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BRIEF REPORT

The Development and Psychometric Evaluation of the Smokeless Tobacco Expectancies Scale (STES)

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Expectancies regarding the effects of various psychoactive substances are important predictors of the initiation and maintenance of substance use. Although measures of outcome expectancies exist for several addictive substances, there is currently no measure to assess smokeless tobacco (ST) expectancies in an adult population. This article presents 2 studies leading to the development and psychometric evaluation of the Smokeless Tobacco Expectancies Scale (STES). Initially, 155 individuals listed all outcomes they expected to occur if they were to use ST products. From these responses, an initial pool of potential STES items was identified. The STES was then administered to 2 samples totaling 813 individuals (265 ST users, 270 cigarette smokers, and 278 nontobacco users). The first study included 315 participants who completed a 68-item measure. An exploratory factor analysis identified 10 items that may account for individuals' ST expectancies. Items loaded on 2 factors: Negative Health Consequences and Positive Reinforcement. A confirmatory factor analysis on an independent sample ($n = 498$) supported the proposed factor structure. Furthermore, in both samples, the STES accurately discriminated ST users from smokers and nonusers. Findings are discussed in terms of the potential uses of the STES for advancing the understanding of ST use.

Keywords: smokeless tobacco, expectancies, scale development, substance use

The use of tobacco products contributes to serious illness, including lung cancer, esophageal cancer, and heart disease (World Health Organization, 2001). Despite this fact, more than 70 million Americans continue to use these products each year (National Institute on Drug Abuse, 2009). Although cigarette smoking is the predominant form of tobacco use, approximately 8 million Americans report currently using smokeless tobacco (ST). Alarmingly, young adults use ST products at much higher rates than do older adults (National Institute on Drug Abuse, 2009).

Most of the recent ST research has focused on whether ST products are less harmful to an individual's health than cigarette smoking. However, most data suggest that switching to ST has little health benefit to tobacco consumers (Hecht & Hatsukami, 2005; Mejia, Ling, & Glantz, 2010; Tomar, Fox, & Severson, 2009). Despite the lack of personal health benefits of switching tobacco products, many individuals continue to believe that ST is less harmful than cigarette smoking. These beliefs, along with the fact that ST use appears to carry less stigma and is associated with more positive character traits compared to cigarette use (Kury, Rodrigue, & Perri, 1998), may contribute to the initiation and maintenance of ST use.

As with other addictive substances, individuals' beliefs about ST and its effects are potentially important, though few studies have investigated this construct as it relates to ST. In one study, Newman and Shell (2005) examined ST expectancy outcomes in a sample of high school students from rural Nebraska. Although the expectancy measure was created using standard methods, some items are specific to the rural community from which the participants came, limiting the generalizability of the measure to other populations. More recently, Wiium and Aaro (2011) investigated ST outcome expectancies in a Norwegian sample using a scale originally designed for nicotine replacement therapy (see Juliano & Brandon, 2004). This measure was adapted from a nicotine replacement therapy measure, however, and all items asked about snus, a form of ST that is popular in northern Europe (Zhu et al., 2009).

To date, no measure we are aware of has been developed to assess ST expectancy outcomes that can be generalized to a broad population of young adults. Although it may seem intuitive to simply adjust existing smoking measures, there are several key differences between cigarette smoking and ST use that argue otherwise. Perhaps most critically, ST use is not heavily restricted, and newer products, like snus, do not require the consumer to spit during use, making them easy to conceal. Further, many items included in smoking expectancy

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measures such as the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) are not relevant to ST users (e.g., "I like to watch the smoke from my cigarette").

The primary goals of the present studies were to develop a measure of ST expectancies and to determine the internal structure of these expectancies. We accomplished these goals using standard practices in scale development, including item generation by the target population and both exploratory and confirmatory factor analysis. We also sought to demonstrate initial reliability of the scale scores by showing that positive and negative expectancy subscales were able to discriminate between those who use and do not use ST products.

Method

An initial sample of 155 participants completed the first phase of this research, including 77 nonusers (49.6%), 42 smokers (27.1%), and 36 ST users (23.2%). As part of an in-class survey, we asked participants to construct a list of the positive and negative effects of ST use. Once participants no longer appeared to provide novel responses (across all usage statuses), we concluded this phase of data collection. These items were used to create a preliminary, 68-item version of the Smokeless Tobacco Expectancies Scale (STES).

In the subsequent phase of the study (Study 1), a second, independent sample of 315 undergraduate students (55.6% female) enrolled in General Psychology at a large public university participated to partially fulfill a course requirement. See Table 1 for complete demographic information.

Participants were recruited on the basis of their responses to a mass testing session conducted early in the academic term. Participants were prompted to select their tobacco use status from a variety of options (e.g., "Have you ever used smokeless tobacco?"). Nonusers were people who had never smoked a cigarette nor used any type of ST product during their lifetime. Cigarette smokers were those who reported trying one or more cigarettes during their lifetime or were current or former cigarette smokers but had never tried using ST. Smokeless tobacco users were identified as anyone who had tried ST, regardless of their cigarette smoking status, as there are few individuals who have tried smokeless tobacco but never smoked a cigarette.

We e-mailed roughly equal numbers of people in each usage group asking them to participate in this study. Our sample included 110 nonusers (34.9%), 104 cigarette smokers (33.0%), and 101 ST users (32.1%). Although self-report measures of substance use are not always the most precise method for determining use, studies have shown that self-report data correspond closely with more objective measures. Further, some research indicates that self-reports may be as accurate as other methods of assessing tobacco use (Harris et al., 2009).

Participants completed the initial 68-item version of the STES online and reported basic demographic characteristics (e.g., gender, age, and ethnicity) and tobacco use behavior (e.g., type of tobacco used, preferred brand). With regard to the STES, participants rated the likelihood that a ST user would experience each of the 68 outcomes using a 10-point Likert scale ranging from *very unlikely* (0) to *very likely* (9). Missing data were handled via listwise deletion.

For the confirmatory phase (Study 2), participants included 498 undergraduate students enrolled in General Psychology at the same large public university. This sample consisted of 168 nonusers (33.7%), 166 smokers (33.3%), and 164 ST users (32.9%). Recruitment procedures, criteria for categorizing tobacco use status, and procedures were identical to those in Study 1. Psychometric analysis included replication of the internal scale structure and tests of measurement invariance across gender and tobacco use status.

Results

Exploratory Factor Analysis

Data were submitted to a maximum likelihood exploratory factor analysis (EFA) using an equamax rotation with Kaiser normalization. Ten factors had eigenvalues greater than 1, and inspection of the scree plot indicated that a two-factor solution was

Table 1
Participant Demographics

Characteristic	Sample 1 (n = 155)	Sample 2 (n = 315)	Sample 3 (n = 498)	Combined (N = 968)
Gender, %				
Male	50.3	44.4	35.9	41.0
Female	49.7	55.6	64.1	59.0
Age, *M* (*SD*)	19.44 (1.76)	20.03 (2.16)	19.55 (3.45)	19.69 (2.86)
Race/ethnicity, %				
African American	2.6	5.4	6.0	5.3
Asian American	0.6	2.5	3.8	2.9
Caucasian	83.8	71.4	68.5	71.8
Hispanic	9.7	15.9	16.7	15.4
Native American	0.0	0.3	0.4	0.3
Biracial or other	3.2	4.5	4.6	4.4
Tobacco use status, %				
Nonusers	49.6	34.9	33.7	36.6
Smokers	27.1	33.0	33.3	32.2
ST users	23.2	32.1	32.9	31.2

Note. No significant differences were found between demographic groups across samples. ST = smokeless tobacco.

most appropriate for the data (accounting for 62.38% of the total variance). Other solutions were also tried; however, two factors provided the most parsimonious and interpretable structure. Items with factor loadings of at least 0.60 were retained, unless the item loaded highly on more than one factor (≥0.30). The resulting scale included 10 items across two factors that appear to represent people's expectations regarding: Negative Health Consequences and Positive Reinforcement (see Table 2).

Confirmatory Factor Analysis

We conducted a maximum-likelihood confirmatory factor analysis (CFA) using AMOS (Version 17; Arbuckle, 2008) on an independent sample (described above). In this model, two latent variables, representing each of the subscales, predicted each of the items on their respective subscales. This model replicated the structure of the EFA, this time with the model accounting for 69.39% of the total variance (see Table 2 for factor loadings). Fit for both the full model and individual subscales was determined by a combination of chi-square, root-mean-square error of approximation (RMSEA), standardized root-mean-square residual (SRMR), Tucker–Lewis index (TLI), and comparative fit index (CFI) fit indices (see Table 3). Fit indices are consistent with a good overall model fit, as well as for each subscale. We should note that the Negative Health Consequences and Positive Reinforcement subscale RMSEA values were above the recommended cutoff for good model fit but below the cutoff for poor fit.

Internal consistency estimates were obtained for the STES as well as the two subscales for each sample (Study 1/Study 2). The full scale showed good overall internal consistency (α = .79 [Study 1], .76 [Study 2]), as did the Negative Health Consequences subscale (α = .91/.93) and the Positive Reinforcement subscale (α = .87/.90). Further, the Negative Health Consequences and Positive Reinforcement factors were only weakly (negatively) correlated, $r(498) = -.17$, $p < .001$, consistent with the relative independence of these forms of ST use expectancies.

Measurement Invariance Across Gender and Tobacco Status

Multigroup CFAs utilizing the combined Study 1/Study 2 sample tested for invariance of factor loadings of the STES. Nested model comparisons indicated that the imposition of constraints that factor loadings be equal across gender groups did not significantly affect model fit, $\Delta\chi^2$ (8, N = 813) = 11.58, p = .171. For tobacco use status, equality constraints did result in a significant change in model chi-square, $\Delta\chi^2$ (16, N = 813) = 27.73, p = .034. However, fit indices differed by .002 or less across the unconstrained and constrained models (CFI = .976, .974; TLI = .969, .970; RMSEA = .038, .037). Follow-up pairwise model comparisons indicated that lack of measurement invariance was observed only between nonusers and smokers, $\Delta\chi^2$ (8, N = 813) = 21.032, p = .007, with fit indices differing by .003 or less. Invariance of factor loadings was supported when comparing ST users with either of the other two groups.

Table 3
CFA Fit Indices for the Smokeless Tobacco Expectancies Scale

Statistic	Negative Health Consequences	Positive Reinforcement	Full model
SRMR	.02	.02	.03
RMSEA	.09	.08	.06
TLI	.98	.98	.98
CFI	.99	.99	.99
χ^2 (*df*)	26.68 (5)	20.32 (5)	88.79 (34)

Note. n = 498. CFA = confirmatory factor analysis; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation; TLI = Tucker–Lewis index; CFI = confirmatory fit index.

Known Groups Validity

In both samples, each of the STES subscales was analyzed using a univariate analysis of variance (ANOVA) with tobacco use status as the predictor. In Study 1, differences between the groups were observed for both subscales (Negative Health Consequences, $F[2, 315] = 14.58$, $p < .001$, $\eta^2 = .09$; Positive Reinforcement, $F[2, 315] = 15.54$, $p < .05$, $\eta^2 = .02$). In Study 2, these results were replicated (Negative Health Consequences, $F[2, 498] = 18.80$, $p < .001$, $\eta^2 = .07$; Positive Reinforcement, $F[2, 498] = 121.42$, $p < .001$, $\eta^2 = .33$). Post hoc comparisons revealed that ST users significantly differed from the other two groups, with lower expectancies regarding negative health conse-

Table 2
EFA/CFA Factor Loadings for the Smokeless Tobacco Expectancies Scale

Item	Study 1/Study 2	NU	SK	ST
Factor 1: Negative Health Consequences				
Chewing tobacco will lead to gum disease	.82/.83	.81	.81	.85
Chewing tobacco leads to nicotine addiction	.73/.75	.87	.68	.64
Chewing tobacco negatively impacts your health	.87/.87	.96	.70	.87
Chewing tobacco leads to discolored teeth	.83/.92	.93	.93	.91
Chewing tobacco causes tooth decay	.83/.93	.96	.88	.92
Factor 2: Positive Reinforcement				
Chewing tobacco causes time to go by faster	.75/.80	.80	.70	.70
Chewing tobacco gives you energy	.87/.90	.91	.89	.74
Chewing tobacco allows you to have more focus	.90/.89	.89	.89	.72
Chewing tobacco makes you feel content	.60/.67	.51	.55	.59
Chewing tobacco keeps you busy	.61/.71	.59	.68	.54

Note. N = 813 (Study 1 n = 315, Study 2 n = 498). The last three columns represent the factor loadings in Study 2 for each subpopulation. EFA = exploratory factor analysis; CFA = confirmatory factor analysis; NU = nonusers; SK = smokers; ST = smokeless tobacco users.

Table 4
Mean (SE) Subscale Scores by Tobacco Use Status

Factor	Nonusers	Smokers	Chewers	Effect size
Study 1 (n = 315)				
Negative Health Consequences	7.79 (.14)$_a$	8.12 (.15)$_a$	7.01 (.15)$_b$	.09
Positive Reinforcement	3.49 (.21)$_a$	3.84 (.21)$_a$	4.25 (.21)$_b$	.02
Study 2 (n = 498)				
Negative Health Consequences	7.91 (.14)$_a$	8.12 (.14)$_a$	7.00 (.14)$_b$	.07
Positive Reinforcement	2.32 (.15)$_a$	3.25 (.15)$_b$	5.46 (.15)$_c$	.33

Note. Means in the same row that do not share the same subscript differ at $p < .05$.

quences of ST and higher expectancies of positive reinforcement of ST use (see Table 4).

Additionally, given that approximately 75% of the ST users surveyed were male, we conducted a 2 (gender) × 3 (tobacco use status) ANOVA on the data collected for Study 2 to ensure that the effects reported above were due to tobacco use status and not gender. Gender did not affect scores on either factor (Negative Health Consequences, $F[1, 498] = 2.42$, $p = .12$; Positive Reinforcement, $F[1, 498] = 0.99$, $p = .32$). The Gender × Tobacco Use Status interaction was not present for either subscale (Negative Health Consequences, $F[2, 498] = 1.27$, $p = .28$; Positive Reinforcement, $F[2, 498] = 0.407$, $p = .67$). Critically, the tobacco use status effects reported above remained.

Discussion

ST use is prevalent among young adults; however, little is known about the expectancies that young adults have regarding ST use. Current measures are limited in their generalizability. In this article, we present the development and psychometric evaluation of a measure that speaks to the content and structure of these beliefs that should be appropriate to a broad population of young adults. This measure has favorable psychometric properties, and initial data support the quality of the measure.

Because the items included in the STES were generated by members of the target population, the content should adequately reflect the nature of their ST use expectancies. We examined the structure of these expectancies using both exploratory and confirmatory factor analysis and found strong consistency across these approaches. In addition, the STES subscales demonstrated internal consistency and discriminated ST users from nonusers, providing initial support for the reliability of test scores. Thus, we believe that the STES is currently the most broadly applicable questionnaire designed to measure ST expectancies. See the Appendix for the final version of the STES.

Although this article provides evidence of sound psychometric properties of the STES as a measure of ST expectancies, this research is not without its limitations. First, the sample consisted of participants from one university, and tobacco use statuses were based on self-report. Although the demographics of the samples employed were similar to those of the target population (i.e., young adults), further research using the STES in diverse settings and samples would enhance to the measure's generalizability.

The STES proved successful in predicting ST use. Future research, however, should examine the relationship between STES scores and rates of usage as well as intentions to continue (or quit) use among ST users. Among nonusers, the STES may prove useful in predicting who will initiate ST use. Such studies would enhance the psychometric properties of the measure, increase the scope of its usage, and potentially lead to better interventions to prevent or help people quit using ST.

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Appendix

Smokeless Tobacco Expectancies Scale (STES)

Please respond to the following statements regarding how likely the following are to occur from using smokeless tobacco. Examples of smokeless tobacco include chewing tobacco, dip, snus, and nasal snuff.

0	1	2	3	4	5	6	7	8	9
Very unlikely									Very likely

_____ 1. Chewing tobacco will lead to gum disease.

_____ 2. Chewing tobacco leads to nicotine addiction.

_____ 3. Chewing tobacco negatively impacts your health.

_____ 4. Chewing tobacco leads to discolored teeth.

_____ 5. Chewing tobacco causes tooth decay.

_____ 6. Chewing tobacco makes you feel content.

_____ 7. Chewing tobacco causes time to go by faster.

_____ 8. Chewing tobacco gives you energy.

_____ 9. Chewing tobacco allows you to have more focus.

_____ 10. Chewing tobacco keeps you busy.

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