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Predicting smokeless tobacco initiation and re-initiation in the United States Air Force

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A B S T R A C T

Introduction: Active Duty United States Air Force (USAF) members have substantially higher rates of smokeless tobacco (ST) use than the general population.
Methods: We longitudinally assessed demographics, tobacco use, intrapersonal factors, and interpersonal factors to determine associations with the initiation or re-initiation of ST in the year following a period of forced abstinence among 2188 newly recruited Airmen. Logistic regression analyses were conducted to examine associations between baseline predictors and ST use at one-year follow-up.
Results: In the final multivariate models compared to never users, the strongest predictors of ST use initiation after BMT were male gender (adjusted OR 8.93, 95% CI 3.82, 20.88), pre-BMT cigarette and cigar use (adjusted OR 1.60, 95% CI 1.00, 2.57; adjusted OR 2.50, 95% CI 1.66, 3.81 respectively). Compared to former ST users, the strongest predictors of re-initiation were male gender (adjusted OR 10.68, 95% CI 2.25, 50.62) and intentions to use ST (adjusted OR 2.10, 95% CI 1.42, 3.12). Compared to initiators of ST, the strongest predictors of re-initiation were intentions to use ST and peer use (adjusted OR 3.26, 95% CI 1.94, 5.49; OR 2.55, 95% CI 1.92, 3.41 respectively).
Conclusions: Our results suggest that initiators may be exploring and viewing ST as a less harmful alternative to cigarette smoking and ST users reporting intentions to use ST in the future often return to use. The development of interventions able to disrupt the link between intentions to use tobacco and future tobacco use in the USAF is vital.

1. Introduction

Tobacco use is the number one cause of preventable death and disability among Americans (U.S. Department of Health and Human Services, 2014). The prevalence of tobacco use in the U.S. Department of Defense (DoD) is higher than in the general population. Approximately 15.5% of American adults in the general population smoke cigarettes compared to 24% of active duty personnel (Barlas, Higgins, Pflieger, & Diecker, 2011; Centers for Disease Control and Prevention, 2018). The discrepancy is even more pronounced among ST users; the prevalence of ST use in the last 30 days in the general population is 3.3% compared to 12.8% among active duty military personnel (Department of Defense, 2011). The goal of the DoD is to be tobacco free, but current DoD spending on the treatment of tobacco-related morbidity among active-duty service members is in excess of $1.6 billion dollars per annum. In order to achieve this goal, intervening on and modifying factors that contribute to tobacco use and initiation is crucial.

Upon joining the United States Air Force (USAF), all Airmen must complete 8 ½ weeks of Basic Military Training (BMT) where they are not able to use any tobacco products (*AFI 40–102 Tobacco Free Living*, 2016). The BMT environment is comprised of close scrutiny which makes secretly using tobacco impossible. Following BMT, Airmen (called Airmen regardless of gender or rank) transition to Technical Training where they learn job skills in the Air Force (such as aircraft maintenance). During the first four weeks of Technical Training (Technical Training is on average 3 months), Airmen are required to remain tobacco free. As a result, all new recruits are tobacco-free for a period of 12 ½ weeks upon entering the Air Force. However, the period immediately following the forced abstinence has been deemed a particularly high risk time for tobacco initiation and re-initiation (Haddock et al., 2018). In a previous study, Little et al. (In press) observed that among 25.4% of Airmen reporting using cigarettes during their first year of service, over one-half reported initiating or re-initiating during Technical Training (Little, In press). Peer tobacco use, living with a tobacco user, owning cigarette branded merchandise, and being led by

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a military instructor who used tobacco have all been associated with cigarette initiation and re-initiation among Airmen during the first year of service (Green, Hunter, Bray, Pemberton, & Williams, 2008; Little et al., In press). Data also suggest that both a history of tobacco use and intentions to use tobacco are predictors of future tobacco use among military members following BMT (Ebbert et al., 2006; Little et al., In press).

Much less is known about the initiation and re-initiation of ST among Airmen during their first year of service. We are aware of only two studies examining ST use among new recruits of which only one examined predictors of ST use at a one-year follow-up (Ebbert et al., 2006; Linde et al., 2016). Linde et al., found that gender, race, high school sports participation, smoking cigarettes, and living with someone who used ST were characteristics associated with use prior to enlistment (Linde et al., 2016). Ebbert et al., (2006) observed that baseline use of cigarettes or ST were strong predictors for ST use at a one-year follow-up. Unfortunately, this study did not assess attitudes, beliefs, and environmental factors associated with ST initiation (Ebbert et al., 2006).

The current study builds upon the limited previous literature to examine how attitudes, beliefs, and environmental influences predict ST initiation and re-initiation 12 months after a period of forced abstinence in the USAF. We conducted our analyses in a sample of 2173 new United States Airmen to gain a greater understanding of the potentially modifiable factors for preventing ST use in this population of young adults.

2. Methods

2.1. Participants and procedures

The study was reviewed and approved by Wilford Hall Ambulatory Surgical Center Institutional Review Board prior to participant contact or enrollment and signed written consent was obtained. We enrolled United States Air Force Technical Training students from Joint Base San Antonio in the 342nd (e.g., Air Force front lines ground personnel), 343rd (e.g., Security Forces), 344th (e.g., Aircrew), and the 937th (e.g. Medical Personnel) Training Squadrons.

During the first week of Technical Training, Trainees are required to attend a number of mandatory classes as a part of the transition from BMT to Technical Training. During this time, our staff deliver a brief alcohol intervention. Following the intervention, Airmen were given a chance to consent to participate in the current study. Of the 8943 Airmen approached to participate in the study, 76% (N = 6880) consented to participate and completed the baseline questionnaire. One year after completing the baseline questionnaire, trained University of Virginia staff contacted Airmen by telephone or email for follow-up. Participants were ineligible if they met one of the following conditions: not active duty (N = 1349), stationed overseas (N = 1142), deployed (N = 282), or transferred to another military branch (N = 4). Airmen were terminated from the study if they separated from the Air Force (N = 680), were deceased (N = 16), or incarcerated (N = 2).

Contact information for consented participants was provided by the Defense Manpower Data Center which maintains the largest archive of personnel, manpower, training, and financial data in the Department of Defense. Of those eligible, 71.4% completed follow-up by phone and 3% responded by email which led to a total of 2188 included in our final analytic sample with complete baseline and one-year follow up tobacco use data.

2.2. Baseline questionnaire

The baseline questionnaire consisted of 29 items assessing four domains: demographics, tobacco use prevalence, intrapersonal factors, and interpersonal factors. Demographic variables included age, body mass index (BMI), gender, marital status, ethnicity, race, education, and region of residence prior to BMT. Tobacco use prevalence was assessed by asking Airmen their history of tobacco use (cigarettes, smokeless tobacco, or cigars) prior to BMT because the Airmen were still tobacco free when surveyed. Response options for ST history prior to BMT included: “I didn't use smokeless tobacco”; “I used smokeless tobacco every day and I used x tins/pouches per week”; “I didn't use smokeless tobacco every day but used at least once a week”; “I didn't use smokeless tobacco every week but used at least once a month”; “I used smokeless tobacco but less than once a month”; “I used smokeless tobacco but quit prior to BMT”. Pre-BMT history of cigar and cigarette use were dichotomized (did not use, any use [including quit prior to BMT]). Dual use was defined as a history of using two or more tobacco products prior to BMT. Intrapersonal factors were explored through items related to Airmen's intentions to use tobacco (plan to remain tobacco free = 0, thinking about using tobacco = 1, definitely will use tobacco = 2), use of a product that claims to be safer than cigarettes (yes/no), use of tobacco to help meet military weight standards (No/Yes) and beliefs such as the effectiveness of tobacco restrictions in BMT/Technical Training to keep people tobacco free (Strongly disagree = 1 to Strongly agree = 5). We also gathered information related to interpersonal factors through items related to peer ST use by asking how many of their closest friends used ST (None = 0 to Almost all, 80% or more = 5), how many BMT Military Training Instructors (MTIs) used each tobacco product (I don't know = 0 to Almost all, 80% or more = 6; ST, cigarettes, or both), and family of origin or roommate use by asking if they lived with someone prior to BMT who regularly used ST, cigarettes, or both cigarettes and ST (yes/no).

2.3. Follow-up questionnaire

ST use was assessed at a one-year follow-up by asking Airmen about their ST use over the past 12 months. At this time, almost all Airmen were at their first location of regular duty following Technical Training. Airmen were able to endorse the following options for ST use rates: “I didn't use smokeless tobacco”, “I used smokeless tobacco every day”, “I don't use smokeless tobacco every day but used at least once a week”, “I don't use smokeless tobacco every week but used at least once a month”, and “I used smokeless tobacco, but less than once a month.”

2.4. Statistical analysis

Participants were categorized by ST use status at the 12-month follow-up as follows: (U.S. Department of Health and Human Services, 2014) “never users” defined as no lifetime ST use prior to BMT and no ST use in the previous 12 months at follow-up; (Centers for Disease Control and Prevention, 2018) “initiators” as no lifetime ST use prior to BMT and less than monthly to daily ST use in the previous 12 months at follow-up; (Barlas et al., 2011) “former users” as lifetime use prior to BMT and no ST use in the previous 12 months at follow-up; and (Department of Defense, 2011) “re-initiators” defined as lifetime use (quit prior to BMT or less than monthly to daily use) prior to BMT and at least some (less than monthly to daily) smokeless tobacco use in the previous 12 months at follow-up.

Differences in proportions of demographic variables across user groups were calculated using ANOVA for continuous variables and $\chi 2$ test for categorical variables. Logistic regression analyses were conducted to examine associations between baseline predictors and ST use at one-year follow-up. The associations were examined in three comparisons: (U.S. Department of Health and Human Services, 2014) initiators and never users; (Centers for Disease Control and Prevention, 2018) re-initiators and former users; and (Barlas et al., 2011) re-initiators and initiators.

Across all comparisons, in the first step of our analyses we established four sets of predictors, including (U.S. Department of Health and Human Services, 2014) 9 demographic predictors, (Centers for Disease Control and Prevention, 2018) 3 tobacco use history predictors, (Barlas

et al., 2011) 5 intrapersonal predictors, and (Department of Defense, 2011) 3 interpersonal predictors. We ran logistic regression models separately by level of influence across the two comparisons predicting ST use at one-year follow-up. In the final step, we ran logistic regression models for each of the two comparisons in which we entered predictors across the predictor sets that were significant at $p < 0.10$ in the second step as well as all demographic predictors. Associations were considered significant at the alpha level of 0.05. Data were analyzed using SAS version 9.4 (SAS Institute, Cary, NC).

3. Results

Prior to BMT, 15.4% of Airmen reported previous use of ST products. At one year follow-up after BMT, 16% reported ST use during their first 12 months of service. Over one-half (60.7%) of Airmen reporting ST use at follow-up reported initiation or re-initiating during Technical Training. Nearly a quarter (23.3%) reported using tobacco at their first duty assignment. At follow-up across the sample (N = 2173), 77.9% (N = 1693) were ST never users, 6.1% (N = 132) were ST former users, 6.7% (N = 145) were ST initiators, and 9.3% (N = 203) were ST re-initiators. Among Airmen who reported never using ST prior to BMT, 92.1% (N = 1693) reported no ST use at follow-up and 7.9% initiated ST use (N = 145). Among Airmen who reported ST use prior to BMT, 39.4% (N = 132) remained free from ST use while 60.6% (N = 335) re-initiated ST use.

Among all tobacco user categories, ST never users reported the lowest intentions to use ST in the future and were least likely to have previously used any tobacco product, to have played sports in high school/college, to indicate desire to use products that claim to be safer than cigarettes, to believe tobacco could help them meet weight standards in the military, and to own ST branded merchandise (Table 1). ST never users were most likely to believe that tobacco restrictions promote abstinence. Additionally, never users were least likely to have peers who use ST, to believe their Military Training Instructor used tobacco (cigarettes, ST or both) and to have lived with others using tobacco (cigarettes, ST or both) prior to BMT (all p values < 0.01).

ST re-initiators were most likely to indicate an intention to use tobacco in the future, to indicate willingness to use products that claim to be safer than cigarettes, to own ST-branded merchandise, and to have peers who use ST. *Re*-initiators were the least likely to believe tobacco restrictions in training are effective in preventing use. Former users were most likely to believe their MTI used tobacco and indicated previously living with tobacco users.

Table 2 presents results from the logistic regression models examining sets of predictors of ST initiation and re-initiation at the one-year follow-up (significance set at $p < 0.10$). ST initiators were more likely to be male and non-Hispanic and less likely to be Black. Initiators were also more likely than never users to be former cigarette or cigar users, indicate they might try a product that claims to be safer than cigarettes, were more likely endorse that they will use tobacco to meet weight military weight standards, less likely to believe tobacco restrictions promote abstinence, less likely to believe using ST is a good way to conceal tobacco use, more likely to have peers who use ST and were more likely to previously live with someone who used ST, cigarettes or both (all p values < 0.10).

Compared to former users, ST re-initiators were more likely to be male, intended to use ST after Technical Training, and were less likely to endorse potential use of tobacco to meet weight standards. *Re*-initiators were more likely than former users to report peer use of ST (all p values < 0.10).

Compared to initiators, ST re-initiators were more likely to be married, to have previously used cigarettes, more likely to report intending to use ST following training, and less likely to believe using ST is a useful way of concealing tobacco use. *Re*-initiators are also nearly three times more likely to report peer ST use than initiators (all p values < 0.10).

Table 3 presents the results of the final multivariate models, including marginally significant predictors from the factor models at $p < 0.10$ as well as demographic predictors. We found that initiators were more likely than never users to be male, non-Hispanic, more than one race, to report prior cigarette or cigar use, and to endorse interest in use of products that claim to be safer than cigarettes. Compared to former users, re-initiators were more likely to be male and to intend to use ST after training and less likely to have previously used cigarettes. Compared to initiators, re-initiators were more likely to intend to use ST, less likely to believe ST is a useful way of concealing tobacco use, and were more likely to report peer use of ST (all p values < 0.05).

4. Discussion

In a sample with ST use rates reaching 16%, Airmen are at risk for tobacco-related health conditions and the search for an effective intervention is critical. There are limits to previous research on predictors of ST use for individuals in this age range (Tomar & Giovino, 1998). We observed that over 60% of the Airmen who initiate or re-initiate ST use did so during their Technical Training. These Airmen use ST immediately following their 12 ½ weeks of forced abstinence, a period of time long enough to eliminate any addiction to nicotine. Therefore, it is likely that psychosocial factors are influencing these high rates of initiation and re-initiation. The current study provides an examination of potentially modifiable factors that can be targeted in behavioral interventions to reduce ST use among a vulnerable young adult population.

Compared to never users, initiators are more likely to have used cigarettes and more likely to have used cigars. These findings may indicate that ST initiators may be looking for harm-reduction strategies which can often lead to harm escalation in the form of dual and poly tobacco use (Klesges, Sherrill-Mittleman, Ebbert, Talcott, & Debon, 2010). However, harm reduction may not be the only consideration as one of the primary differences between re-initiators and initiators is the assumption that ST is a more concealable form of tobacco use. Initiators of ST are significantly more likely to believe ST is a good way to conceal tobacco use as compared to re-initiators. We hypothesize that re-initiators understand that ST use is noticeable to others given their previous experience with the product, while new initiators may falsely assume that ST is largely unnoticed. This assumption is an important misconception to address when designing ST prevention interventions as perceived concealability may be a driver for initiation. Correcting such cognitive misconceptions may be particularly useful in the military due to the existence of guidelines regarding when and where tobacco use is authorized. If an intervention highlights the likelihood that ST users are unable to conceal their tobacco use, initiation rates may be reduced.

With regard to the social component of tobacco use, prior research has observed that adolescent perception of peer approval of ST use was predictive of regular ST use (Tomar & Giovino, 1998). Consistent with previous research, we found that pre-training peer use of ST predicted ST re-initiation at follow-up. This finding is especially interesting given that Airmen are separated from these pre-BMT peer groups when allowed to re-initiate. Yet this is one of the strongest predictors of re-initiation. Future research should explore how peer influence is operating on their ST use. For example, Airmen might select new peer groups after military training that are similar to their pre-BMT peer groups in terms of tobacco behavior. Alternatively, late adolescent peer groups may have lasting influences into young adulthood.

Not surprisingly, most ST users who report intentions to use ST in the future end up initiating and re-initiating. Associations between intentions to use tobacco and future tobacco use is consistent with extant literature (Little et al., In press). In order to reduce the risk for future tobacco use behaviors, interventions that address intentions to use tobacco products with an emphasis on readiness to change may be useful in reducing future tobacco use (Little, Talcott, Bursac, et al., 2015; Lundahl, Kunz, Brownell, Tollefson & Burke, 2010). However, focusing

Table 1
Baseline characteristics by smokeless tobacco user groups at one year follow-up (N = 2173)[a].

	Never users (*N* = 1693)	Initiators (N = 145)	Former users (N = 132)	*Re*-Initiators (N = 203)	*p*-value
Demographic factors					
Over 21	40.11%	35.17%	38.64%	36.45%	0.5304
Male	69.11%	95.86%	87.88%	99.01%	< **0.0001**
BMI[b]	23.46(2.43)	23.28(2.33)	24.04(2.40)	24.25(2.13)	< **0.0001**
Married	12.12%	6.21%	10.61%	16.26%	0.0394
Hispanic	15.56%	11.11%	6.82%	6.40%	**0.0002**
Race					< **0.0001**
White	65.38%	74.83%	90.08%	87.19%	
Black	16.72%	5.59%	3.05%	2.46%	
Asian	3.91%	2.80%	0.76%	0.49%	
Other	6.34%	6.29%	2.29%	3.45%	
More than one race	7.65%	10.49%	3.82%	6.40%	
Some college	50.98%	42.07%	50.00%	39.41%	**0.0049**
State of residence prior to BMT					0.4401
South	39.75%	36.36%	39.39%	36.95%	
Northeast	13.83%	15.38%	15.91%	10.34%	
Midwest	21.81%	20.28%	24.24%	28.57%	
West	23.96%	27.97%	20.45%	24.14%	
Other	0.66%	–	–	–	
Played sports in high school/college	64.02%	72.41%	79.55%	79.80%	< **0.0001**
Tobacco use history					
Pre-BMT cigarette use	17.02%	40.69%	68.18%	56.65%	< **0.0001**
Pre-BMT cigar use	17.13%	48.95%	58.33%	52.22%	< **0.0001**
Dual use	11.40%	28.28%	30.30%	28.57%	< **0.0001**
Intrapersonal factors					
Intentions to use tobacco after technical training[bc]	0.13(0.40)	0.37(0.58)	0.66(0.74)	1.00(0.74)	< **0.0001**
Will use product that claims to be safer than cigarettes	5.80%	22.76%	36.36%	41.87%	< **0.0001**
Will use tobacco to help me meet weight standards in the military[b]	3.13%	15.86%	27.27%	25.62%	< **0.0001**
Tobacco restrictions in training are effective in preventing use[bd]	3.84(1.13)	3.36(1.26)	3.20(1.29)	2.78(1.24)	< **0.0001**
Own smokeless tobacco branded merchandise	0.77%	1.38%	9.09%	10.84%	< **0.0001**
Interpersonal factors					
Peer smokeless tobacco use[be]	0.87 (0.98)	1.20(1.02)	2.09(1.16)	2.44(1.08)	< **0.0001**
Military training instructor tobacco (ST/Cig/Both) Use[bf]	0.60(0.82)	0.69(1.02)	0.96(1.17)	0.78(0.94)	< **0.0001**
Lived with tobacco (ST/Cig/Both) user prior to BMT	45.19%	56.55%	62.12%	59.61%	< **0.0001**

P-values calculated with ANOVA for continuous variables and χ^2 calculated for categorical variables.
All p values < 0.01 are highlighted in bold.
[a] All figures are percentages, unless otherwise noted.
[b] Mean (standard deviation).
[c] Responses range from 0 to 2.
[d] Responses range from 1 to 5.
[e] Responses range from 0 to 4.
[f] Responses range from 0 to 5.

solely on intentions may fail to prevent initiation among never users as we observed that intentions to use ST did not predict initiation among never users. Additionally, given that this particular group of Airmen have been tobacco free for 12.5 weeks, interventions should focus on reasons not to change tobacco use status or the benefits of being tobacco-free. One example is the Brief Tobacco Intervention (BTI), a 40 min group-based intervention delivered to Airmen during the week between graduation from BMT and the start of Technical Training. The BTI is based on the Theory of Planned Behavior, is delivered in a style consistent with motivational interviewing, and has shown promise in reducing intentions to use tobacco with this population of young adults (Little et al., 2015).

Our study has several limitations. First, we were constrained by time and therefore limited in the number of questions we are able to ask due to the nature and intensity of military training. Additionally, our study may be somewhat limited with respect to generalizability to other Air Force service members further along in their careers who do not have the benefit of a recent period of forced abstinence. Of note, the Air Force regularly reports lower rates of tobacco use than other services within the Department of Defense (DoD) which may also limit the representativeness of the sample to other military branches. However, our observed rates of ST use more than quadruple that which is observed in the civilian sector (Department of Defense, 2011). Furthermore, our study only examined ST use at one-year follow-up. Given that prior ST use is often associated with future use of more harmful tobacco products (i.e., conventional cigarettes), which is of particular concern due to the high prevalence rates of cigarette smoking in the Air Force (Klesges et al., 2010), future studies should include a measure to examine whether ST predicts use of other tobacco products.

The primary strength of this study is the use of a large longitudinal non-college-based sample of young adults beginning their military careers. As such, our results are likely generalizable to the civilian population to the extent that data were collected at baseline early in their military service and asks about behaviors prior to joining the Air Force when they were still civilians. Our study adds to the limited research conducted with this population on ST use. While Ebbert et al., (2006) explored predictors of ST use, their analyses were limited to demographic variables, psychosocial characteristics and prior use of tobacco (Ebbert et al., 2006). Linde et al. (2016) measured socio-environmental correlates of prior ST use among new recruits entering the Air Force, but their study was limited to a cross-sectional assessment (Linde et al., 2016). The longitudinal data collected in our study builds upon this previous work by measuring socio-environmental predictors of initiation and re-initiation of ST use, thereby addressing a knowledge gap in

Table 2
Logistic regression analyses using baseline characteristics to predict smokeless tobacco use status at the one year follow-up.

	Initiators vs. Never Users	*Re*-Initiators vs. Former Users	Re-Initiators vs. Initiators
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Model 1: demographic predictors			
Over 21	0.86(0.56,1.34)	1.03(0.56,1.9)	0.96(0.55,1.67)
Male	**9.55(4.16,21.92)**	**15.18(3.35,68.68)**	3.59(0.68,18.98)
BMI	1.07(0.99,1.15)	1.03(0.93,1.15)	1.09(0.98,1.21)
Married	0.47(0.22,1)	1.44(0.68,3.05)	**3.04(1.28,7.26)**
Hispanic	**0.41(0.21,0.8)**	0.58(0.21,1.58)	0.94(0.35,2.54)
Race			
White	1.00 (ref)	1.0 (ref)	1.00 (ref)
Black	**0.33(0.16,0.7)**	0.75(0.19,3)	0.39(0.12,1.25)
Asian	0.67(0.23,1.91)	0.84(0.05,14.24)	0.18(0.02,1.68)
Other	1.32(0.59,2.92)	1.62(0.36,7.4)	0.39(0.12,1.32)
More than one race	1.77(0.93,3.35)	1.87(0.58,6.09)	0.54(0.23,1.31)
Some college	0.78(0.51,1.18)	0.58(0.33,1.03)	0.84(0.5,1.41)
State of residence prior to BMT			
South	1.00 (ref)	1.0 (ref)	1.00 (ref)
Northeast	1(0.57,1.74)	0.6(0.29,1.26)	0.68(0.33,1.41)
Midwest	0.92(0.56,1.5)	1.24(0.68,2.26)	1.27(0.7,2.3)
West	1.17(0.74,1.84)	1.12(0.59,2.11)	0.97(0.54,1.76)
Model 2: tobacco use predictors			
Pre-BMT cigarette use	**2.18(1.44,3.29)**	0.63(0.39,1.01)	**2.03(1.27,3.27)**
Pre-BMT cigar use	**3.68(2.46,5.48)**	0.84(0.52,1.35)	0.87(0.55,1.4)
Dual use	0.98(0.61,1.59)	0.82(0.49,1.36)	0.94(0.58,1.53)
Model 3: intrapersonal predictors			
Intentions to use tobacco after technical training	1.18(0.78,1.79)	**1.95(1.31,2.89)**	**3.7(2.29,5.99)**
Will use product that claims to be safer than cigarettes	**2.45(1.42,4.21)**	0.81(0.48,1.37)	0.9(0.49,1.66)
Will use tobacco to help me meet weight standards in the military	**2.34(1.21,4.54)**	**0.53(0.29,0.97)**	0.54(0.26,1.09)
Tobacco restrictions in training are effective in preventing use	**0.85(0.72,0.99)**	0.89(0.73,1.09)	0.95(0.77,1.18)
Own at least one item that has smokeless tobacco advertising on it	1.65(0.35,7.85)	0.73(0.33,1.65)	3.53(0.73,17.04)
The health risks of using both cigarettes and smokeless tobacco are about the same as just smoking	1.09(0.95,1.25)	1.15(0.96,1.39)	0.97(0.8,1.18)
Smokeless tobacco is safer than cigarettes	0.88(0.73,1.07)	0.94(0.75,1.19)	0.91(0.71,1.16)
Using smokeless tobacco is a great way to conceal tobacco use	**0.78(0.65,0.93)**	0.81(0.64,1.02)	**0.65(0.5,0.84)**
Model 4: interpersonal predictors			
Peer smokeless tobacco use	**1.31(1.12,1.54)**	**1.34(1.10,1.65)**	**2.88(2.25,3.68)**
Military training instructor tobacco (ST/Cig/Both) Use	1.08(0.89,1.31)	0.85(0.69,1.05)	1.12(0.87,1.45)
Lived with tobacco (ST/Cig/Both) user prior to BMT	**1.42(1.00,2.01)**	0.82(0.51,1.29)	0.90(0.54,1.50)

Notes. Odds Ratios $p < 0.10$ are highlighted in bold.

the literature and providing a deeper understanding of the factors most likely to predict ST use.

The importance of understanding variables that predict ST use among active duty military personnel cannot be overstated. The DoD is one of the largest employers in the United States with 1.4 million active duty military personnel (*DoD announces recruiting and retention numbers for fiscal 2014, through August* 2014, n.d.) and it spends approximately $1.6 billion dollars each year treating tobacco-related morbidity in active duty military personnel (Little et al., In press). Each year approximately 220,000 individuals enter the military and 250,000 individuals leave the military, which underscores the magnitude of the health implications at a population level within the military and the United States as a whole (Segal & Segal, 2004). Future studies identifying predictors of ST initiation and re-initiation in other services within the DoD and civilian young adults are warranted to advance the development of tailored interventions to reduce rates of ST initiation and use. Such interventions could build on well-established theories, such as Theory of Planned behavior, social learning theory, and be delivered in a style consistent with motivational interviewing while addressing the perceptions of harm-reduction through use of ST, concealment of ST and peer use of ST.

In conclusion, we found high rates of initiation and re-initiation following a period of forced abstinence among new military trainees. Such rates are important when considering the implications of these health-risk behaviors to an otherwise healthy young adult population. Much could be learned from these data to inform opportunities for population health scaled interventions for reducing rates of ST use among young adults.

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Declaration of interests

None.

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Table 3
Final multivariate models: demographics, intrapersonal and interpersonal variables predicting smokeless tobacco use (significant at $p < 0.05$).

	Initiators vs. Never Users	*Re*-Initiators vs. Former Users	Re-Initiators vs. Initiators
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Over 21	0.89(0.56,1.41)	1.11(0.58,2.10)	1.18(0.60,2.32)
Male	**8.93(3.82,20.88)**	**10.68(2.25,50.62)**	2.95(0.48,18.06)
BMI	1.06(0.98,1.15)	0.99(0.89,1.11)	0.97(0.85,1.12)
Married	0.49(0.22,1.07)	1.71(0.77,3.81)	2.17(0.77,6.18)
Hispanic	**0.44(0.21,0.9)**	0.69(0.77,3.81)	1.66(0.46,6.00)
Race			
White	1.00 (ref)	1.0 (ref)	1.00 (ref)
Black	**0.43(0.19,0.94)**	1.05(0.25,4.48)	0.69(0.18,2.63)
Asian	0.83(0.26,2.63)	1.45(0.08,25.36)	0.46(0.03,6.16)
Other	1.48(0.63,3.49)	1.77(0.34,9.16)	0.41(0.08,2.08)
More than one race	**2.01(1.00,4.02)**	2.74(0.80,9.36)	0.70(0.23,2.13)
Some college	0.81(0.52,1.26)	0.63(0.35,1.15)	1.15(0.60,2.20)
State of residence prior to BMT			
South	1.00 (ref)	1.0 (ref)	1.00 (ref)
Northeast	0.92(0.51,1.65)	0.62(0.29,1.35)	0.49(0.19,1.24)
Midwest	0.88(0.52,1.48)	1.39(0.74,2.63)	1.35(0.64,2.86)
West	1.39(0.86,2.3)	1.04(0.53,2.05)	1.11(0.51,2.40)
Pre-BMT cigarette use	**1.60(1.00,2.57)**	**0.54(0.32,0.94)**	1.57(0.82,3.01)
Pre-BMT cigar use	**2.50(1.66,3.81)**	–	–
Intentions to use tobacco after technical training	–	**2.10(1.42,3.12)**	**3.26(1.94,5.49)**
Will use product that claims to be safer than cigarettes	**2.15(1.21,3.81)**	–	–
Will use tobacco to help me meet weight standards in the military	1.53(0.78,2.98)	0.60(0.32,1.10)	0.62(0.27,1.40)
Tobacco restrictions in training are effective in preventing use	0.87(0.74,1.03)	–	–
Using smokeless tobacco is a great way to conceal use	0.83(0.69,1.00)	0.87(0.69,1.09)	**0.67(0.50,0.89)**
Peer smokeless tobacco use	1.10(0.91,1.33)	1.20(0.95,1.53)	**2.55(1.92,3.41)**
Lived with tobacco (ST/Cig/Both) user prior to BMT	1.38(0.94,2.02)	–	–

Notes. Odds Ratios from Table 2 that were $p < 0.10$ as well as the demographic predictors were included in the final multivariate models.
All *p* values < 0.05 are highlighted in bold

Pharmaceuticals, Orexigen, and Pfizer outside the submitted work.

Disclaimer

The opinions expressed on this document are solely those of the authors and do not represent an endorsement by or the views of the United States Air Force, the Department of Defense, or the United States Government. The voluntary, fully informed consent of the subjects used in this research was obtained as required by 32 CFR 219 and DODI 3216.02_AFI 40-402.

References

AFI 40–102 Tobacco Free Living.

Barlas, F. M., Higgins, W. B., Pflieger, J. C., & Diecker, K. (2011). In Department of Defense TMA, Defense Health Cost Assessment and Program Evaluation (DHCAPE), and the United States Coast Guard (Vol. Ed.), *Health related behaviors survey of active duty military personnel. Vol. 2013*. Virginia: Fairfax.

Centers for Disease Control and Prevention (2018). Current cigarette smoking among adults—United States, 2016. *Morbidity and Mortality Weekly Report, 67*(2), 53–59 (accessed 2018 Feb 22).

Department of Defense (2011). Department of Defense Health Related Behaviors Survey of active duty military personnel. 2013. http://www.murray.senate.gov/public/_cache/files/889efd07-2475-40ee-b3b0-508947957a0f/final-2011-hrb-active-duty-survey-report.pdf.

DoD announces recruiting and retention numbers for fiscal 2014, through August 2014. press release http://1.usa.gov/1j6x5YS2014.

Ebbert, J., Keith Haddock, C., Vander Weg, M., Klesges, R., Poston, W., & Debon, M. (2006). Predictors of smokeless tobacco initiation in a young adult military cohort. *American Journal of Health Behavior, 30*(1), 103–112. https://doi.org/10.5993/ajhb.30.1.10.

Green, K., Hunter, C., Bray, R., Pemberton, M., & Williams, J. (2008). Peer and role model influences for cigarette smoking in a young adult military population. *Nicotine & Tobacco Research, 10*(10), 1533–1541. https://doi.org/10.1080/14622200802398763.

Haddock, C., O'Byrne, K., Klesges, R., Talcott, G., Lando, H., & Peterson, A. (2018). Relapse to smoking after basic military training in the U.S. *Air force*. Retrieved from https://uthscsa.influuent.utsystem.edu/en/publications/relapse-to-smoking-after-basic-military-training-in-the-us-air-fo.

Klesges, R., Sherrill-Mittleman, D., Ebbert, J., Talcott, G., & Debon, M. (2010). Tobacco use harm reduction, elimination, and escalation in a large military cohort. *American Journal of Public Health, 100*(12), 2487–2492. https://doi.org/10.2105/ajph.2009.175091.

Linde, B., Ebbert, J., Schroeder, D., Hanson, A., Talcott, G., & Klesges, R. (2016). Smokeless tobacco use among United States air Force trainees. *Substance Abuse, 38*(3), 278–284. https://doi.org/10.1080/08897077.2016.1275924.

Little, M.A., Ebbert, J.O., Krukowski, R.A., Kalpinski, R., Patten, C., Boothe, T., Pasker, C., Klesges, R., Talcott, G.W. (In Press). Predicting Cigarette Initiation and Re-initiation among Active Duty Air Force Recruits. *Substance Abuse*.

Little, M., Talcott, G., Bursac, Z., et al. (2015). Efficacy of a brief tobacco intervention for tobacco and nicotine containing product use in the US air force. *Nicotine & Tobacco Research, 18*(5), 1142–1149. https://doi.org/10.1093/ntr/ntv242.

Lundahl, B., Kunz, C., Brownell, C., Tollefson, D., & Burke, B. (2010). A meta-analysis of motivational interviewing: Twenty-five years of empirical studies. *Research on Social Work Practice, 20*(2), 137–160. https://doi.org/10.1177/1049731509347850.

Segal, D., & Segal, M. (2004). America's military population. *Population Bulletin, 59*(4), 8–9.

Tomar, S., & Giovino, G. (1998). Incidence and predictors of smokeless tobacco use among US youth. *American Journal of Public Health, 88*(1), 20–26. https://doi.org/10.2105/ajph.88.1.20.

U.S. Department of Health and Human Services (January, 2014). The health consequences of smoking—50 years of progress: A report of the Surgeon General, 2014. Retrieved from https://www.surgeongeneral.gov/library/reports/50-years-of-progress/.