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Application of the Smokeless Tobacco Expectancies Questionnaire to Snus

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Abstract

Objective—Measures of consumer perceptions of emerging tobacco products are needed for understanding the potential for product adoption and use. The purpose of this research was to evaluate the applicability of the Smokeless Tobacco Expectancies questionnaire to snus, and examine its association with interest in using snus.

Methods—A web-based recruited 116 adolescents (14-17 years of age), 463 young adults (18-34 years of age), and 596 older adults (35-65 years of age) from a web-based opt-in panel. Participants completed a 10-item Snus Expectancies Questionnaire and questions about their interest in trying snus in the next month.

Results—Confirmatory factor analysis supported a latent factor structure representing Positive Reinforcement (PR) and Negative Health Consequences (NHC) within each age group. The scales differentiate smokers and smokeless tobacco users and nonusers. Each scale was associated with interest in purchasing snus for younger (PR: OR 1.90; NHC: OR 0.66) and older (PR: OR 1.36; NHC: OR 0.69) adults controlling for tobacco use status.

Conclusions—The modified Smokeless Tobacco Expectancies Questionnaire is a valid measure of snus-related outcome expectancies, which are in turn associated with self-reported tobacco use, and may help to identify groups who are susceptible to snus initiation and use.

Valid scales to measure consumer perceptions of emerging tobacco products have become an important tool to understand potential for product adoption and use, as well as to guide the development of tobacco control approaches. A significant category of tobacco product that has emerged in the U.S. market in recent years is Swedish-style smokeless tobacco or “snus.”^{1–3} Snus is a pasteurized form of smokeless tobacco, typically packaged in pouches

and used orally (commonly between the upper lip and gum). Switching completely to snus may have potential health benefits for combustible cigarette smokers who are unable to quit tobacco all together.⁴ Research from Sweden has shown that snus use is associated with an increased likelihood of cessation among current smokers and a reduced risk of becoming a daily smoker.^{5,6} In the US, the leading brand of snus is Camel Snus (CS), made by RJ Reynolds.^{3,7} It differs in substantial ways from Swedish snus, including nicotine and nitrosamine content.^{8,9} Burris and colleagues¹⁰ randomized smokers to use a 2-week supply of CS either to cope with smoking restrictions, or to specifically reduce smoking, and saw declines in smoking in both groups. One published randomized trial showed equivalent efficacy for cessation between CS and nicotine gum, though snus was associated with higher toxicant exposure (but still lower relative to cigarettes).⁴ In a naturalistic study, Carpenter and colleagues¹¹ randomized smokers to receive a 6-week supply of CS (versus nothing) and found that those receiving snus used it sparingly, and were less likely to make a quit attempt, though no difference in quit success was seen between the groups.

In order to estimate how consumers will likely respond to the marketing and availability of emerging tobacco products, including snus, it is helpful to have validated measures of consumer perceptions that are likely to be associated with uptake of these new and emerging products. Outcome expectancies are an important cognitive construct closely associated with substance use, initiation, and maintenance. According to outcome expectancy theory, behavioral choices are guided by motivations to (or not to) experience specific reinforcing effects.^{12–14} Individuals are more likely to engage in behaviors they expect to result in positive outcomes and less likely to engage in behaviors that result in negative outcomes. Expectancies are well established predictors of substance use and have consistently been strong predictors of smoking initiation,¹⁵ dependence,¹⁶ and relapse.¹⁷ Smoking expectancies have also been associated with quit intentions and predict smoking cessation.⁷ Despite the broad literature demonstrating a link between expectancies and tobacco use behavior, expectancies for various forms of smokeless tobacco products remain largely unstudied (see for exception^{18,19}).

Product expectancy measures that are specific to smokeless products are needed because those expectancies may be quite different than expectancies for cigarettes. To fill this gap, Gottlieb and colleagues developed the Smokeless Tobacco Expectancies Scale (STES).²⁰ Their research provided initial development and validation of 2 underlying expectancy constructs: Negative Health Consequences (NHC) and Positive Reinforcement (PR) associated with use. This research assessed smokeless tobacco generally; however, product-specific measures may be necessary because consumers may perceive conventional smokeless tobacco products, such as moist snuff, differently from snus.²¹ For example, Bahreinifar et al²⁰ conducted 8 focus groups among smokers and found that participants viewed snus as different from “chewing tobacco”, and Adkison et al²² found that perceptions of greater prevalence of smokeless tobacco use (typically associated with greater product use) were *inversely* associated with an interest in trying snus. Existing measures of snus expectancies^{18,19} were developed in the Scandinavian context, which may not reflect beliefs in North America, where views about snus are likely to be colored by traditional chewing tobacco and moist snuff. The current research seeks to establish the validity of the STES as it pertains to snus (Snus Expectancy Scale) among 3 groups: (1) adolescents aged

14-17 (age at which tobacco product uptake typically occurs), (2) young adults aged 18-34, and (3) older adults aged 35-65.

METHODS

Survey and Procedure

A web-based opt-in panel maintained by Global Market Insite²³ was used to recruit study participants and collect survey data over a 1-month period in 2014. Participants were invited to respond to the survey via email and were eligible if they were between the ages of 14 and 65 years and provided informed consent. GMI's "specialty youth panel" complies with the *Children's Online Privacy Protection Rule* (16 C.F.R. Part 312) and adolescents' parents were e-mailed a statement describing the risks and benefits of participation, compensation, and confidentiality prior to their child completing the survey. The original sample included 2695 adults (aged 18–65 years) and 306 adolescents (aged 14-17 years). Respondents were compensated 60 GMI "marketpoints" (20 marketpoints = \$1) for their time. The study protocol was approved by the Institutional Review Board at Roswell Park Cancer Institute, Buffalo, NY. The snus awareness and Snus Expectancy Scale items were completed prior to seeing any product advertisements. After seeing advertisements for Camel Snus and Camel Cigarettes, participants were asked to report which, of the products they had seen, they would be most interested in trying, and to rate their intention to purchase that product on a 0-10 scale.

Participants

Data from 116 adolescents (aged 14-17 years), 463 young adults (aged 18-34 years), and 596 older adults (aged 35-65 years) who responded "Yes" to the question "New types of smokeless tobacco products are now available that come in teabag-like pouches that are put in the mouth, under the lip. They do not involve chewing, spitting, or smoking. Have you heard of any products like this?" were included in this study.

Adolescent sample—Respondents were classified as "non-users" if they reported having never smoked a cigarette, even a few puffs, and reported having never used smokeless tobacco. "Smokers" were those who reported ever use of cigarettes, even just a few puffs, but reported having never used smokeless tobacco. "Smokeless tobacco users" were those who reported having used smokeless tobacco, regardless of cigarette use (all but 3 respondents reported having tried cigarettes at some point or were current smokers: results were similar whether these 3 respondents were included or excluded, so they are included).

Young adult and older adult sample—Respondents were classified as "non-users" if they reported not currently smoking cigarettes or using smokeless tobacco at all. "Smokers" were those who reported currently smoking cigarettes some days or every day, but not currently using smokeless tobacco products at all. "Smokeless tobacco users" were those who reported currently using smokeless tobacco some days or every day and may or may not currently use cigarettes (all but 7 reported dual use of cigarettes and smokeless tobacco: results were similar whether these 7 respondents were included or excluded, so they are included).

Measures

Snus expectancies—Respondents were administered a 10-item Snus Expectancies Scale that was adapted from the STES (See Table 2 for items).²⁰ The wording of each item was adjusted to ensure respondents were aware the questions were measuring perceptions about a particular smokeless tobacco product class (snus) rather than smokeless tobacco products more generally. Response options ranged from 1 'very unlikely' to 10 'very likely'.

Interest in trying snus—To gauge interest in snus as a product and as potential for use as a modified risk product, respondents were then shown ads for Camel cigarettes and Camel Snus and were asked “which of the products would you be most interested in trying?” Response options included: Camel Cigarettes, Camel Snus, None. Those who selected “Camel Snus” were coded as 1, all others were coded as 0 to create a dichotomous dependent variable for interest in snus. Following product selection, respondents who selected snus or cigarettes were also asked, “How likely are you to purchase Camel Snus in the next month?” on an eleven point (0-10) scale. Responses were dichotomized for analysis as 0 = ‘No chance (1)’ to ‘fair chance (4)’ vs 1 = ‘fairly good possibility (5)’ to ‘certain, practically certain (10)’.

Statistical Analyses

Confirmatory factor analysis (CFA) with maximum likelihood estimation using Amos 21 was employed to evaluate the latent factor structure of the measure. Goodness-of-fit for the CFA was assessed using the comparative fit index (CFI>0.95), root-mean-square error of approximation (RMSEA<0.08), Standardized root mean square residual (SRMR<0.09),²⁴ and minimum discrepancy (CMIN/DF<3).²⁴ Internal consistency (Cronbach's alpha) was analyzed using SPSS 21. ANOVA and t-tests were used to identify differences in scale scores for Negative Health Consequences and Positive Reinforcement for using snus by tobacco use status and to identify significant mean differences on the expectancy scales by reported interest in snus. Logistic regression was used to evaluate intent to purchase snus in the next 30 days. Each analysis controlled for race, sex, age, and tobacco use status where appropriate.

RESULTS

Demographic Characteristics

Demographic variables included age, sex, and race. Participant characteristics and tobacco use status for each sample are presented in Table 1.

Confirmatory Factor Analyses

Confirmatory factor analysis confirmed the latent factor structure for NHC and PR associated with snus use demonstrating that the data fit the model well. Model fit for each sample was within the acceptable range for most statistics (see Table 2). Consistent with Gottlieb et al²⁰ these data also produced RMSEA values above recommended values, but below the threshold for bad fit. Minimum discrepancy (chi-square/degree of freedom) was slightly above the recommended cutoff point for the young adult and older adult samples

though this was expected given the large sample size (typical in samples larger than 400; see Table 2). NHR and PR factor scores were uncorrelated ($r = .01$, $p = .782$).

Scale Reliability

Table 3 outlines the descriptive and reliability statistics for the snus expectancies scales. The scales demonstrated excellent reliability and generally each sample reported that the NHC of using snus were high (averaging 8 out of 10) compared with the PR (averaging 5 or 6 out of 10) associated with snus use.

Known Groups Validity

Tobacco use status—To establish known group validity, the subscale scores for NHC and PR associated with snus use were analyzed with ANOVA with tobacco user status as the fixed factor controlling for age, sex, and race. For the adolescent sample, differences by tobacco user status were present for both the PR ($F[2, 113] = 8.823$, $p < .001$, $\eta^2 = .143$) and NHC ($F[2, 113] = 10.959$, $p < .001$, $\eta^2 = .171$). Post hoc comparisons with the Tukey adjustment showed that non-users reported lower PR scores than ever users of cigarettes and smokeless tobacco. Ever users of smokeless tobacco reported significantly lower scores on the NHC scale than never users (Table 4).

Among the young adult sample, significant differences were present by tobacco use status for the PR ($F[2, 460] = 59.191$, $p < .001$, $\eta^2 = .211$) but not the NHC subscale ($F[2, 460] = 1.626$, $p = .198$, $\eta^2 = .007$). Post hoc comparisons showed that ever users reported significantly higher on the PR for snus than non-users and smokers and significantly lower NHC than non-users, but not for the smokers (Table 3).

Tobacco use status was also significantly associated with the scales among older adults (PR: $F[2, 595] = 30.276$, $p < .001$, $\eta^2 = .094$; NHC: $F[2, 595] = 10.030$, $p < .001$, $\eta^2 = 0.033$). Non-users rated the NHC as significantly higher than smokers and smokeless tobacco users and smokeless tobacco users rated the PR scale higher than nonusers and smokers. PR increased across age categories among nonusers and SLT users, but decreased among smokers across the 3 age categories (see Table 4).

Interest in trying snus—The selection of snus as the product that respondents were most interested in trying was low in this sample (Adolescents: 16%, Young Adults: 19%, Older Adults: 15%); those who were least interested were predominantly adolescents who had tried smokeless tobacco and adults who reported current use of smokeless tobacco. Among the adolescent sample, the NHC subscale differentiated between respondents who selected snus as the product most interested in trying and those who did not ($t(114) = 2.910$, $p = .004$), but the PR did not ($t(114) = 1.269$, $p = .207$). For the young adult sample, t-tests showed that those with lower NHC scores ($t(461) = 4.875$, $p < .001$), and higher PR ($t(211.92) = 6.55$, $p < .001$) were more likely to select snus as a product they were interested in trying.

The NHC and PR scores were also able to differentiate between those who expressed fairly 'good' to 'certain', rather than 'none' to 'fair', interest in product purchase within the next 30 days for both samples (Adolescents: NHC, ($t(114) = 4.25$, $p < .001$; PR, ($t(114) = 2.95$, $p < .$

001); Young Adult: (NHC, ($t(461) = 3.24$, $p = .001$); PR, ($t(435.47) = 15.49$, $p < .001$); Older Adult: (NHC, ($t(166.13) = 4.55$, $p < .001$); PR, ($t(213.32) = 9.81$, $p < .001$). After adjustment for race, sex, and tobacco user status, higher scores on the PR (Adolescent: OR: 1.37, 95% CI: 1.01, 1.84; Young Adult: OR: 1.65, 95% CI: 1.49, 2.09; Older Adult: OR: 1.36, 95% CI: 1.19, 1.56) was significantly associated with an increased intention to purchase snus, and higher scores on the NHC (Adolescent: OR: 0.57, 95% CI: 0.39, 0.82; Young Adult: OR: 0.67, 95% CI: 0.56, 0.82; Older Adult: OR: 0.69, 95% CI: 0.58, 0.81) was significantly associated with a decreased intention to purchase snus within the next 30 days.

DISCUSSION

The current research sought to validate the Smokeless Tobacco Expectancy Scale with respect to snus among a sample of adolescents, young adults, and older adults. The confirmatory factor analysis supported the underlying 2-factor structure representing Negative Health Consequences (NHC) and Positive Reinforcements (PR) associated with snus use and demonstrated discriminant validity between factors. Furthermore, the factors effectively discriminated between tobacco user subtypes, further supporting their validity. In addition, each scale was independently associated with an intention to purchase snus in the next 30 days while controlling for covariates. That the pattern of item loadings mirrors the prior work,²⁰ and is consistent with work on cigarette expectancies,^{12,13} suggests that adapting such expectancies measures to other emerging tobacco products such as electronic cigarettes, cigars, and hookah should be relatively straightforward and provide useful cross-product comparisons. Future research should develop appropriate measures and evaluate expectancies across tobacco product types and prospectively examine their predictive validity for product uptake.

While snus may present a substitute for other more dangerous tobacco products, the introduction of new smokeless tobacco products in the U.S. and other countries has generated concerns about possible unintended consequences. For example, marketing of snus as a safer alternative may result in product uptake among those who would not otherwise use any tobacco, or perhaps maintain tobacco use among those who might otherwise quit smoking, or encourage dual use of both snus and cigarettes. Consistent with previous research, we observed low level interest in snus among all age groups and tobacco user statuses, with the majority of interest among those who use smokeless tobacco. Whether snus becomes a viable option for harm reduction will depend on whether current tobacco users are able to completely switch to snus, while non-tobacco users refrain from initiating use of snus. This validated measure of snus expectancies may provide a tool for understanding factors that promote snus uptake, and so inform future harm reduction intervention efforts. For example, when Negative Health Consequences (NHC) are much higher than the Positive reinforcement (PR), then a given person would likely show little or no interest in the product (risk protection). In the current study, smokers, unlike, SLT users, showed relatively large differences between NHC and PR, suggesting that they are unlikely to switch to snus, which is consistent with existing literature,^{3,25} and thus indicating Snus may not be a practical option for widespread harm reduction.

A few limitations should be considered when interpreting the results of this research. First, this sample is taken from a web-based opt-in panel, not necessarily representing the population as a whole and therefore limiting the generalizability of these findings. Second, we do not have prospective data and cannot evaluate if product expectancies are associated future snus use. This is an important area for future research as new, more novel products enter the market. Despite these limitations, tobacco class-specific measures are necessary for understanding attitudes related to specific product adoption and use. As new products continue to enter the market, the addition of effective measures to evaluate attitudes and future use intentions are increasingly needed.

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Conflict of Interest Statement KMC has received grant funding from Pfizer, Inc. to study the impact of a hospital based tobacco cessation intervention, has served as an expert witness in litigation filed against the tobacco industry, reports paid and unpaid consultancies to South Carolina Tobacco-Free Collaborative, California Tobacco Control Program, Louisiana Tobacco Control Program, Yale University, FDA Center for Tobacco Products, Centers for Disease Control and Prevention, and International Association for the Study of Lung Cancer, and has received travel support from World Conference on Lung Cancer and Mayo Clinic/Pfizer. RJO is a member of the Tobacco Products Scientific Advisory Committee (TPSAC) of the Food and Drug Administration (FDA); any opinions expressed are his own and should not be imputed to TPSAC or FDA. RJO also reports travel support and consultancy from NIH, Connecticut Academy of Science and Engineering, RTI International, and speaking fees from Ohio State University. VWR reports consultancies with FDA CTP, Michigan State University, and University of Pittsburgh, and travel support from Hamad Medical Corp (International Conference on Waterpipe Smoking Research). DKH reports consultancies with FDA, Truth Initiative, Campaign for Tobacco Free Kids, Ohio State University, University of Vermont and Yale TCORS, and University of Connecticut, travel and speaking fees from several US academic institutions. DKH is also a member of WHO Study Group on Tobacco Product Regulation (TobReg).

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Table 1

Participant Demographics

	Adolescent (Age 14–17)	Young Adults (age 18–34)	Older Adults (age 35–65)
	(N = 116)	(N = 463)	(N = 596)
Sex			
Male	52.6	50.1	55.0
Female	47.4	49.9	45.0
Age ^a			
14 / 18–22 / 35–39	19.0	13.8	21.6
15 / 22–25 / 40–45	29.3	22.2	26.7
16 / 26–30 / 46–50	28.4	35.4	24.3
17 / 31–34 / 50–65	23.3	28.4	27.3
Race			
White	70.7	69.8	81.4
Hispanic	12.9	15.3	8.7
Black	8.6	6.9	3.7
Other	7.8	8.0	6.2
Tobacco Use Status ^b			
Non-user	41.4	15.6	34.1
Smoker	33.6	43.6	46.6
ST user	25.0	40.8	19.3

Note:

^a Adolescent sample age / young adult sample age / older adults sample age range;^b for the adolescent sample tobacco use status refers to “ever use” of cigarettes or smokeless tobacco while the adult samples refer to “current daily or non-daily use”

Table 2

Confirmatory Factor Analysis Model Fit Statistics for the Snus Expectancies Scale

	Adolescent	Young Adult	Older Adults
SRMR	0.027	0.035	0.026
CFI	0.978	0.977	0.980
TLI	0.971	0.970	0.974
RMSEA	0.087	0.085	0.078
CMIN/DF	1.861	4.362	4.636

Note.

Abbreviations: SRMR = Standardized root mean square residual; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root-mean-square error of approximation; CMIN/DF = minimum discrepancy

Table 3

Descriptive Statistics for the Snus Expectancies Scale

	Adolescents		Young Adults		Older Adults	
	Mean	SD	Mean	SD	Mean	SD
	$\alpha = 0.96$		$\alpha = 0.95$		$\alpha = 0.96$	
Negative Health Consequences	8.3	1.8	8.1	1.8	8.3	1.8
1. Snus will lead to gum disease.	8.2	2.0	8.1	2.1	8.3	1.9
2. Snus leads to nicotine addiction.	8.3	1.8	8.0	2.1	8.4	1.9
3. Snus negatively impacts your health.	8.3	1.8	8.0	1.9	8.3	2.0
4. Snus leads to discolored teeth.	8.3	2.0	8.0	2.0	8.4	1.9
5. Snus causes tooth decay.	8.3	2.0	8.1	2.0	8.2	2.0
Positive Reinforcement	5.1	2.9	6.0	2.8	5.0	2.7
	$\alpha = 0.95$		$\alpha = 0.96$		$\alpha = 0.94$	
6. Snus makes you feel content.	5.5	3.1	6.2	2.9	5.5	2.9
7. Snus causes time to go by faster.	5.2	3.3	6.1	3.1	5.0	3.1
8. Snus gives you energy.	4.8	3.2	5.9	3.1	4.8	3.1
9. Snus allows you to have more focus.	4.9	3.2	5.9	3.1	4.9	3.1
10. Snus keeps you busy.	5.2	3.3	6.2	3.0	5.1	3.0

Note: Scale range from 1 "Very Unlikely" to 10 "Very Likely"

α = Cronbach's alpha

Table 4

Estimated Marginal Means for Each Scale by Smoking Status

Factor	Nonusers	Smokers	SLT Users
Adolescent (N = 116)			
NHC	8.39	7.59	6.61
PR	4.51	7.24	6.07
Young Adult (N = 463)			
NHC	8.45	8.17	7.89
PR	5.29	5.33	7.48
Older Adults (N = 596)			
NHC	8.71	8.07	7.89
PR	5.22	5.33	7.48