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Original investigation

Perceptions of Snus Among US Adult Smokers Given Free Product

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Abstract

Introduction: Snus uptake is nominal among US smokers. This longitudinal study examines (1) perceptions of snus among US smokers given free snus for 6 weeks and (2) a method for assessment of an alternative tobacco product at the population level.

Methods: Adult smokers (n = 543; 69.2% female; M_{age} = 49.3 years), uninterested in quitting, received free snus for ad libitum use. Based on their snus use during a 6-week sampling period, participants included: (1) never users (18.4%, n = 100); (2) experimenters; that is, used ≥ once, but not during the last week of sampling (33.1%; n = 180); and (3) persistent users; that is, used ≥ once during the final week, and ≥ once during any other week of the sampling period. (48.4%; n = 263).

Results: Following the sampling period, those who became persistent users were more likely than experimenters to report that switching to alternative tobacco products would lower their risk for health problems (66.5% vs. 50.0%; p = .006). Persistent users also reported greater negative affect relief and craving reduction (ps < .001) than experimenters. Finally, persistent users were more likely than experimenters to describe snus in favorable terms with respect to ease of use, satisfaction, and liking (ps < .05).

Conclusions: Subjective experiences with snus, rather than nicotine dependence, explained experimentation versus persistent use. Even among smokers who became persistent snus users, snus was perceived as a poor substitute for cigarettes. This study design (randomized, yet naturalistic) could be extended to other novel tobacco products, including e-cigarettes, to help understand the role new products may have in the tobacco landscape.

Implications: This is the first large scale, US-based naturalistic assessment of smokers' reactions to snus during an extended sampling period. This study is directly in line with FDA goals to better understand predictors of initiation, uptake, and use of other tobacco products such as snus, and serves as model for assessment methods of alternative tobacco products at the population level. Most smokers tried the provided sample of snus (approximately 82%). Subjective experiences with snus, rather than nicotine dependence, explained experimentation versus persistent use. Even among smokers who became persistent snus users, snus was perceived as a poor substitute for cigarettes.

Introduction

The recent proliferation of Alternative Tobacco Products (ATPs) constitutes a major change in the tobacco landscape. Snus is an oral, spitless, smokeless ATP, with lower levels of tobacco-specific nitrosamines than both cigarettes and traditional forms of smokeless tobacco (SLT).[1,2] Because snus contains lower levels of carcinogens, it may serve as a less harmful alternative to combusted tobacco.[3] Decreased rates of smoking and smoking-related illnesses in Sweden and elsewhere have been attributed to snus use.[4–7] In the United States, experimentation with snus increased over the past few years,[8] but overall use remains very low (eg, daily use = 1.8%),[8–10] raising skepticism as to whether the prevalence of snus use (and decreased smoking) in the United States will ever approach Sweden's.[11]

In the United States, snus has been advertised to smokers as a quit aid or means to circumvent smoking restrictions[12,13] yet there is low uptake among smokers. Several laboratory studies examine comparative use and acceptability of snus and other nicotine products. In a crossover trial examining smokers' reactions to snus following a 24-hour sampling period,[14] participants reported more withdrawal symptoms, greater urge to smoke, and lower satisfaction with snus compared to cigarettes. In another study, smokers were instructed to try snus, dissolvable tobacco, and nicotine replacement lozenges (NRT) at least once during a 1-week sampling period.[15] Following the sampling period, more smokers preferred NRT over snus and dissolvable tobacco. Additionally, most smokers only partially substituted snus for their cigarettes, rather than 100% substitution. Similarly, in a randomized control trial, smokers were instructed to use their own cigarettes, snus to cope with smoking restrictions, or snus to reduce their cigarette smoking, for two weeks.[16] Both snus groups reported significantly greater reductions in cigarettes per day (CPD) compared to the usual brand control group, and at least 64%–71% of participants used snus daily; however, 100% substitution was rare. Finally, in a 12-week randomized trial of snus versus nicotine gum, approximately 38% of smokers were able to switch to snus completely by week 6 of the trial, but this reduced to approximately 27% by week 12.[17] Additionally, nicotine gum was reported as more satisfying and psychological rewarding than snus. Collectively, the available evidence suggests that while some smokers may prefer snus over some products (eg, nicotine gum)[17,18] and can successfully stop smoking,[17] cigarettes are still largely favored[14] and complete product substitution is low in most studies.

Aside from effects on craving and withdrawal, harm perceptions may drive experimentation with snus. US smokers who perceive snus and cigarettes as having comparable harm are less likely to try snus.[19,20] Among Norwegian samples of smokers, lower perceptions of the harmfulness of snus compared to cigarettes are related to greater willingness to use snus in future quit attempts.[21] Although research has examined some harm perceptions-related factors, it has yet to examine other factors that may influence snus use (eg, desire to use where smoking is restricted).

Understanding differences in US smokers who use and do not use snus will help better characterize snus users and the potential role of snus in the tobacco landscape. The FDA has highlighted this as an area of importance in their recently announced Request for Information[22] for studies examining predictors of initiation, uptake, and use of other tobacco products such as snus. Existing studies are limited by small sample sizes, scope of assessment, cross-sectional or lab-based designs, and minimal follow-up periods that may not allow sufficient time for stabilization of product use patterns. In addition, when research studies have provided snus to smokers it often involved proscribed rules that may not accurately reflect natural patterns of use. The present study examines longitudinal perceptions of snus within a randomized controlled trial in which US adult smokers, uninterested in stopping smoking, were provided free samples of snus to use ad libitum. This study also provides a model for assessing alternative products at the population level and could be replicated with other ATPs.

Method

Parent Study Overview

This study used a subsample of participants from a randomized control trial[23,24] in which smokers were assigned to either receive/not receive snus by mail to sample ad libitum for 6 weeks. Participants completed three assessments during the sampling phase (week 0, week 3, and week 6). Participant enrollment occurred from November 2011 to August 2013. The current study is restricted to participants assigned to the snus condition (N = 626) and examines snus use during the 6-week sampling period. No support was provided by the tobacco industry. All procedures were approved by the institution's review board.

Participants

Eligible participants were adult (≥19 years old) smokers (10 cigarettes/day) who were uninterested in quitting smoking in the next 30 days. Participants also met these criteria: (1) English speaking, (2) US residence, (3) denied SLT use on more than one occasion during the past 6 months, (4) denied breastfeeding/pregnancy/plan to become pregnant, (5) denied any cardiovascular trauma in the past 6 months, (6) no quit attempt lasting ≥ 1 week during the past 6 months, and (7) no cessation pharmacotherapy use during the past 3 months. The sample was further restricted to participants who completed all assessments during the 6-week sampling window (N = 543; 86.7%).

Product

Camel Snus (Reynolds American, Inc.) is an oral, smokeless, spit-free, moist tobacco product that comes in a pouch. Camel Snus has lower levels of tobacco-specific nitrosamines compared to cigarettes and other SLT products currently available (eg, Copenhagen).[1,2] For clarity, we categorize snus as an ATP in this paper and traditional SLT (eg, Copenhagen) as SLT.

Procedure

Using two US national market research panels (SSI and Knowledge Networks), individuals noted as smokers in the panels' databases were e-mailed a link containing a study invitation and eligibility survey. Eligible and interested persons were mailed consent forms and a baseline questionnaire along with a letter describing the purpose of the study: "A study for cigarette smokers who are not motivated to quit that will test a new, potentially safer tobacco product." Researchers conducted all follow-up assessments by phone. Participants earned $10 for completion of the week 0 and week 3 assessments, and $20 for the week 6 completion (total = $40).

Upon the first study phone call (week 0), participants answered questions about their smoking and use/perceptions of ATPs (eg, including snus), were given a brief description of snus, and offered samples of snus to use as they wished. Samples were delivered to participants via mail and provided free of charge. Participants received

information specific to Camel Snus, including (1) what makes it spit-free (eg, "Camel Snus is pasteurized [a high-temperature sterilization process] rather than fermented [like moist snuff] so there is less salt in the blend, which means less moisture. This produces less saliva and reduces the need for spitting"), (2) how to use it ("Snus is placed between your upper lip and gum"), and (3) its tar and nicotine level (eg, "This is a tobacco product so it does contain nicotine. Since Snus is smokeless and does not burn, it does not produce tar"). Those electing to receive snus were instructed on use with an emphasis on self-choice ("Use it as you like, whether to reduce cigarette smoking, use within smoking restrictions, both, or not at all."). Participants could choose between two flavors: Winterchill (menthol/mint) or Robust (tobacco), both 2.5–2.8 mg nicotine/pouch.[17]

At week 3, a second call occurred at which time participants completed questions about their snus use. If a participant reported snus use, callers assessed reactions to it and preference versus cigarettes. All participants were asked if they would like to receive a shipment of snus. At week 6, a third call occurred, with a protocol similar to that just described. The sampling period concluded at week 6 and no more snus was provided. Between weeks 0 and 6, up to 20 tins of Camel Snus (15 pouches/tin) were sent to participants who requested it during the context of the aforementioned scheduled study calls; five tins were mailed at a time to each participant who requested snus, with shipments spaced 7–10 days apart.

Measures

Use of Camel Snus

At each call, use was assessed in two ways: (1) any use since the prior call (yes/no), and (2) 7-day timeline follow-back. We categorized participants as: (1) "never users," who denied use of snus at any time during the sampling period; (2) "experimenters," who reported trying snus at some point during the sampling period, but denied use in final week of the sampling period, or (3) "persistent users," used snus ≥ once during the final week and ≥ once during any other week of the sampling period.

Attitudes and Risk Perceptions of ATPs

Participants completed a 12-item attitudes and risk perception scale at each call. Prior to answering questions, participants were read a uniform script about what ATPs are (ie, "Ariva/Exalt/Stonewall/Camel Snus" and "pouches or lozenges that you put in your mouth"). Additionally, participants were told the "manufactures' claim" that products may provide a reduced risk compared to cigarettes and have fewer toxins. This information was intended to provide participants clarifying information about what products they were rating (eg, dissolvable tobacco/snus, not traditional SLT). Three items assessed perceptions of harmfulness: "On a scale of 0–10, where 0 is not at all and 10 is very much, how harmful is cigarette smoking (ATP use) ... " (1) "in general," (2) "to you personally," and (3) "to those around you." There was no "I don't know" option. Items within each tobacco group (cigarettes/ATPs) displayed good reliability within this sample (cigarette's harmfulness $\alpha = 0.81$; ATP's harmfulness $\alpha = 0.73$; total scale $\alpha = 0.80$).

Participants answered two additional questions addressing conditional risk perceptions: (1) "Switching from cigarettes to SLT products would lower my risk for health problems (eg, cancer)" and (2) "Switching from cigarettes to SLT products would lower the risk of health problems (eg, cancer) for others around me." Responses ranged from 1 (strongly agree) to 4 (strongly disagree) and were categorized as agree versus disagree.

Four additional items assessed likelihood of (1) buying ATPs, and using them to (2) reduce smoking, (3) quit smoking, and (4) get around smoking restrictions. Responses ranged from 1 (very likely) to 4 (not at all likely) and were categorized as somewhat/very likely versus not.

Snus Outcome Expectancies

Participants who reported snus use during the sampling period (ie, experimenters/persistent users) completed a 13-item expectancy scale. Items came from prior literature[25] and assessed reactions to snus such as "it helps me relax" and "satisfies my nicotine cravings." Responses ranged from 1 (very unlikely) to 5 (very likely). This measure contains five subscales including (1) negative affect relief, (2) craving reduction, (3) weight control, (4) health risks, and (5) quitting facilitation (total scale $\alpha = 0.82$). Items within each subscale displayed good reliability (α's = 0.77–0.88).

Product Preference for Snus Versus Cigarettes

Participants who used snus during the sampling period completed a 5-item scale assessing preference for snus versus cigarettes in regards to withdrawal, reducing cravings, ease of use, satisfaction, and liking (eg, "Which product helped reduce cravings to smoke?"). This scale was adapted from the Product Evaluation Scale[26] and response options were "snus," "equal," or "cigarettes."

Data Analysis

Analyses were conducted using SPSS, version 20 (IBM Corp, Armonk NY). Descriptive statistics were used to examine the sample at baseline. Baseline demographic, tobacco use history, and pre-sampling attitudes variables were compared between never users, experimenters, and persistent users using analysis of variances (ANOVAs) and Chi-square tests, as appropriate. Any significant baseline differences were treated as covariates in subsequent end of sampling period analyses.

All end of sampling period analyses were conducted using week 6 data. Separate 2 (cigarettes vs. ATPs) × 3 (never, experimenter, and persistent user) analysis of covariances (ANCOVAs) were conducted to test the interaction between ratings of harmfulness by product across snus use groups. Gender, previous traditional SLT use, Heaviness of Smoking Index (HSI), and baseline attitudes demonstrated statistically significant group differences and were statistically controlled for. Post hoc tests comprised of pairwise comparisons (eg, *t* tests). ANCOVAs were chosen given their ability to show differential responses to products across snus use groups while controlling for significant covariates. Logistic and multinomial regressions were used to test categorical responses where appropriate (eg, preference for snus vs. cigarettes). Given the potential for statistically, but not clinically significant results, effect sizes were calculated for all ANCOVAs (partial η^2) and logistic regressions (odds ratios). When gender was found to be a significant covariate in post-sampling analyses, separate ANCOVAs were conducted to test the interaction between responses by gender.

Results

Sample Characteristics

Participants' mean age was 49.3 (*SD* = 12.4) years. Most participants were white, non-Hispanic (89.4%), females (69.2%), with at least some college education (64.7%). Employment status varied with 27.9% of participants working full time. Mean CPD was 20.4

(*SD* = 8.7) with a mean age of daily smoking onset of 16.8 years (*SD* = 3.7). Complete descriptive data are in Table 1.

Snus Use Groups

At the close of the 6-week sampling period, the sample consisted of 100 never users (18.4%), 180 experimenters (33.1%), and 263 persistent users (48.4%). Some never users declined to receive snus in the mail ($n = 21$; 4% of the total sample); the remainder were mailed the product but denied use. Females were disproportionately represented among never users (84%) and experimenters (72.2%) compared to only 61.6% of persistent users; thus, gender was a covariate in all analyses. There were significant differences between groups in their lifetime history of traditional SLT use (eg, Copenhagen), with more persistent users endorsing this behavior (9.9%) than experimenters (6.1%) and never users (2.0%); thus, a history of SLT use was also used as a covariate in all end of sampling period analyses. There were small yet statistically significant differences between groups in CPD ($p = .05$) and nicotine dependence (HSI; $p < .01$); we included HSI as a covariate, given that it is summed from CPD and minutes to first cigarette, in all end of sampling period analyses.

At baseline, there were no significant differences between snus use groups on reports of perceived harmfulness of cigarettes/ATPs and ATPs' likelihood of reducing others' health problems (*p*s > .05). However, those who became persistent users were more likely than never users and experimenters to believe that switching to ATPs would lower their likelihood of health problems ($p < .05$). Similarly, they were more likely to report intention to buy and/or use ATPs to reduce smoking, quit smoking, and circumvent smoking restrictions (*p*s < .05).

Group Differences at End of Sampling Period

Attitudes Toward ATPs

Attitudes towards ATPs among never users, experimenters, and persistent users, while controlling for gender, past SLT use, and HSI are in Table 2. A significant interaction emerged between snus use groups and ratings of product harmfulness ($p = .02$, $\eta^2 = 0.02$). Smokers who became experimenters or persistent users reported greater perceived harmfulness of cigarettes "to you personally" than never users; however, perceived harmfulness of ATPs was equal across users. There were no significant interactions for perceived harmfulness of cigarettes "in general" ($p = .23$, $\eta^2 = 0.006$) and "to others around you" ($p = .20$, $\eta^2 = 0.006$). Gender was a significant predictor in the model examining perceived harmfulness of cigarettes/ATPs "to others around you" ($p = .001$, $\eta^2 = 0.02$), but not for perceived harmfulness "in general" ($p = .96$, $\eta^2 = 0.00$) or "to you personally" ($p = .50$, $\eta^2 = 0.001$).

Separate ANCOVAs examining differences in male and female perceptions of harmfulness (while controlling for past SLT use) revealed a significant interaction between gender and ratings of product harmfulness ($p = .003$, $\eta^2 = 0.02$). Females ($M = 6.63$, $SD = 3.41$)

Table 1. Demographic and Tobacco Use History Across Snus Use Groups at Baseline ($n = 543$)

	Never users	Experimenters	Persistent users	Total *M*(*SD*)	
	(*n* = 100)	(*n* = 180)	(*n* = 263)	(*n* = 543)	
Variables	*M (SD)* or %				*p*
Age	48.2 (12.3)	48.4 (12.4)	50.3 (12.3)	49.3 (12.4)	.227
Female	84%	72.2%	61.6%	69.2%	**<.001**
Race					.770
White	92.9%	89.8%	87.8%	89.4%	
Other	7.1%	10.2%	11.2%	10.5%	
Hispanic[1]	6.1%	3.9%	5.0%	4.8%	.710
Employment status					.834
Full time	30.0%	28.3%	26.7%	27.9%	
Other[2]	70.0%	71.8%	73.3%	72.2%	
Cigarettes per day	19.4 (7.8)	19.5 (7.9)	21.3 (9.4)	20.4 (8.7)	**.05**
Age of daily smoking onset	16.5 (3.2)	16.9 (3.6)	16.9 (4.0)	16.8 (3.7)	.634
Number of quit attempts	2.5 (2.41	2.8 (7.7)	2.4 (2.7)	2.6 (4.9)	.684
Number of 24 h quit attempts	2.5 (3.4)	2.9 (5.1)	2.6 (4.2)	2.7 (4.4)	.601
Minutes to first cigarette					.051
Within 5 min	33.0%	36.2%	46.2%	40.4%	
6–30 min	53.0%	53.1%	44.3%	48.8%	
31–60 min	7.0%	7.9%	7.6%	7.6%	
After 60 min	7.0%	2.8%	1.9%	3.2%	
HSI—dependence[3]	3.3 (1.2)[a]	3.5 (1.2)[a,b]	3.7 (1.2)[b]	3.6 (1.2)	**.01**
Heard of Camel Snus	65.0%	71.1%	70.7%	69.8%	.510
Tried Camel Snus	2.0%	5.6%	5.7%	5.0%	.317
Heard of Marlboro Snus	53.0%	53.3%	57.0%	55.1%	.669
Tried Marlboro Snus	0.0%	5.0%	5.7%	4.4%	.055
Heard of SLT	85.0%	82.2%	78.7%	81.0%	.347
Tried SLT	2.0%[a]	6.1%[b]	9.9%[c]	7.2%	**.027**

SD = standard deviation; SLT = Smokeless tobacco. Non-alike superscripts (a, b) indicate significant differences between groups. Bold *p*-values indicate significant group differences.

[1]Hispanic was not a mutually exclusive choice.

[2]Other = 41% employed, 26.6% on disability, 16.4% retired, 14.8% unemployed, and 1.3% students.

[3]HSI = Heaviness of Smoking Index, 1–2 very low dependence, 3 = low to moderate dependence, 4 = moderate dependence, ≥5 = high dependence.

perceived cigarettes as more harmful "to others around you" than males ($M = 5.68$, $SD = 3.22$; $p = .001$). There were no differences between males ($M = 1.39$, $SD = 2.60$) and females ($M = 1.17$, $SD = 2.28$) in perceived harmfulness of ATPs "to others around you" ($p = .40$). Both males ($p < .001$) and females ($p < .001$) reported that compared to ATPs, cigarettes were more harmful to others.

The likelihood of using ATPs among never users, experimenters, and persistent users, while controlling for gender, past SLT use, HSI, and baseline responses, is seen in Table 2. Odds ratios from significant between group comparisons (conducted twice—once with never users as the reference group, and once with experimenters as the reference group) are noted below (not listed in table). Those who became never (OR = 1.79) and persistent users (OR = 1.80) were more likely than experimenters to believe that switching to ATPs would lower their likelihood of health problems. Those who became persistent users were more likely than experimenters (OR = 1.81) to believe switching to ATPs would lower others' health risk. Those who became persistent users also reported greater likelihood of buying ATPs (OR = 4.26 vs. never users; OR = 4.13 vs. experimenters), and using ATPs to reduce smoking (OR = 6.84 vs. never users; OR = 5.76 vs. experimenters), quit smoking (OR = 2.75 vs. never users; OR = 2.83 vs. experimenters), and get around smoking restrictions (OR = 5.75 vs. never users; OR = 3.49 vs. experimenters), than experimenters and never users. Gender was not a significant predictor in any models examining likelihood of switching to or using ATPs (all ps > .05).

Outcome Expectancies (Experimenters and Persistent Users Only)

Participants' reactions to snus after trying it, while controlling for gender, SLT use, and HSI are in Table 3. Compared to those who became experimenters, persistent users reported that snus provided greater negative affect relief ($p < .001$, $\eta^2 = 0.14$), craving reduction ($p < .001$; $\eta^2 = 0.14$), and weight control ($p = .002$; $\eta^2 = 0.02$). When examining individual items, persistent users reported higher favorability across all items compared to experimenters, with the exception of items assessing health risks (Odds ratios for individual item analyses shown in Table 3's far right column). Gender was not a significant predictor in any of the overall models or when examining individual items (ps > .05).

Product Preference (Experimenters and Persistent Users Only)

Responses for head-to-head comparisons (cigarettes vs. snus), while controlling for gender, SLT use, and HSI are shown in Table 4. Statistically significant differences emerged on all items (ps < .05). Compared to experimenters, a higher proportion of persistent users reported that snus provides equal or better (42.5%) relief from withdrawal (experimenters: 28.5%). Similar results were found for craving (56.2% vs. 36.5%), ease of use (68.8% vs. 38.3%), satisfaction (19.7% vs. 4.5%), and liking (22% vs. 4.6%). Gender was not a significant predictor in any of the models (ps > .05).

Table 2. Attitudes and Risk Perceptions Towards ATPs Among Never Users, Experimenters, and Persistent Users of Snus at Week 6 ($N = 543$)

	M (SD)			
Attitudes items (ANCOVA)	Never users ($n = 100$)	Experimenters ($n = 180$)	Persistent users ($n = 263$)	Interaction p
Harmfulness of product (In general)[1]				.23
Cigarettes	7.76 (2.33)[a]	8.34 (2.03)[b]	8.40 (2.10)[b]	
ATPs	6.05 (2.53)[a]	6.14 (2.54)[a]	6.04 (2.59)[a]	
Harmfulness of product (personally)[1]				**.02**
Cigarettes	7.43 (2.60)[a]	7.94 (2.47)[b]	8.17 (2.22)[b]	
ATPs	6.14 (2.54)[a]	6.38 (2.69)[a]	6.01 (2.66)[a]	
Harmfulness of product (to others)[1]				.20
Cigarettes	5.47 (3.45)[a]	6.40 (3.39)[b]	6.62 (3.38)[b]	
ATPs	0.72 (1.60)[a]	1.43 (2.66)[b]	1.31 (2.41)[a,b]	
	% Agreed			
Attitude items (Logistic regression)	Never users	Experimenters	Persistent users	Model p
Switching would lower health problems for[2]				
Me[3]	61.0[a]	50.0[b]	66.5[a]	**< .001**
Those around me	86.0[a,b]	80.6[a]	87.8[b]	**.012**
Likelihood of[4]				
Buying ATPs[3]	21.0[a]	24.4[a]	63.4[b]	**<.001**
Using ATPs to cut down on cigarettes[3]	45.0[a]	52.8[a]	86.7[b]	**<.001**
Using ATPs to quit smoking[3]	39.0[a]	41.1[a]	70.3[b]	**<.001**
Using ATPs to get around smoking restrictions[3]	43.0[a]	56.1[a]	84.4[b]	**<.001**

ATP = Alternative Tobacco Product; ANCOVA = Analysis of Covariance; HSI = Heaviness of Smoking Index; *SD* = standard devaition; SLT = Smokeless tobacco. Non-alike superscript letters (a, b) denote differences between groups. All groups reported that cigarettes were significantly more harmful than ATPs in general, personally, and to others. Bold p-values indicate significant group differences.

[1]Responses ranged from 0 (not at all) to10 (very much).

[2]Responses ranged from 1 (strongly agree) to 4 (strongly disagree). Values represent those who endorsed "agree" or "strongly agree" with items.

[3]Analyses are controlling for baseline attitudes as these were significantly different between groups. All analyses control for gender, past SLT use, and HSI.

[4]Responses ranged from 1 (very likely) to 4 (not at all likely). Values represent those who endorsed "likely" or "very likely" with items.

Table 3. Reactions to Snus Among Experimenters and Persistent Users as Measured by the Outcome Expectancies Scale at Week 6 ($n = 443$)

	Experimenters	Persistent users	Total		
	($N = 180$)	($N = 263$)	($N = 443$)		
Reaction subscales		*M*(*SD*) or % agreed		*p*	Odds ratio[1]
Negative affect relief (Possible range: 4–20)	10.94 (4.48)	14.84 (4.57)	13.25 (4.91)	**<.001**	
Snus helps me to relax	12.8%	42.2%	30.3%	**<.001**	4.65
Snus helps me deal with anger	2.8%	15.2%	10.2%	**<.001**	5.95
Snus calms me down when I feel nervous	15.6%	39.2%	29.6%	**<.001**	3.42
Snus helps me reduce or handle tension	15.1%	42.0%	31.1%	**<.001**	4.00
Craving reduction (Possible range: 2–10)	5.11 (2.47)	7.02 (2.04)	6.24 (2.41)	**<.001**	
Snus satisfies my nicotine cravings	35.8%	65.6%	53.5%	**<.001**	3.25
Snus satisfies my urges to smoke	29.1%	59.7%	47.3%	**<.001**	3.44
Weight control (Possible range: 3–15)	6.14 (2.74)	7.05 (3.22)	6.68 (3.06)	**.002**	
Snus keeps me from overeating	7.3%	19.0%	14.3%	**.001**	4.24
Snus keeps my weight down	5.0%	14.1%	10.4%	**.002**	3.27
Snus keeps me from eating more than I should	8.4%	17.1%	13.6%	**.005**	2.40
Health risks (Possible range: 2–10)	7.11 (1.87)	7.10 (1.98)	7.10 (1.94)	.99	
Snus is hazardous to my health	58.1%	60.5%	59.5%	.64	1.13
Snus increases the risk of cancer	49.2 %	58.0%	54.4%	.08	1.46
Quitting facilitation (Possible range: 2–10)	5.51 (7.31)	6.59 (2.05)	6.15 (4.94)	.06	
Snus increases my chances of quitting smoking	24.6%	54.0%	42.1%	**<.001**	3.45
Snus makes quitting smoking easier	21.8%	51.0%	39.1%	**<.001**	3.64

ANCOVA = Analysis of Covariance; HSI = Heaviness of Smoking Index; *SD* = standard devaition; SLT = Smokeless tobacco. Bold *p*-values indicate significant group differences.

[1]Odds ratios from logistic regressions comparing experimenters versus persistent users on individual scale items. Subscales data depict results of ANCOVAs controlling for gender, past SLT use, and HSI. Items are answered on a scale of 1 (totally disagree) to 5 (totally agree). Numbers for subscales represent the mean of each item within that subscale. Numbers for individual items represent the percent of participants who reported "agree" or "totally agree." Those who reported never trying the snus that was sent or declined to have snus sent to them ($n = 100$) did not answer items used for these analyses and are excluded.

Table 4. Product Evaluation: Preference for Cigarettes Versus Snus at Week 6 ($N = 443$)

Product evaluation items	Experimenters % ($N = 180$)	Persistent users % ($N = 263$)	Total %	Group differences *p*	Odds ratio[1]
Gave you more relief from withdrawal				**.011**	
Cigarettes	71.4	57.5	63.1		
Equal	25.1	32.8	29.7	.08	1.47
Snus	3.4	9.7	7.1	**.013**	3.27
Helped reduce your cravings to smoke				**>.001**	
Cigarettes	63.4	43.8	51.7		
Equal	25.1	31.8	29.1	**.014**	1.77
Snus	11.4	24.4	19.2	**>.001**	2.91
Easier to use				**>.001**	
Cigarettes	61.7	31.3	43.5		
Equal	16.0	28.6	23.5	**>.001**	3.41
Snus	22.3	40.2	32.9	**>.001**	3.41
More satisfying				**>.001**	
Cigarettes	95.4	80.3	86.4		
Equal	3.4	13.9	9.7	**.001**	4.65
Snus	1.1	5.8	3.9	**.014**	6.45
Liked best				**>.001**	
Cigarettes	95.4	78.0	85.0		
Equal	2.9	13.5	9.2	**>.001**	5.59
Snus	1.7	8.5	5.8	**.004**	6.21

HSI = Heaviness of Smoking Index; SLT = Smokeless tobacco. Bold *p*-values indicate significant group differences.

[1]Odds ratios from logistic regressions analyzing the proportion of experimenters versus persistent users who selected "equal" or "snus" for each individual item (eg, The odds of being a persistent user and reporting that snus provides equal relief from withdrawal as cigarettes were 1.47 greater than for experimenters). Those who reported never trying the snus that was sent to them or decline to have snus sent ($n = 100$) did not answer items used for these analyses. All analyses control for gender, past SLT use, and HSI.

Discussion

This is the first large scale, US-based naturalistic assessment of smokers' reactions to snus during an extended sampling period. We expanded on previous research[14,15,18,27] by providing minimal instructions for use allowing smokers to try snus across multiple externally valid settings (eg, home and car), with varying possible motives (eg, to quit/reduce smoking and circumvent smoking restrictions). The extended sampling period allowed for sufficient time to observe stabilization of use patterns and prospective assessment of use factors. Furthermore, this study serves as model for assessment methods of ATPs at the population level.

Approximately 82% of participants tried the free sample of snus provided, and almost half (48.4%) were persistent users of snus at the end of the 6-week sampling period. Compared to smokers who became persistent users, experimenters were less likely to find snus to be an effective means to relieve negative affect, cravings, or control weight. Similarly, in head-to-head product comparisons, more experimenters than persistent users preferred cigarettes over snus as it pertains to cravings and ease of use. These results overlap with research showing many smokers are unable to fully substitute snus for cigarettes, even when explicitly asked to do so.[14] Important to note, persistent users still received more satisfaction from cigarettes and liked them best, a preference that was more pronounced among experimenters. Additionally, after accounting for past SLT use and HSI, gender was not predictive of responses to snus. In sum, experimenters reported fewer positive reactions to snus than persistent users (potentially explaining their discontinuation of use); however, overall smokers reported that snus was a poor substitute for their cigarettes.

Across all models, gender was only a significant predictor for perceptions of harmfulness of product "to others around you." Compared to males, females perceived cigarettes as more harmful to others around them; however, there were no differences for ATPs. Somewhat consistent with these results, a previous study of Norwegian adolescents showed that males perceived cigarettes and snus as less harmful than females did.[28] Although there are likely additional differences in perceptions of cigarettes/ATPs between males and females within the current sample, in regards to the current study's aims, gender did not independently predict other outcomes. We did not further examine differences between perceptions of products as a function of gender as it is beyond the scope of this paper.

This study has several limitations worth noting. First, we cannot make a direct comparison between snus use in this US-based study and other countries (eg, Scandinavian countries). Second, we have limited information about never users' perceptions during the sampling period in part because they could not provide feedback on a product they did not try. Third, the study was limited to smokers who were uninterested in quitting, and therefore, the results should not be generalized to all smokers. Fourth, participants were only informed of the manufactures' claim that snus and other ATPs provide lowered risk compared to cigarettes and not told about research also supporting this claim. Making this message clearer, which can be more easily done under different regulatory constraints, may have increased experimentation. These limitations are offset by study strengths, including a novel design of a longitudinal assessment of naturalistic use, among a group of unmotivated to quit smokers.

In conclusion, while several Scandinavian countries have experienced successful reduction in smoking prevalence and smoking-related illness, likely as a function of widespread snus use, this trend has not replicated in the United States. The present study provides further insight into low uptake of snus in the United States. Future research is needed to determine if other factors such as social acceptability and norms, and the influence of newer ATPs (eg, e-cigarettes) limit snus's acceptability among smokers.

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Declaration of Interests

EM, JLB, KMG, AJA, MJC, and AW have no competing interests to declare. KMC has received grant funding from the Pfizer, Inc., to study the impact of a hospital based tobacco cessation intervention. He also receives funding as an expert witness in litigation filed against the tobacco industry.

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