

Smokeless Tobacco Use Among Military Flight Personnel: A Survey of 543 Aviators

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Introduction: Although there has been a steady decline in smoking rates among adults in the United States in recent years, the consumption of smokeless tobacco (ST) continues to increase. Moreover, ST use in the U.S. military is far higher than in the general population. This study was designed to determine the extent of ST use in a military aviation population and measure users' attitudes toward elements of a proposed cessation program. **Methods:** A study was conducted at two naval aviation training wings in western Florida. The target population ($N = 2233$) included flight instructors, students, and staff/support personnel who were rated aviators or flight officers. A total of 543 usable questionnaires were returned, yielding a response rate of 24.3%. **Results:** There were 71 respondents who reported using ST in the last 30 d (13.1%). This group responded favorably to questions regarding the involvement of both medical and dental health professionals as critical components of an effective ST cessation program. **Discussion:** This survey provides evidence for a rate of ST use among military aviators that is much higher than the U.S. national civilian average of 3.5%. Drawing upon the background of previous dental health-based studies, we propose augmenting existing tobacco cessation resources by creating separate ST cessation programs to reduce ST use among U.S. military aviators.

Keywords: snuff, smokeless tobacco, chewing tobacco, spit tobacco, dental health-based tobacco cessation programs.

AN ESTIMATED 2.9% OF U.S. adults (5.3 million) were current users of smokeless tobacco (ST) in 1991 (2). Estimates for U.S. adults in 2006 have shown an increase to as high as 3.5% (7.6 million) (17). Moreover, ST use in the U.S. military and its subpopulations (i.e., special operations forces) is 4 to 15 times higher (14.5–50.0%) than the general population (6,10,15). A recent large-scale survey of health-related behaviors in the military revealed a significant increase in the percentage of military personnel who used ST in the past 30 d from 11.7% in 1998 to 14.5% in 2005 (1). This survey reported ST prevalence rates, but did not provide the level of detail needed to identify factors that contribute to its initiation, continuation, and cessation (1). In military studies where these issues were specifically addressed, the vast majority of respondents consisted of non-aviation personnel (10,11,18). An extensive literature review did not identify historical ST prevalence rates solely among military aviation personnel.

A questionnaire was developed to establish a benchmark prevalence rate and discover insight into ways to reduce ST use in a military aviation population. Military aviation service members stationed at two naval fixed-wing and helicopter training wings in western Florida

were surveyed to determine the extent of their ST use. Secondary aims were to: 1) determine their knowledge and attitudes about ST and its potential adverse health implications; and 2) identify factors that contribute to ST initiation, continuation, and cessation.

METHODS

A questionnaire was administered as a web-based application from February 28, 2006, to May 18, 2006. Respondents from the aviation training wings at Pensacola Naval Air Station and Naval Air Station Whiting Field were invited to visit the website via e-mail, formal safety presentations, and in-processing briefings. Questionnaire respondents consisted of members of the U.S. Navy, Marine Corps, Air Force, and Coast Guard. Targeted personnel were officers serving in an active duty or reserve status. Eligible respondents' duty occupations consisted of flight instructors (i.e., rated aviators and flight officers), students (i.e., student pilots, flight officers, and weapon system operators), and staff/support personnel who were rated aviators or flight officers. This latter group of four personnel was included in the instructor group due to its small sample size. All responses remained anonymous and completion of the questionnaire was voluntary. The Institutional Review Board at Pensacola Naval Air Station approved the study and classified it as minimal risk due to anonymity of reported findings.

The questionnaire was administered in four parts: 1) demographics, 2) general tobacco use history, 3) ST use history for current and former users, and 4) general awareness and attitudes toward ST use. Three categories of ST use were defined: A) current users were defined as any ST use in the past 30 d; B) former users used ST one or more times more than 30 d ago; and C) nonusers. Of

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the 2276 aviation personnel stationed and contacted at the 2 naval aviation training wings, 586 individuals responded to the online questionnaire (25.8%). No questionnaires were returned incomplete. There were 43 individuals excluded because they were not U.S. military flight students, rated aviators, or flight officers (14 enlisted personnel, 12 Foreign Service flight students, 7 non-aviation support officers, 5 civilians, and 5 retirees). Excluded groups were initially included as potential respondents for ease of contacting all possible eligible personnel. Of a total of 2233 eligible U.S. military aviation officers at the 2 training wings, 543 responses (24.3%) were included in the data analysis.

Frequencies of ST use and values for the tables were calculated using SPSS software version 15.0. One-way analysis of variance (ANOVA) was used to compare means of continuous variables (i.e., age and years of education) across the levels of ST use. Fisher's exact test was used to estimate the *P*-value for categorical variables with observed counts less than five. Pearson's Chi-square statistic was used to estimate the *P*-value for the remainder of the categorical variables. The level of significance for all statistical analysis was defined as $P < 0.05$.

RESULTS

Of the survey respondents, 71 (13.1%) were identified as current users. There was a significant difference in age across the three user groups ($P = 0.033$). Mean ages were 28.6 yr (SD 4.81) for current users, 30.2 yr (SD 6.10) for former users, and 28.9 yr (SD 5.65) for nonusers. Age-specific rates showed the 26–29 age group had proportionally more current users (17.6%) than the 22–25 age group (12.4%), the 30–34 age group (12.6%), and the 35+ age group (9.0%). Differences in age-specific rates for current users, however, were not found to be significantly different from former or nonusers ($P = 0.276$). The mean difference in years of education across the three user groups was also not significant ($P = 0.273$).

Categorical demographic variables are listed in Table I. The statistically significant variables were commission source ($P = 0.047$) and sex ($P < 0.001$). The gender-specific rate for ST use among men of all ages was 13.7%. Only 33 women were included in our study sample and conclusions regarding ST use among women in this study were difficult to propose due to the large preponderance of men in the sample.

The most common reasons why current and former users initiated ST use were "friends used it," "curiosity to try something new," "thought I would enjoy it," "sports team or other group members used it," and "used with alcohol" (15 choices). The most popular reasons mentioned for continued use of ST after attempts to quit were "enjoyed the taste," "enjoyed the effect or feeling resulting from its use," "out of boredom," "used as a stimulant to keep me going," "helped me stay awake," "used with alcohol," and "felt as if I was hooked or addicted" (21 choices). "Stress from being in the military," "stress of flying," and "stress in general" were uncommon responses for both current and former users with each of these questions.

Of former users, 80% responded that cold turkey was the cessation method believed to be most helpful, but it took them between two and three attempts to quit before they were successful with this technique. There were 43 current users who previously made attempts to quit and tried an average of three times. Of the 43 current users who previously tried to quit, 35 individuals (81.4%) considered the cold turkey method most promising. Of those current users, 14 tried nicotine replacement therapy. Current users attempting to quit either cold turkey or with the help of nicotine replacement therapy each had an average of four quit attempts. Nine people tried tapering down, but were unsuccessful, none used bupropion therapy, and only three enlisted the help of a tobacco cessation program.

Responses to healthcare professional involvement in the cessation process revealed 58.5% of current users and 40.0% of former users reported their dentist

TABLE I. STUDY DEMOGRAPHICS.

Category	Current Users	Former Users	Non-Users	Sample Total	Pearson's Chi-Square <i>P</i> -Values
Group Total	71	166	306	543	
Duty Occupation					
Students	39	75	167	281	0.127
Instructors	32	91	139	262	
Prior Service Status*					
Enlisted	13	28	63	104	0.856
Active Duty Officer, Reserve or NG	6	11	20	37	
None	52	127	223	402	
Sex					
Male	70	164	276	510	< 0.001 [†]
Female	1	2	30	33	
Commission Source					
Officer Candidate School (OCS)	33	51	92	176	0.047
Reserve Officer Training Corps (ROTC)	22	54	102	178	
Military Academy	9	45	91	145	
Other	7	16	21	44	

* Nine respondents had prior service in multiple categories (only the longest prior service status was included above).

[†] *P*-value derived from Fisher's exact test.

frequently discussed ST use with them, including options for quitting. This figure was similar for dental hygienists (47.7% for current users and 35.4% for former users), but lower for flight surgeons (29.2% and 26.2%, respectively). The best techniques current and former users believed would help them quit ST were pointing out oral lesions and other areas of concern during their dental exam, receiving general information at dental visits about the benefits of quitting (i.e., handouts and pamphlets), graphic posters in dental offices depicting the hazards of ST use, flight surgeon discussions about ST and the benefits of quitting, and individual counseling with their unit flight surgeon or in tobacco cessation clinics. Group counseling of any type were unpopular in both groups. Most notably, the majority of current users who thought their dentist or dental hygienist would be important figures in helping them quit were students, but more instructors thought their flight surgeon would play an important role in their quit efforts. Former users, however, instructors in particular, reported individual counseling with their unit flight surgeon would have been more beneficial than individual counseling in tobacco cessation clinics.

A statistically significant proportion ($P < 0.001$) of current users (28.2%) approved of their ST use compared to former (2.4%) and nonusers (1.6%). The majority of current users thought superiors, significant others, parents, siblings, other family members, and their parent military service disapproved of ST use. Their friends, unit members, and sports team/other group members were the three groups whose perceived approval rating of ST use was higher than perceived disapproval.

Fellow unit members were the only group whose approval rating was higher than perceived disapproval for former users. In contrast to current users, former users perceived most of their friends and sports team/other group members as disapproving of ST use. Most nonusers thought all groups listed above disapproved of ST.

All questionnaire respondents were further asked to describe their awareness level of potential adverse

effects of ST use. Responses are listed in **Table II**. Fewer current users were "very aware" of the adverse cardiovascular effects ($P = 0.032$) and the problems with dental/periodontal structures ($P = 0.039$) associated with ST. For other potential adverse health effects of ST, awareness levels were similar to other user groups.

Current users believed dental professionals (33.8%), physicians (16.9%), friends/coworkers (16.9%), and spouse/family members (9.9%) were the most important ST cessation resources. Differences in responses for current users were significantly different from former and nonusers ($P < 0.001$). Former and nonusers thought friends/coworkers and physicians were the most important ST cessation resources. Other categories included the chain of command, the Internet, magazines, newspapers, public figures (i.e., professional athletes), government figures, tobacco companies, and a write-in category in which very few responses were entered. Dental professionals, physicians, friends/coworkers, and spouse/family members all ranked in the top five responses for all user groups as important resources to help people quit ST.

DISCUSSION

Current ST use for this questionnaire sample (13.1%) was comparable to other military surveys (14.5–50.0%) conducted between 1996 and 2005 (1,10,15), but was far greater than the civilian benchmark of 3.5% (17). The inclusion of a large number of younger men with their known high prevalence of ST use, especially in the military (1), is a potential confounder that needs to be considered in the analysis of the high crude rate of ST use. Age-specific rates for all age groups in this study, however, were two to three times higher than national adult civilian averages (17), with the largest disparity evident in age groups under 30. In addition, the gender-specific rate for ST use among men (13.7%) was also higher than the national male civilian average of 6.9% (17). Findings in this study provide evidence for the lack of effectiveness of our current means of ST prevention and

TABLE II. AWARENESS LEVELS OF POTENTIAL ADVERSE EFFECTS OF ST USE.

Category	Current Users	Former Users	Non-Users	Fisher's Exact Test P-Values
Group Total	71	166	306	
Contains the Addictive Drug Nicotine				
Very Aware	69	162	287	0.156
Somewhat Aware/Not Aware	2	4	19	
Contains Proven Cancer-Forming Ingredients				
Very Aware	68	165	291	0.028
Somewhat Aware/Not Aware	3	1	15	
May Lead to Problems with Dental/Periodontal Structures				
Very Aware	67	165	295	0.039
Somewhat Aware/Not Aware	4	1	11	
May Lead to Adverse Cardiovascular Effects				
Very Aware	44	130	229	0.029*
Somewhat Aware/Not Aware	27	36	77	
May Lead to Cancers of the Head and Neck Regions				
Very Aware	59	152	269	0.162*
Somewhat Aware/Not Aware	12	14	37	

* P-values derived from Pearson's Chi-square statistic.

treatment in the military, particularly in its young, male population.

Surprisingly, education level was not a risk factor for ST use in this study. In addition, although current users were less aware of the potential harmful cardiovascular effects and the problems with dental/periodontal structures associated with ST, they were reportedly very aware of other adverse health implications when compared to former and nonusers. This knowledge, however, was insufficient to result in a change of their behavior. This latter finding was noted in a similar study where comparable general health awareness questions were asked of ST users (10).

Reasons for initiation of ST did not definitively conclude when current users began ST use, but the mean age of initiation (17.9 yr, SD 4.87) suggests most began in high school, their early college years, or as they entered the military as enlisted service members. Initiation of ST at these times have been suggested in other studies (6,11,20). This was most notable in a 2005 DoD study where 17.5% of men ages 18 to 25 indicated they had initiated ST use since joining the military (1).

A cursory explanation of these findings may be that the stresses of enlisted service, OCS, or flight school led to the initiation and continued use of ST. Many of the reasons listed for initiating or continuing ST use lend some support to this claim. The responses involve issues that affect many individuals at this stage of life, including peer pressure, abundant times of boredom/inactivity, stressful life changes, and experimentation with alcohol, drugs, and other forms of tobacco.

Reasons for initiation and continued ST use, however, such as the use of ST to help respondents deal with the stresses of the military, stress of flying, or stress in general were uncommon responses for current users. This suggests a younger age combined with starting enlisted service, OCS, or flight school was more a risk factor for initiating and continuing ST use rather than any of those career paths taken alone. This explanation also agrees with the observation of proportionally more instructors belonging to the former user group. These individuals simply matured and/or underwent positive life changes (i.e., marriage, having children, advancement in their aviation skills and careers, further education, etc.) which may have assisted the majority of former users in their attempts to quit. This maturity, however, did not occur until age 30 or older for most former users.

In terms of ST cessation methods investigated in this questionnaire, "cold turkey" was an ineffective method of cessation for the majority of current users. Given the lack of success current users had quitting "cold turkey" and the large number of former users who had difficulty quitting ST using this method, subsets of aviators who use ST (i.e., those with multiple unsuccessful quit attempts) exist who need targeted cessation interventions. This is where healthcare professionals should focus their efforts to improve ST cessation rates among U.S. military aviators.

In a 1996 study conducted at a U.S. Army post in Fort Knox, KY (10), healthcare professionals, including

dentists, dental hygienists, physicians, and nurses, were identified by the majority of respondents (55.7%) as the single most important source of information about ST. They were selected much more frequently than friends/coworkers, television, parents/relatives, advertising, and other printed media. The importance of dental professional involvement in the cessation process has also been echoed in previous work (13,14,16).

Relatively few respondents (27%) stated their dentist or dental hygienist had ever discussed ST use with them (10). Other studies have reported analogous conclusions (13,14) and results in this questionnaire were similar. It is encouraging that 58.5% of current users reported their dentist frequently discussed ST use and cessation strategies with them, but results were lower for dental hygienists (47.7%) and even lower for flight surgeons (29.2%). This trend needs to improve, most notably for flight surgeons, in order to increase awareness and improve cessation rates in military aviation.

Dental health-based studies in the past 15 yr have reported ST cessation rates of 9–35% (4,19,20). These figures are lower than the 38% cessation rate reported in some smoking cessation clinics, but better than the 2.3% 6-mo cessation rate seen when ST users have been enrolled in cessation programs designed for smokers (5). Drawing upon these studies, we propose augmenting existing tobacco cessation resources by creating separate tobacco cessation programs designed exclusively for ST users. Dental health professionals have been shown to be underutilized assets in the ST cessation process, and dental health-based programs have been shown to be feasible, effective, and well received by participants in these studies.

The involvement of healthcare professionals in the ST cessation process should not be limited to dental health professionals. Questionnaire results support the involvement of unit flight surgeons and other medical professionals, working together with their dental counterparts, as an equally important part of the process. The best techniques current users admitted would help them quit ST centered on interventions provided by both medical and dental health professionals. Furthermore, among current and former users, the majority of students thought their dentist or dental hygienist would be important figures in helping them quit, while most instructors believed their flight surgeons would best fit this role. A combination of dental and medical health professionals is needed to increase awareness of ST health risks and assist with ST cessation.

Results from recent studies have shown that successful ST cessation programs must address common problems surrounding the initiation and continued use of ST (4,6,13). Many of these issues were listed by current and former users in the questionnaire. Specific factors include oral fixation with dip or chew, peer pressure in the younger male populations, comorbid use of alcohol or other drugs, and the use of ST as a stimulant, a substitute for boredom, a coping mechanism for stress, or as a smoking additive or alternative. The concept of smokers switching to ST as a "safer" alternative is concerning in

light of a recent study by Henley et al. (9) which found the risks of dying from all causes and from major tobacco-related diseases (i.e., lung cancer, coronary heart disease, and stroke) were significantly higher among former male cigarette smokers who switched to ST than among those who quit tobacco use entirely. The expertise of dental health professionals working together with their medical counterparts is a formidable combination to effectively address these problems.

Behavioral therapy is also a key component in the ST cessation process. The decision to use small groups (i.e., buddy system with friends or family members) versus individual-based settings to implement these behavioral strategies will ultimately be determined by patient preference. Family and friends were popular cessation resources to use in small group settings, but a more personalized approach may be needed based on results in this study. This latter approach was favored among the senior aviation personnel (i.e., instructors) and must be taken into account when implementing behavioral strategies and designing ST cessation programs for a variety of age groups at the small unit level.

Using a combined standard medical-dental health professional approach, similar cessation rates for current ST users are expected to compare to previous dental health-based studies (7,12,16). A comprehensive approach to the pharmacological, psychosocial, personal, and environmental factors involved in the ST cessation process will be necessary (5). In fact, ST cessation rates may approach those seen in traditional smoking cessation clinics through the use of behavioral therapy over multiple sessions (8). No definitive timeline has been established, but based on previous work (8), implementing behavioral therapies weekly for at least 12 wk is recommended to be most effective.

Limitations of our study included a one-time sampling of a small group of people whose opinions and responses may change over time. In addition, self-reporting from respondents may have been subject to potential underreporting of current ST use secondary to recall bias (3). Our study population consisted exclusively of military personnel stationed at two geographically similar military installations and reported findings may not be representative of other military or civilian aviation populations. Furthermore, selection bias from self-selection of respondents could not be controlled for with the lack of random sampling techniques used in the choice of study participants (3). This latter shortfall was dictated by operational constraints at each of the training wings, including rapid turnover of personnel, financial resources, and interference with student training time. Lastly, potential sampling bias due to a low response rate of 24.3% is also problematic when attempting to make any direct comparisons to larger military and civilian aviation populations.

Despite these limitations, important inferences can be drawn regarding the success of similar ST cessation programs in general aviation. ST prevention and cessation must begin with increased awareness among health-care professionals about the widespread prevalence

and adverse health effects of ST. There is clearly a need for involvement of both medical and dental health professionals in prevention and cessation processes. This will foster improved prevention methods, more vigilant detection practices, prompt referral to ST cessation resources, and the development of more effective management techniques designed to address the unique nicotine addiction of the ST user. All of these steps are critical to reduce ST use and, ultimately, decrease morbidity and mortality from this growing addiction in the coming decades.

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