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Factors Associated with Smokeless Tobacco Cessation in an Appalachian Population

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Abstract

Identifying factors associated with successful tobacco quit attempts may help in the development and targeting of effective cessation strategies. This paper aims to describe factors associated with smokeless tobacco (ST) cessation and compares the results to findings in the smoking cessation literature. Prospective data on 116 men aged 19 to 70 and participating in a ST cessation program were used to examine correlates of successful ST cessation at 1 year post-intervention. Controlling for age, level of education ($p = 0.002$) and daily coffee consumption ($p = 0.005$) had significant independent associations with successful cessation. No ST use variables were significant predictors of cessation success. In a multivariable logistic regression model three factors were significantly associated with cessation: education ($p = 0.010$), coffee consumption ($p = 0.019$), and age ($p = 0.029$). Factors associated with successful ST cessation in this sample are consistent with predictors of smoking cessation reported in the literature. Based on its widespread use and the strength of its association with successful quitting, the role of caffeine consumption in ST cessation merits further study.

Keywords

smokeless tobacco; tobacco cessation; Appalachian; rural

1. Introduction

According to recent estimates 6.1% of American men and 0.4% of American women report having used smokeless tobacco (ST) products in the past month (SAMHSA, 2006). Use of ST is highest among the young and those living in rural areas (Nelson et al., 2006). National Health Interview Survey estimates from 2000 indicate that the prevalence of ST use among adult men 18–24 and 25–44 years old (5.0% and 5.8%, respectively) was greater than that among 45–64 year olds (3.1%) or those 65 and older (2.8%; Nelson et al., 2006). There is also regional

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variation in ST use, with higher use among adults in the South and Midwest, particularly in the tobacco-growing Appalachian region (Nelson et al., 2006; Wewers et al., 2000).

Since the mid-1980s use of ST in the U.S. has been in decline (Nelson et al., 2006). Despite this trend, recent developments have positioned ST products to make a comeback. Tobacco companies are promoting ST products as an alternative to smoking when faced with public bans (Henningfield, Rose, & Giovino, 2002), and are also looking to capitalize on recent efforts to promote ST as a harm reduction product (USST, 2003). While evidence indicates that ST use is unlikely to lead to smoking (O'Connor, Kozlowski, Flaherty, & Edwards, 2005), the potential for increased use is still troubling. The negative health consequences of ST use are abundant and well documented. Use of ST products increases the risk of oral pathologies, cardiovascular disease, and several types of cancer (Hatsukami & Severson, 1999; Hecht, 2006; USHHS, 1986). These problems are compounded by nicotine dependence, which can make ST cessation a challenge once the behavior is initiated (USHHS, 1986). In light of these facts, the need for effective ST cessation methods is evident.

Traditionally, the issue of smokeless tobacco has been overshadowed by the larger problem of cigarettes. Consequently tobacco control efforts have focused on smoking cessation. Unfortunately, it remains unclear to what extent studies of smoking can be applied to smokeless tobacco use. Tobacco products including ST and cigarettes are, essentially, nicotine delivery products (Benowitz & Henningfield, 1994); however the nicotine uptake rates and dose delivered are different for the two types of products and distinct neurological responses have been demonstrated in an animal model (Alford et al., 2006; USHHS, 1986). The ways in which these distinct exposure profiles impact tobacco dependence and cessation have yet to be fully explored.

An understanding of the cessation process is important for the development of effective cessation programs. Much work has been done to examine factors related to successful cessation among cigarette smokers, including the study of sociodemographic variables, tobacco use characteristics, and use of other drugs including alcohol and caffeine (Fernandez et al., 1997; Hegaard, Kjaergaard, Moller, Wachmann, & Ottesen, 2003; Olsen, 1993; Osler & Prescott, 1998; Shiffman & Balabanis, 1995; van Loon, Tijhuis, Surtees, & Ormel, 2005; Westmaas & Langsam, 2005). This study examines the distribution of these factors in a sample of ST users attempting to quit tobacco use to determine which factors are associated with successful cessation. Additionally, we compare these results to previous studies among cigarette smokers to gauge the degree to which findings among studies of cigarette smokers may be generalized to ST users.

2. Methods

2.1 Design and Procedures

The data analyzed were collected during a pilot study to test the feasibility of a smokeless tobacco cessation intervention. All participants were residents of a single south-central Ohio county, part of the Appalachian region. Recruitment was carried out by local research staff who invited individuals to take part in the cessation protocol. Inclusion criteria were that the participant be an English-speaking male, aged 18 or older, currently reporting daily ST use. Subjects were excluded from the study if they had conditions contraindicating the use of nicotine replacement therapy, and each provided informed written consent before taking part in the study. All study procedures were approved by the institutional review board of The Ohio State University.

Once enrolled, subjects received a dental health examination, during which the dentist strongly advised them to quit ST use. Following the exam, participants received a cessation intervention

based on the Treating Tobacco Use and Dependence guideline (Fiore et al., 2000). Briefly, the intervention was composed of two components. The behavioral component consisted of six face-to-face sessions with a trained lay health advisor from the county where the study was conducted. Participants also received nicotine replacement therapy (NRT) as a pharmacological aid for cessation. A nicotine patch (21 mg) was worn daily for eight weeks to help reduce cravings and other withdrawal symptomatology.

A total of 116 men were enrolled in the study and completed the interview at baseline. Men were surveyed again and smokeless tobacco abstinence was evaluated at 12 months post-intervention. As data on prolonged abstinence were unavailable, successful cessation was defined as a self-report of no tobacco use during the previous 7 days, confirmed by salivary cotinine levels ≤ 14 ng/mL (SRNT Subcommittee on Biochemical Verification, 2002). The study had a high retention rate, with 94% of the men completing the study. Intent to treat analysis was utilized and individuals not providing a saliva sample for cotinine assessment at 12 months were assumed to have continued using smokeless tobacco.

2.2 Questionnaire

During the interviews at baseline and 12 months participants self-reported demographic information including their age, race, education, occupation, income, and marital status. Participants were also asked about the methods by which they paid for and received medical care. Questions relating to ST usage surveyed the participants' age at first use, years of ST use, and type of product used, as well as inquiring about tobacco use by their social network. The Smokeless Tobacco Dependence Scale and a Decisional Balance Scale, modified to address smokeless tobacco use, were also included (Severson, 1997; Velicer, DiClemente, Prochaska, & Brandenburg, 1985). The Decisional Balance Scale consisted of two subscales; a 10-item "pro" subscale evaluating aspects of tobacco use the participant viewed as positive (e.g., "Tobacco use is pleasurable.") and a 10-item "con" subscale evaluating negative aspects of ST use (e.g., "Others close to me would suffer if I became ill from tobacco use."). A decisional balance score was calculated by subtracting the con score from the pro score, with higher scores indicating more favorable views of tobacco use (Velicer et al., 1985). Participants were asked to report their alcohol and coffee consumption. Depression was measured using the CES-D and the Perceived Social Stress scale was used to gauge the degree to which participants considered their lives stressful (Cohen, Kamarck, & Mermelstein, 1983; Radloff, 1977). To ensure validity of the outcome measure, smokeless tobacco usage was assessed using a nicotine biomarker. The concentration of cotinine in saliva collected from the participant at baseline and follow-up was measured using a standard protocol (Hariharan & VanNoord, 1991). Unlike cigarettes which come in natural units, variations in ST products and individual use patterns (e.g. size of "pinch") make quantifying ST consumption a challenge, therefore tertiles of baseline cotinine level were used to categorize a participant's level of tobacco usage prior to the intervention.

2.3 Statistical Methods

Quit rates, the percentage of individuals abstaining from ST use at follow-up, were calculated for groups defined by variables of interest. Age adjusted odds ratios (OR) and 95% confidence intervals were calculated for each group by fitting a logistic regression model containing age and the grouping variable.

A multiple logistic regression model was used to identify the factors most strongly associated with successful ST cessation. The model was built using forward selection of variables, including variables with significant Wald test p-values ($p < 0.05$). Due to the relatively small number of successful quitters, care was taken to ensure that the model was appropriately fit. Continuous variables were checked for linearity in the logit, and second-order terms were added

or variables categorized when necessary. Model stability was evaluated by examination of the standard errors of the coefficients at each stage of the model building process, and overall model fit was assessed using the Hosmer-Lemeshow goodness-of-fit test (Hosmer & Lemeshow, 1980). Data were analyzed using SAS v9.1 (SAS Institute Inc., Cary, NC).

3. Results

Data from 116 men, ages 19 to 70, were analyzed for this study. Sample demographics, alcohol use, and coffee consumption are presented in the first column of Table 1. Since the county is more than 90% white (U.S. Census Bureau, 2006), and ST use is highest among whites (Nelson et al., 2006), the sample was almost exclusively white. At baseline most of the men used ST only (86.2%), however a few also used cigarettes (13.8%). A total of 25 men (21.6%) were identified as being biochemically abstinent from tobacco at 12 months post-intervention. The distribution of demographic factors among quitters is presented in the second column of Table 1 along with quit rates and ORs for quitting, adjusting for age.

Quit rates increased with increasing age, ranging from 3.5% among men under 30 to 33.3% among men over 50. Controlling for age, men who were married or cohabiting had higher quit rates than those who did not, though the difference was not statistically significant (OR = 1.91, 95% CI: 0.57–6.35). Level of education was strongly associated with successful cessation ($p = 0.0023$) after controlling for age. Men with more than a high school education had more than 7 times the odds of quitting compared with their less-educated counterparts, controlling for differences in age (OR = 7.40, 95% CI: 2.04–26.88). Alcohol consumption was not associated with cessation in this population (OR = 1.00, 95% CI: 0.40–2.53), however quit rates for individuals who drank 1–2 servings of coffee per day (44.0%) and those who did not drink coffee (19.7%) were much greater than those for those who drank three or more servings daily (6.7%).

The impact of healthcare access on ST cessation was also examined. A majority of men (82.8%) paid for healthcare through private insurance or a plan provided by an employer (data not shown). The remainder paid for medical care through Medicaid (1.7%), Medicare (3.4%), or self-paid for services (12.1%). All 25 men who successfully quit tobacco use had private medical insurance or insurance provided by an employer. Of this group, 26.0% were confirmed tobacco abstainers at the 12-month follow-up. Due to perfect separation of the outcome within insurance categories, this relationship was not examined in the logistic regression models. Most of the men (81.9%) usually received medical care from a doctor's office or clinic, with the remainder utilizing the emergency room (8.6%), urgent care (4.3%), or another source (5.2%). Twenty-four (24) of the 25 men who quit ST received their care from a doctor's office or health clinic. The quit rate was 25.3% among this group.

The distribution of tobacco use related variables in the sample is outlined in Table 2. Age at first ST use was observed to be positively correlated with successful cessation, increasing from a 12% quit rate in individuals initiating before the age of 10 to more than 30% among those starting at age 18 or older. Age at first use was not, however, a significant predictor of successful cessation when controlling for age at intervention ($p = 0.5021$). Duration of ST use was also not a significant predictor of cessation when taking age into account ($p = 0.1678$). Individuals making a quit attempt in the past year were more likely to have a successful quit attempt than those who did not, though the difference was not significant. Baseline cotinine level was not a significant predictor of cessation at 1 year in this sample. An individual's decisional balance score, calculated as pro minus con, was found to be inversely associated with quit success. The odds of quitting in the middle and lower tertiles were 38% and 63% greater, respectively. These increases were not significant. Individuals with at least one parent who smoked had only half

the odds of quitting ST use compared with those who did not, though again the difference was not statistically significant.

Table 3 outlines the results of the multivariable model. Three factors were significantly related to ST cessation when concurrently entered in the final model: age ($p = 0.0290$), level of education ($p = 0.0096$), and coffee consumption ($p = 0.0190$). Age, modeled as a continuous variable, was found to be positively correlated with quit success, with the odds of quitting nearly doubling with each ten-year increase in age (OR = 1.84, 95% CI: 1.07–3.20). A higher level of education was also associated with an increased probability of ST cessation. Individuals with more than a high school education had 5.85 times the odds of quitting (95% CI: 1.53–22.27) compared to those with 12 or less years of schooling. Coffee consumers were divided into three groups based on daily reported consumption: abstainers, moderate consumers (1–2 servings), and heavy consumers (≥ 3 servings). Heavy consumers had the lowest quit rates. Abstainers and moderate users had 5.90 (95% CI: 1.00–34.76) and 12.56 (95% CI: 2.10–75.01) times the odds of successful quitting, respectively. The model showed acceptable fit (Hosmer-Lemeshow p -value = 0.55) and had an area under the Receiver Operating Characteristic curve of 0.82 indicating good discrimination.

4. Discussion

The 12-month, cotinine validated quit rate of 21.5% observed in the study is comparable to ST cessation rates previously reported in the literature. Behavioral interventions have reported 12-month quit rates ranging between 10.2% and 34.5% (Severson, 2003). A comparable intervention involving NRT and behavioral therapy reported 37.9% quit rates at 6 months (Howard-Pitney, Killen, & Fortmann, 1999), while another study examining NRT observed 29% abstinence, biochemically verified, 12 months after the intervention's end in individuals using active nicotine patches (Hatsukami et al., 2000).

Though a number of studies have assessed interventions for ST cessation, little has been done to identify factors associated with the outcome. Similar studies have, however, been carried out in smokers trying to quit, and our findings regarding factors associated with ST cessation are largely consistent with factors associated with smoking cessation previously observed in the literature. As in our study, studies among smokers have found that those who are older (Fernandez et al., 1997; Osler & Prescott, 1998; van Loon et al., 2005; Westmaas & Langsam, 2005), are married (Fernandez et al., 1997; Osler & Prescott, 1998; van Loon et al., 2005), and are better educated or of higher socioeconomic status (Fernandez et al., 1997; Osler & Prescott, 1998; van Loon et al., 2005) are more likely to successfully halt tobacco usage. The observed relationship between tobacco and caffeine consumption is also consistent with existing knowledge.

A positive association between tobacco use and caffeine consumption (de Leon et al., 2003; Morabia, Curtin, & Bernstein, 1999; Siegel, Benowitz, Ernster, Grady, & Hauck, 1992; Swanson, Lee, & Hopp, 1994) and an inverse relationship between coffee consumption and tobacco cessation (Fernandez et al., 1997; Hegaard et al., 2003; Olsen, 1993; Westmaas & Langsam, 2005) have been observed in both females and males in a variety of cultural settings. Hypothesized behavioral mechanisms for this association include reduced caffeine consumption as a marker for healthy lifestyle change (Fernandez et al., 1997) and coffee consumption as a cue for tobacco use (Krall, Garvey, & Garcia, 2002). Proposed pharmacological explanations are accelerated caffeine metabolism during tobacco consumption leading to caffeine toxicity during cessation (Swanson, Lee, Hopp, & Berk, 1997), reduced nicotine uptake due to oral acidification by caffeinated beverages (Henningfield, Radzius, Cooper, & Clayton, 1990; Tomar & Henningfield, 1997), and enhancement of nicotine's neurologic effects by caffeine (Tanda & Goldberg, 2000). To date

no studies have examined the effect of simultaneous caffeine reductions on the success of ST cessation. In light of these findings, it appears that such studies are merited.

Though no significant associations were observed between tobacco use related variables and successful cessation, several trends in the data merit mention. The direction of the relationships between tobacco use variables and cessation observed in the present study were consistent with expectations. Those with prior quit attempts, lower tobacco dependence, and more negative views of tobacco use were more likely to successfully quit. It should be noted that more than 84% of the individuals started using smokeless tobacco before the age of eighteen; more than a fifth had started by the age of 10. Though there was no significant association between age at first use and cessation success in the sample, the extremely early ages at first use observed in the study indicate the degree to which ST use is ingrained in Appalachian culture. In this tobacco-growing region, the use of ST products is, for many, a part of their cultural heritage. This fact should be taken into account when designing and implementing cessation programs in this setting.

The present study had several limitations. To take part in the study, individuals had to use ST products daily and they therefore may be heavier-than average ST users. The study utilized data collected during a ST cessation intervention, so participants may not be representative of the general population of ST users, however two studies comparing participants in ST cessation program with a random sample of ST users found that the groups are generally similar on demographic factors (Andrews, Severson, Akers, Lichtenstein, & Barckley, 2001; Howard-Pitney, Fortmann, & Killen, 2001). Both studies did find that participants tended to have higher levels of tobacco dependence, and Andrews et al. (2001) found that those in the cessation program were older and better educated. The small size of this pilot study resulted in wide confidence intervals for estimates and only allowed for the detection of large effects, potentially explaining the lack of significant effects observed for variables relating to ST use.

Despite these limitations, this study identifies several factors which may be important predictors of ST cessation. The finding that coffee consumption is associated with successful quit attempts reemphasizes the need for interventions that take into account other health behaviors when attempting to motivate change. Due to its widespread use, caffeine could play an important role in determining the success of intervention programs at the population level. Further research is needed to refine our understanding of caffeine's role in nicotine addiction. The high degree of agreement between factors associated with ST cessation observed in this sample and previously reported predictors of smoking cessation lends support to the belief that nicotine addiction may be regarded as a unified construct regardless of the nicotine delivery system, however further work is needed to clarify the degree to which findings for smokers may be applied to those using ST products.

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Abbreviations

ST
smokeless tobacco

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Table 1

Distribution of 116 smokeless tobacco users from an Appalachian Ohio county, quit rates, and odds ratios for quitting by selected demographic variables.

	Total Sample		ST Quitters		Quit Rate	Age-Adjusted
	N	%	N	%	%	OR (95% CI)
Age						
< 30	29	25.00	1	4.00	3.45	
30–39	54	46.55	14	56.00	25.92	
40–49	18	15.52	5	20.00	27.78	
≥ 50	15	12.93	5	20.00	33.33	
Marital status						
Not married or partnered ^a	27	23.28	4	16.00	14.81	1
Married or partnered	89	76.72	21	84.00	23.60	1.9 (0.6–6.4)
Education						
High school or less	49	42.24	3	12.00	6.12	1
More than high school	67	57.76	22	88.00	32.84	7.4 (2.0–26.9)
Occupation						
Unskilled labor	36	31.03	4	16.00	11.11	1
Skilled labor	53	45.69	12	48.00	22.64	1.9 (0.5–6.7)
Professional	27	23.28	9	36.00	33.33	3.3 (0.9–12.6)
Alcohol use (past month)						
Yes	71	61.21	15	60.00	21.13	1
No	45	38.79	10	40.00	22.22	1.0 (0.4–2.5)
Coffee consumption						
≥ 3 servings daily	30	25.86	2	8.00	6.67	1
1–2 servings daily	25	21.55	11	44.00	44.00	17.6 (3.0–104.1)
Abstainer	61	52.59	12	48.00	19.67	7.3 (1.2–42.9)

^a Includes single, widowed, separated, and divorced

Table 2

Distribution of 116 smokeless tobacco users from an Appalachian Ohio county, quit rates, and odds ratios for quitting by selected tobacco use related variables.

	Total Sample		ST Quitters		Quit Rate	Age-Adjusted
	N	%	N	%	%	OR (95% CI)
Smoke cigarettes						
Yes	16	13.79	3	12.00	18.75	1
No	100	86.21	22	88.00	22.00	1.3 (0.3–5.0)
Age at first ST use						
≤ 10 years old	26	22.41	3	12.00	11.54	1
11–17 years old	64	55.17	14	56.00	21.88	2.1 (0.6–8.3)
≥ 18 years old	26	22.41	8	32.00	30.77	2.5 (0.6–11.5)
Years of ST use						
≤ 15 years	54	46.55	7	28.00	12.96	1
16–20 years	35	30.17	11	44.00	31.43	2.8 (1.0–8.3)
≥ 21 years	27	23.28	7	28.00	25.93	1.5 (0.4–5.6)
Quit attempt in past year						
No	55	49.55	11	44.00	20.00	1
Yes	56	50.45	14	56.00	25.00	1.4 (0.6–3.6)
Baseline cotinine (ng/ml)						
Highest tertile (681–1596)	38	33.04	8	32.00	21.05	1
Middle tertile (383–680)	39	33.91	7	28.00	17.95	1.0 (0.3–3.4)
Lowest tertile (17–382)	38	33.04	10	40.00	26.32	1.6 (0.5–4.8)
Decisional balance (Pro-Con)						
Highest tertile (≥1)	38	32.76	6	24.00	15.79	1
Middle tertile (–4 to 0)	40	34.48	9	36.00	22.50	1.4 (0.4–4.5)
Lowest tertile (≤–5)	38	32.76	10	40.00	26.32	1.7 (0.5–5.3)
Parental tobacco use						
Yes	24	20.69	3	12.00	12.50	1
No	92	79.31	22	88.00	23.91	1.9 (0.5–7.3)

Table 3

Multiple logistic regression analysis. Baseline predictors of cotinine confirmed smokeless tobacco cessation at 1 year post-intervention.

	OR	95% CI	p-value ^a
Education			0.0096
High school or less	1		
More than high school	5.85	1.54–22.27	
Coffee Consumption			0.0190
≥ 3 servings daily	1		
1–2 servings daily	12.56	2.10–75.01	
Abstainer	5.91	1.00–34.76	
Age (continuous, in decades) ^b	1.85	1.07–3.20	0.0290

^aType 3 Wald test

^bOdds ratio for a 10 year increase in age