

Predictors of Smokeless Tobacco Cessation Among Telephone Quitline Participants

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Background: The prevalence of smokeless tobacco use in the U.S. is increasing and its use is a risk factor for a number of adverse health outcomes. Currently, there is limited evidence on the effectiveness of quitlines for tobacco cessation among smokeless tobacco users.

Purpose: To examine factors related to tobacco abstinence among exclusive smokeless tobacco users registering for services with the Oklahoma Tobacco Helpline.

Methods: Participants included 959 male exclusive smokeless tobacco users registering with the Helpline between 2004 and 2012; a total of 374 completed a follow-up survey 7 months post-registration. Data were collected between 2004 and 2013 and included baseline data at Helpline registration, services received, and 7-month follow-up for 30-day point-prevalence for tobacco abstinence. Univariate and multiple logistic regression examined associations between abstinence and participant characteristics, intensity of Helpline intervention, and behavioral factors. ORs and 95% CIs were reported. Analyses were completed in 2013.

Results: At the 7-month follow-up, 43% of the participants reported 30-day abstinence from tobacco. Each additional completed Helpline call increased the likelihood of tobacco cessation by 20% (OR=1.20, 95% CI=1.05, 1.38). Smokeless tobacco users with higher levels of motivation to quit at baseline were twice as likely to be abstinent than those with low or moderate levels of motivation (OR=2.05, 95% CI=1.25, 3.35). Use of nicotine replacement therapy was not associated with abstinence when adjusted for Helpline calls, income, and level of motivation.

Conclusions: Tobacco quitlines offer an effective intervention to increase smokeless tobacco abstinence. (Am J Prev Med 2015;48(1S1):S54–S60) © 2015 American Journal of Preventive Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

Introduction

Despite decreases in smoking prevalence, an estimated 8.7 million U.S. adults use smokeless tobacco (ST).¹ The prevalence of ST use in some states is as high as 9.8% and approximately 13.4% of men in Oklahoma are ST users.² ST use is associated with a number of ill health effects ranging from oral lesions to diabetes, cardiovascular disease, and cancers of the oral cavity, esophagus, pancreas, and lung.³ According to the 1986 Surgeon General's Report,⁴ ST use can result in nicotine addiction. In response to smoking restrictions, concerns about secondhand smoke, and the overall

decline in cigarette consumption, leading cigarette manufacturers have acquired some of the ST companies, enhanced their marketing of ST products,⁵ and introduced new ST products designed to offer a less harmful, more convenient, and socially acceptable alternative to smoking.^{6,7} The increasing prevalence of ST use,^{2,8} its association with serious health consequences, and growing concern about emerging smokeless products call for the development and implementation of effective strategies to prevent the initiation of ST use and encourage ST cessation.

The 2008 update to *Treating Tobacco Dependence Use and Dependence*,⁹ also known as the Clinical Practice Guideline, identified the need for additional research related to the effectiveness of behavioral counseling and pharmacotherapy for the treatment of nicotine dependence among ST users. There are a limited number of published studies focused on ST cessation. Most of these studies are RCTs, assessing the effect of pharmacologic and behavioral interventions on ST cessation.^{9–16} These

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studies report limited effectiveness of pharmacologic interventions.¹⁰ However, there has been inconsistent evidence of a positive impact of various behavioral interventions, including telephone-based counseling, on ST cessation.⁹ A recent meta-analysis of published studies reported quit rates among ST users at 12 months between 10.2% and 34.5% for behavioral interventions.¹⁰

Telephone quitlines have become an integral part of state tobacco control programs over the past 20 years, and their effectiveness in assisting smokers to quit cigarette smoking is well established.^{9,17} These professionally run quitlines reportedly enhance 12-month abstinence by up to 30% among smokers.¹⁸ There are a number of factors related to smoking abstinence among quitline participants. Previously conducted research focused on smokers utilizing state quitlines identified the following factors associated with abstinence: previous quit attempts, tobacco consumption, stage of change, number of quitline sessions, and nicotine replacement therapy (NRT).^{19,20} Compared to cigarette smokers, quitline services are not aggressively marketed to ST users. Currently, there is insufficient evidence on the effectiveness of quitline intervention for ST users. This study examines the relationships among sociodemographics, tobacco use history, intrinsic and extrinsic behavioral factors, and the probability of tobacco abstinence among exclusive ST users registering for services with the Oklahoma Tobacco Helpline.

Methods

Eligible participants for this study were 959 male exclusive ST users²¹ who registered with the Oklahoma Tobacco Helpline between March 2004 and June 2012. The focus of this analysis was the 39% of these individuals (374) who completed a follow-up evaluation survey 7 months postregistration. Other eligibility criteria included English-speaking, aged ≥ 18 years and older, at least one intervention call completed, consent for follow-up, and private residence. The Oklahoma Tobacco Helpline, established in 2003, is a free statewide tobacco-cessation quitline operated by Alere Wellbeing, Inc., and funded by the Oklahoma Tobacco Settlement Endowment Trust, Oklahoma State Department of Health, Oklahoma Health Care Authority, and Oklahoma Employees Group Insurance Board. Services include mailed self-help materials, telephone counseling, a variety of U.S. Food and Drug Administration–approved tobacco-cessation medications, online support, and referral to community resources. Readiness to quit, participant preferences, and insurance status determine the level of intervention received from the Helpline. During the study period, eligibility criteria for services changed. From 2003 through 2010, all tobacco users were eligible for the multiple-call intervention and up to 8 weeks of NRT. Beginning in 2011, tobacco users with private insurance were only eligible for the single-call program and 2 weeks of NRT. State employees with HealthChoice insurance continued to be eligible for more intensive services through an arrangement with the Oklahoma Employees Group

Insurance Board. Thus, ST users in this study may have received a single call or multiple call intervention, and anywhere from 0 to 8 weeks of NRT from the Helpline. The nicotine lozenge, as well as patch and gum, were available to ST users enrolled in the Helpline.

Longitudinal data from 374 exclusive ST users who completed the 7-month follow-up survey were used for this analysis. Data were collected from 2004 to 2013, and came from the participants' Helpline registration records, which included sociodemographic factors, tobacco use behavioral factors, and presence of any chronic disease. Sociodemographic factors included age, sex, race, area of residence, education level, and annual income. Behavioral factors were divided into two main categories: intrinsic and extrinsic factors. Intrinsic factors were composed of tobacco use characteristics (nicotine dependence, time to first chew, years of tobacco use, number of cans/pouches per week, number of past quit attempts, and length of the longest past quit attempt) and readiness to quit, which was measured by level of motivation to quit (low to moderate or high) and level of confidence to quit (low to moderate or high). Levels of motivation and confidence to quit were measured as ordinal scales (ranging from 1 to 10) and these responses were categorized as low to moderate (1–7) or high (8–10). For measuring nicotine dependence, an approach similar to heaviness of smoking index was used where time to first chew/dip and number of cans/pouches of ST per week were used to classify dependence as light, moderate, or heavy.²² Extrinsic factors consisted of access to tobacco and social influence factors (family influence, home smoking policy, and around smokers at home or at work). Information regarding Helpline interventions, such as the number of completed Helpline calls (one to five calls) and NRT provided by the quitline (no NRT and 2, 4, and 8 weeks) was also obtained from the Helpline services delivery database.

Study participants completed a follow-up evaluation phone survey at 7 months post-registration. The 7-month follow-up survey was administered by the external evaluator of the Helpline, using a standardized protocol²³ and trained survey staff. Participants for the follow-up survey were randomly selected and mailed a pre-notification letter. Up to 15 attempts were made by telephone to complete the survey. Thirty-day tobacco point-prevalence quit rates were based on the respondent's self-report of being tobacco free for the last 30 days or more at the time of the 7-month survey. This study was approved by the University of Oklahoma IRB (IRB No. 2616).

Exploratory univariate analysis of all the variables in the study was performed to obtain descriptive statistics. In order to evaluate the association between 30-day abstinence and various explanatory variables, logistic regression analyses were performed to obtain crude and adjusted ORs. These analyses were performed in three steps. First, the univariate association of individual factors with the abstinence was analyzed. Variables associated with 30-day abstinence at a significance level of 0.05 from simple logistic regression were used in the multivariate analysis. Multiple logistic regression analysis was performed separately for the aforementioned variable groupings, sociodemographic factors, intrinsic and extrinsic behavioral factors, and quitline interventions. A stepwise selection procedure with a significance level of 0.10 was applied to find a parsimonious solution to the association between abstinence and predictor variables in each model. Finally, the variables obtained from the multiple logistic regression analysis of the aforementioned categories were evaluated together. Confounding and effect

modification were checked for the variables that were significantly associated with 30-day abstinence. All analyses were conducted in 2013 using SAS, version 9.2 (SAS Institute Inc., Cary NC), and a level of 0.05 was used for statistical significance. ORs and 95% CIs are reported.

Results

Among the 374 ST users in this study who completed the 7-month follow-up, 162 (43%) reported 30-day abstinence. The mean age of the sample was 41.3 (SD=13.2) years, and the majority of the participants were white (83%). Nearly two thirds (61%) of participants used ST products for at least 20 years, 68% used three or more cans/pouches of ST products per week, and 89% attempted to quit tobacco use in the past. This group had a high level of motivation (73%) and high level of confidence to quit (53%) at registration. The mean number of completed scheduled Helpline calls was 2.4 (SD=1.5), and >85% received NRT for either 2-4 weeks (65%) or 8 weeks (20%). An intent-to-treat analysis was applied to the total sample of 959 ST users who registered for services between 2004 and 2012, resulting in a 15% quit rate.

Results of the univariate analysis demonstrated that individuals with higher income were 1.74 times more likely to quit tobacco use compared to participants with

lower income (Table 1). No other significant association was observed between sociodemographic factors and tobacco abstinence. Behavioral factors were analyzed in two groups, intrinsic and extrinsic factors, to find their association with tobacco abstinence (Table 2). For the extrinsic factors, there was no association with tobacco cessation. Univariate analysis of the intrinsic behavioral factors showed that the participants who had a higher level of motivation at baseline were twice as likely to be abstinent at the 7-month follow-up.

The stepwise selection procedure in multiple logistic regression analysis retained level of motivation as the significant predictor of tobacco abstinence among intrinsic and extrinsic behavioral factors. There was no interaction between income and the level of motivation ($p=0.703$). The results of the multivariate analysis showed that both level of motivation and income remained significantly associated with abstinence (OR=2.10, 95% CI=1.17, 3.75 and OR=1.79, 95% CI=1.04, 3.09, respectively).

The univariate analysis of the Helpline interventions showed a moderately strong positive association between number of completed scheduled calls and tobacco abstinence (Tables 3 and 4). Each additional completed Helpline call resulted in a 20% increase in the likelihood of tobacco cessation (OR=1.20, 95% CI: 1.04, 1.38).

When Helpline calls were categorized as a two-level factor, ST users who completed more than one call were 1.77 times more likely to quit tobacco use as compared to those who completed a single call. The majority of the participants (85%) received NRT from the Helpline (Table 3). Findings of the univariate analysis demonstrated that tobacco abstinence exhibited a positive NRT gradient: ST users who received 8 weeks of NRT were more likely to quit tobacco compared to non-NRT users. However, there was no statistically significant difference in abstinence rates between those who received 2-4 weeks of NRT and non-NRT users (crude OR=1.30, 95% CI=0.70, 2.43, Table 4).

Two-way interactions between Helpline interventions, income, and level of motivation

Table 1. Thirty-day abstinence rates at the 7-month follow-up and crude association with sociodemographic characteristics (N=374)

Variable	30-day abstinence from tobacco		
	Yes n (%)	No n (%)	OR (95% CI)
Race			
White	136 (43.6)	176 (56.4)	1.13 (0.64, 1.98)
Other	24 (40.7)	35 (59.3)	ref
Area of residence			
Urban	87 (42.2)	119 (57.8)	0.93 (0.62, 1.41)
Rural	73 (44.0)	93 (56.0)	ref
Marital status			
Single/separated	47 (39.2)	73 (60.8)	ref
Married	115 (45.6)	137 (54.4)	1.30 (0.84, 2.03)
Education level			
High school or less	61 (43.0)	81 (57.0)	ref
Some college or more	101 (43.9)	129 (56.1)	1.04 (0.68, 1.59)
Annual income (\$)			
<20,000	28 (32.9)	57 (67.1)	ref
≥20,000	124 (46.1)	145 (53.9)	1.74 (1.04, 2.90)

Table 2. Thirty-day abstinence rates at the 7-month follow-up and crude association with intrinsic and extrinsic behavioral factors

Variable	30-day abstinence from tobacco		
	Yes n (%)	No n (%)	OR (95% CI)
Intrinsic factors			
Nicotine dependence			
Light	43 (44.6)	59 (57.8)	ref
Moderate	85 (42.5)	115 (57.5)	1.02 (0.63, 1.66)
Heavy	33 (45.8)	39 (54.2)	1.16 (0.63, 2.13)
Time to first chew (minutes)			
≤5	51 (43.2)	67 (57.8)	ref
6–30	54 (43.2)	71 (57.8)	1.00 (0.60, 1.66)
31–60	26 (42.6)	35 (57.4)	0.98 (0.52, 1.82)
>60	30 (43.5)	39 (56.5)	1.01 (0.55, 1.84)
Cans/pouches per week			
≤1 or	12 (54.5)	10 (45.5)	ref
2–3	62 (41.3)	88 (58.7)	0.59 (0.24, 1.44)
>3	88 (43.6)	114 (56.4)	0.64 (0.27, 1.56)
Years of ST use			
<20	62 (43.7)	80 (56.4)	ref
≥20	95 (43.0)	126 (57.0)	1.03 (0.67, 1.57)
Number of past quit attempts			
0	17 (42.5)	23 (57.5)	ref
1	35 (42.2)	48 (57.8)	0.99 (0.46, 2.12)
2–5	75 (42.6)	101 (57.4)	1.00 (0.50, 2.01)
≥6	26 (48.1)	28 (51.8)	1.26 (0.55, 2.86)
Length of longest quit attempt (months)			
<1	46 (39.3)	71 (60.7)	ref
≥1	39 (43.3)	51 (56.7)	1.18 (0.68, 2.06)
Level of motivation			
Low to moderate	21 (29.2)	51 (70.8)	ref
High	129 (47.4)	143 (52.6)	2.19 (1.25, 3.84)
Level of confidence			
Low to moderate	48 (39.3)	74 (60.7)	ref
High	94 (47.0)	106 (53.0)	1.37 (0.86, 2.16)
Presence of chronic disease			
Yes	21 (45.6)	25 (54.4)	1.11 (0.60, 2.07)
No	141 (43.0)	187 (57.0)	ref

(continued on next page)

were evaluated; no significant interaction was observed among these variables. However, there was confounding between NRT and other variables. Therefore, the observed positive overall association between NRT and tobacco abstinence did not remain significant when the model was corrected for level of motivation, income, and number of completed scheduled calls. Results of the multivariate analysis indicated that level of motivation, income, and Helpline calls were strong predictors of tobacco abstinence when adjusted for each other (Table 4).

Discussion

Among male ST users who enrolled in the Oklahoma Tobacco Helpline and completed a 7-month follow-up survey, 43% reported tobacco abstinence for at least 30 days. This respondent quit rate of 43% is based on 39% of all ST quitline callers completing the 7-month follow-up survey. Using an intent-to-treat approach to the calculation of the quit rate, where non-respondents are included in the denominator, results are more conservative with an estimated quit rate of 15%. Even this conservative estimate is within the range of quit rates (9.6%–40.4%) reported by other ST cessation studies.¹⁰ Rates of abstinence among ST users in this study were higher than reported in previous studies that employed other behavioral interventions such as self-help, dental clinic behavioral treatment, and group support.^{10,24}

Although a number of studies have been conducted to assess the effectiveness of interventions for ST cessation, limited research has been conducted to identify the predictors of ST cessation.^{13,25} This is the first study to identify the

Table 2. Thirty-day abstinence rates at the 7-month follow-up and crude association with intrinsic and extrinsic behavioral factors (continued)

Variable	30-day abstinence from tobacco		
	Yes n (%)	No n (%)	OR (95% CI)
Extrinsic factors			
Influence of family to quit			
Yes	65 (43.1)	86 (56.9)	1.07 (0.70, 1.63)
No	93 (44.7)	115 (55.3)	ref
Home smoking policy			
Not allowed	144 (45.3)	174 (54.7)	1.54 (0.79, 3.00)
Allowed	15 (34.9)	28 (65.1)	ref
Around smokers at work or at home			
Yes	67 (46.2)	78 (53.8)	ref
No	52 (46.4)	60 (53.6)	1.00 (0.62, 1.65)

ST, smokeless tobacco.

predictors of tobacco abstinence among ST users registering with a state quitline, and it examined a broader range of determinants of tobacco abstinence among ST users.

Behavioral interventions have been shown to be effective in tobacco abstinence among ST users.^{9-12,14-16} Telephone counseling is used as one of the behavioral interventions for tobacco cessation. There is experimental evidence of its efficacy in tobacco cessation, as the results of RCTs of ST users have reported higher rates of abstinence among ST users who were enrolled in telephone-based

Table 3. Association between helpline interventions and 30-day abstinence from tobacco (N=374)

Helpline interventions	30-day abstinence from tobacco		
	Yes n (%)	No n (%)	χ^2 (p-value)
Number of completed scheduled helpline calls			9.66 (0.046)
1	57 (35.4)	104 (64.6)	
2	30 (46.1)	35 (53.9)	
3	25 (52.1)	23 (47.9)	
4	19 (42.2)	26 (57.8)	
5	31 (56.4)	24 (43.6)	
NRT from the helpline			8.22 (0.016)
No NRT	18 (34.6)	34 (65.4)	
2-4 weeks	100 (40.8)	145 (59.2)	
8 weeks	44 (57.1)	33 (42.9)	

NRT, nicotine replacement therapy.

counseling.^{11,12,15} Telephone-based services for tobacco cessation are an integral part of comprehensive tobacco control programs in the U.S., but their effectiveness with ST users who are quitline participants has not been previously reported. The number of completed quitline calls has been found to be one of the determinants of successful tobacco cessation among smokers.²⁶ Similar to the findings for smokers, the results of the current study also indicated that a greater number of completed quitline calls by ST users resulted in higher rates of tobacco abstinence at the 7-month follow-up. These findings are worth noting, as ST users who enroll in telephone quitline benefit from the completion of quitline calls irrespective of their

baseline level of motivation.

The effectiveness of NRT for smoking cessation has been well established, but such effectiveness has not been demonstrated in ST users.^{9,10} Similarly, this study did not find a significant contribution of NRT in tobacco abstinence among ST quitline participants, after controlling for level of motivation, income, and the number of completed Helpline calls. These findings are consistent with those of previously conducted ST cessation research.¹⁰ The majority of the participants (85%) obtained some NRT from the Helpline, and findings of the univariate analysis demonstrated more favorable outcomes along the NRT gradient, but the results of the multivariate analysis could not validate this association. However, these findings should be cautiously interpreted, as there was a significant difference in the sample size across different levels of NRT and the study did not examine the role of different types of NRT in tobacco cessation. These findings call for careful evaluation of the role of NRT in tobacco cessation among ST users.

Social influence factors contribute to tobacco cessation, but high levels of self-efficacy and a positive attitude toward quitting are associated with higher rates of cessation success.²⁷ The present study found high level of motivation at

Table 4. Crude and adjusted association between helpline interventions and 30-day abstinence from tobacco (N=374)

Helpline interventions	30-day abstinence from tobacco	
	Crude OR (95% CI)	Adjusted OR (95% CI) ^a
Number of completed scheduled helpline calls		
1		ref
≥2	1.77 (1.16, 2.70)	1.97 (1.32, 2.93)
Nicotine replacement therapy		
No		ref
2–4 weeks	1.30 (0.70, 2.43)	1.04 (0.51, 2.15)
8 weeks	2.52 (1.22, 5.22)	1.90 (0.78, 4.59)
Level of motivation		
Low to moderate		ref
High	2.19 (1.25, 3.84)	2.05 (1.25, 3.35)
Annual income (\$)		
<20,000		ref
≥20,000	1.74 (1.04, 2.90)	2.19 (1.36, 3.53)

^aAdjusted for number of completed scheduled helpline calls, annual income, and level of motivation at baseline.

registration to be a strong predictor of tobacco abstinence. These results highlight the role of self-efficacy in tobacco cessation among ST users. There was no confounding between level of motivation and number of Helpline calls; therefore, the effects of these factors on tobacco abstinence are independent of each other. According to the Integrative Model of Behavioral Prediction, if number of quitline calls is considered an explicit behavioral social influence, even ST users with lower self-efficacy can benefit from the quitline calls.²⁸

Study findings indicate a significant association between annual income and tobacco abstinence. When adjusted for level of motivation and quitline calls, ST users who had annual income >\$20,000 were twice as likely to quit tobacco. However, we did not find any significant associations between other sociodemographic factors and tobacco use characteristics with tobacco abstinence in this group.

This study has some limitations. Main study findings are based on the 39% of ST quitline callers who completed the 7-month follow-up survey. As a result, study findings may be prone to selection bias. All participants were male ST users, and the majority of them were white. The stages of behavior change as conceptualized by the stages of change model is a significant predictor of smoking cessation.²⁹ Most of the participants of the current study were in contemplation phase at the time of Helpline

registration and are assumed to have a high likelihood of progressing to the action stage with delivery of the intervention. Demographic characteristics and the stage of behavior change of the participants of the current study distinguish them from the ST users in the general population; thus, the results may not be generalizable. Data regarding behavioral factors were missing for some participants, ranging from <1% for sociodemographic factors to >10% for some of the behavioral factors. Data for the motivation level were missing for 9% of the participants. These missing data might introduce bias; however, analysis of the missing data

showed that there was no statistically significant difference in the pattern of missing data for other study variables, such as tobacco abstinence and number of completed Helpline calls. Thus, the authors assume the data were missing completely at random, having minimal effect on the findings. Another potential limitation in the study is not biochemically verified abstinence. Self-reporting of tobacco abstinence is typical in quitline studies and has been shown to be accurate.³⁰ The effect of NRT on tobacco abstinence was evaluated by administrative data (i.e., NRT provided by the quitline). Other information such as NRT compliance and information regarding the use of NRT from other sources was not obtained. However, evaluation reports of state tobacco quitline services utilize similar proxy variables to assess the effect of NRT on tobacco cessation among quitline participants.³¹

In conclusion, this study suggests that telephone counseling delivered through a state quitline is an effective strategy for exclusive ST users wanting to quit tobacco. The study identifies important factors that are predictors of tobacco abstinence among ST users participating in a state quitline, such as motivation to quit, income, and the number of completed calls. However, based on the findings of the current study and evidence from past research, the significance of NRT for tobacco cessation among ST users remains inconclusive.

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