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Measuring nicotine dependence among smokeless tobacco users

Janet L. Thomas [a,*], Jon O. Ebbert [b], Christi A. Patten [c], Lowell C. Dale [b], Carrie A. Bronars [d], Darrell R. Schroeder [e]

[a] *University of Kansas Medical Center, Department of Preventive Medicine and Public Health, 3901 Rainbow Boulevard, Kansas City, KS 66160, United States*

[b] *Nicotine Research Program, Mayo Clinic College of Medicine, United States*

[c] *Department of Psychiatry and Psychology, Mayo Clinic, United States*

[d] *University of Kansas, Department of Psychology, United States*

[e] *Division of Biostatistics; Mayo Clinic College of Medicine, United States*

Abstract

The objective of this study was to assess the concurrent validity of the FTQ-ST and the DIS-IV diagnosis of nicotine dependence among 68 adult ST users enrolled in a randomized, controlled clinical trial of bupropion SR. FTQ-ST scores were not found to differ between those with and without a current DIS-IV diagnosis of nicotine dependence (7.4 ± 2.1 vs. 6.8 ± 2.8, $P = 0.325$). For all possible FTQ-ST cutoff scores, the observed agreement between the FTQ-ST and the DIS-IV was not found to be different from that expected due to chance. FTQ-ST total scores were positively correlated with serum cotinine (Spearman's $r = 0.40$, $P < 0.001$), amount of tobacco used ($r = 0.51$ and $r = 0.41$ for average dips/chews per day; average tins/pouches per week, respectively, $P < 0.001$), and a reduced likelihood of abstinence at 3 months (OR = 0.76, 95% C.I. 0.61–0.96; $P = 0.019$). Participants meeting DIS-IV criteria had lower cotinine concentrations than those without this diagnosis (411 ± 263 ng/ml vs. 493 ± 246 ng/ml; $P = 0.042$). Poor concordance was observed between the FTQ-ST and the DIS-IV in the assessment of nicotine dependence in ST users.

Keywords: Tobacco; Smokeless; Nicotine dependence; Tobacco use cessation; DIS-IV

* Corresponding author. Tel.: +1 913 588 1568; fax: +1 913 588 2780.
E-mail address: jthomas2@kumc.edu (J.L. Thomas).

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1. Introduction

Smokeless tobacco (ST) is a known human carcinogen (National Toxicology Program of the U.S. Department of Health and Human Services, 2002). An estimated 7.3 million U.S. individuals older than 12 years of age (3.2% of total population) are current ST users (Substance Abuse and Mental Health Services Administration, 2002). Although the majority of current ST users desire to quit (Severson, 1992), high rates of relapse are observed when ST users attempt to quit (Hatsukami, Jensen, Allen, Grillo, & Bliss, 1996). Unfortunately, most pharmacologic or behavioral treatment intervention trials have not been shown to be effective for ST users (Ebbert et al., 2003). The paucity of effective treatments available for ST users may reflect our limited understanding of nicotine dependence among this select group.

Measures commonly used to assess nicotine dependence among *cigarette smokers* include the Fagerström Tolerance Questionnaire (FTQ) (Fagerström, 1978), and the interviewer-administered Nicotine Dependence Module of the Diagnostic Interview Schedule (DIS) (Robins et al., 1999). Several studies comparing the Fagerström questionnaires with the DIS among cigarette smokers have observed weak correlations (Breslau & Johnson, 2000; Hughes, Gust, & Pechacek, 1987; Marks, Pomerleau, & Pomerleau, 1998; Moolchan et al., 2002). Most recently, in a retrospective chart review study, Moolchan et al. (2002) examined the association between the FTND and the DIS nicotine dependence criteria among 370 cigarette smokers. These authors observed little or no beyond-chance agreement between the two measures and concluded that the Fagerström and the DIS "appear to measure different aspects of the tobacco dependence process." While the DIS emphasizes adverse consequences of tobacco use and failed quit attempts, the FTQ highlights frequency of use and difficulty refraining from use. Further, the DIS is administered as a structured clinical interview and the FTQ is completed as a self-report measure. Thus, the DIS and the FTQ may be assessing different constructs or dimensions associated with nicotine dependence in cigarette smokers; however, no prior investigations have examined the use of these two common measures of nicotine dependence in ST users.

Thus, in order to further our understanding of nicotine dependence among ST users, in this study, we examined demographic, psychosocial and tobacco-related variables associated with FTQ-ST scores and criteria for nicotine dependence as detailed in the fourth edition of the DIS interview (DIS-IV-ND). We also assessed the concurrent validity of the FTQ-ST and the DIS-IV-ND and examined the association of each measure with 3- and 6-month abstinence outcomes among ST users.

2. Research design and methods

2.1. Participants

Eligible participants ($N=68$) were enrolled in a randomized, double-blind, placebo-controlled pilot study of bupropion SR for the treatment of ST use (Dale et al., 2002). This study was approved by the Mayo Foundation Institutional Review Board.

2.2. Procedure

During the baseline assessment visit, participants completed the FTQ-ST, the DIS-IV Nicotine Dependence Module, and measures of demographic, tobacco-related and psychosocial variables. Serum

samples for nicotine and cotinine were collected. Subjects were randomly assigned to receive bupropion SR 150 mg twice per day (one tablet once a day for three days and then one twice per day) or an identical-appearing placebo for 3 months. Self-reported tobacco abstinence at 3- and 6-month follow-up was biochemically confirmed.

2.3. Measures

2.3.1. Fagerström Tolerance Questionnaire Modified for ST users (FTQ-ST)

To assess dependence in ST users, Boyle and colleagues modified the FTQ and developed a 9-item scale designed to address nicotine dependence among ST users [FTQ-ST] (Boyle, Jensen, Hatsukami, & Severson, 1995). This self-rated questionnaire has a total possible score of 13 with a higher score indicating greater nicotine dependence.

2.3.2. Diagnostic Interview Schedule–fourth edition (DIS-IV)

The Nicotine Dependence Module of the DIS-IV (Robins et al., 1999) is a structured interview which provides reliable and valid psychiatric diagnoses of nicotine dependence based on the DSM-IV criteria (American Psychiatric Association, 1994). The DIS-IV assesses the presence of a diagnosis of nicotine dependence in the past year (i.e., current) and a lifetime history of nicotine dependence. In the current study, the DIS-IV was administered by trained interviewers.

2.3.3. Positive and Negative Affect Scales (PANAS)

The PANAS is a 20-item self-report questionnaire assessing the general dimensions of positive and negative affect (Watson, Clark, & Tellegen, 1988). Each of 10 positive-affect and 10 negative-affect items is rated on a 5-point Likert scale from 0 (very slightly) to 5 (very much). Higher negative-affect subscale scores reflect more distress, while lower scores are associated with calmness and serenity (Becona, Vasquez, Fuentes, & Lorenzo, 1999; Watson et al., 1988).

2.3.4. Self-Administered Alcohol Screening Test

The SAAST is a 35-item instrument designed to be used as a screening test for current alcohol dependence (Davis, 2000; Swenson & Morse, 1975). A score of 7 or more indicates possible alcohol dependence (Davis, Jr., Hurt, Morse, & O'Brien, 1987; Hurt, Morse, & Swenson, 1980).

2.3.5. Tobacco use outcomes

Tobacco use outcomes were defined using biochemically confirmed 7-day point-prevalence abstinence rates. Subjects were biochemically confirmed to be tobacco abstinent if their urine cotinine concentrations were <50 ng/mL.

2.4. Statistical analyses

Using DIS-IV diagnostic criteria, subjects were classified according to the presence or absence of nicotine dependence. The FTQ-ST total score was calculated using published guidelines (Boyle et al., 1995). Demographic characteristic, tobacco use characteristics, cotinine concentrations, and PANAS and SAAST scores were compared between those with and without a current diagnosis of nicotine

dependence using the Mann–Whitney *U* test, and associations of these variables with FTQ-ST total scores were assessed using a Spearman's rank correlation.

To assess the concurrent validity of the two measures of nicotine dependence, the FTQ-ST total scores and individual item responses were compared between those with and without a current diagnosis of nicotine dependence using the Mann–Whitney *U* test and the Mantel–Haenszel Chi-square test. To further assess the potential degree of agreement between DIS-IV and FTQ-ST, a series of 2×2 tables were created for nicotine dependence using cutoff scores for FTQ-ST ranging from 4 to 12. For each cutoff score the overall percentage agreement was calculated as well as the kappa coefficient (κ) and corresponding 95% confidence interval (Fleiss, Cohen, & Everitt, 1969).

Logistic regression (LR) analyses were used to assess whether the FTQ-ST and the DIS-IV were associated with biochemically confirmed point prevalence tobacco abstinence at the end of the medication phase of the trial (week 12) and at 6 months following randomization. LR was performed separately for each measure and using a model that included both measures simultaneously. For these LR models, biochemically confirmed point prevalence tobacco abstinence was the dependent variable and treatment group (bupropion SR vs. placebo) was included as a covariate. In all cases, two-sided tests were used with *P*-values less than or equal to 0.05 considered statistically significant.

3. Results

3.1. Participants

Subjects consisted of 68 (67 male, 1 female) ST users. All subjects were Caucasian and the median age was 32 years (range = 24 to 72 years) (Table 1).

3.2. DIS-IV

Based upon the DIS-IV, 32 (47%) subjects had a diagnosis of current nicotine dependence (i.e., prior 12-month period), 12 (18%) met criteria for a lifetime history of nicotine dependence but not current, and 24 (35%) had no lifetime diagnosis of nicotine dependence (Table 1). Consistent with previous investigations (Moolchan et al., 2002), subjects not meeting diagnostic criteria for current nicotine dependence were combined into a single category. Unexpectedly, subjects meeting diagnostic criteria had 1) *fewer* years of regular tobacco use, 2) reported keeping one dip/chew was in the mouth for *less* time, and 3) had *lower* baseline serum cotinine concentrations as compared to those without current nicotine dependence according to the DIS-IV criteria. In addition, positive affect (PANAS) was significantly higher in those with, versus without, current nicotine dependence by the DIS-IV. The average amount of tobacco used per week did not differ significantly between those with and without a current diagnosis of nicotine dependence.

3.3. FTQ-ST

The mean ± S.D. FTQ-ST score was 7.1 ± 2.5 (median = 7, range = 3 to 12). FTQ-ST total score was positively correlated with the amount of tobacco used and with serum nicotine and cotinine concentrations (Table 2).

Table 1
Baseline demographics and tobacco use characteristics of 68 smokeless tobacco users enrolled in a randomized, controlled aid-to-cessation clinical trial of bupropion SR

Characteristic	Total sample	Current nicotine dependence by the DIS-IV		
	Mean ± S.D.	No (N=36)	Yes (N=32)	Mann–Whitney
		Mean ± S.D.	Mean ± S.D.	U Test p-value
	Median (range)	Median (range)	Median (range)	
Age	36.5 ± 12.5	40.2 ± 15.1	32.3 ± 6.9	0.016
	32 (24 to 79)	34 (25 to 79)	30 (24 to 50)	
Average minutes one plug/dip in mouth[a]	82.9 ± 131.9	87.8 ± 101.1	77.5 ± 161.3	0.049
	45 (10 to 930)[a]	60 (10 to 560)	35 (15 to 930)[a]	
Average use in past 6 months, dips/chews per day	13.3 ± 10.5	11.0 ± 6.5	15.9 ± 13.3	0.092
	11 (3 to 70)	10 (3 to 25)	12 (5 to 70)	
Average use in past 6 months, tins/pouches per week	3.3 ± 2.1	3.3 ± 2.4	3.3 ± 1.9	0.567
	3.0 (1 to 11)	2.8 (1 to 11)	3.0 (1 to 8)	
Years of regular ST use	17.1 ± 11.4	20.2 ± 14.0	13.6 ± 5.9	0.024
	14 (3 to 63)	15.5 (8 to 63)	12 (3 to 25)	
Serum nicotine[b] (ng/mL)	23 ± 11	24 ± 12	22 ± 10	0.590
	22 (7 to 48)	22 (6 to 48)	22 (8 to 42)	
Serum cotinine (ng/mL)	454 ± 256	493 ± 246	411 ± 263	0.042
	402 (102 to 1230)	435 (106 to 1130)	320 (102 to 1230)	
*Number of serious stop attempts[c] (%)				0.160
0	18	25	9	
1–2	41	39	44	
3–4	19	11	28	
5+	22	25	19	
*Longest duration of abstinence[c] (%)				0.661
<24 h	8	9	6	
1–7 days	25	24	25	
2–8 weeks	25	27	44	
9 weeks–6 months	23	27	19	
>6 months	9	12	6	
*PANAS[d]				
Positive Affect	30.7 ± 7.1	29.0 ± 7.1	32.6 ± 6.7	0.045
	32 (14 to 44)	30 (14 to 42)	34 (18 to 44)	
Negative Affect	15.2 ± 5.5	14.3 ± 5.3	16.1 ± 5.7	0.057
	14 (10 to 34)	12 (10 to 32)	14 (10 to 34)	
*SAAST[e] (%)				1.000
≤6	89	88	90	
≥7	11	12	10	

*Categorical variables are presented as percentages.

[a] For subjects reporting consistently leaving tobacco in mouth and adding to it throughout the day, time corresponds to approximate hours awake.

[b] Data were missing for 4 subjects (3 with and 1 without DIS-IV Current Nicotine Dependence).

[c] Data were collected categorically. For analysis purposes, ordinal variables were created using the response categories specified and compared between groups using the Mann–Whitney U test. Data for longest time off tobacco were not available for 3 subjects without DIS-IV Current Nicotine Dependence.

[d] Data for the Positive and Negative Affect Scales (PANAS) were not available for 2 subjects (1 with and 1 without DIS-IV Current Nicotine Dependence).

[e] Data for the Self-Administered Alcoholism Screening Test (SAAST) were not available for 4 subjects (2 with and 2 without DIS-IV Current Nicotine Dependence).

Table 2
Association between baseline demographics and tobacco use characteristics with the FTQ ST of 68 smokeless tobacco users enrolled in a randomized, controlled aid-to-cessation clinical trial of bupropion SR

Characteristic	Spearman's rank correlation[a]	
	r	*P*
Age (years)	0.09	0.469
Average minutes one plug/dip in mouth	0.03	0.800
Average use in past 6 months, dips/chews per day	0.51	<0.001
Average use in past 6 months, tins/pouches per week	0.41	<0.001
Years of regular ST use	0.21	0.082
Serum nicotine concentration (ng/mL)	0.32	0.010
Serum cotinine concentration (ng/mL)	0.40	<0.001
Number of serious stop attempts[b]	−0.08	0.533
Longest duration of tobacco abstinenceb	−0.13	0.289
PANAS—Positive Affect	0.13	0.309
PANAS—Negative Affect	−0.04	0.739
SAAST[b]	0.14	0.258

[a] $N=68$ for all characteristics with the exception of serum nicotine concentration ($n=64$), longest time off tobacco ($n=65$), PANAS ($n=66$), and SAAST ($N=64$).
[b] Characteristic was analyzed as an ordinal variable as described in Table 1.

3.4. DIS-IV and FTQ-ST

FTQ-ST total score and individual item scores did not differ significantly between those with and without current nicotine dependence as assessed by the DIS-IV (Table 3). Using cutoff scores for FTQ-ST ranging from 4 to 12, the maximum percentage agreement between FTQ-ST and DIS-IV was found using the cutoff of FTQ-ST ≥ 8 (overall percentage agreement=60%; $\kappa=+0.20$, 95% C.I. −0.03 to +0.44). However, for all possible FTQ-ST cutoff scores, the observed agreement between the FTQ-ST and the DIS-IV was not found to be significantly different from that expected due to chance.

Of the 68 subjects enrolled, 34 were assigned to each treatment group (active or placebo bupropion SR). The percentage of subjects with current nicotine dependence by the DIS-IV was identical for each treatment group (47%), and FTQ-ST scores were similar between groups (7.2 ± 2.4 vs. 7.1 ± 2.7, active vs. placebo, respectively, $p=0.758$). At the end of the medication phase of the trial (week 12), the biochemically confirmed 7-day point-prevalence tobacco abstinence rate was 44% (15/34) for those on bupropion SR and 26% (9/34) for those on placebo. Higher FTQ-ST total score was associated with a reduced likelihood of tobacco abstinence at 3 months (OR=0.76 for each unit increase, 95% CI 0.61 to 0.96; $P=0.019$) (Table 4). Tobacco abstinence also tended to be lower in those with a current DIS-IV diagnosis of nicotine dependence compared to those without this diagnosis (OR=0.54, 95% CI 0.19 to 1.51; $p=0.238$). At 6 months following randomization, the biochemically confirmed 7-day point-prevalence tobacco abstinence rate was 29% (10/34) for each treatment group. Neither measure of nicotine dependence was found to be significantly predictive of tobacco abstinence at 6 months (Table 4). However, findings were directionally consistent with higher FTQ-ST total scores associated with a reduced likelihood of tobacco abstinence at 6 months, and tobacco abstinence being lower in those with a current DIS-IV diagnosis of nicotine dependence compared to those without this diagnosis. When both nicotine dependence measures were assessed simultaneously in a multiple logistic regression model, the

Table 3
FTQ-ST total score and item responses for 68 smokeless tobacco users enrolled in a randomized, controlled aid-to-cessation clinical trial of bupropion SR

Characteristic	Overall	Stratified according to DIS-IV Current Nicotine Dependence		
		No ($N=36$)	Yes ($N=32$)	P-value[a]
FTQ-ST				0.262
Mean ± S.D.	7.1 ± 2.5	6.8 ± 2.8	7.4 ± 2.1	
Median (range)	7 (3–12)	7 (3–12)	8 (3–11)	
How soon after waking do you have your first chew?				0.374
0–30	37	42	31	
>30	63	58	69	
Do you find it difficult to refrain from chewing in situations where it would be inappropriate?				0.684
Yes	59	61	56	
No	41	39	44	
Do you chew when you are so ill you remain in bed?				0.684
Yes	59	61	56	
No	41	39	44	
Nicotine content of chew or snuff				0.560
Low	3	6	0	
Medium	29	28	31	
High	53	67	69	
Number of tins/pouches used per week				0.621
2 or fewer	32	31	34	
>2 and <4	40	39	41	
4+	28	31	25	
How often do you swallow your tobacco juice rather than spit?				0.591
Never	29	31	28	
Sometimes	32	25	41	
Always	38	44	31	
Do you chew more in the morning than the rest of the day?				0.206
Yes	13	8	19	
No	87	92	81	
Which chew would be the hardest to give up?				0.069
Morning	71	61	81	
Any other	29	39	19	
What is the length of the dipping day?				0.289
≤14.5 h	31	33	28	
14.5 to 15.5 h	25	31	19	
>15.5 h	44	36	53	

Entries are percentages unless otherwise indicated.

[a] Total FTQ-ST score was compared between groups using the Mann–Whitney U test. Individual items were compared using the Mantel–Haenszel χ^2.

Table 4
Association of nicotine dependence measures with tobacco abstinence among 68 smokeless tobacco users enrolled in a randomized, controlled aid-to-cessation clinical trial of bupropion SR

Logistic regression models[a]	Odds ratio	95% CI	*P*-value
Predicting abstinence at 3 months (end of treatment)			
Model 1			
DIS-IV Current Nicotine Dependence	0.54	(0.19, 1.51)	0.238
Bupropion SR	2.23	(0.80, 6.25)	0.123
Model 2			
FTQ-ST total score[b]	0.76	(0.61, 0.96)	0.019
Bupropion	2.50	(0.80, 6.25)	0.098
Model 3			
DIS-IV Current Nicotine Dependence	0.61	(0.21, 1.81)	0.373
FTQ-ST total scoreb	0.77	(0.62, 0.97)	0.026
Bupropion SR	2.53	(0.85, 7.52)	0.096
Predicting abstinence at 6 months			
Model 1			
DIS-IV Current Nicotine Dependence	0.67	(0.23, 1.92)	0.453
Bupropion SR	1.00	(0.35, 2.85)	1.000
Model 2			
FTQ-ST total scoreb	0.86	(0.69, 1.06)	0.158
Bupropion	1.03	(0.36, 2.97)	0.964
Model 3			
DIS-IV Current Nicotine Dependence	0.73	(0.25, 2.16)	0.572
FTQ-ST total scoreb	0.86	(0.69, 1.07)	0.186
Bupropion SR	1.03	(0.36, 2.99)	0.957

[a] The biochemically confirmed 7-day point-prevalence tobacco abstinence rate at the end of treatment (week 12) was 44% (15/34) for those on bupropion SR and 26% (9/34) for those on placebo. At 6 months following randomization, the abstinence rate was 29% (10/34) for both groups. For both end of treatment and 6-month outcomes, logistic regression analyses were performed separately for each nicotine dependence measure (Model 1 and Model 2) and also using a model that included both measures simultaneously (Model 3). In all cases, biochemically confirmed tobacco abstinence was the dependent variable and treatment group (bupropion SR vs. placebo) was included as a covariate.

[b] FTQ-ST total score was treated as a continuous variable, thus the odds ratio presented for this measure corresponds to that associated with a one-unit increase in FTQ-ST total score.

estimated odds ratios were similar to those found when the measures were assessed in separate models (Table 4).

4. Discussion

We observed that among ST users neither FTQ-ST total scores nor individual item scores differed significantly between those with and without a DIS-IV diagnosis of nicotine dependence. For all possible FTQ-ST score cutoffs, the observed agreement between these two measures was not found to be significantly different from chance. However, the FTQ-ST was associated with a statistically significant reduced likelihood of tobacco cessation at 3 months while the DIS-IV was not. The finding that the FTQ-ST and the DIS demonstrated poor concordance supported our a priori hypothesis based upon

similar findings reported in the cigarette smoking literature. Investigators examining these measures among cigarette smokers (e.g., (Breslau and Johnson, 2000; Hughes et al., 1987; Marks et al., 1998; Moolchan et al., 2002) have also observed little or no beyond-chance agreement between the two measures. These findings address a gap in the tobacco control literature related to the assessment of nicotine dependence among ST users by providing information on the concurrent validity of two measures of nicotine dependence among ST users participating in a tobacco cessation intervention.

Less than half of the participants (47%) met DIS-IV criteria for nicotine dependence during the prior 12-month period and only 65% met lifetime, but not current, criteria for dependence. In contrast, prior observations among cigarette smokers in the general population indicate that between 50–80% meet criteria for current nicotine dependence (American Psychiatric Association, 1994). These results were surprising given that all participants voluntarily enrolled in a study to help them quit ST and 82% reported at least one prior, unsuccessful quit attempt. Thus, it was assumed that they would meet criteria for "nicotine dependence". Further, based on the established smoking literature, we hypothesized that number of years of tobacco use, amount used per day, cotinine concentrations, negative affect and alcohol use problems would be positively correlated with dependence. However, subjects meeting DIS-determined diagnostic criteria for current dependence had *fewer* years of regular tobacco use, kept the plug/dip in their mouth for *less* time and had *lower* levels of blood cotinine than those not meeting criteria for dependence. Further, no difference was identified in the amount of tobacco used between those meeting DIS-IV criteria vs. not. In comparison, total scores on the FTQ-ST were positively correlated with cotinine and amount of tobacco used but not other variables. These results are expected given that the FTQ-ST contains items that assess amount of tobacco used and supports prior research in cigarette smokers (Moolchan et al., 2002).

Our data also supports prior literature suggesting that questionnaires based on the Fagerström may be more reliable predictors of abstinence from tobacco than the DIS criteria. In our study, only the FTQ-ST predicted tobacco abstinence at 3 months. However, neither the FTQ-ST nor the DIS-IV predicted abstinence at 6 months. These results share some similarities with those reported by Breslau and Johnson (2000). Although they reported that both the DIS and the FTQ predicted abstinence at 2 years among cigarette smokers, DIS determined nicotine dependence was not as effective a predictor as was the Fagerstrom measure.

Our findings suggest that the FTQ-ST and the DIS-IV may measure different aspects of nicotine dependence and supports the observation that a universal set of criteria for nicotine dependence may not exist (Colby et al., 2000). Although official committees have issued a series of definitions for nicotine dependence (American Psychiatric Association, 1987, 2000; World Health Organization, 1992), these are not mutually consistent, universally accepted, or derived from addiction theory (Colby, Tiffany, Shiffman, & Niaura, 2000; Edwards & Gross, 1976; Hughes, 1998; Rounsaville, Spitzer, & Williams, 1986). A recent review of measures of nicotine dependence concluded "...the field lacks a widely accepted, theoretically derived, and psychometrically sound research tool for evaluating Nicotine Dependence" (Colby et al., 2000, p. 36). Without consensus over what constitutes nicotine dependence, concordance between disparate measures should be anticipated.

In conclusion, as suggested by previous authors in relation to cigarette smokers (Moolchan et al., 2002), our results suggest that multiple instruments should be used to assess tobacco dependence in ST users. However, several limitations of this investigation should be considered when interpreting the results. First, the small sample size limits our statistical power for the logistic regression analyses assessing predictive validity of the dependence measures at longer time points. Future researchers are

encouraged to utilize larger samples to attempt to replicate these findings. Second, almost the entire sample was composed of Caucasian male participants actively seeking treatment for ST use. Although the racial composition is reflective of both our local population and ST users nationally (Office of Applied Studies of the Substance Abuse and Mental Health Services Administration, 1998), this limits generalizability. Although males have higher ST use rates than females in the general U.S. population, some subgroups of females in the U.S. have particularly high rates of ST use. For example, the prevalence of current ST use among adult Alaska Native women is markedly higher than among women in the general U.S. population (50% vs. 0.7%) (U.S. Department of Health and Human Services, 1986). Finally, the intention of this study was to examine the concurrent validity of the FTQ-ST with the DIS-IV criteria. Future studies are suggested to examine the utility of recently developed ST assessment tools include the Smokeless Tobacco Behavioral Questionnaire (Glover, Nilsson, Westin, & Glover, 2002) and the Smokeless Tobacco Dependence Scale (Severson, Akers, Andrews, & Boles, 2003).

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