a lower proportion of users of novel smokeless tobacco products, such as snus or dissolvable tobacco products, reported seeing a warning label on a smokeless tobacco product compared with users of conventional smokeless tobacco products or with respondents who combined use of conventional plus novel smokeless tobacco products. This finding may suggest a dilutory effect of the visibility or impact of text-only health labels by the highly colorful packaging of novel smokeless tobacco products and

underscores the need for stronger health warnings for smokeless tobacco products (such as a combination of graphic and text warnings) and bans or restrictions on smokeless tobacco advertisements.

The relatively low quit-intention rates among respondents who combined use of conventional plus novel smokeless tobacco products, coupled with the finding of the protective effect of risk perception of all tobacco products, highlights the role that pediatricians can play in providing cessation support by educating youth on risks of tobacco use during pediatric consultation visits. This can also be an opportunity to either refer an accompanying household member who might be using smokeless tobacco or offer cessation support to that member considering that that household member's continued smokeless tobacco use might be associated with greater odds that the adolescent child may use smokeless tobacco too.

This study used a large, nationally representative sample to assess

patterns of conventional and novel smokeless tobacco use and access and factors related to use. Nonetheless, the findings in this study are subject to a number of limitations due to its design. First, recall bias may have resulted in an underreporting of tobacco use. Also, the cross-sectional study design precludes making inferences on causality and can only indicate associations.

CONCLUSIONS

This study revealed that conventional smokeless tobacco products remain the predominant form of smokeless tobacco use and that most users of novel smokeless tobacco products also concurrently smoked combustible tobacco products. Moreover, smokeless tobacco use was associated with lower perception of harm from all tobacco products and protobacco social influences, indicating the need to change adolescents' perception about the dangers of all tobacco products and to denormalize tobacco use through evidence-based interventions.

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